



Michigan Recycling Measurement Project:
Annual Collection and Diversion of Municipal Solid Waste

Michigan Recycling Coalition
Prepared By Cara Clore
MRC Program Manager
December 1, 2001

Annual Collection and Diversion of Municipal Solid Waste in Michigan

Summary

The results of the Michigan Recycling Measurement Study illustrate the need for a proactive approach to fostering recycling programs, businesses and markets in the State. With a total population in Michigan of 9,938,444 in 1999, and a total of 772 curbside and dropoff programs serving an estimated 3,670,072 and 5,471,053 residents respectively, Michiganders are clearly underserved.

Municipalities, townships and villages provide for the majority of programs. These local units operate and/or manage a total of 493 programs. County agencies operate and/or manage a total of 150 programs, while governmental authorities, private businesses, and non-profits are responsible for 46, 40 and 21 respectively. A total of 225 curbside and 92 dropoff programs accept residential yard waste; this provides services to 2,915, 210 (30% of the population) and 4,302,810 (43% of the population) Michiganders respectively. Michigan has a total of 163 compost sites and 49 material recovery facilities.

A need for more investment in recycling is supported by MRC's estimation that in 1999, the State achieved a MSW recycling rate of 20%. This results in a per capita recycling rate of 1.4 pounds of MSW recycled by each Michigan resident, each day. Or a total of 2,509,567 tons of MSW handled for recycling, with breakouts by the following broad categories of materials:

- ◆ Glass: 167,447 Tons
- ◆ Metals: 869,837 Tons
- ◆ Organics: 739,904 Tons
- ◆ Paper: 712,526 Tons
- ◆ Plastics: 40,624Tons
- ◆ Other: 19,908 Tons

With a 20% recycling rate, Michigan is behind the average of 26% for Great Lake States, as reported by BioCycle in their 13th annual nationwide survey, examining disposal, incineration, recycling, composting, and wood recovery activities.

Introduction

This report presents information from the Michigan Recycling Measurement Project (MRMP), conducted by the Michigan Recycling Coalition (MRC) from October 2000 thru April 2001. Included in this report is the first comprehensive overview of the State's residential recycling programs, and data on the total volumes and types of municipal solid waste (MSW) recycled through those programs in 1999. The MRMP also collected information to assess the economic impacts recycling activities have on Michigan's economy. Those results are reported in a separate document published on the MRC website titled, *Michigan Recycling Measurement Project: The Economic Impact of Recycling*.

This report was preliminarily published in May 2001 and was reviewed by a group of recycling professionals last summer. This report differs from the earlier published version as a result of recommendations made by this peer review group. A change in the projected recycling rate, from 16% to 20%, results from:

- Changes made to the denominator of the recycling rate equation; modifications to the amount of Type II waste disposed in 1999 to accurately reflect Michigan MSW only.
- Calculation of a recycling rate based on the mean disposal rate of several States in the Midwest.

The review group also suggested that MRC calculate a per capita recycling rate. These three methods provide a consistent approach to evaluate MSW recycling activities, which can be systematically replicated in future years to further understand MSW recycling trends in Michigan.

Recycling data is collected around the country for a variety of reasons; information can be used to track progress towards recycling goals, to identify trends in recycling that could impact local, state, or regional planning, to assist with recyclable materials market development efforts, and more. It is important to note that many States collecting recycling data do so for benchmarking purposes. Taking an annual or bi-annual "snap-shot" of recycling activities, and comparing these pictures over time, provides a useful tool to measure progress towards achieving State diversion goals. In many states, these diversion or recycling goals, play a strong role as part of a broader policy to effectively manage solid waste.

Michigan's Solid Waste Policy was last updated in 1988. The Policy lists the following goals to be met by 2005: incineration 40%, recycling 25%, composting 10%, source reduction 10%, landfilling 10%, and reuse 5%. Michigan legislators mandated that the Michigan Department of Environmental Quality's Waste Management Division (DEQ-WMD) develop a plan to collect recycling data in 1996. However, without funding to support a data collection program, very little came of the 1996 mandate. Currently, DEQ-WMD is unable to conduct annual measurements, which would provide an indication of how well Michigan is meeting goals set out in the 1988 policy.

Members of the MRC, representing the spectrum of recycling industries in Michigan, began meeting in mid 1997 to discuss ways to address the need for recycling data. Participants included representatives from large collection, processing and brokering firms, private consulting firms, and state and local government agencies. The committee concluded that the first course of action was to conduct a solid waste characterization study, to determine the types of materials currently disposed into landfills and incinerators, and so potentially available for recycling.

However, with an estimated cost of more than \$600,000, the group narrowed its focus to the collection of information about the types and quantities of materials currently recycled in the State. To this end, the MRC submitted a grant proposal, and was awarded funding from US EPA Region 5 to conduct the Project.

With a main goal to address the need for information about the environmental and economic impacts of the industries activities, the Recycling Measurement Project sought to accomplish three main objectives:

- To develop an inventory of the State's residential recycling programs, and to gather information about the businesses that move materials collected from these programs to points of processing, and marketing for end-use.
- To collect data on the types and volumes of municipal solid waste diverted from disposal through programs in order to calculate a recycling rate, and
- To collect financial and employment information from recycling processors to demonstrate the significant contributions the industry makes to Michigan's economy.

To gather the information needed to meet the Project objectives, MRC conducted several surveys of recycling professionals. A study of residential recycling programs was accomplished by interviewing county, local, private and non-profit program planners and coordinators for information. Two separate surveys collected data on the types and quantities of materials handled by processors and brokers during calendar years 1998 and 1999. Additionally, financial information was gathered from processors and brokers on the amount of revenues and employment generated annually by their firms.

