Strategy for Sustainable Solid Waste Management

prepared for

Mid-America Regional Council (MARC) Solid Waste Management District Kansas City, Missouri

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prepared by

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DEFINITIONS OF PROGRAMS AND TERMS USED IN THIS REPORT

Composting: The process of collecting, grinding, mixing, piling, and supplying sufficient moisture and air to organic materials to speed natural decay. The finished product of a composting operations is compost, a soil amendment suitable for incorporating into topsoil and for growing plants. Compost is different than mulch, which is a shredded or chipped organic product placed on top of soil as a protective layer.

Construction and demolition (C&D) waste: Building materials and solid waste from construction, deconstruction, remodeling, repair, cleanup, or demolition operations that are not hazardous. This term includes, but is not limited to: asphalt, concrete, Portland cement, brick, lumber, wallboard, roofing material, ceramic tile, plastic pipe, and associated packaging.

Deconstruction: The process of taking apart a structure with the primary goal of preserving the value of all useful building materials, so that they may be reused or recycled.

Disposal: For diversion purposes, disposal is all waste created by all businesses and residents which is disposed of at properly permitted landfill.

Diversion: For waste measurement purposes, diversion is any combination of waste prevention (source reduction), recycling, reuse and composting activities that reduces waste disposed of at a properly permitted landfill.

E-waste: End-of-life electronic materials.

EPA hierarchy for solid waste management: A ranking established by the U.S. Environmental Protection Agency of solid waste management practices from most preferred to least preferred. The ranking is as follows: source reduction and reuse, recycling/composting, combustion with energy recovery, and landfilling and incineration without energy recovery. The state of Missouri has adopted this hierarchy in its resource recovery policy.

Generation: The total amount of waste produced by a jurisdiction. The basic formula is disposal plus diversion equals generation.

Green waste: Organic wastes derived from plants growing in residential and commercial land use areas. This term includes grass cuttings, leaves, and tree branches and is used synonymously with the term “yard waste.”

Household hazardous waste (HHW): Hazardous waste materials discarded, typically in small quantities, by households (as opposed to large quantities disposed by businesses). Typical household hazardous wastes include used motor oil and oil filters, antifreeze and other vehicle fluids, paints and varnishes, pesticides, and cleaning supplies.

Materials recovery facility: More commonly called a MRF (pronounced "Murf"). An intermediate processing facility designed to remove recyclables and other valuable materials from the waste stream. A "dirty MRF" removes reusable materials from unseparated trash. A "clean MRF" separates materials from commingled recyclables, typically collected from residential curbside or commercial on-site collection programs.

Near zero waste: A solid waste management planning scenario that approaches closed loop utilization of resources, maximizing source reduction, recycling, and composting diversion. Specifically, a planning scenario where existing diversion technologies are used to divert maximum amounts of waste (80 percent) and future emerging technologies (diversion or conversion, with diversion given the priority) are assumed to recover or reuse an additional 10 percent of the waste stream that existing diversion technologies are not able to recover or reuse.

Organics: Materials that are or were recently living, such as leaves, grass, agricultural crop residues, or food scraps.

Policy incentive: A course of action adopted by an organization of authority in the solid waste management system that establishes an advantage (normally economic) for users of the system who comply with specific solid waste management related activities identified by the organization.

Procurement program: Programs that encourage the purchase of recycled-content products by companies, jurisdictions and others. Joint recycled-content product purchasing pools and buy-recycled campaigns are two examples.

Public Education: Creation of understanding and appreciation among the population concerning a particular issue and ways to address that issue.

Recycling: The process of collecting, sorting, cleansing, treating, and reconstituting materials that would otherwise become solid waste and returning them to the economic mainstream in the form of raw material for new, reused, or reconstituted products that meet the quality standards necessary to be used in the marketplace.

Reuse: The recovery or reapplication of a package or product for uses similar or identical to its originally intended application, without manufacturing or preparation processes that significantly alter the original package or product.

Source reduction: Source reduction means any action which causes a net reduction in the generation of solid waste. Source reduction includes, but is not limited to, reducing the use of nonrecyclable materials, replacing disposable materials and products with reusable materials and products, reducing packaging, reducing the amount of yard wastes generated, establishing garbage rate structures with incentives to reduce waste tonnage generated, and increasing the efficiency of the use of paper, cardboard, glass, metal, plastic, and other materials.

Specific waste materials: Solid wastes that are not collected in normal curbside or on-site collection operations but require management in the solid waste system. This term includes, but is not limited to: industrial and municipal sludge, tires, white goods, scrap metal, and rendering waste.

Sustainable solid waste management practices: Activities performed by the solid waste management industry that meet the following "more with less" criteria. Sustainable industry practices will produce "more" value from recovered materials and energy, while also using "less" waste (due to waste reduction efforts to minimize the amounts of waste that require industry management), energy, and space and producing "less" emissions (from Integrated Solid Waste Management – a Life Cycle Inventory, 2nd edition, McDougall, Forbes, et. al., 2001).

White goods: Discarded major appliances of any color. These items are often enamel-coated and include, but are not limited to: washing machines, clothes dryers, hot water heaters, stoves, and refrigerators. This definition does not include electronics.

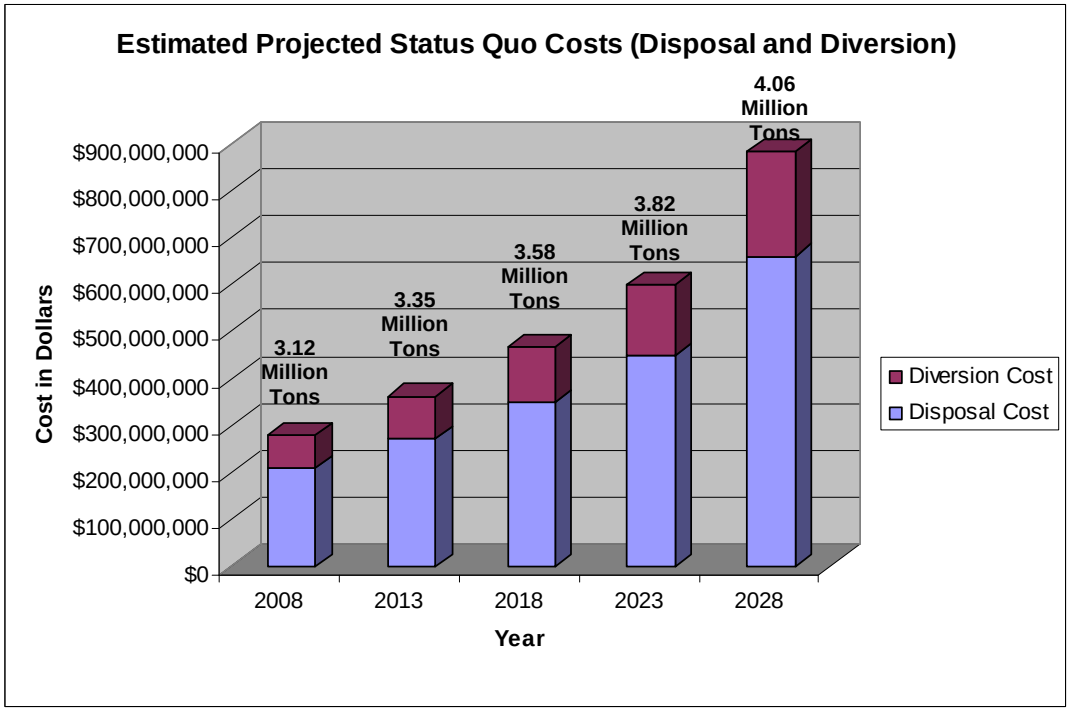
Yard waste: Organic wastes derived from plants growing in residential and commercial land use areas. This term includes grass cuttings, leaves, and tree branches and is used synonymously with the term "green waste."

Zero waste: A goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing zero waste will eliminate all discharges to land, water or air that may be a threat to planetary, human, animal or plant health (working definition adopted by the Planning Group of the Zero Waste International Alliance on November 29, 2004). The Planning Group of the Zero Waste International Alliance also adopted a set of principles to guide and evaluate current and future zero waste policies and programs. These principles can be viewed at www.zwia.org/standards.html.

EXECUTIVE SUMMARY

This report presents a sustainable, economically viable, and socially responsible solid waste management strategy for the Kansas City metropolitan area throughout the next 20 years. This area is referred to throughout this report as the District. The District includes the five Missouri counties (Cass, Clay, Jackson, Platte, and Ray) which constitute the Mid-America Regional Council Solid Waste Management District (MARC SWMD), a regional solid waste management planning agency recognized by the state of Missouri, and the four Kansas counties (Johnson, Miami, Leavenworth, and Wyandotte) with which the MARC SWMD works cooperatively. The solid waste covered by the report includes municipal solid waste (MSW) and construction and demolition (C&D) waste. MSW includes residential and commercial solid waste but does not include industrial solid waste or special wastes.

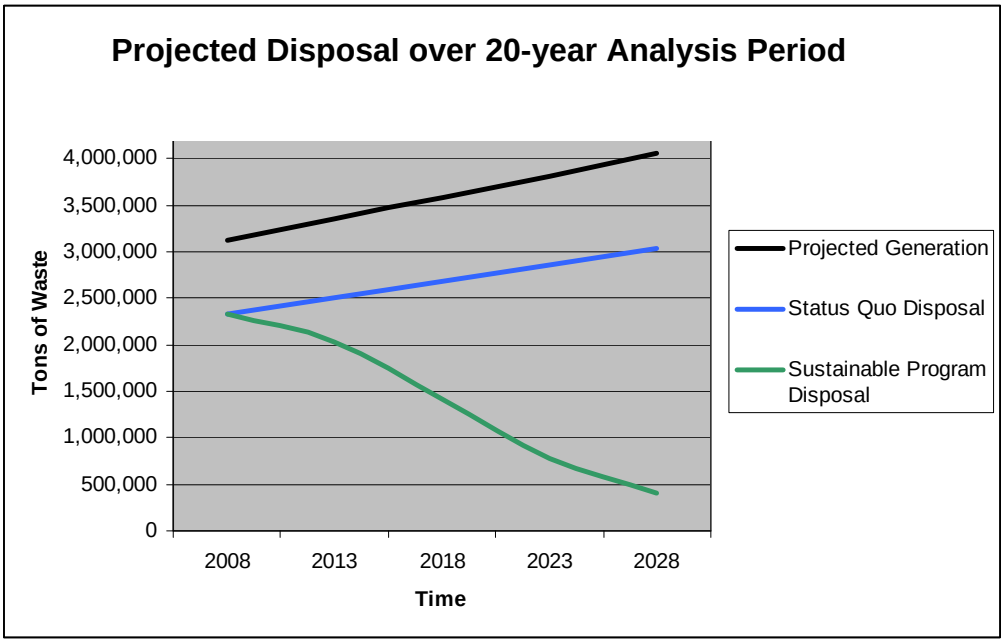
Before adopting a new solid waste management strategy, it is important to understand the current system, defined as the status quo, and projections of status quo operations over the next 20 years. Under the status quo, it is estimated that in 2008 the District diverted about 25 percent of generation. The system's total annual (diversion and disposal) cost was approximately $278 million. Projecting the status quo system to 2028, the District would be generating 4.06 million tons per year and disposing of 3.04 million tons at a projected total annual system cost of nearly $882 million. This projection assumes that by 2028 most District MSW will be disposed of using additional transfer stations and transfer of waste to more distant landfills due to local landfill closures.



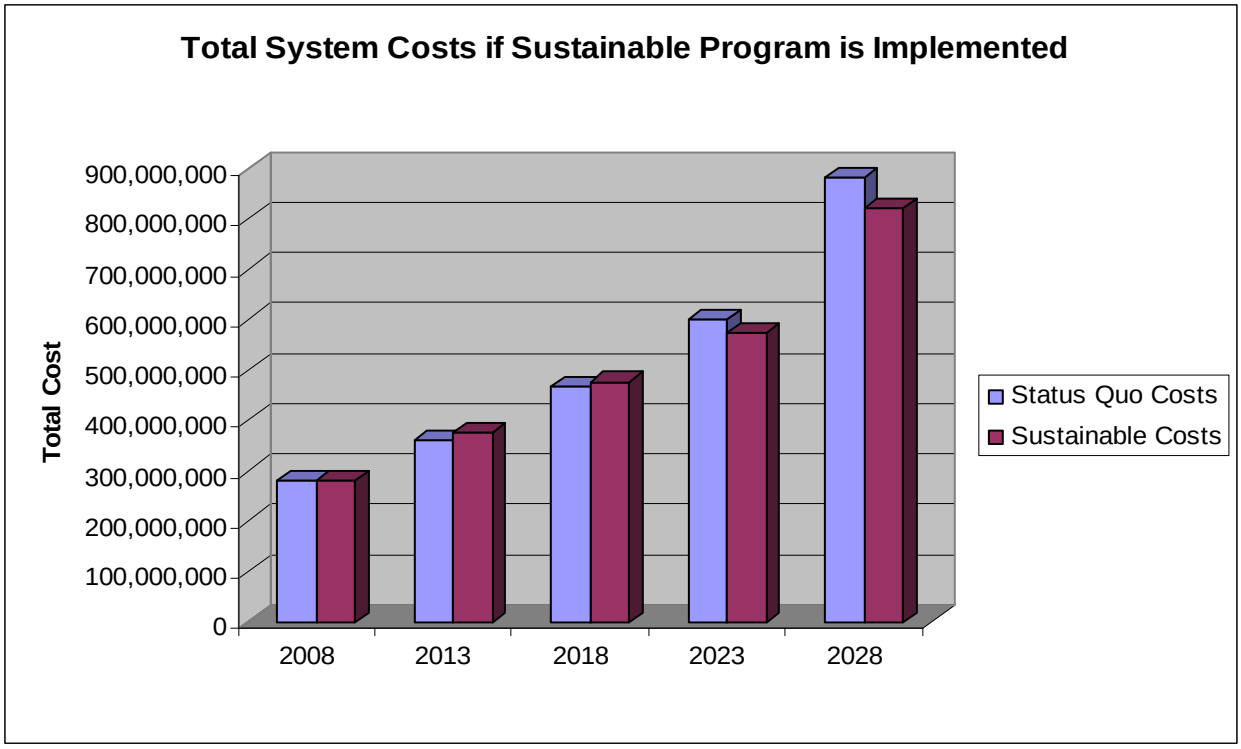
Implementing an alternative sustainable solid waste management strategy offers the District the opportunity to dramatically decrease landfill disposal over the next 20 years (see graph below) at cost competitive rates. The strategy set forth in this study envisions four, 5-year planning horizons designed to reach incremental 40 percent, 60 percent, and 80 percent diversion and near zero waste by 2028. Based on successfully implemented programs in communities in other areas of the United States, a total of 44 practices in the following seven categories of programs were selected for priority ranking by District stakeholders as potential sustainable practices for implementation:

- Source reduction
- Recycling
- Composting
- C&D/specific waste materials
- Public education
- Policy incentives
- Household Hazardous Waste (HHW) and e-waste

During the program ranking discussions, District stakeholders expressed a definite desire for highest and best use of materials in MSW and a near-unanimous approval of the EPA hierarchy for solid waste management. Therefore, the programs included in the scenarios described below give preference to reuse, recycling, and composting strategies over thermal conversion. Based on the results achieved by other example communities, successful implementation of the sustainable practices more highly ranked by District stakeholders is expected to result in the significant reduction of projected waste disposal quantities shown in the following graph.