EPA funding necessitated the use of a standardized method developed for calculating recycling rates. This method focuses on materials recycled from the MSW waste stream only. This narrowed focus allows for more uniform comparisons of recycling rates among states and local communities. MSW is defined as residential, commercial, and institutional waste, as well as industrial administrative and packaging waste. Not included is the recycling of materials resulting from industrial and manufacturing processes, such as construction and demolition debris and biosolids. Data was collected on the recycling of these wastes but it has not been included in this report. MRC understands that the recycling of industrial process wastes may represent the majority of materials (in terms of volume) diverted from disposal through recycling in the state. Although the measurement of industrial waste recycling was beyond the scope of the Project's time and resources, MRC hopes to be able to facilitate the collection of information on industrial recycling in the future.

The MRMP represents an important first step towards strengthening recycling programs and businesses. However, accurate recycling data will become more significant over time, as consistent measures are taken to allow for a deeper examination of activities and trends. Furthermore, it is crucial that Michigan have an up to date and relevant solid waste and recycling policy, to guide the interpretation and design of further data collection efforts.

Disclaimer

The Michigan Recycling Measurement Project is a first attempt to comprehensively gather data on the State's recycling activities. As such, several significant challenges existed which should be mentioned.

Challenge: Developing relationships with survey recipients to gain participation and the ability of recipients to provide quality data. Personal contacts were made to all of the survey recipients to gain participation in the study, to educate on the potential benefits of reporting, and to assure the confidentiality and integrity of MRC as a collection agency for those supplying proprietary information. Each recipient was contacted by phone, and also by fax, a minimum of three times each. Prioritizing time to personally connect with all recipients significantly contributed to the high participation rate in the surveys. More than 47% of all survey recipients provided the necessary information to report the recycling volume data, and greater than 80% for recycling program information. However, future efforts must be made to educate stakeholders on the benefits of reporting recycling data and to develop personal relationships with recyclers in order to gain participation in data collection studies.

Recyclers vary significantly in their ability to provide quality data on the materials they handle for recycling. Some entities have invested in the technology and staff necessary to quickly produce reliable reports on the volumes and types of materials collected, processed or brokered. Some do not have the resources (in terms of staff and technology) to track materials, or are simply unwilling, and do not see the benefit in tracking business activities. Still other stakeholders track activities on paper, through sales, by manifest number, or other means that make it difficult to supply information on the types and quantities of materials handled in a reasonable amount of time, without undue effort. Additionally, those entities that had the means to provide information still had a difficult time reporting to the degree of detail needed to properly execute the study.

Challenge: Developing basic information about recycling programs and businesses. In order to effectively conduct a study to determine the impacts of the industry on the State's environment and economy, it is necessary to have an understanding of the following:

1. What entities comprise the industry? These entities include waste haulers providing recycling services, recycling processors and brokers preparing materials for sale to markets, manufacturers utilizing recycled feedstock in production processes, retail and corporate wholesale distribution and reclamation centers that sell materials directly to markets, institutions like universities and secondary schools with recycling programs, and others.
2. Where do recycling programs and businesses exist, and how do they function? Furthermore, where are stakeholders located, what material streams are accepted for collection, processing and end use, and how are programs managed and operated?
3. How do materials move from points of collection to processing and marketing?

These types of basic information did not exist in a comprehensive manner prior to the start of the MRMP. The MRC was able develop much of this information by working with

Coalition members and other recycling professionals, trade associations, and through a survey of local and county governments. However, without information with which to compare findings, it is difficult to determine if survey recipients accurately represented the entire industry.

Challenge: Working with limited funding, and resources relevant to the recycling industry. Many states conducting recycling measurement and related studies have funding dollars budgeted to do so. The MRC, however, was limited in funding, and as a result had to make the most of the information currently available. For instance, to determine the amount of municipal solid waste generated in Michigan –the denominator of the recycling rate equation - it was necessary to modify data received from the DEQ-WMD Landfill reports on the origin of solid wastes disposed into Michigan landfills. Modification was needed as landfills do not detail the origin of wastes to the degree of specificity required by the EPA method. DEQ-WMD requires landfills to track waste disposal by origin, but not type. In general, wastes are deemed to be Type II or Type III, depending on which type of landfill receives the wastes:

- Type II Waste, which includes commercial, residential, institutional, industrial administrative, packaging and non-toxic process waste streams, and
- Type III General, Mixed and Segregated wastes, which includes toxic industrial process/manufacturing wastes.

MRC achieved a survey participation rate for the two recycling data collections of more than 47%. However, it was difficult to extrapolate the data to reflect activities of the entire industry due to a lack of specific data on the size of the industry and its various sectors. Information of this sort can be found for other industries such as mining, or automobile manufacture, arranged by Standard Industrial Code (SIC) or North American Industrial Classification System (NAICS) categories. If information of this type had been available, MRC could have developed very specific multipliers based on the percentage of the industry's activities covered in participant's responses. However, without data on the overall size of the industry, and the make up of various segments, the extrapolation method is not as precise.

Collection & Processing of Municipal Solid Wastes

A survey of Michigan's residential recycling programs was conducted in the summer of 2000. The primary goal of the effort was to learn how MSW recyclables are moved from points of collection to processing and end-use, and to identify the key players that manage materials along the way. The information gained from the survey provided a necessary foundation from which to build a measurement program specifically suited to Michigan's residential recycling framework. In particular, the survey provided MRC with knowledge of the processors and brokers handling the majority of MSW recycled in the State. This information is the key to accurately designing a recycling measurement program to determine the percentage of MSW recycled annually. In addition to aiding in the calculation of the State's recycling rate, the survey enabled the MRC to develop the first inventory and database of information on Michigan's residential recycling programs.

The survey was carried out in two stages. An initial questionnaire was sent to more than 100 individuals responsible for county solid waste planning and/or county resource recovery program coordinators. Recipients were asked to provide location and contact information for all collection programs operating within the county they represented. Using the contacts gained

through this initial survey, MRC distributed a second questionnaire to approximately 450 people, to gather specific information about the nature of existing programs. Individuals representing local, county, private, and non-profit programs were asked to provide a variety of information, including:

- **Recycling Collection method**, i.e. curbside, dropoff, special collections, etc.
- **Collection frequency**, i.e. weekly, monthly, seasonally, annually, etc.
- **Program funding**, i.e. general funds, landfill tipping fees, user fees, annual tax assessments, etc.
- **Broad categories and specific grades of MSW collected**, i.e. paper: newspaper, corrugated card board, plastic: hdpe & pet, organics: yard waste, brush, etc.
- **Program management and operation responsibility**, i.e. local contract with private hauler, locally managed and operated, local contract with hauler to transport materials to publicly owned mrf, etc.
- **Processing destinations of materials collected through programs**, including names of contractors collecting and transporting materials, and those of the businesses that that process, broker or put materials to end-use.

The information in this section represents an overview of that which was collected in the two surveys described above. To facilitate reporting, the State has been divided into nine regions. The regions and corresponding counties contained within are illustrated in the table below. This report will illustrate regional totals only. Detailed program information for specific areas of the State is available by contacting the MRC.

Table 1: Michigan's Recycling Regions	
REGION	COUNTIES
<i>DOWNRIVER & SE MI</i>	Hillsdale, Jackson, Lenawee, Livingston, Monroe, Washtenaw
<i>METRO DETROIT</i>	Macomb, Oakland, Wayne
<i>MID-MI</i>	Clare, Clinton, Eaton, Ingham, Ionia, Isabella, Mecosta, Montcalm, Osceola, Roscommon, Shiawassee
<i>NORTHERN LOWER MI</i>	Antrim, Benzie, Charlevoix, Cheboygan, Crawford, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, Montmorency, Otsego, Presque Isle, Wexford
<i>SOUTHWEST MI</i>	Allegan, Barry, Berrien, Branch, Calhoun, Cass, Kalamazoo, St. Joseph, Van Buren
<i>SUNRISE SIDE</i>	Alcona, Alpena, Arenac, Bay, Gladwin, Iosco, Midland, Ogemaw, Oscoda, Saginaw
<i>THUMB</i>	Genessee, Huron, Lapeer, Sanilac, St. Clair, Tuscola
<i>WEST COAST</i>	Kent, Lake, Mason, Muskegon, Newago, Oceana, Ottawa
<i>UPPER PENNINSULA</i>	Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, Schoolcraft

Curbside & Dropoff Collection Programs

A total of 303 communities manage and/or operate 347 curbside programs for approximately 3,670,072 of Michigan's residents. Likewise, 377 communities and private businesses manage and/or operate 425 dropoff collection programs that serve approximately 5,471,053 residents (Michigan Department of Management and Budget, Michigan Information Center, 2000 Census.) In many instances, individuals have access to a combination of services, which may include:

- Curbside and dropoff collection of recyclables and/or yard waste,
- Dropoff recyclables and curbside yard waste collection,
- Curbside yard waste and dropoff recyclables collection,
- Dropoff or curbside collection of recyclables or yard waste only.

Table 2 on the following page illustrates regional populations with access to curbside and dropoff recycling services. It also indicates where material recovery facilities, typically responsible for processing materials collected through programs, are located regionally throughout the State. MRC estimates that as much as one-half of the State's residents do not have access to any recycling services, with the exception of those who may be able to individually subscribe to curbside collection through a private waste hauler. However, curbside subscription services tend to be available in more populated regions of the State, where communities already have recycling programs in place. Residents with access to dropoff sites tend to be under serviced, with an average of 23,385 people to each dropoff station in the State. Additionally, in as many as 40 counties, less than a dozen communities manage or operate sites for their residents, yet the entire county's population has been included as having access to a dropoff program. This is because private companies operate one or two sites in each county, which are open to all residents for a nominal fee, or free of charge.

The map illustrations, located on pages 9 and 10, detail the level of access each county of the State has to curbside and dropoff programs, respectively. The curbside map indicates:

- In 30 counties residents do not have curbside recycling service,
- In 19 counties, between 1 to 20% of the population has service,
- In 11 counties, between 20.1 to 40% of the population has service,
- In 13 counties, between 40.1 to 60% of the population has service,
- In 8 counties, between 60.1 to 80% of the population has service, and
- In 2 counties, between 80.1 to 100% of the population has service