Successful policy implementation will not only result in lower disposal quantities, it will also result in competitive costs throughout the 20-year program period and lower costs near the end of the 20-year period (see graph below) as more District solid waste needs to be transferred to regional landfills outside the District.



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Other benefits of implementing the sustainable strategies include conserving resources, improving overall environmental quality, creating jobs, and minimizing waste transport to more distant landfills.

Therefore, implementation of a series of 5-year planning scenarios, incorporating the sustainable practices highly ranked by District stakeholders, is recommended to approach near zero waste by 2028. To achieve 40 percent diversion in the first 5-year period (by 2013), the primary focus is on the public education of source reduction activities and the implementation of curbside/on-site collection programs for recyclables and green waste from residences and businesses throughout the District. Achievement of the goal to implement these practices is seen as the most important task in the sustainable program implementation. Upon District-wide (or nearly District-wide) availability to curbside and on-site collection of recyclables and green waste, the remaining sustainable program practices are essentially modifications to increase the types and quantities of materials diverted from landfill disposal.

To achieve 60 percent diversion by 2018, the focus during the second 5-year period is to expand participation and types of materials collected in the programs previously put in place throughout the

District for the 40 Percent Diversion Scenario (2013). The major new initiatives to be implemented during this period include adoption of volume-based rates for all residential and commercial waste collection and initial establishment of incentive programs for C&D waste recycling.

To achieve 80 percent diversion by 2023, further expansion of programs implemented during the previous two periods to achieve maximum feasible recovery, as well as the implementation of food waste collection and composting and backyard composting of green waste will be emphasized. Programs implemented during the previous periods continue and, in some cases, recovery rates are assumed to increase as a result of on-going promotion and increased awareness of the importance of recycling.

To get to near zero waste (90 percent diversion) in 2028, the focus is on the implementation of one or more emerging technologies to recover and/or use additional quantities of materials that are not easily recovered through previously demonstrated diversion programs. It is expected that additional diversion and conversion technologies will be available for consideration by the start of this 5-year period, with diversion technologies receiving the priority. Although emerging technology is estimated to be very expensive on a unit price ($/ton) basis, the high rate of diversion achieved prior to adoption of emerging technology results in a more moderate increase in overall system cost. It is assumed that programs implemented during the previous periods would be continued and that recovery rates would remain relatively constant at the high rates associated with a focused, mature program promoting diversion.

Projections of diversion by type of waste over the 20-year planning period are shown in the following table.

Projected Diversion by Waste Type
(tons/yr)

Year (Diversion Goal)	Residential	Commercial	C&D	Emerging Technology	Total
2013 (40%)	569,000	539,000	217,000		1,325,000
2018 (60%)	844,400	795,000	520,600		2,160,000
2023 (80%)	1,109,300	1,104,700	837,400		3,051,400
2028 (Near Zero Waste) (90%)	1,188,200	1,156,800	881,900	420,000	3,646,900

The following near-term activities are recommended to be carried out to maximize the potential for the District to realize the benefits of implementing the sustainable solid waste program:

- MARC SWMD adopts the scenario goals of the sustainable program outlined in the study;
- MARC SWMD prepares a guideline strategy document to define alternative methods for District communities to modify existing solid waste management operations or implement revised operations to provide curbside/on-site collection of recyclables and green waste to all residences and businesses;
- MARC SWMD implements an outreach program using printed media, electronic media, broadcast media, presentations, strategy meetings, etc. promoting the following decisions by all (or nearly all) District cities and towns:
    - Adoption of the scenario goals of the sustainable program by a date to be established and
    - Commitment to implement solid waste management operations that provide curbside/on-site collection of recyclables and green waste to all residences and businesses by 2013; and
- Upon substantial achievement of District commitment to the sustainable practices program, MARC SWMD modifies its outreach program to become a District-wide public education program using the same outreach methods to educate the entire District community of the benefits of the sustainable practices program.

The greater Kansas City area has demonstrated a commitment to sustainability initiatives such as America's Green Region and the Greater Kansas City Chamber of Commerce Climate Protection Partnership. Achieving near zero waste is an attainable goal for the District through the implementation of these sustainable practices and the leadership of the MARC SWMD.

* * * * *

1.0 INTRODUCTION

1.1 BACKGROUND

The Mid-America Regional Council Solid Waste Management District (MARC SWMD) is a regional solid waste planning agency recognized by the state of Missouri. The MARC SWMD was formed in 1991 in response to the Missouri Solid Waste Management Law of 1990 and serves the local governments in Cass, Clay, Jackson, Platte, and Ray counties in Missouri and works cooperatively with Johnson, Leavenworth, Miami, and Wyandotte counties in Kansas. These nine counties, the bi-state Kansas City metropolitan area, are consistent with the planning boundary of the Mid-America Regional Council. The nine-county area is referred to in this report as the District.

Municipal solid waste (MSW) and construction and demolition (C&D) waste landfill capacity within the District will decline significantly in the next 20 years. The MARC SWMD supports regional and local efforts to reduce the amount of waste disposed of in area landfills and received a grant from the Missouri Department of Natural Resources to assess sustainable solid waste management alternatives.

1.2 PURPOSE

This report is intended to provide policy orientation to guide solid waste planning and decision making in the District over a planning period in excess of 20 years. The report summarizes Calendar Year 2007 practices, quantities, and costs (the status quo) regarding solid waste management in the District and compares proposed alternative long-term, sustainable solid waste management scenarios with a future extension of the status quo. In addition, this analysis concentrates on proven sustainable practices and policies; unproven emerging technologies with unknown future costs and performance were considered only as options for managing the small portion of solid waste that remains after proven sustainable options are fully implemented.

1.3 SCOPE

This report provides background information and analyses of the following scenarios regarding District MSW and C&D waste management:

- Snapshot of the status quo;
- Snapshot of the status quo conditions projected 20 years into future; and
- Alternative sustainable management strategies with specific policy and cost scenarios that could lead the District to more aggressive waste diversion and ultimately near zero waste.

2.0 SNAPSHOT OF THE STATUS QUO

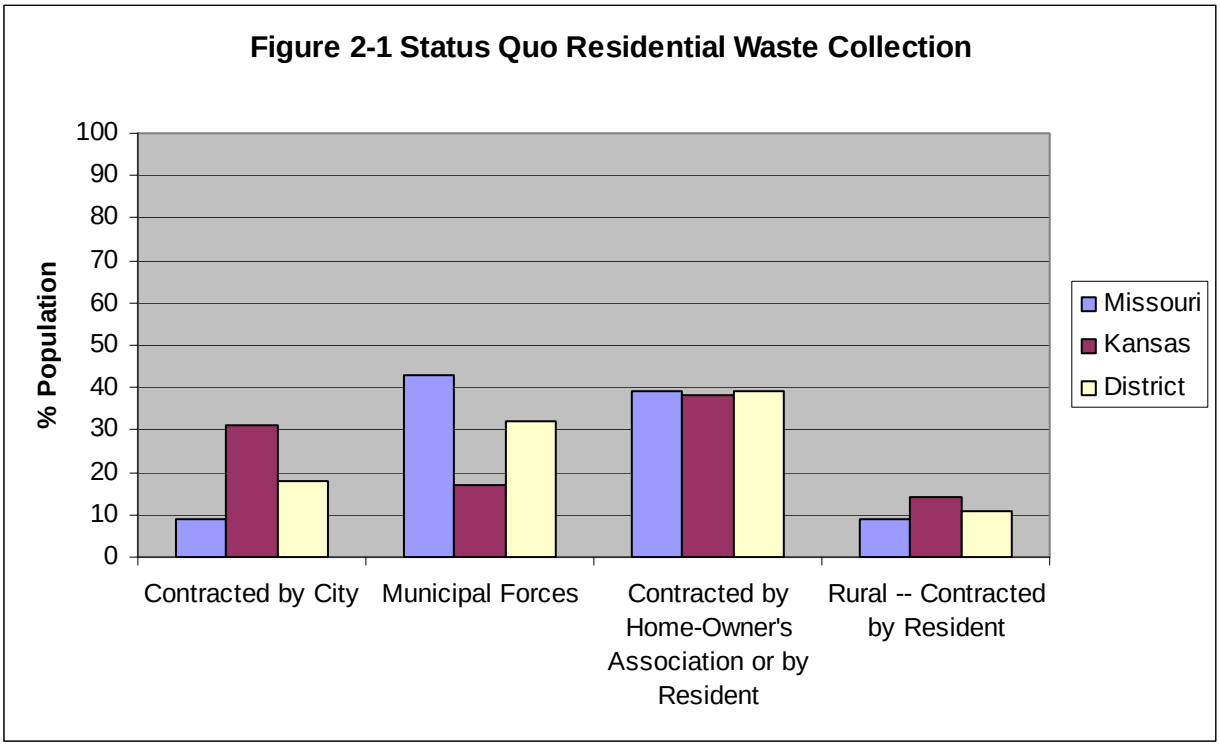
A summary of District solid waste management practices, quantities, and costs for the base year of 2007 (status quo) is presented in this chapter.

2.1 DESCRIPTION OF SOLID WASTE MANAGEMENT

2.1.1 Residential Waste

Residential solid waste collection is provided by a variety of services throughout the District. Figure 2-1 summarizes the status quo information on residential waste collection services presented city-by-city under the Column labeled "Residential Collection Service" on the first page of Appendix A and Appendix B. Approximately 50 percent of the District's population lives in cities or towns that are actively engaged in residential solid waste management activities, either through contracting with a private company to collect residential solid waste or providing the service themselves. Another 37 percent of the District's population contracts directly with a private hauler for collection services or contracts with a private hauler through their homeowner's association.

Figure 2-1 Status Quo Residential Waste Collection



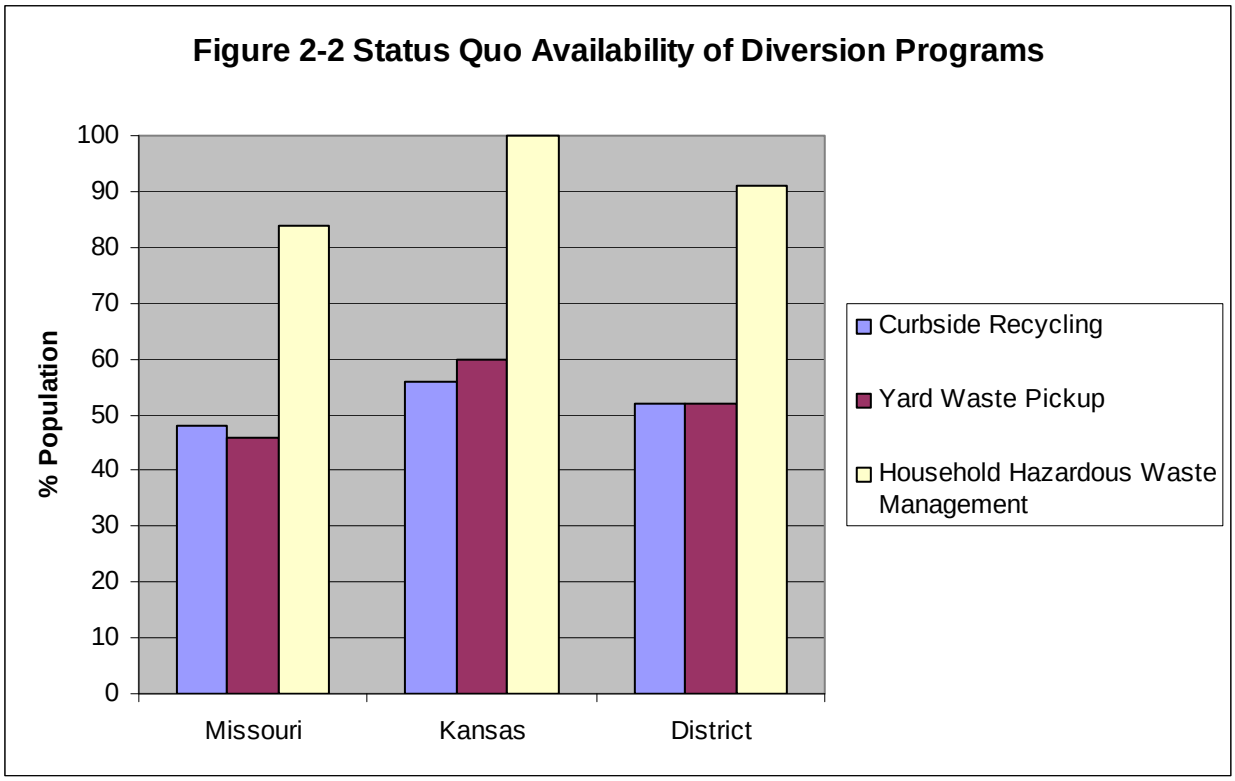
Sources: (1) MARC SWMD, January 2006 and April 2007.
(2) MARC, February, 2006.

No definitive waste tracking information for the entire District is available. The Kansas Department of Health and Environment (KDHE) Bureau of Waste Management prepared a map of known and estimated waste flows (2005 tonnage) for northeastern Kansas and western Missouri that incorporates the entire District (KDHE- Bureau of Waste Management, 2007). Based on the KDHE information and other available information (landfill tonnage records), most residential waste in the District is disposed of in the three operating MSW landfills located in the District. These landfills are generally characterized as follows (reported receipts incorporate all wastes received by the landfills, including MSW, C&D, and special/industrial wastes):

Landfill	Location	Reported Receipts (tons/year)	Expected Closure Date (limiting condition)
Johnson County	Shawnee, KS	1,749,999	2027 (zoning)
Courtney Ridge	Sugar Creek, MO	520,394	2027 (capacity)
Lee's Summit	Lee's Summit, MO	86,909	2014 - 2016 (capacity)
	Total	2,357,302	

Some District residential waste is hauled to the five transfer stations located on the Missouri side and three transfer stations located on the Kansas side of the District. Waste received at these transfer stations generally is transferred to one of the following regional landfills outside the District: Hamm Landfill in Jefferson County, Kansas; Oak Grove Landfill in Crawford County, Kansas; Show-Me Landfill in Johnson County, Missouri, and Central Missouri Landfill in Pettis County, Missouri.

Just as residential collection systems vary throughout the District, waste diversion programs also are not consistent across the District as shown in Figure 2-2. This figure shows that a little over 50 percent of the District's population has access to curbside recycling and yard waste (grass, leaf, and brush) pickup. Often these diversion systems are available for an additional fee on top of the normal trash collection fee. The great majority of the citizens of the District have a household hazardous waste (HHW) drop-off center available. Only a few municipalities on the Missouri side of the District do not participate in the MARC SWMD HHW program.



Sources: (1) MARC SWMD, January 2006 and April 2007.
(2) MARC, February, 2006.

The Deffenbaugh Materials Recycling Facility in Wyandotte County, Kansas, is the one material recovery facility (MRF) located in the District capable of processing single stream recycle materials into components streams (metals, paper, plastics) for subsequent sale. Town & Country Disposal anticipates opening a MRF in Cass County, Missouri in early 2009 with the capability of processing single stream recycle materials. Other recycling facilities operate in both Missouri and Kansas and receive/process single materials or source-separated materials.

Four municipalities in the District (Olathe, Kansas; Kansas City, Missouri; Platte City, Missouri; and Sugar Creek, Missouri) provide residential collection using municipal forces. Brief descriptions of the services offered by three of the cities that track residential waste disposal and diversion quantities follow:

- Olathe, Kansas (approximate 2007 population of 96,600) is the only major city in Johnson County, Kansas providing residential solid waste collection using municipal forces. All residential waste is hauled to a city-operated transfer station and then transported to an out-of-District landfill (Hamm Landfill) for disposal. For a base monthly fee, Olathe provides curbside waste collection, bulky waste collection, yard waste collection (for composting at a

city-owned site), and access to its HHW center. Curbside recycling is offered for an additional fee and a city drop-off recycling site is available. Olathe diversion rates (Seyfried, Kent, June 2008) are shown in Table 2-1.

- Platte City, Missouri (approximate 2007 population 4,400) provides municipal residential waste collection. Platte City provides curbside waste collection, bulky waste collection, curbside recycling, and access to the MARC SWMD HHW program for a base monthly fee. A city drop off recycling site is also available. Platte City diversion rates (Anderson, Sharon, May 2008) are shown in Table 2-1.
- Kansas City, Missouri (approximate 2007 population 441,500) provides residential waste collection in the city center using municipal forces and contracts for residential waste pick-up in additional zones of the city. Kansas City provides a base residential collection program through the city's earning tax. This program includes modified pay-as-you-throw curbside pick-up with curbside recycling, bulky waste collection, yard waste pickup in the Spring and Fall, and access to city yard mulching drop-off sites. Residents also have access to the city's HHW facility operated by the Water Services Department. Kansas City diversion rates (SCS Engineers, February 2008) are shown in Table 2-1.

Table 2-1 Selected City Diversion Rates

	Olathe, KS	Platte City. MO	Kansas City, MO
Curbside Recycling	3.4%	7.5%	10.9%
Drop-off Recycling	1.2%	Less Than 1.0%	5.1%
Yard Waste Composting/Mulching			
Measured	16.0%	NR	20.0%
***Adjusted**	NA	20.0%	20.0%
Others (appliances, HHW, e-waste)			
Measured	NR	NR	NR
Total			
Measured	20.7%	7.5%	18.0%
***Adjusted**	20.7%	27.5%	36.0%

* Adjusted for privately contracted or self hauling, on-site management, and Missouri's landfill ban on yard waste.
NR – not reported
NA – not adjusted

Based on the above data and other available data on diversion and characteristics of disposed waste, the overall residential diversion rates for the Missouri and Kansas communities, respectively, were estimated to be 27 percent and 16 percent. A major factor in the higher diversion rate on the Missouri side of the District is the state's ban on landfill disposal of yard waste.

The Johnson County Environmental Department and MARC SWMD commissioned solid waste sorts of Missouri and Kansas residential solid waste arriving at the Johnson County Landfill and the Olathe Transfer Station (Engineering Solutions and Design, Inc., September 2007). Appendix C presents the results of the average composition of residential waste from both Missouri and Kansas sources. The final columns in Appendix C represent a weighted average overall composition of the residential waste stream being disposed of in the District.

2.1.2 Commercial Waste

Typically, commercial establishments contract directly with a private hauler for collection and removal service using front-end loading packer trucks or compactor and open roll-off units. Based on existing information (KDHE, 2007 and landfill tonnage records), disposal of commercial waste is similar to the disposal of residential waste discussed previously. Most commercial waste is disposed of in the three previously identified operating MSW landfills located in the District, while some commercial waste is hauled to transfer stations for subsequent transfer to one of the previously identified regional landfills outside the District.

No municipalities in the District are known to currently track commercial waste disposal and diversion quantities. The overall estimated commercial diversion rate throughout the District is 30 percent based on available information (Johnson County Solid Waste Management Committee, December 2007 and SCS Engineers, February 2008). The predominant recycled materials from the commercial waste stream are paper products and scrap metals. The recycled materials are processed and sold by the Deffenbaugh MRF and other recycling facilities located in the District.

The previously discussed waste sorts at Johnson County, Kansas, facilities included analysis of both Missouri and Kansas commercial solid waste (Engineering Solutions and Design, Inc., September 2007). Appendix D presents the results of the average composition of commercial waste from both Missouri and Kansas sources and a weighted average overall composition of the commercial waste stream disposed of in the District.

2.1.3 C&D Waste

Contractors and private haulers in the District collect and transport C&D waste in a variety of vehicles ranging from pick-up trucks and trailers to 40-cubic yard roll-off containers. C&D waste is disposed of in the previously identified MSW landfills as well as permitted C&D landfills. Nearly all C&D landfills in the District are located in Kansas because the Missouri regulations for C&D waste landfills are more

stringent, approaching the same requirements as for MSW landfills. Landfills in the District that dispose of C&D waste are generally characterized as follows (reported waste receipts are based on landfill tonnage records):

Landfill	Location	Type of Landfill Permit	Reported C&D Waste Receipts (tons/year)
Missouri			
Courtney Ridge	Sugar Creek	MSW	*89,967
Lee's Summit	Lee's Summit	MSW	*15,024
Pink Hill Acres	Blue Springs	C&D	34,659
Kansas			
Johnson County	Shawnee	MSW	**226,389
O'Donnell & Sons	Olathe	C&D	127,407
APAC-Reno	Overland Park	C&D	84,101
Asphalt Sales	Olathe	C&D	42,067
Holland Corp	Olathe	C&D	38,435
City of Olathe	Olathe	C&D	6,813
Larkin Excavating	Easton	C&D	3,779
Miami County	Paola	C&D	2,687
Lansing Correctional	Lansing	C&D	1,501
City of Lenexa	Lenexa	C&D	936
City of Overland Park	Overland Park	C&D	868
		Total	**674,633**

* Estimated C&D waste quantity based on C&D waste being approximately 17 percent of total waste receipts (Midwest Assistance Program, Inc., 1999).
** Actual C&D waste quantity-Johnson County Landfill reports C&D waste separately from other wastes received at the landfill.

The larger C&D landfills shown above generally have estimated remaining lives of 5 to 15 years (Johnson County Solid Waste Management Committee, December 2007).

Diversion of C&D waste in the District has not been quantified. One previous report (Franklin Associates, a Division of ERG, October 2003) suggested that C&D waste diversion in the District was minimal (0.1 percent); however, this analysis considered only building materials diverted during deconstruction and from surplus supplies. Building waste recycling is estimated to remain at a relatively low percentage; however, more diversion is occurring through Kansas City Habitat ReStore's

deconstruction program and on-site recycling programs initiated by several major construction companies in the region. Another previous report (Johnson County Solid Waste Management Committee, December 2007) recognizes that significant amounts of road and bridge demolition material is either recycled to produce new product (especially asphalt) or reused as clean rubble fill (no permitting required in either Missouri or Kansas). Comparing District generation quantities calculated using 2007 population and previously developed per capita generation rates, updated to 2007, for urban/suburban and rural areas (Johnson County Solid Waste Management Committee, December 2007 and Franklin Associates, a Division of ERG, October 2003) to the reported disposal quantities shown above, the C&D waste diversion rate is approximately 23 percent. The diverted material is believed to be composed almost entirely of asphalt, concrete, and other clean rubble.

The Johnson County Environmental Department and MARC SWMD commissioned a vehicle observation program of Kansas and Missouri C&D waste sources carried out at the APAC-Reno C&D Landfill (Engineering Solutions and Design, Inc., September 2007). Based on these observations, the predominant materials in the C&D waste being disposed of in the District are scrap lumber, metals, and cardboard. Other materials observed less often but still with significant frequency include wood pallets, carpet, plastic, shingles, drywall, yard waste, and concrete.

2.2 ESTIMATED QUANTITIES

The previous section showed that total reported annual gate receipts for the District's MSW and C&D landfills were approximately 2,700,000 tons. The 1999 Missouri statewide solid waste composition study (Midwest Assistance Program, Inc., 1999) found that MSW represented approximately 60 percent of the total landfilled waste stream in Missouri. Applying this 60 percent factor to the total landfilled waste results in an estimated MSW annual disposal quantity of approximately 1,620,000 tons in District landfills. The remaining waste disposed of consisted of C&D waste (approximately 675,000 tons annually) and special and industrial wastes (approximately 405,000 tons annually). Special and industrial wastes are not included in the scope of this analysis.

It was also assumed that the relatively small portion of MSW being disposed of in regional landfills outside the District (e.g., transfer of Olathe and Leavenworth County waste to the Hamm Landfill in Kansas and transfer of solid waste from Missouri transfer stations to Central Missouri Landfill and Show-Me Landfill in Missouri) is offset by MSW from outside the District being imported to the District landfills (e.g., transfer of waste from Atchison and Doniphan Counties in northeastern Kansas, which until recently included waste from the City of St. Joseph in northwest Missouri, to Johnson County Landfill). This effect was demonstrated in the previous KDHE waste tracking effort (KDHE, 2007).

Based on this assumption, the gate receipts at District landfills reasonably represent the quantity of waste being disposed of by the District.

The total District MSW disposal stream is broken down into residential and commercial components by city in Missouri and Kansas, respectively, in Appendices A and B. The same appendices show C&D waste disposal by city. The per capita disposal rates shown in Appendices A and B were derived by applying applicable diversion factors for the various cities to per capita residential, commercial, and C&D generation rates from recent studies (Johnson County Solid Waste Committee, December 2007; SCS Engineers, February 2008; and Franklin Associates, a Division of ERG, October 2003). The total status quo District residential and commercial waste disposal quantities were estimated to be approximately 840,000 and 779,000 tons, respectively. The total status quo C&D waste disposal quantity was previously shown to be approximately 674,600 tons per year based on C&D disposal records.

Figure 2-3 shows the total District status quo generation broken down by disposal and diversion, based on the applicable diversion factors developed previously. Figure 2-4 shows the comparison between Missouri and Kansas status quo residential disposal and diversion quantities. The figure shows more diversion in Missouri, which can be attributed to the ban on landfilling yard waste in that state.

Figure 2-3 Status Quo Generation

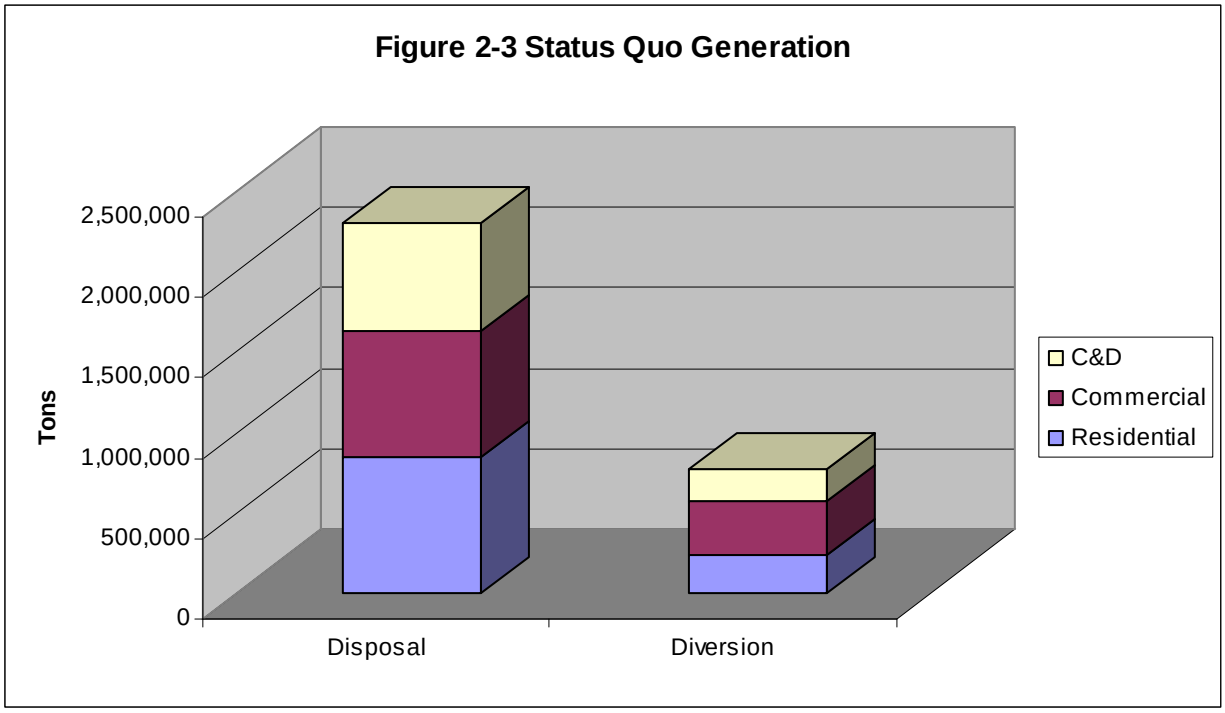
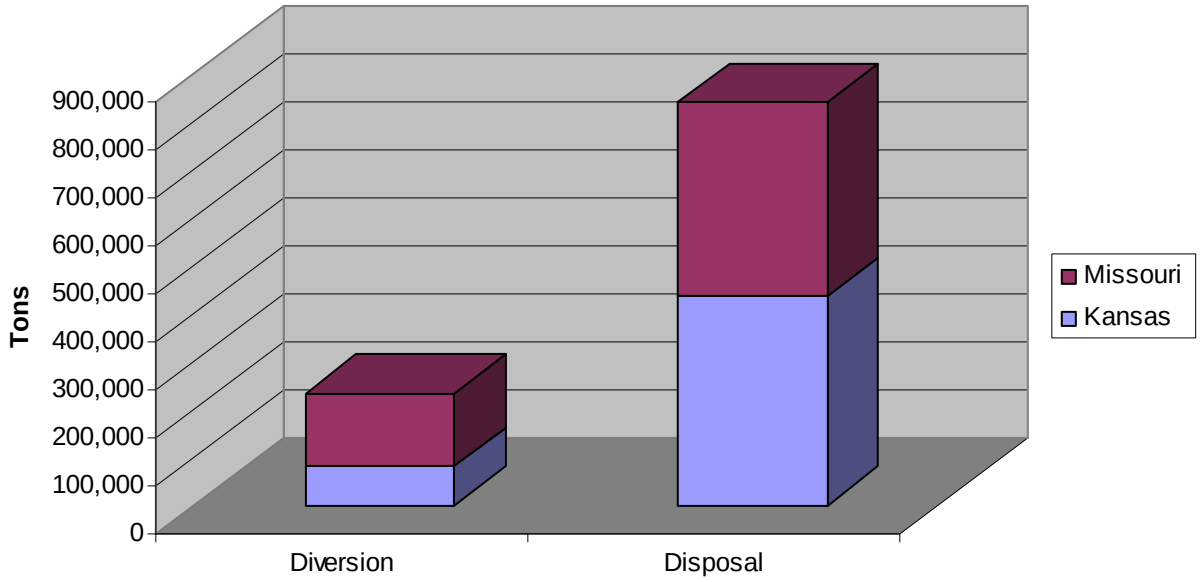


Figure 2-4 Status Quo Residential Diversion Compared to Residential Disposal



2.3 ESTIMATED COSTS

The overall District solid waste (residential, commercial, and C&D waste) management system unit cost for the status quo system was estimated to be $86 per ton. This figure represents the status quo average user cost for managing residential, commercial, and C&D waste, based on estimated quantities and average 2007 user costs for current management programs. The individual management program and overall average costs are shown below:

Program	Estimated Tons	Estimated Cost	Unit Cost
Source Reduction	213,262	$100,000	$0.47/ton
Recycling	439,784	$39,140,776	$89/ton
Composting	113,888	$12,641,568	$111/ton
HHW and e-waste	1,408	$1,465,728	$1,041/ton
Disposal	2,294,007	$211,048,644	$92/ton
Total	3,062,347	$264,396,716	$86/ton

* * * * *

3.0 PROJECTION OF STATUS QUO SOLID WASTE MANAGEMENT

While it is recognized that some changes in the status quo system will be implemented over time, projection of the status quo solid waste management into the future provides a base case for comparison with future more sustainable management practices.