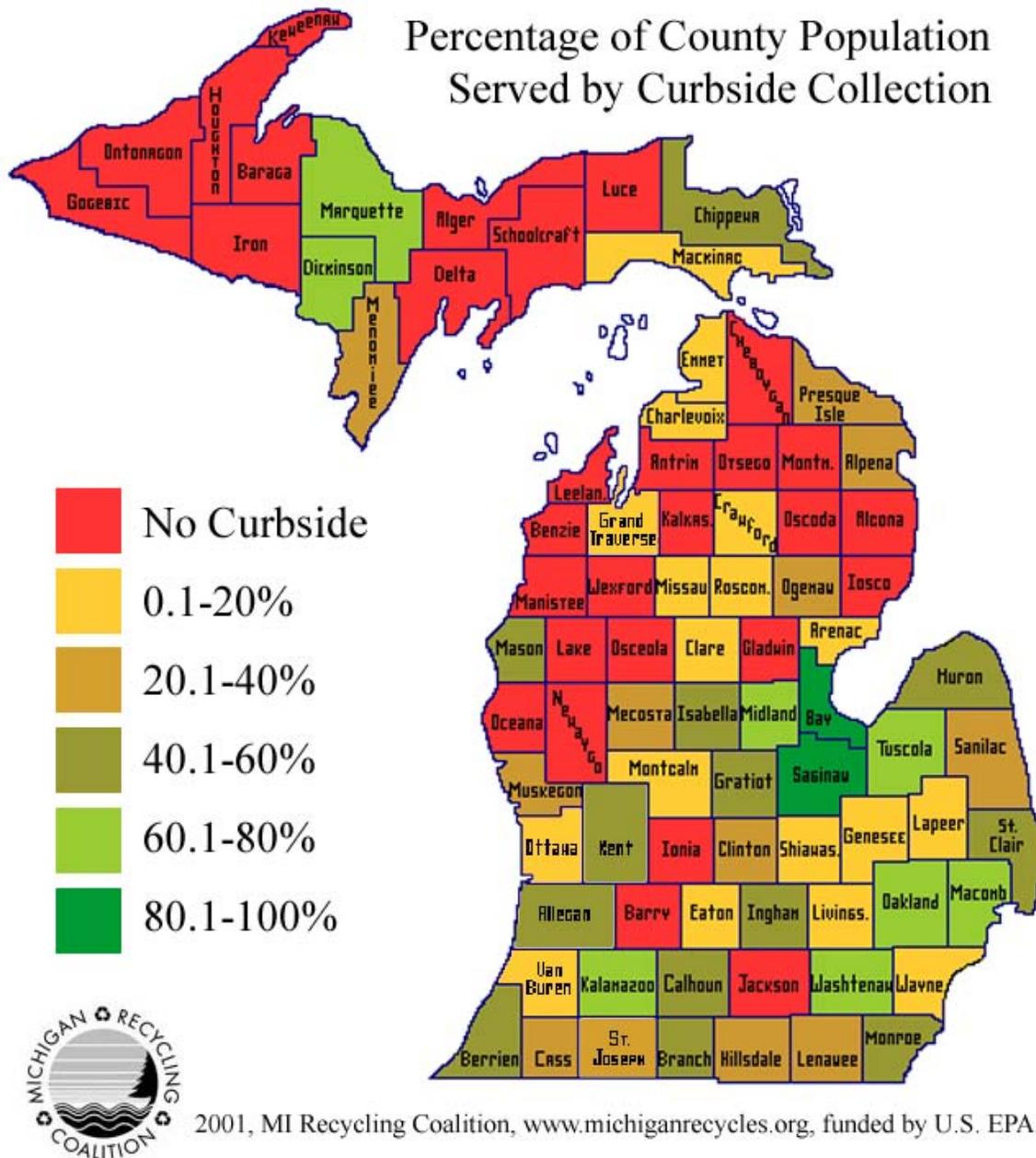
The dropoff map indicates:

- 18 counties have 0 dropoff sites,
- 31 counties have between 1 and 4 dropoff sites,
- 14 counties have between 5 and 8 dropoff sites,
- 12 counties have between 9 and 12 dropoff sites,
- 4 counties have between 13 and 16 dropoff sites, and
- 4 counties have more than 16 dropoff sites.

Table 2: Regional populations with access to curbside and recycling dropoff services.

Table 2: Municipal Recyclables Collection & Processing					
REGION	CURBSIDE COLLECTION		DROPOFF COLLECTION		PROCESSING
	# of Programs	% of Population	# of Sites	% of Population	# of MRFs
<i>Downriver & SE MI</i>	37	$\frac{354,859}{906,575} = 39\%$	57	$\frac{906,575}{906,575} = 100\%$	6
<i>Metro Detroit</i>	61	$\frac{1,711,198}{4,078,555} = 42\%$	32	$\frac{1,278,542}{4,078,555} = 31\%$	4
<i>Mid-Michigan</i>	31	$\frac{270,335}{867,257} = 31\%$	59	$\frac{533,781}{867,257} = 62\%$	8
<i>Northern Lower MI</i>	6	$\frac{24,480}{354,892} = 7\%$	66	$\frac{268,994}{354,892} = 76\%$	4
<i>Southwest MI</i>	70	$\frac{400,186}{920,329} = 43\%$	102	$\frac{920,329}{920,329} = 100\%$	6
<i>Sunrise Side</i>	57	$\frac{365,702}{540,787} = 68\%$	23	$\frac{440,787}{540,787} = 82\%$	5
<i>Thumb</i>	52	$\frac{162,740}{825,184} = 24\%$	38	$\frac{363,687}{825,184} = 44\%$	5
<i>West Coast</i>	14	$\frac{295,257}{1,058,535} = 28\%$	7	$\frac{559,027}{1,058,535} = 53\%$	3
<i>Upper Peninsula</i>	19	$\frac{85,315}{364,081} = 23\%$	41	$\frac{199,331}{364,081} = 54\%$	8
TOTAL	347	$\frac{3,670,072}{9,938,444} = 37\%$	425	$\frac{5,471,053}{9,938,444} = 55\%$	49

Curbside Recycling Service in Michigan



Material Collection

Table 3 shows the percentage of programs that collect basic materials at curbside and dropoff locations. Not included in the Table, but accepted by small amount of programs, are materials such as batteries, antifreeze, waste oil, ceramic and plate glass, aseptic packaging, phonebooks, hard and soft cover books, and plastics #4 through #7.

Table 3: Curbside & Dropoff Collection Programs		
Percentage of programs to accept commonly recycled items		
MATERIAL	CURBSIDE	DROPOFF
GLASS		
Clear	72%	69%
Amber	59%	62%
Green	50%	52%
METAL		
Kitchen Metals	71%	72%
Aluminum	71%	71%
Scrap Aluminum	1%	3%
Scrap Steel	2%	2%
Aerosol Cans	4%	.5%
PAPER		
Newspapers & Inserts	70%	72%
Magazines & Catalogs	46%	56%
Corrugated Cardboard & Kraft Bags	50%	58%
Residential Mail	33%	34%
Other Paper	34%	37%
Paper Board	27%	21%
PLASTIC		
HDPE	67%	67%
LDPE	63%	62%
Styrofoam	13%	10%

Yardwaste Collection Programs

A total of 225 curbside and 92 dropoff programs accept residential yardwaste; this provides services to 2,915, 210 (30%) and 4,302,810 (43%) Michiganders respectively. A regional overview of yardwaste collection programs is provided in Table 4 on the following page. The Table also indicates how many composting sites are located by region throughout the State.

HHW, On-Site & Special Collections

MRC also collected very basic information on household hazardous waste (HHW), and other special collection programs, such as computer/electronics, tires, books, seasonal spring “clean-ups”, etc. A regional overview of the number of HHW collection programs is included in Table 5, below. Information was also collected on “on-site” recycling opportunities open to the public; a minimum of 250 businesses collect a wide range of materials, including waste oil, batteries, tires, scrap auto parts, antifreeze, etc. for recycling, usually charging a small fee. Unfortunately, attaining detailed information on these programs was beyond the scope of this project.

Table 5: Household Hazardous Waste Collection Programs										
REGION	Downriver & SE MI	Metro Detroit	Mid-Michigan	Northern Lower	SE MI	Sunrise Side	Thumb	West Coast	Upper Peninsula	Total
Number of Programs	5	13	7	5	11	2	4	4	3	54

Table 4 shows a regional overview of yardwaste collection programs in Michigan.

Table 4: Municipal Yard Waste Collection & Processing					
REGION	CURBSIDE COLLECTION		DROPOFF COLLECTION		PROCESSING
	# of Programs	% of Population	# of Sites	% of Population	# of Compost Sites
<i>Downriver & SE MI</i>	21	<u>297,897</u> = 33% 906,575	16	<u>872,503</u> = 96% 906,575	23
<i>Metro Detroit</i>	49	<u>1,257,212</u> = 31% 4,078,555	8	<u>1,972,060</u> = 48% 4,078,555	12
<i>Mid-Michigan</i>	21	<u>254,610</u> = 29% 867,257	18	<u>479,358</u> = 55% 867,257	30
<i>Northern Lower MI</i>	6	<u>13,177</u> = 4% 354,892	6	<u>22,026</u> = 6% 354,892	14
<i>Southwest MI</i>	47	<u>350,713</u> = 38% 920,329	24	<u>648,347</u> = 70% 920,329	28
<i>Sunrise Side</i>	42	<u>338,030</u> = 63% 540,787	3	<u>21,668</u> = 4% 540,787	12
<i>Thumb</i>	20	<u>92,545</u> = 11% 825,184	7	<u>102,101</u> = 12% 825,184	12
<i>West Coast</i>	11	<u>281,763</u> = 27% 1,058,535	2	<u>71,361</u> = 7% 1,058,535	20
<i>Upper Peninsula</i>	8	<u>65,363</u> = 18% 364,081	8	<u>113,386</u> = 31% 364,081	12
TOTAL	225	<u>2,951,310</u> = 30% 9,938,444	92	<u>4,302,810</u> = 43% 9,938,444	163

Program Management, Operation & Processing of Materials

Michigan’s residential recycling programs are administered and/or operated by local and county agencies, intergovernmental councils and authorities, non-profits and private businesses. All of these entities partner in variety of ways to provide services to residents. Programs that are administered and operated in similar ways tend to also similarly process materials for marketing to final end users. “Management” refers to how programs are administered by a public entity, whereas, “operation” refers to the physical act of collecting materials from the curb and/or dropoff site, and transporting them to processing or warehousing destinations.

In general, local, county and authority managed and operated recycling programs sell materials directly to processors, brokers and in some cases, end users. In contrast, materials collected through programs privately operated via a local, county, or authority-managed contract, tend to be transferred to privately owned material recovery facilities (MRFs). Exceptions include isolated programs that contract with private haulers to transport materials to publicly operated or publicly owned, but privately operated material processing facilities. To understand

how to gather data on residential materials processed for recycling, information on program management, operation and materials processing was collected.

Table 6 provides an overview of operation and management of recycling programs and processing facilities in Michigan.