3.1 DESCRIPTIONS OF PROJECTED MANAGEMENT

The projection of current solid waste management practices into the future assumes that the same level of service that is offered today continues throughout the analysis period. The current levels of residential, commercial, and C&D waste source reduction, recycling, composting, disposal, and HHW/e-waste management would continue to characterize the waste management system. The projection assumes the following conditions with respect to landfill disposal:

- Current transfer stations continue to operate at the existing level of service to the District through 2027 while local landfill disposal capacity is available.
- The Lee's Summit Landfill closes between 2014 and 2016 with most waste being diverted to the two remaining District landfills.
- The Johnson County and Courtney Ridge Landfills close in 2027 with subsequent greater use of existing transfer stations or construction of additional transfer station(s) and transfer trucking of the waste stream previously disposed of in District landfills to more distant (assumed 50 miles one way) landfills.
- Current C&D landfills in the region are expanded and/or new landfills are sited such that the regional demand for C&D waste landfill capacity is met by regional landfills.

3.2 PROJECTED ESTIMATED QUANTITIES

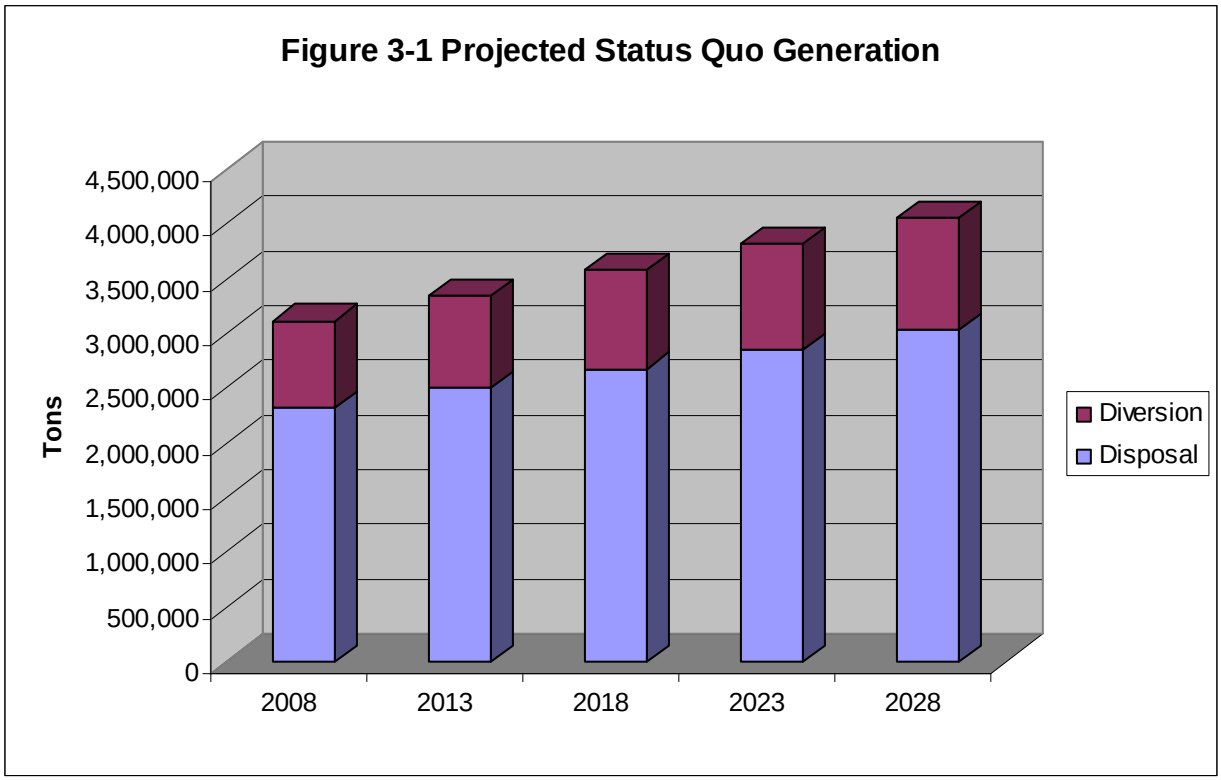
Estimates of total waste generation, disposal, and diversion quantities assuming the status quo waste management system were projected in 5-year intervals through the year 2028. These projections include the following assumptions:

- Population increases per MARC projections (MARC, February 2006);
- MSW (residential and commercial) and C&D per capita generation rate increases of 0.64 percent and 0.42 percent, respectively, annually based on previous projections (Franklin Associates, a Division of ERG, October 2003) for the period 2002 to 2013; and

- No change in management programs or diversion rates.

The projected quantities are summarized in Figure 3-1.

Figure 3-1 Projected Status Quo Generation



3.3 PROJECTED ESTIMATED COSTS

Estimated costs assuming the status quo waste management system were projected in five-year intervals through the year 2028. These projections include the following assumptions:

- Three percent general cost inflation;
- Four percent disposal cost inflation (increased rate due to declining capacity, change to public investor ownership of major landfill, known difficulty with siting new landfill, and case history showing four percent annual increase in user costs from 1998 to 2008); and
- No change in management programs or diversion rates other than increased use of transfer stations and 50-mile one way transport to distant landfills begins in 2027. Increased transfer station use beginning in 2027 was assumed to result in an increase in unit cost of $36.10 (2007 dollars) per ton for transfer station and waste transfer operations.

The projected costs are summarized in Figures 3-2 and 3-3.

Figure 3-2 Projected Status Quo Costs (Total)

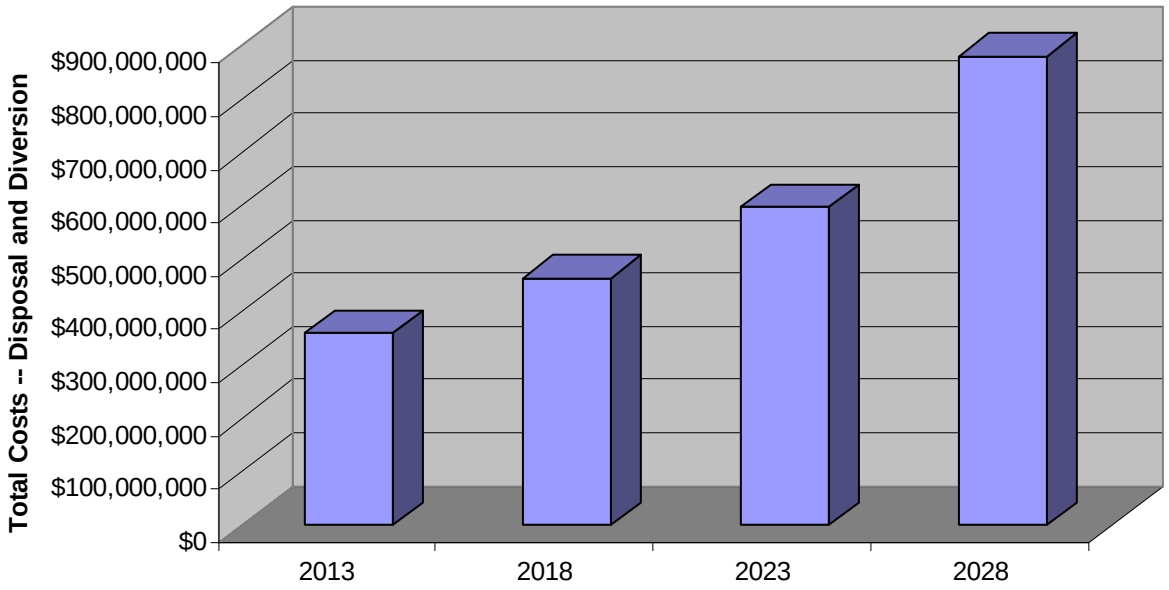
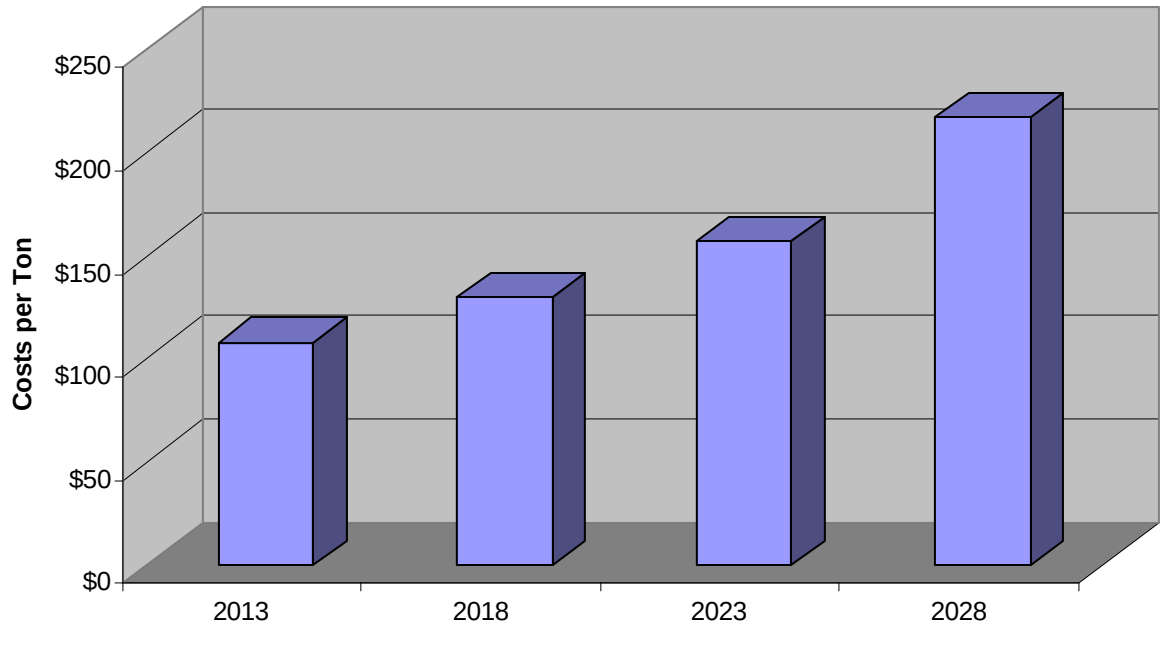


Figure 3-3 Status Quo Costs (per Ton)



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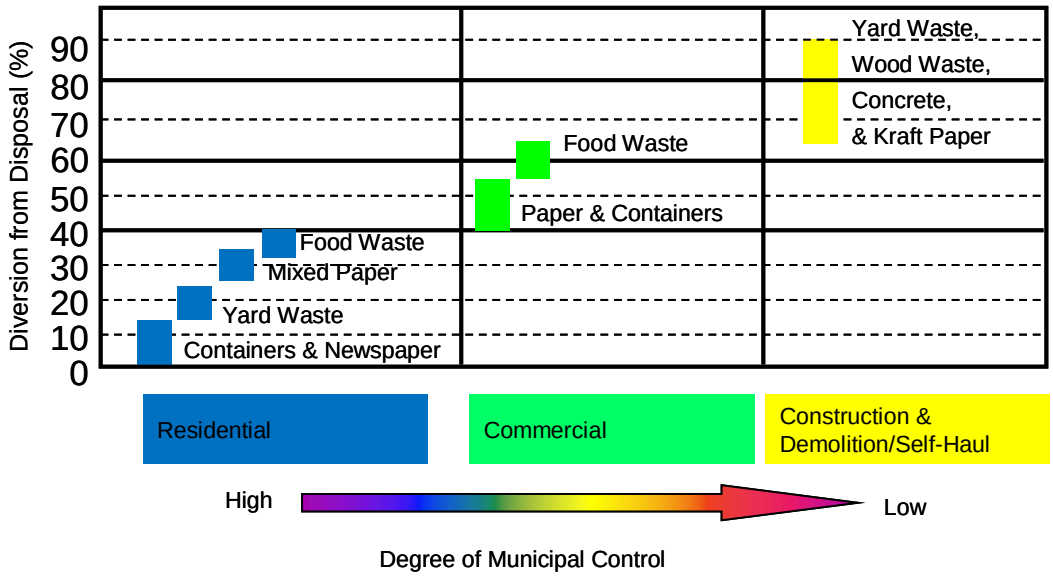
4.0 SUSTAINABLE SOLID WASTE MANAGEMENT PRACTICES

Progressive solid waste management practices need to be implemented throughout the District in order to achieve high levels of solid waste diversion from landfill disposal. The objective of this phase of the work was to develop specific alternative sustainable solid waste management practices that could provide diversion levels of 40 percent, 60 percent, 80 percent, and 90 percent (near zero waste) in the District over a 20-year period. The following activities were undertaken to accomplish this objective:

- Identification and review of successful examples of implementation of sustainable solid waste management practices to achieve higher levels of waste diversion;
- Development of a preliminary array of alternative sustainable solid waste management practices which could be implemented within the District;
- Presentation of the array of practices to a group of District solid waste management professionals on May 21, 2008;
- Preparation of a matrix of alternative practices to achieve the targeted diversion levels over 20 years (in 5-year increments);
- Estimation of the unit costs ($/ton) associated with the matrix of alternative practices; and
- Presentation of the results to a group of District local elected officials on August 25, 2008.