Table 6: Management & Operation of Collection Programs & Processing Facilities									
REGION	Local	County	Authority	Private	Non-Profit	Contract With Private Hauler			TOTAL
						Local	County	Authority	
<i>Curbside Recyclables</i>	1		1			111	8		121
<i>Curbside Recyclables & Yard waste</i>	7					90	1	27	125
<i>Curbside Yard waste</i>	97					4			101
<i>Dropoff Recyclables</i>	23	36	13	34	20	93	107	1	327
<i>Dropoff Recyclables & Yard waste</i>	15		1	10		10	5	3	44
<i>Dropoff Yard waste</i>	44			9	1				54
TOTAL	187	36	15	53	21	308	121	31	772
<i>Compost Sites</i>	116		3	52		4			175
<i>MRFs</i>	3	6	6	25	6	1	2	1	50
TOTAL	119	6	9	25	6	5	2	1	225

Local Management and/or Operation of Programs & Processing Facilities

Municipalities, townships and villages provide management and operation for 187 collection programs, including:

- Recycling Collection Only: 1 curbside and 23 dropoff programs
- Recycling and Yard waste Collection: 7 curbside and 15 dropoff programs
- Yard waste Collection Only: 97 curbside and 44 dropoff programs
- Compost Sites: 116
- Material Recovery Facilities: 3

Local governmental units manage contracts for 308 programs. Unless noted, services are provided by private waste haulers who handle processing of materials:

- Recycling Collection Only: 111 curbside program (*1 through contract with nonprofit*), and 93 dropoff programs

- Recycling and Yard waste Collection: 90 curbside (*1 contract with nonprofit, 18 contracts with a private hauler to transport to Authority-owned mrf*) and 10 dropoff programs
- Yard waste Collection Only: 4 curbside programs
- Compost Sites: 4
- Material Recovery Facilities: 1

County Management and/or Operation of Programs & Processing Facilities

County agencies provide management and operation for 36 dropoff recycling programs.

Counties manage contracts for 121 collection programs, including:

- Recycling Collection Only: 8 curbside and 107 dropoff programs
- Recycling and Yard waste Collection: 1 curbside and 5 dropoff programs
- Material Recovery Facilities: 6 publicly operated, 2 through partnership with private firm

Authority Management and/or Operation of Programs & Processing Facilities

Authorities manage and operate 15 collection programs, including:

- Recycling Collection: 1 curbside and 13 dropoff program
- Recycling and Yard waste Collection: 1 dropoff program
- Compost Sites: 3
- Material Recovery Facilities: 6

Authorities manage contracts for 31 programs, including:

- Recycling and Yard waste Collection: 27 curbside and 1 dropoff programs
- Recycling and Yard waste Collection: 3 dropoff programs
- Material Recovery Facilities: 1

Privately Operated Programs & Processing Facilities

Private waste haulers that operate material recovery facilities often operate dropoff sites open to residents. Most often these recycling sites are offered free of charge, while yard waste sites charge a small fee. Sites include:

- Recycling Collection Only: 34 dropoff sites
- Recycling and Yard waste Collection: 10 dropoff sites
- Yard waste Collection Only: 9 dropoff sites
- Compost Sites: 52
- Material Recovery Facilities: 25

Non-Profit Operated Dropoff Sites & Yard Waste Processing

These dropoff programs are offered to residents free of charge.

- Recycling Collection Only: 20 dropoff programs
- Yard waste Collection Only: 1 dropoff program
- Compost Sites: 6

MSW Recycling Rate Calculation

A main objective of the MRMP was to calculate a recycling rate based on the amount of MSW diverted from disposal annually. To this end, the EPA's recycling rate model was used. The rate equation is a division of the amount of materials recycled annually by the amount of materials generated (recycled + disposed) annually. To determine how much material is recycled annually, MRC conducted two surveys to gather data from Michigan processors and brokers. The DEQ-WMD annual landfill report, and a survey of the four waste-to-energy facilities active in 1999, provided a basis for information on materials disposed. However, the landfill report does not provide disposal information in a way that is consistent with the scope of MSW used in the model. As a result, the landfill data was adjusted to reflect disposal of Michigan MSW only. This was accomplished using DEQ-WMD data on Type II In-State waste disposed in 1999, and subtracting tonnages calculated for non-MSW materials disposed. The EPA model was also used to calculate a second recycling rate for comparison purposes. This second rate, however, is based on a mean MSW disposal number for States in the Midwest. A per capita recycling figure was also developed by dividing the total pounds of MSW recycled in 1999 by the State's population for that year.

Recycling Data Collection

MRC conducted two surveys of recycling processors and brokers to collect information on the amount of materials recycled in the State. As mentioned earlier in this report, a listing of survey recipients was developed through a study of residential collection programs, and by drawing upon the expertise of MRC members and other recycling professionals. The combination of the two surveys resulted in a response from 210 of the 430 survey recipients, about 47%. Survey Participants responded primarily with data for calendar year 1999, with about ¼ responding with data from 2000.

Respondents to the recycling measurement survey represented only a portion of all processors in Michigan. For survey results to represent recycling activity for the entire industry, they must be extrapolated out, or made to reflect all industry activities. Usually, such extrapolation is based on information about how well respondents to the survey represent the entire industry. However, very little information exists to determine either the number of recycled material processors in Michigan or differences between survey respondents and those who did not respond. The extrapolation procedures used to calculate these preliminary estimates of recycling activity are based on two assumptions:

1. The mailing list for the survey was complete. That is, it represented all processors of recycled materials in Michigan.
2. There is no systematic difference between firms who responded to the survey and those who did not respond.