Figure 4-1 presents a generalized overview of an array of progressive sustainable solid waste management practices that have been implemented to achieve high levels of solid waste diversion from landfill disposal.

Figure 4-1 Overview of Practices Achieving High Levels of Diversion



4.1 EXAMPLE COMMUNITIES ACHIEVING HIGHER DIVERSION RATES

The following are examples of communities that have achieved higher levels of waste diversion by adopting sustainable solid waste management practices. General characteristics of these programs include the following:

- Diversion rates increase over time;
- On-going practices are continued and new or revised practices are added over time;
- Local government exercises a degree of control over the solid waste management system through enforcement of requirements on contractors or municipal operation; and
- A wide variety of source reduction, recycling, and composting practices are offered in order to maximize material capture and citizen participation.

San Francisco, California

San Francisco (population approximately 750,000 and referred to as City in this section) recovers approximately 70 percent of its MSW and C&D waste generation using a comprehensive set of programs ranging from waste reduction to materials recovery processing. The City has a short-term goal of 75 percent landfill diversion by 2010 and a longer-term goal of zero waste by 2020. Currently the City generates approximately 2 million tons of solid waste annually.

To achieve its current diversion rate, the City employs approximately 40 diversion programs among the residential, business, and city government sectors. The waste reduction and reuse programs focus on producer responsibility, consumer responsibility, and government leadership and demonstration of surplus exchange.

The City uses the services of a single waste hauler to perform collection, processing, and disposal of materials generated by the residential and commercial sectors. The City offers incentives to the waste hauler to divert materials from landfill disposal. The costs of the solid waste management program are recovered through volume-based waste collection rates. Other private haulers also supply recycling services to the commercial sector of the City.

Recycling collection and drop-off options cover a wide range of material types for residents, businesses, and City government. Programs include source-separated recyclables collection, recycling centers, and C&D debris recycling. The City's composting program includes worm and backyard composting and collection of source-separated organics from residents, businesses, and City government. The City also has enacted ordinances, including food service waste reduction and a plastic bag ban.

Napa, California

The City of Napa, California (population of approximately 80,000 and referred to as City in this section) recovers approximately 55 percent of its MSW and C&D waste generation using a comprehensive set of programs ranging from waste reduction to materials recovery processing.

The City contracts with a single private contractor to collect and process solid waste generated by residences and businesses. The solid waste stream is segregated by residential and commercial customers into three streams: recyclables, compostables, and residue. Residential customers and small businesses are provided wheeled carts for setout of materials.

The costs of the program are recovered through volume-based waste collection rates. Residential customers are provided weekly service and are charged based on the size of their residue containers. Commercial customers are charged based on the size of their containers and frequency of collection. Customers are not charged for the collection of recyclables or compostables. The service contract includes incentives for the contractor to divert materials from landfill disposal and to market the recovered materials at the highest and best use.

The City provides single stream recyclables collection for the residential sector. Commercial businesses are offered commingled collection of recyclables, as well as separate collection of certain streams (e.g., paper and cardboard). The recycling program also includes City government departments and buildings.

Collected recyclable and compostable materials are processed in a facility city-owned Materials Diversion Facility (MDF) operated by the private contractor. Recyclable materials accepted and processed at the City's MDF include:

- Single stream recyclables;
- Source separated grades of paper from commercial businesses;
- Source-separated construction and demolition materials;
- Electronic waste;
- Tires; and
- Bulky goods.

Source separated green waste collected by the City's composting program is processed at the composting facility within the MDF. Additionally, the composting facility accepts source separated green waste and wood waste from the public and small commercial contractors.

The City employs a variety of waste reduction and reuse programs, including the following:

- Public education;
- Waste exchange;
- Bulky goods drop-off coupons;
- Tire drop-off coupons; and
- Backyard composting training.

Much of the current diversion is achieved as a result of the volume-based rates for residue disposal, the provision of recycling services at no additional cost, public education, and the incentives to the contractor.

Madison, Wisconsin

Madison, Wisconsin implemented the first curbside residential recycling program in the United States in 1968. Residential diversion increased from 18 percent to 34 percent in 1989 when the city mandated source-separation of green waste materials for composting. In 1991, the city mandated recycling and provided containers. By 1996, residential diversion was up to 50 percent. In 2006, the city implemented single stream recycling with automated cart collection and by 2007 total residential diversion was 59 percent. Today, recycled materials are collected curbside, along with seasonal curbside collection of yard waste. Drop-off centers accept yard waste, appliances, large items, and e-waste.

4.2 PRELIMINARY ARRAY OF DIVERSION ALTERNATIVES

A preliminary array of diversion alternatives was developed based on programs and practices that have been successfully implemented by communities in other areas of the United States. To achieve very high levels of diversion, CalRecovery developed alternatives for each of the three waste streams evaluated in the study: (1) residential; (2) commercial; and (3) construction and demolition. Seven categories of diversion programs were identified:

- Source reduction;
- Recycling;
- Composting;
- C&D and specific waste materials;

- Public education;
- Policy incentives; and
- Household hazardous wastes (HHW) and e-waste.

Within each of the seven categories of programs, specific programs or practices were identified. For example, within the category of source reduction, the following practices were considered: grasscycling (using a mulching mower and leaving grass on the lawn after mowing), backyard and on-site composting/mulching, business source reduction, procurement, school source reduction, government source reduction, and material exchange/thrift shops. A total of 44 diversion alternatives were presented to the first District stakeholder group on May 21 for discussion and ranking. The presentation included a discussion of the practices (including their track record and standing in the EPA hierarchy for solid waste management), approaches used in other communities, and evaluation criteria. CalRecovery presented thermal conversion technologies, including commercially proven combustion with energy recovery and emerging technologies such as plasma arc and pyrolysis. A copy of the handout distributed to the participants is provided in Appendix E.

Stakeholders rated the 44 diversion alternatives by priority with 1 being highest and 5 being lowest. If the group wanted to continue a program currently in place, it was given a higher rating. The rating detail by group and the overall ranking for each program are presented in Appendix F, and a summary of the results is in Table 4-1.

The group consensus was that the highest priority should be given to source reduction activities, residential and commercial recycling, recovery of high-volume C&D waste materials, public education, economic incentives and ordinances, education and collection programs for HHW and e-waste.

The only alternative that was excluded from consideration was curbside collection of household hazardous waste. Sludge recycling and rendering were also rated very low in priority.

Table 4-1 Overview of Ranking of Alternatives by Stakeholders

	High Priority	Medium Priority	Low Priority	Excluded
Source Reduction	Grasscycling Source reduction Procurement	Backyard/on-site composting Material exchange, thrift shops		
Recycling	Curbside/on-site collection Residential drop-off School and government recycling Special collections	Commercial self-haul	Residential buy-back	
Composting		Residential curbside collection/ self-haul of green waste Commercial self-haul of green waste Food waste composting School/government composting	Commercial on-site collection of green waste	
Special Waste Materials (includes C&D waste)	C&D concrete/asphalt/ rubble Tires Wood waste	White goods Shingles	Scrap metal Sludge Rendering	
Public Education	Electronic/Print Schools Outreach			
Policy Incentives	Economic incentives Ordinances	Product and landfill bans		
Household Hazardous Wastes and e-waste	Drop-off Mobile/periodic collection Education e-waste	Waste exchange		Curbside collection

During the meeting, stakeholders discussed the following evaluation criteria:

Evaluation Criteria	Comments from Stakeholders
Agreement with EPA hierarchy for solid waste management	Desire highest and best use for materials, maximizing use of resources. Waste-to-energy could be a consideration for processing residuals, but only interested in using energy recovery for materials that would otherwise be landfilled. Fully support the EPA hierarchy.
Importance of track record	Track record important, but willing to consider new technologies.
High levels of diversion in spite of potentially higher costs	Cost is definitely a consideration.
Acceptability of combustion or thermal processing	Should consider conversion technologies. Commitment to look at waste-to-energy recovery as a potential long-term strategy, in keeping with the national goal to diversify energy sources.
Economic incentives (volume-based rates)	Incentives are important. There is a substantial amount of room for improvement in residential recycling.

Based on this input, the stakeholders agreed that energy conversion technologies would be considered only for wastes that cannot be otherwise reused, recycled, or composted.

4.3 PROGRAM STRATEGIES

4.3.1 Selection Methodology

The next phase of the analysis involved the development of diversion strategies to reach four targeted levels of diversion: 40 percent, 60 percent, 80 percent, and 90 percent (near zero waste). Based on current practices, a near zero waste target was established to include 80 percent diversion using conventional technologies and an additional 10 percent diverted from landfill disposal using emerging diversion or conversion technologies. The planning horizon for the study was 20 years (2008 to 2028). The following targets were identified:

Year	Diversion Target
2013	40%
2018	60%
2023	80%
2028	90% (near zero waste)

The following characteristics served as the basis for the development of the strategies:

- Stakeholder ranking (from May 21 meeting)
- Diversion impact
- Proven track record (see example community descriptions in Section 4.1)
- Ease of implementation
- Cost of implementation

4.3.2 Overview of Selected Diversion Strategies

Descriptions of the strategies selected to reach the targeted diversion levels are presented in Table 4-2. Note that five of the seven categories of programs that were rated by District stakeholders are included in Table 4-2. The other two program categories, Public Education and Policy Incentives, are included within the five program categories developed in Table 4-2.

The implementation schedule for the strategies assumes that previously implemented practices are not only continued into the future but are improved over time through expansion of materials handled or increases in participation. Further, the schedule incorporates the concept of periodic increases in the number of practices with the goal of continually increasing material coverage and program participation. For example, San Francisco has implemented over 40 practices to reach its current level of 70 percent diversion.

A wide diversity of residential recycling and composting activities exists in the various communities comprising the District (See Section 2.1.1). Consequently, some of the practices identified for implementation in the first target period, for example, may already be in place in some communities. It is not the intent of the strategy to delineate the schedule that each community should follow in practice implementation, but rather to provide implementation benchmarks for each 5-year period.

The estimated costs and outlines of policy/implementation issues for the various diversion program scenarios are based on CalRecovery's experience in evaluating, planning, designing, and implementing these types of programs in various communities in the United States. In particular, the company has performed such work in San Francisco which achieved 50 percent waste diversion from landfills almost ten years ago, is now diverting between 60 percent and 70 percent, and is targeting and implementing programs to reach diversion levels of 75 percent or more.

Table 4-2 Overview of Strategies to Reach Targeted Diversion Levels*

Program Category	40% Diversion (2013)	60% Diversion (2018)	80% Diversion (2023)	Near Zero Waste (2028) (90% Diversion)
Source Reduction	• Public education program to encourage grasscycling, business, school and government source reduction, business procurement	• Increased public education to encourage grasscycling, source reduction, procurement • Promotion of reuse facilities (e.g., thrift shops)	• Expansion of existing activities • Implementation of backyard composting program	
Recycling	• Curbside/on-site collection of recyclables from urban residential and commercial customers • On-site collection of recyclables from schools and government facilities • Recycling of bulky goods collected from urban residential customers • Expansion of rural drop-off facilities	• Transition to volume-based rates • Expansion of on-site collection of recyclables from schools and government facilities	• Expansion of existing activities • Increase in capacity/materials at drop-off facilities for rural customers • Increased recycling of bulky goods collected from urban residential customers	• Implementation of emerging technology(ies)
Composting	• Curbside/on-site collection of yard waste from urban residential and commercial customers • Implementation of on-site collection of yard waste from schools and government facilities	• Transition to volume-based rates • Expansion of on-site collection of yard waste from schools and government facilities	• Expansion of existing activities • Increase in drop-off facilities for rural customers • Implementation of food waste collection and composting	
Special Wastes (Tires, White Goods, C&D)	• Promotion of existing programs, including tire and wood waste recycling	• Implementation of incentive program for C&D materials; expansion of types of materials targeted, including white goods and shingles	• Collection of special wastes from residential and commercial customers • Expansion of incentive program for C&D materials	
Household Hazardous Waste and E-Waste	• Increased public education regarding HHW • Expansion of e-waste activities			

*Table presents information on program implementation/expansion. Unless indicated, assumes that existing program will continue.

The intent of the cost analysis is to provide a global view of the anticipated total costs of District solid waste management, including implementation of the recommended practices, over time. More detailed cost analyses will be needed to fully implement programs or practices. Estimates of the costs for implementation of the four diversion scenarios include:

- Program costs, including annualized capital costs as well as annual operating costs;
- Program revenues, resulting from the sale of recovered materials; and
- Disposal costs for quantities of waste not recovered, based on disposal cost projections ($/ton) described in Section 3.3.

The general basis of the financial analysis for the present study is cost data that CalRecovery has developed for diversion programs, e.g., material recovery facilities, collection of single stream recyclables, public education, etc. To estimate the overall costs of diversion programs presented in this report, CalRecovery adjusted financial data to reflect the local marketplace and conditions. Adjustments to the basic financial parameters were based on local costs of labor, waste collection, and waste disposal and on market prices of recyclable materials. In addition, CalRecovery used cost information related to District solid waste collection and disposal that is reported in Section 3.3. Thus, the summary costs used in the financial analysis of this report are site-specific and represent the overall average cost for solid waste collection, diversion, and disposal for each District scenario.

Costs are presented on a unit cost basis (i.e., $/ton of waste generated) to allow easy comparison with the projected status quo costs. The unit costs represent net costs, i.e., costs minus revenues, but will be referred to here simply as "costs." In reviewing the costs, it is important to keep the following in mind:

- Costs represent the District-wide average for each of the diversion strategies. Due to the wide variations among the communities (e.g., contractual arrangements with hauler, relative proportion of residential, commercial, and C&D waste streams; and proximity to processing capacity and to landfill disposal), the unit costs will vary by community;
- Costs assume District-wide implementation of programs. District-wide implementation allows for economies of scale and system design benefits that would not be realized otherwise. Such benefits would include, for example, larger regional processing facilities rather than smaller local processing facilities and joint public education activities. Costs could vary substantially if programs are not implemented District-wide;
- Costs for each diversion scenario assume implementation of all of the programs within the diversion scenario. Because there are certain levels of integration and synergy among the programs, if only some programs within the diversion scenario are selected for

implementation, it could have an impact on the cost and effectiveness of other programs within the scenario; and

- Costs and revenues were escalated over the 20-year planning period using the same escalation rates used in the projection of the status quo system (see Section 3).