Based on these assumptions, extrapolation factors were calculated for each material in the following manner. First, the number of firms in Michigan that handled a particular material was determined from the MRC database. This number was assumed to represent all firms in the State that handled the material (*handled* means either processing the material or passing it through to a broker or processor without processing). Second, survey results were used to calculate the number of responding firms that *handled* each material and the number that *processed* each

material. Third, the proportion of responding firms that processed a particular material was calculated as the number of responding firms that *handled* the material divided by the number of responding firms that *processed* the material. Applying this proportion to the total number of firms in Michigan believed to handle material yields an estimate of the number of firms in Michigan that processed the material. Dividing this estimate by the number of responding firms that reported processing the material yields the extrapolation factor for that material. The extrapolation factor represents the adjustment that must be made to survey results so they reflect the entire industry.

Table 7 shows the calculation of extrapolation factors for each class of material.

MATERIAL	MI Firms That Handle	Respondents That Handle	Respondents That Process	Proportion That Process	Extrapolation factor
<i>Paper</i>	76	70	52	.743	1.086
<i>Glass</i>	34 ^a	36	21	.583	1.000
<i>Metals</i>	140	63	27	.429	2.222
<i>Plastics</i>	69	47	19	.404	1.468
<i>Organics</i>	145	103	96	.932	1.408
<i>Other</i>	21 ^a	34	27	.794	1.000

^a The number of respondents who reported handling these materials exceeded the number thought to handle the material. The number of MI firms thought to handle the material was set equal to the number of respondents who reported handling the material.

Table 8 shows the extrapolated quantity of material collected from Michigan commercial and residential sources by material class.

MATERIAL	Unadjusted Tons Collected	Extrapolation Factor	Extrapolated Tons Collected
<i>Paper</i>	656,101	1.086	712,526
<i>Glass</i>	149,339	1.000	149,339
<i>Metals</i>	389,855	2.222	866,258
<i>Plastics</i>	14,736	1.468	21,632
<i>Organics</i>	524,790	1.408	739,904
<i>Other</i>	19,908	1.000	19,908
TOTAL	1,754,729		2,509,567

Annual Recycling of Deposit Containers

Michigan's Bottle Deposit System successfully diverts MSW from disposal each year. These recycling activities must be reflected in the total materials recycled annually to develop an accurate recycling rate. The two major handlers of deposit containers participated in the surveys

for recycling data. However, MRC took additional measures to include deposit container tonnages that did not get reported as a result of non-participation by some of the smaller handlers of deposit material. This was accomplished by calculating the total tonnages diverted through the system based on information from the Michigan Department of Treasury on the number of containers redeemed in 1999. The container tonnages reported in the survey were subtracted from the total amount diverted through the system. The resulting tonnages were then added to the total quantity of materials recycled in 1999, to arrive at the figures needed to calculate the State's recycling rate.

The Michigan Dept. of Treasury reported that \$428,952,122.00 in deposits was generated by distributors and manufacturers through the Bottle Bill system in 1999. Refunds made to retailers for redeemed beverage containers totaled \$407,013,214.00. If all of the containers returned to distributors were used to manufacture new containers, it can be assumed that 4,070,132,140 containers were recycled in 1999.

Information on the amounts of beverage containers sold according to packaging type in Michigan is not available. As a result, national figures for common bottle bill packaging (glass, aluminum, PET) were used. According to the Beverage Marketing Corp., 148,290,000,000 soft drink and beer containers were sold in the US in 1999. About 16.14%, or 23,940,000,000 containers were made of PET plastic. Aluminum comprised 65.68% of the total containers sold, or 97,400,000,000 units. Glass made up 18.2% of all containers sold. However, approximately 1.48% of that amount resulted from returnable glass, which is reused and not recycled. Thus, recycled glass comprised 16.76% of the total containers sold. Applying these percentages to containers recycled through Michigan's deposit system results in the following.:

- PET: 656,919,327 containers
- Aluminum: 2,673,262,790 containers
- Glass: 682,154,147 containers

Using standard weights reported by Container Recycling Institute of .0302 pounds per aluminum can, .068 pounds per average PET plastic bottle and .45 pounds per glass bottle, the total tons estimated for each type of container collected through the Bottle Deposit System are:

- PET: 44,670,514 lbs., 22,335 Tons
- Aluminum: 80,732,536 lbs., 40,366 Tons
- Glass: 306,969,366 lbs., 153,485 Tons

Processors of deposit material reported that they handled a total of 175,598 tons of containers. The total tons reported for each type of container collected are:

- PET: 3,434 ton
- Aluminum: 36,787 tons
- Glass Total: 135,377 tons

When the above figures are compared to the total materials collected through the bottle deposit system in 1999, it appears that most of the tonnages are accounted for, however, those tonnages that went unreported are added to the total amount of materials recycled in 1999.

Table 9 shows the bottle deposit tonnages not reported in the survey, which must be included in the total amount of materials recycled in 1999.

Table 9: Bottle Deposit Tonnages Unreported in Recycling Survey			
MATERIAL	Total Tons Diverted	Tons Reported in Survey	Unreported Tons Added to Recycling Figures
<i>Glass</i>	153,485	135,377	18,108
<i>Aluminum</i>	40,366	36,787	3,579
<i>PET</i>	22,335	3,343	18,992
TOTAL	216,186	175,507	40,679

Table 10 shows the total quantity of materials recycled from commercial and residential sources in 1999.

Table 10: Quantity of Michigan Municipal Solid Waste Recycled in 1999	
MATERIAL	Tons Collected
<i>Paper</i>	712,526
<i>Glass</i>	167,447
<i>Metals</i>	869,837
<i>Plastics</i>	40,624
<i>Organics</i>	739,904
<i>Other</i>	19,908
TOTAL	2,550,246

Annual Disposal of MSW

As mentioned above, MRC used two methods to calculate annual disposal of MSW for use in the recycling rate equation. The basis of data for the first method is Waste-To-Energy facilities active in 1999, and an adjustment of data from the DEQ-WMD Landfill Report for the same year. The second method uses waste disposal data reported by States in the surrounding region to calculate the disposal number.