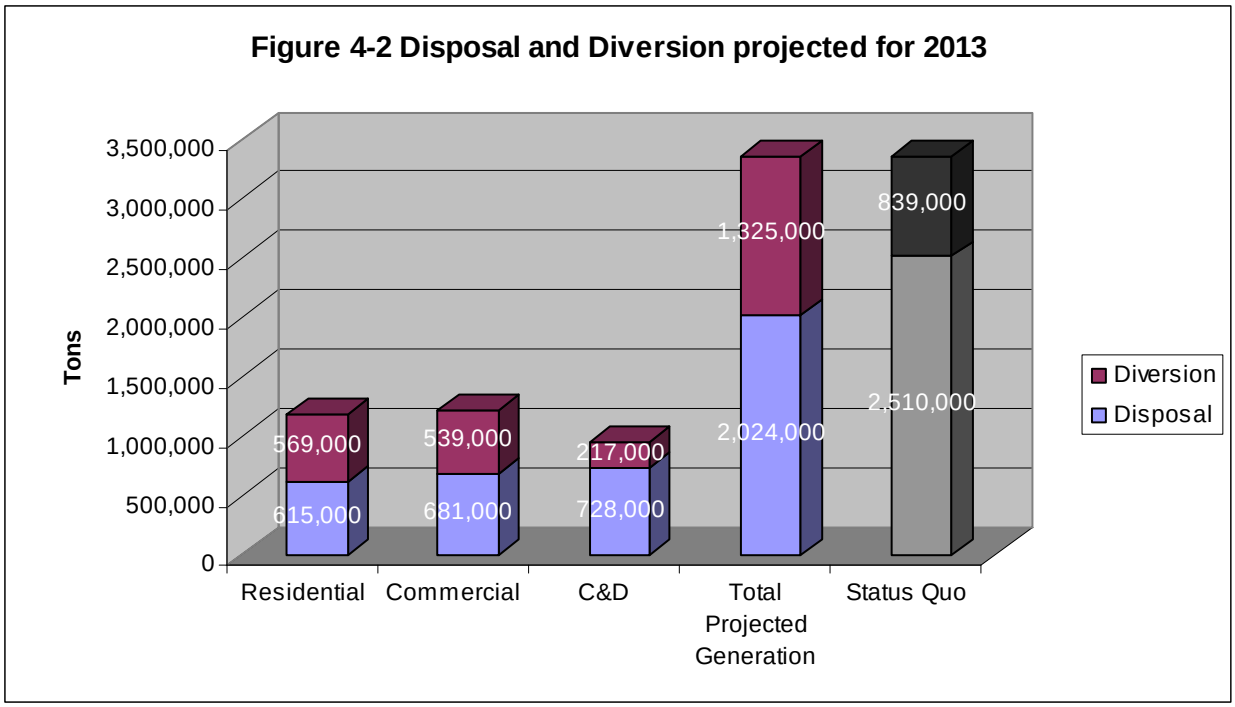
Estimated costs of each scenario are compared with estimated costs associated with future projections of the status quo system in the individual scenario discussions below.

4.3.3 40% Diversion Scenario (2013)

The primary focus during the first 5-year period is on the promotion of source reduction activities and the implementation of collection programs for recyclables and green waste throughout the District. The specific practices included are shown under the column headed "40% Diversion (2013)" in Table 4-2.

The estimated quantities of materials that could be diverted or disposed of by District-wide implementation of these programs are compared with similar quantities for the projection of the status quo to 2013 in Figure 4-2. A more detailed breakdown of the quantities associated with the 40% Diversion Scenario (2013) can be found in Appendix G.

Figure 4-2 Disposal and Diversion projected for 2013



Estimated costs of this scenario are compared with similar costs for the projection of the status quo to 2013 in Figure 4-3. The overall system costs for the 40% Diversion Scenario are estimated to be about 5 percent higher than the status quo.

Figure 4-3 Projected Status Quo Costs compared to Sustainable Program Costs for 2013

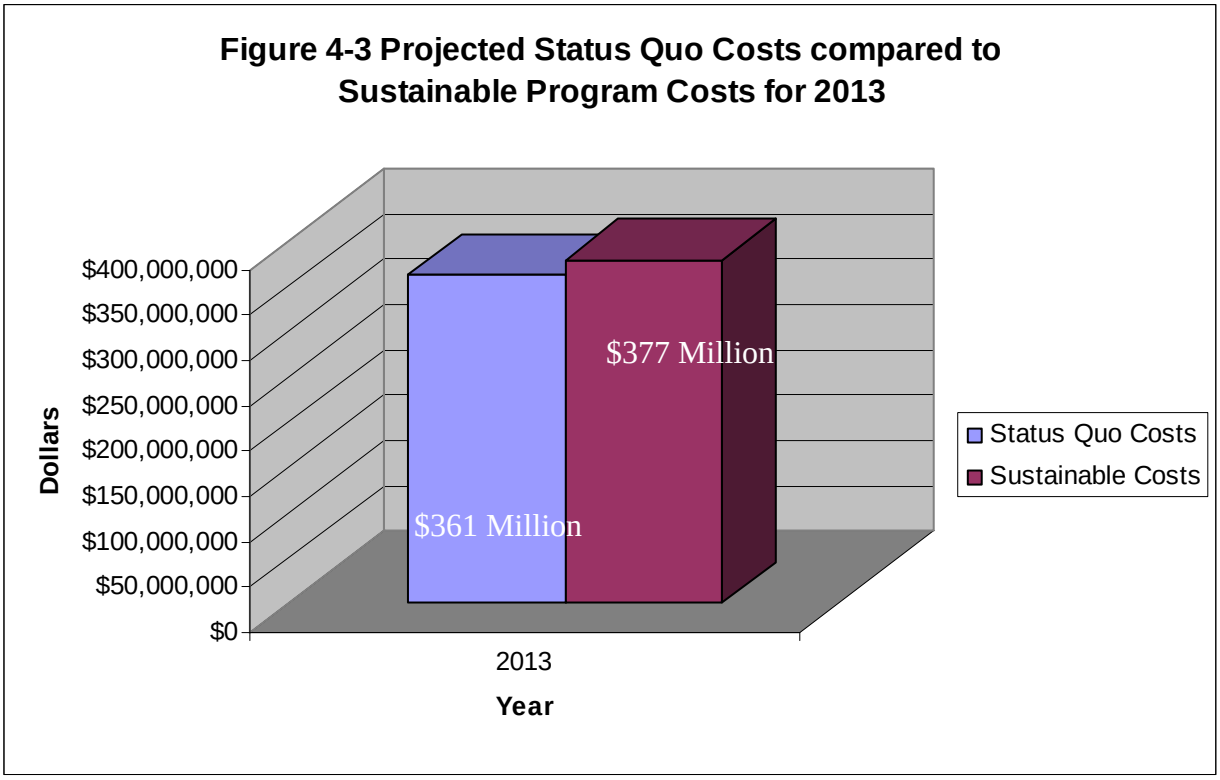


Table 4-3 identifies major policy/implementation issues specific to the major programs recommended for implementation in the 40% Diversion Scenario (2013).

Table 4-3 Policy/Implementation Issues – 40% Diversion Scenario (2013)

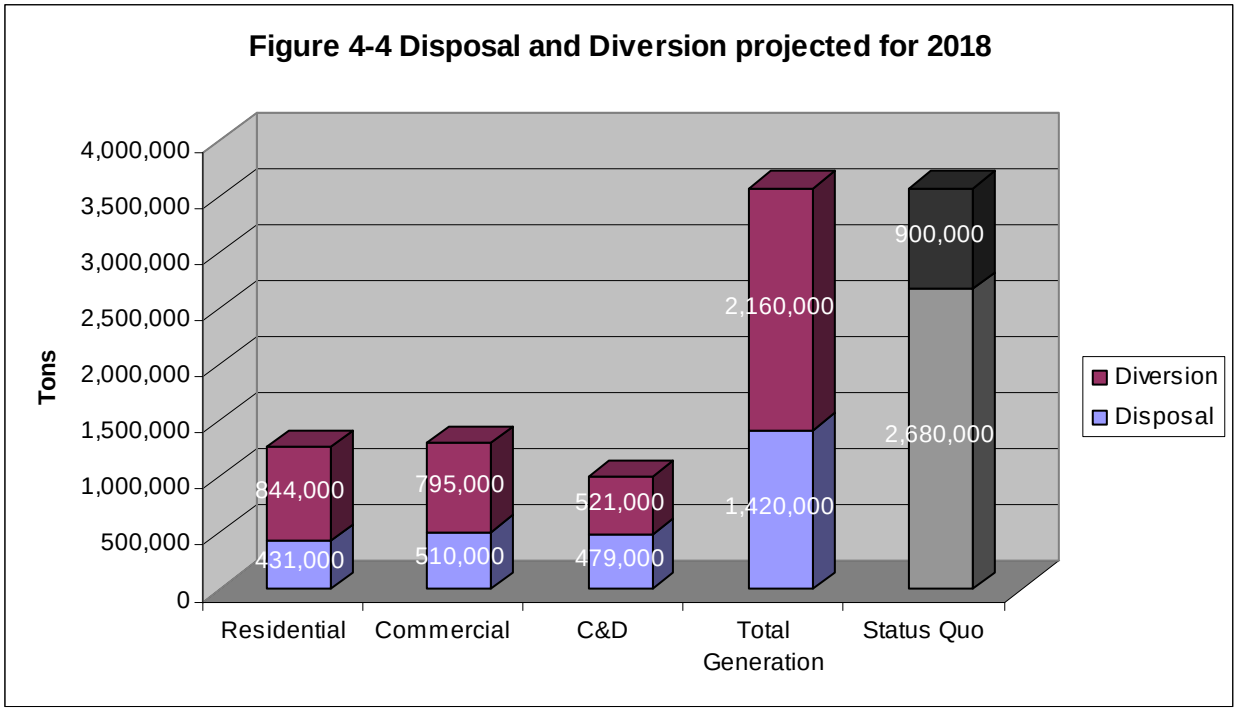
Description of Major New/Revised Practices to be Implemented	Public education to encourage source reduction and curbside/on-site collection of recyclables and green waste in urban areas – residential, commercial, schools, government.
Policy Decisions	District and cities to adopt scenario goals and slightly increased costs; Implement appropriate curbside/on-site collection for all waste generators; and Implement public education campaign, planned at District level and adopted locally.
Implementation Considerations	Cooperation of private haulers; Conformance with applicable laws (e.g., Hancock and Kansas City, Missouri, earnings tax; franchise notice); Capacity of existing and proposed processing facilities; and Definition of target audience for public education.
Implementation Activities Note: Examples of activities that likely would need to be	<u>Recyclables and Green Waste Collection</u> Assess local contractual arrangements with current hauler(s) – contract termination date, ability of City to direct collection

undertaken. Will vary by community. Not intended to be all-inclusive.	system; Determine if procurement for collection services is needed, perform required legal activities, and conduct solicitation if needed; Enter into negotiations and implement collection system modification; Determine need for additional processing capacity, decide on method for securing capacity, conduct solicitation if needed; and Enter into negotiations/implement additional processing capacity. <u>Collect Data for Volume-Based Rates</u> Assess current cost recovery mechanism(s) for solid waste services and modifications needed (e.g., to hauler contracts, to property assessments); Compile data on current customers (size of containers, number of containers, collection frequency) and quantities of recyclables, green waste, and trash; and Project the number, size, and type of containers and the collection frequency for the volume-based rate program, taking into consideration migration to smaller sizes of trash containers. <u>Public Education Program</u> Assess current education practice and identify areas for improvement/expansion; Develop strategy including, for each target audience, theme, specific message(s), and method(s); Establish monitoring system for evaluating public education; and Implement public education modifications.
Implementation Schedule Note: some activities may be undertaken simultaneously	<u>Recyclables and Green Waste Collection</u> 2-3 years to assess, provide notice, and solicit modified collection services (if needed); and 1-3 years to implement collection services and additional processing capacity. <u>Public Education Program</u> 1-2 years to assess, design, and implement public education.

4.3.4 60% Diversion Scenario (2018)

The focus during the second 5-year period is to expand participation and types of materials collected in the programs previously put in place for the 40% Diversion Scenario (2013). The major new initiatives for this period include adoption of volume-based rates for all residential and commercial waste collection and initial establishment of incentive programs for C&D waste recycling. The specific practices included are shown under the column headed "60% Diversion (2018)" in Table 4-2.

The estimated quantities of materials that could be diverted or disposed of by implementation of these programs are compared with similar quantities for the projection of the status quo to 2018 in Figure 4-4. A more detailed breakdown of the quantities associated with the 60% Diversion Scenario (2018) can be found in Appendix G.



Estimated costs of this scenario are compared with similar costs for the projection of the status quo to 2018 in Figure 4-5. The overall system costs for the 60% Diversion Scenario are estimated to be about 3 percent higher than the projected 2018 cost of the status quo system.

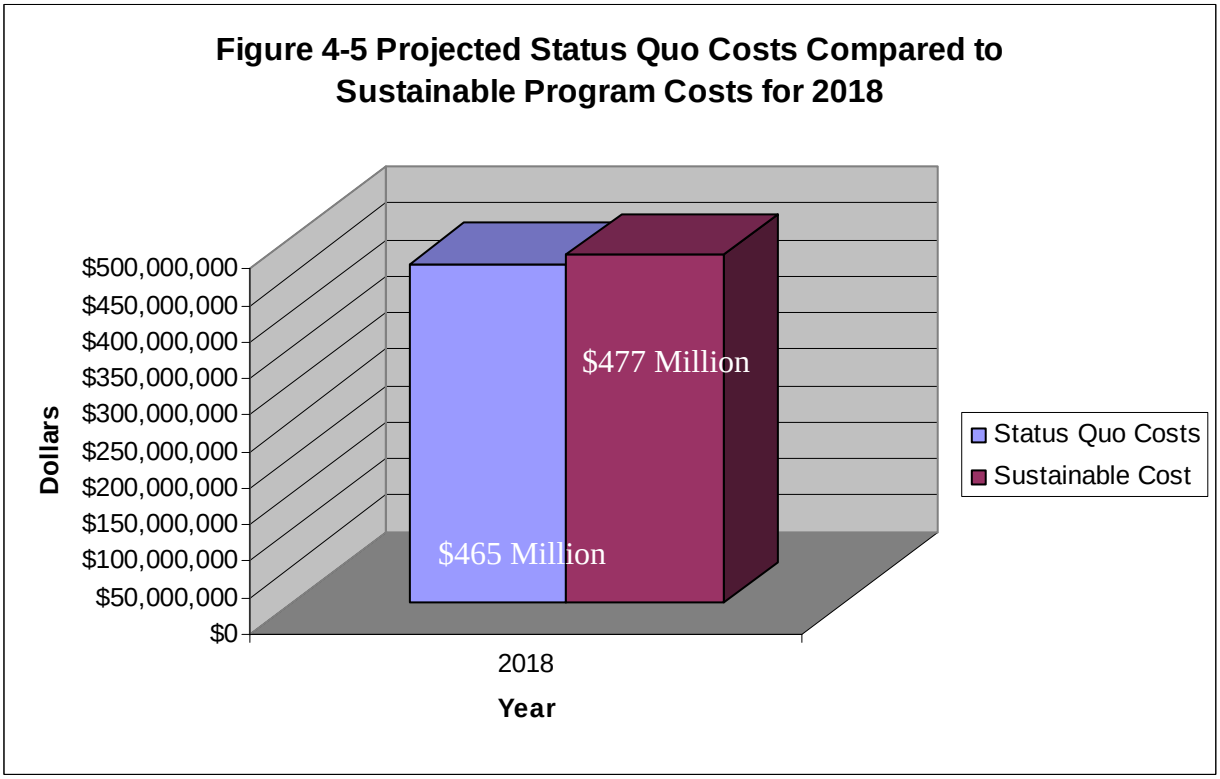


Table 4-4 identifies major policy/implementation issues specific to the 60% Diversion Scenario (2018).

Table 4-4 Policy/Implementation Issues – 60% Diversion Scenario (2018)

Description of Major New/Revised Practices to be Implemented	Transition to volume-based rates for all waste generators and implementation of incentive programs to encourage C&D waste recycling.
Policy Decisions	District and cities adopt scenario goals and slightly increased costs; Implementing volume-based rates requires commitment by cities to evaluate rates and make changes based on limited information; MARC SWMD or other District entity funds up-front study of C&D quantities and practices.
Implementation Considerations	Quality of data available from implementation of the 40% Diversion Scenario; Volume-based rate structure design to ensure that fees for disposal collection cover costs of recycling and/or composting diversion services; Start up of new practice (C&D recycling incentives) with little previous District experience or expertise; and Capacity of existing and proposed processing facilities.
Implementation Activities Note: Examples of activities that likely would need to be undertaken. Will vary by community. Not intended to be all-inclusive.	<u>Volume-Based Rates</u> Determine the optimum cost recovery method for the volume-based rate structure (e.g., direct billing to customers); Design rate structure to ensure cost recovery; Publicize the program, and send out notices to customers for selection of container size; Order additional carts if needed; and Implement modifications to billing system as needed. <u>C&D Recycling Incentives</u> Compile data on C&D activities – types of projects, size of projects in terms of square footage and value, sector (residential/commercial), quantities of C&D waste generated; Evaluate capacity of existing processing facilities and options for expansion; Determine mechanisms to incentivize C&D recycling (e.g., C&D ordinance, building permit rebate, reduced hauling rates for recyclables, LEED construction rebates, etc.); Conduct stakeholder meetings with C&D contractors, real estate development companies, etc.; Design incentive mechanisms based on characteristics of local C&D projects; Certify processing facilities (if needed under selected program); and Notify contractors about program and conduct facility monitoring visits as necessary.

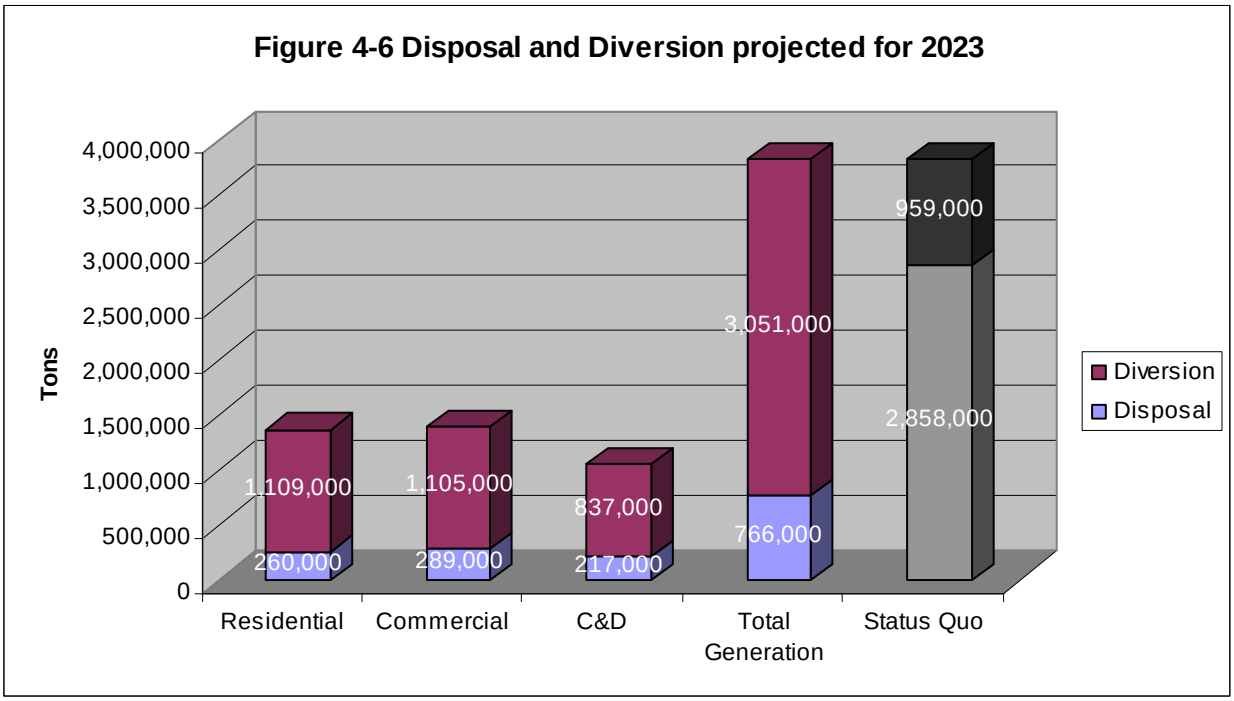
Implementation Schedule	Volume-Based Rates 6 months to 2 years for planning and data collection (depending on availability of data and extent of changes required) and 6 months for implementation. C&D Recycling Incentives 1-2 years (or longer) depending on availability of data, type of incentive mechanism selected, and availability of processing capacity.

4.3.5 80% Diversion Scenario (2023)

The primary focus during the third 5-year period is further expansion of programs implemented during the previous two periods to achieve maximum feasible recovery, as well as the implementation of food waste collection and composting and backyard composting of green waste. Programs implemented during the previous periods continue and in some cases recovery rates are assumed to increase as a result of on-going promotion and increased awareness of the importance of recycling. The specific practices included are shown under the column headed "80% Diversion (2023)" in Table 4-2.

The estimated quantities of materials that could be diverted or disposed of by implementation of these practices are compared with similar quantities for the projection of the status quo to 2023 in Figure 4-6. A more detailed breakdown of the quantities associated with the 80% Diversion Scenario (2023) can be found in Appendix G.

Figure 4-6 Disposal and Diversion projected for 2023



Estimated costs of this scenario are compared with similar costs for the projection of the status quo to 2023 in Figure 4-7. The overall system costs for the 80% Diversion Scenario are estimated to be slightly lower than the projected 2023 cost of the status quo system.

Figure 4-7 Projected Status Quo Costs Compared to Sustainable Program Costs for 2023

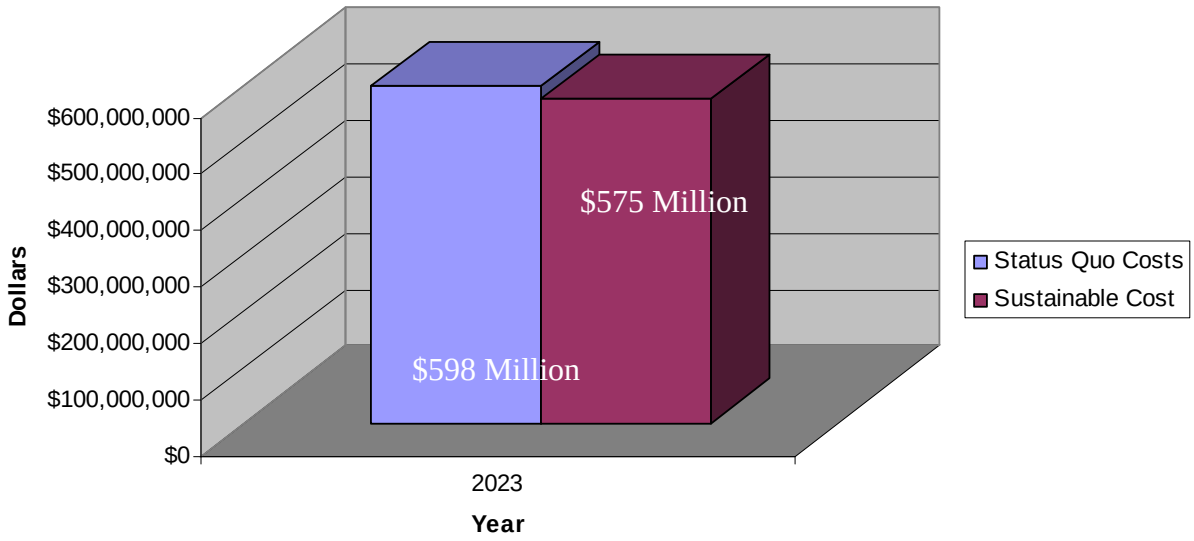


Table 4-5 identifies major policy/implementation issues specific to the 80% Diversion Scenario (2023).

Table 4-5 Policy/Implementation Issues – 80% Diversion Scenario (2023)

Description of Major New/Revised Practices to be Implemented	Food waste collection and composting and backyard composting of green waste.
Policy Decisions	Local communities adopt scenario goals; Implement promotion of backyard composting resulting in a relatively small increase in diversion; and MARC SWMD or other District entity funds up-front study of food waste quantities and characteristics.
Implementation Considerations	Design of food waste collection system that controls nuisances; Availability of food waste processing capacity; Capable personnel to provide backyard composting training; and Establish systems to effectively monitor and track backyard composting practices.

Implementation Activities Note: Examples of activities that likely would need to be undertaken. Will vary by community. Not intended to be all-inclusive.	Food Waste Composting Use national and regional available data to estimate quantities and characteristics of food waste disposed of in the residential and commercial waste streams; Evaluate capacity of existing composting facilities to process food waste without creating nuisances (e.g., odor, vectors); Modify or expand composting capacity as needed; Design system for storage of food waste on-site and for collection of food waste such that nuisances are controlled (systems for residential and commercial customers will likely vary); and Promote the program and provide containers as needed. Backyard Composting of Green Waste Identify areas where backyard composting should be targeted; Determine scope of the program (e.g., training workshops only, distribution of compost bins, etc.); Estimate the program cost (education and training) and allocate across the avoided tonnage; Identify personnel to conduct training and train them, if necessary; and Promote practice, schedule workshops, and distribute bins if applicable.
Implementation Schedule Note: some activities may be undertaken simultaneously	Food Waste Composting 6 months to 1 year for data collection and evaluation of facility capacity; 6 months to 1 year for design of system; 6 months to 2 years (or longer) for modifications or expansion to composting system if needed (longer time assumes need for permit revisions); 6 months to 1 year for implementation. Backyard Composting 6 to 12 months to plan program and receive compost bins.

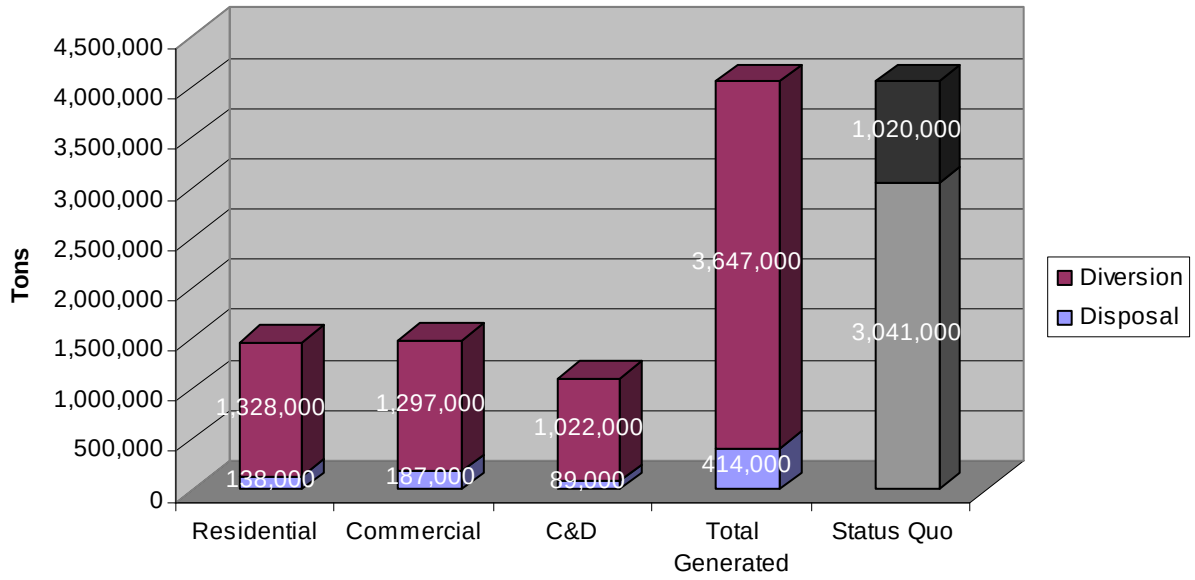
4.3.6 Near Zero Waste (90% Diversion) Scenario (2028)

Programs implemented during the previous periods would be continued and recovery rates for previously developed programs would remain relatively constant at the high rates associated with a focused, mature program promoting diversion. The focus during the final 5-year period of the 20-year program is on the implementation of one or more emerging diversion or conversion technologies, to recover additional quantities of materials that are not easily recovered through previously demonstrated recycling programs. Zero waste is an approach to resource planning that strives for closed loop utilization of resources, maximizing source reduction and recycling diversion. As such it has a strong preference for emerging source reduction and recycling diversion programs, but this plan is expanded to include conversion technologies as well to approach 90 percent diversion.

In this period emerging diversion technologies, currently untested will be the initial focus for increased diversion. Emerging conversion technologies which may include larger scale applications of known technologies such as plasma arc, pyrolysis, thermal gasification as well as currently unknown technologies will be considered only following exhaustion of diversion technology options. Finally, materials which are rejects or otherwise non-recoverable with respect to the emerging technologies will be landfilled.

The estimated quantities of materials that could be diverted or disposed of by implementation of an emerging technology in addition to all previously implemented practices are compared with similar quantities for the projection of the status quo to 2028 in Figure 4-8. A more detailed breakdown of the quantities associated with the Near Zero Waste (90% Diversion) Scenario (2028) can be found in Appendix G.

Figure 4-8 Disposal and Diversion projected for 2028



Estimated costs of this scenario are compared with similar costs for the projection of the status quo to 2028 in Figure 4-9. The overall system costs for the Near Zero Waste (90% Diversion) Scenario are estimated to be approximately 9 percent less than the projected 2028 cost of the status quo system. Two major factors contribute to the dramatic difference between sustainable program costs versus projected status quo system costs beginning in 2028. Firstly, the status quo projection assumes that most of the District waste will have to be hauled to transfer stations and then transferred to more distant regional landfills beginning in 2027 when essentially all of the existing capacity District landfills will no longer be available. Secondly, the emerging technology assumed to be implemented in 2028 is only processing approximately 10 percent of the District's waste generation. Therefore, although emerging technology is

estimated to be very expensive on a unit price ($/ton) basis, the high rate of diversion achieved prior to adoption of emerging technology results in a more moderate increase in overall system cost.

Figure 4-9 Projected Status Quo Costs Compared to Sustainable Program Costs for 2028

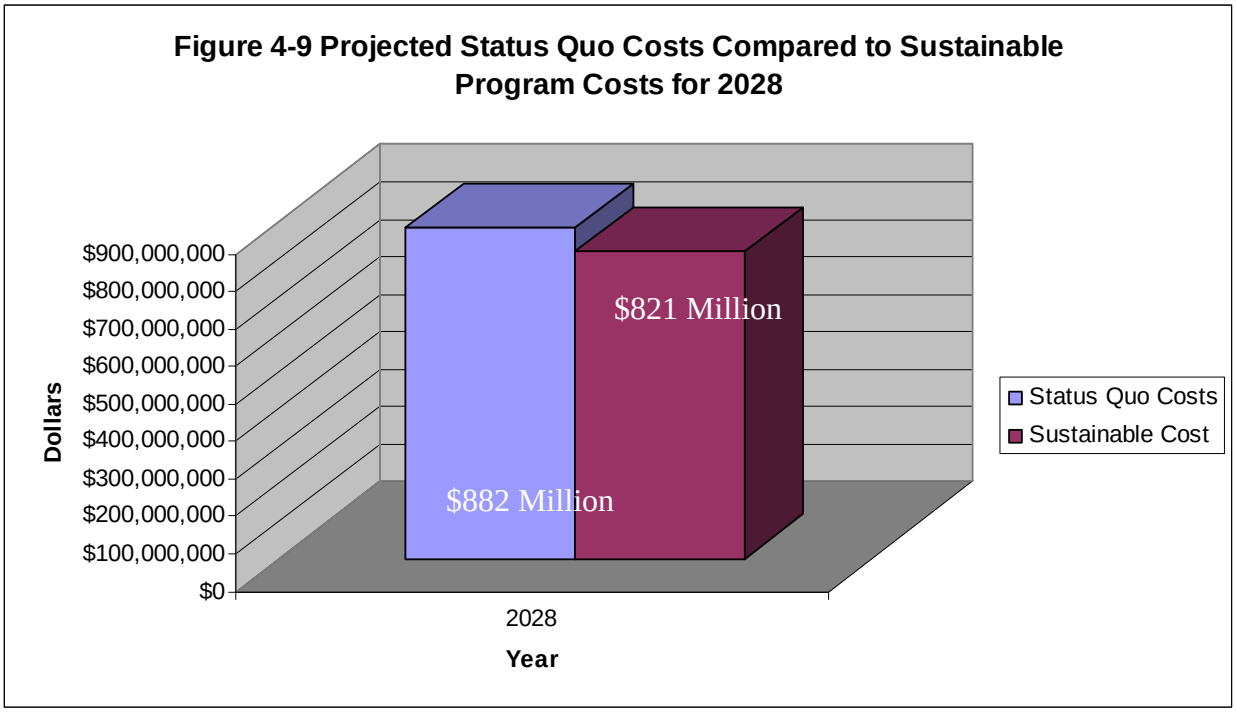


Table 4-6 discusses the major policy/implementation issues specific to the Near Zero Waste (90% Diversion) Scenario (2028).

Table 4-6 Policy/Implementation Issues – Near Zero Waste (90% Diversion) Scenario (2028)

Description of Major New/Revised Practices to be Implemented	Utilization of emerging technology (with priority to emerging diversion technology) to maximize diversion of difficult-to-recycle materials.
Policy Decisions	MARC SWMD and local communities adopt scenario goals at high unit ($/ton) costs.
Implementation Considerations	Quantity and characteristics of disposed waste and Facility technology, procurement method, financing, ownership, and operation.
Implementation Activities Note: Examples of activities that likely would need to be undertaken. Will vary by community. Not intended to be all-inclusive.	Analyze disposed waste quantities and characteristics; Identify best markets for facility products and by-products; Prepare procurement documents seeking conversion of waste to most marketable products; and Enter into discussions and negotiate facility construction and operation.
Implementation Schedule	1-2 years for development of procurement documents and 2-3 years for implementation.

4.3.7 District Stakeholder Review of Scenarios

A second meeting of District stakeholders (elected officials) was held on August 25, 2008. The purpose of the meeting was to present the results of the analysis of existing programs and diversion scenarios. A copy of the handout to participants is included in Appendix H.

The first part of the presentation at the meeting was a summary of the status quo (including collection methods, availability of diversion programs, and diversion rates), a discussion of the methodology used in the 20-year projections, and the estimated costs associated with projecting the status quo solid waste management system into the future.

The second part of the presentation involved a discussion of the analysis of the proposed sustainable alternatives. The results of the first stakeholders meeting were presented, as well as the impacts of projected diversion, ease of implementation, cost of implementation, and technology record on alternative selection. The proposed program scenarios to reach 40 percent, 60 percent, 80 percent, and 90 percent diversion (near zero waste) levels were presented; issues related to implementation of the programs were discussed; and costs were presented. Projected costs of the diversion programs were also compared to estimated costs of projections of the status quo system.

During the meeting, there was much discussion among the stakeholders. It was stressed that the programs presented were to be considered as an overall regional approach, realizing that different communities were at different stages in the process. Based on discussions during the meeting, stakeholders were satisfied with the results of the analysis and the approach to sustainable waste management and increasing diversion.

4.4 SUMMARY COSTS AND BENEFITS OF IMPLEMENTING SUSTAINABLE PRACTICE SCENARIOS

Summary costs of the sustainable practice scenarios are presented in Table 4-7. As shown in the table, the costs associated with the diversion programs increase over time, while the costs for disposal decrease. In 2013, disposal represents 62 percent of the total cost, while by 2028, disposal represents only 13 percent of the total cost. This reduction in relative disposal cost (as a result of reduced quantities requiring disposal) is very important for overall future solid waste management costs. Implementation of these four sustainable practice scenarios will result in significant reduced investment and operation costs necessary to manage residual waste. By 2025, when existing landfill capacity is projected to be nearly depleted, the alternatives for managing residual waste appear to be transfer to more distant landfills (as assumed in the status quo projections), development of a local District landfill, or an emerging technology

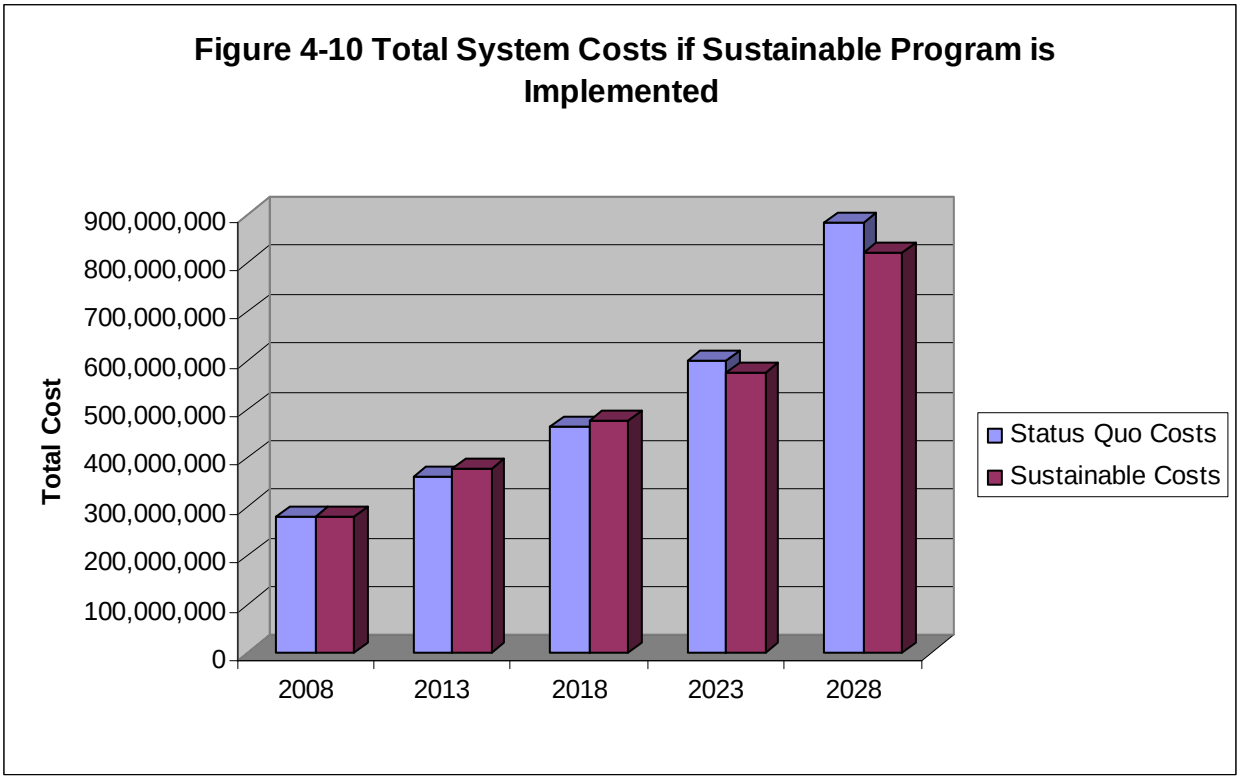
Table 4-7 Projected Costs* of Diversion Scenarios

Year (Diversion Goal)	Diversion Cost (M$/yr)	Disposal Cost (M$/yr)	Total Cost (M$/yr)	Unit Cost ($/ton)
2013 (40%)	141.7	235.5	377.2	113
2018 (60%)	275.6	201.1	476.8	133
2023 (80%)	443.6	131.7	575.3	151
2028 (Near Zero Waste) (90%)	717.8	103.1	820.8	202

*Escalated

to recover waste from energy. The costs associated with whichever alternative is chosen are dramatically reduced because of the lower disposal quantities resulting from the full implementation of the sustainable diversion practices. This cost reduction is evident when comparing the projected costs of the status quo system to the costs of implementing the diversion scenarios. Figure 4-10 shows that projected costs are approximately 9 percent lower by 2028. While Figure 4-10 does show that the sustainable practices are marginally more expensive (less than 5 percent in 2013 and 3% in 2018) over the next approximately 10 years, the case histories of successful higher diversion programs indicate that a minimum of 10 to 15 years of sustainable program operation are required in order to achieve the higher levels of diversion. Therefore, the long-term economic benefits resulting from higher diversion levels will most

Figure 4-10 Total System Costs if Sustainable Program is Implemented



likely be available to the District at the time of highly escalating disposal costs if the District begins to focus on implementing sustainable practices in the near future.

Additional benefits, other than direct solid waste management system reduced costs, will result from the implementation of the sustainable practice program. These benefits can be generally classified as job creation, improvement in overall environmental quality, and resource conservation. The following are specific examples of these benefits:

- Fewer vehicles would be needed to collect waste due to a combination of decreases in waste generation and increases in collection efficiency as a result of better-organized collection of recyclables, yard waste, and mixed solid waste. Fewer vehicles result in less engine exhaust emissions and, therefore, better air quality in the District;
- Recycling of post-consumer materials creates jobs and other multiplier economic benefits for the community. Large regional recycling programs generate sufficient recovered materials to attract industries that construct and operate manufacturing facilities near the location of materials generation;
- Reduction in the generation of waste at the source conserves natural resources, both in terms of conservation of materials and of energy;
- Support of the vision for America's Green Region, as originally proposed and endorsed by seven regional organizations including local governments and civic, business, and planning groups. Every program in support of this vision will serve to encourage the community to adopt additional environmental improvement opportunities. For example, implementing the sustainable practices identified in this report could be an impetus for instituting more efficient and environmentally friendly solid waste collection systems fueled by domestically plentiful or renewable fuels, in particular methane-based fuels such as natural gas or biogas; and
- Use of compost to support local food production and improve the fertility of marginal soils. The benefits of incorporating compost into poor or marginal soils also include improved water retention capacity, weed suppression, and lower rate of evaporation of irrigation water.

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5.0 CONCLUSIONS AND RECOMMENDATIONS

The status quo solid waste management system within the District utilizes a variety of collection and removal operations ranging from providing the service using municipal forces to near total release of municipal control and reliance on informal contracts between private haulers and individual residents and businesses. A range of material recycling and yard waste composting programs diverting MSW from landfill disposal also are currently in place. The net effect of the status quo system for MSW and C&D waste in the District is a modest level of waste diversion, but the District still relies on landfill disposal for an estimated 75 percent of waste generated.

This report shows that alternative sustainable solid waste practices are available to significantly reduce reliance on landfill disposal in the District and meet the following criteria:

- Resulted in significant diversion when implemented in other locations;
- Designated priority options for implementation by District stakeholders;
- Cost effective when compared with projections of the status quo system into the future;
- Create employment opportunities;
- Improve overall environmental quality; and
- Conserve resources.

The following recommendations identify near-term activities and decisions that will maximize the benefits associated with an emphasis on sustainable solid waste management throughout the nine-county District:

- MARC SWMD adoption of the sustainable program scenario goals;
- MARC SWMD preparation of a guideline strategy document to define alternative methods for District communities to modify existing solid waste management operations or implement revised operations that will provide curbside/on-site collection of recyclables and green waste to all residences and businesses, including means for collection of appropriate data after the modified or revised operations have begun. While it is recognized that some of the larger communities may decide to develop their own unique strategy, the availability of a general guideline will provide a tool for smaller communities to implement strategies generally applicable throughout the District without having to expend funds for additional evaluations and analyses.

- MARC SWMD implements an outreach program using printed media, electronic media, broadcast media, presentations, strategy meetings, etc. promoting the following decisions by all (or nearly all) District cities and towns:
    - Adoption of the scenario goals of the sustainable program by a date to be established and
    - Commitment to implement by 2013 solid waste management operations that provide curbside/on-site collection of recyclables and green waste to all local residences and businesses.

  This activity is probably the most important in the implementation of the entire sustainability program. All of the remaining scenarios are based on and built up from achieving the 2013 scenario goal of District-wide (or nearly District-wide) availability of curbside/on-site collection of recyclables and green waste for residences and businesses.
- Upon substantial achievement of local community commitment to the sustainable practices program, MARC SWMD continues its public education outreach program to emphasize the benefits of the sustainable practices program to individuals and groups throughout the District.

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