DEQ-WMD Landfill Data to Calculate MSW Disposal

According to the DEQ-WMD, 38,606,454 c.y. of Type II waste was disposed in Michigan in 1999 (See Table 11). However, this figure includes waste that does not meet the EPA definition of MSW. To modify Type II In-State waste disposal data to reflect MSW only, several adjustments were made:

1. Add MSW tonnages incinerated, minus disposal of ashes resulting from incineration.
2. Exclude tonnages from disposal of industrial waste.
3. Exclude tonnages from disposal of construction and demolition debris.

Table 11 shows the break down of In-State waste disposed in 1999.

Table 11: 1999 In-State Waste Landfilled	
<i>Source: DEQ-WMD Landfill Report</i>	
WASTE TYPE	VOLUME (C.Y.)
<i>Type II In-State</i>	38,606,454
<i>General Type III In-State</i>	4,030,930
<i>Total Type III In-State Mixed</i>	428,289
<i>Total Type III In-State Segregated</i>	2,542,097
TOTAL	45,607,770

To account for MSW incinerated in 1999, MRC conducted a survey of the four Waste-To-Energy facilities active in 1999. Facility managers were asked to report the amount of MSW received prior to incineration, and the ash resulting from incineration that was disposed into a landfill. This is demonstrated in Table 12, in addition to the total amount of MSW incinerated to add to the MSW disposal number used in the recycling rate equation.

Table 12: Incineration of Municipal Solid Waste in 1999			
FACILITY	Tons Incinerated (minus metals recycled)	Tons of Ash Disposed	Total Tons to Add to MSW Disposal Number
<i>Greater Detroit Resource Recovery Authority</i>	1,001,872	291,718	710,154
<i>Grosse Pointe Clinton Refuse Disposal Authority</i>	9,228	2,307	6,921
<i>Jackson County Resource Recovery Plant</i>	49,752	13,063	36,689
<i>Kent County Department of Public Works</i>	175,726	32,686	143,040
TOTAL	1,401,578	339,774	896,804

Industrial waste generation was estimated by using 1997 employment data from the Michigan Department of Career Development for manufacturing industries comprising the 200 and 300 SIC code groups. The employment numbers were then multiplied by specific waste generation factors for various industry groups. Total industrial waste generation is estimated at 4,100,295 tons. However, this figure represents waste generated and not disposed. To account for the recycling of some of these wastes, information on industrial recycling rates from Ohio was used which estimates industrial recycling rates as being as high as 80%, or as low as 40%. A figure of 50% was used for this study, which would make the amount to be subtracted from the Type II waste disposal number 2,050,148 tons.

Data from the State of Ohio was used to further adjust the DEQ landfill data to account for the inclusion of construction and demolition waste. Ohio data was used because the State reports on the disposal of construction and demolition wastes separate from general MSW, and because the State's industries are very similar to those in Michigan. Table 13 shows the steps taken to adjust Michigan's data for construction and demolition waste. The result is a deduction of 1,300,603 tons from the total for Type II In-State waste disposed.

Table 13. Calculations to Adjust Michigan's Type II Disposal Data to Account for Inclusion of Type III Construction and Demolition Debris

Source: Resource Recycling Systems, Inc.

Total Reported Non-Industrial, Non-Exempt Tons Landfilled		
General	11,000,000	82.09%
C&D	2,400,000	17.91%
Total Reported Non-Industrial, Non-Exempt Tons Landfilled	13,400,000	100.00%
Michigan Equivalent Landfill Data		
Total Reported Tons Landfilled w/out industrial		
Type II w/WtoE and w/out Disposed Industrial	11,880,474	92.18%
General Type III	1,007,733	7.82%
Total Reported Tons Landfilled w/out industrial	12,888,207	100.00%
Michigan Adjusted Landfill Data to Fit Ohio C&D Measurements		
Total Reported Tons Landfilled w/out industrial		
Type II w/WtoE and w/out Disposed Industrial	10,579,871	82.09%
General Type III	2,308,335	17.91%
Total Reported Tons Landfilled w/out industrial	12,888,207	100.00%
Proposed Reduction in General Type II Waste to Adjust for Type III being Landfilled as Type II for Michigan	1,300,603	

Table 14 provides a summary of the above information, all of which results in a disposal number of 10,412,871 tons of MSW for 1999.

TABLE 14: Adjustments to DEQ-WMD Type II Waste Landfilled, MSW Disposed in 1999		
<i>Type II Waste Landfilled, CY</i>	38,606,454 CY	Table 11, DEQ-WMD
<i>Conversion to Tons at 3 CY for each ton</i>	12,868,818 Tons	Industry Standard
<i>Increase to account for incineration of MSW</i>	896,804 Tons	Table 12-MRC Survey
<i>Adjusted Total after adding Waste to Energy Tons</i>	13,763,622 Tons	Type II Disposed
<i>Deduct for Manufacturing Waste Disposed as Type II Waste</i>	(2,050,148 Tons)	RRSI
<i>Adjusted Total after Deducting Manufacturing Waste Disposed as Type II Waste</i>	11,713,474 Tons	Adjustment to Type II Disposed
<i>Deduct for Construction and Demolition Wastes Disposed as Type II Waste</i>	(1,300,603 Tons)	RRSI
<i>Adjusted Total after Deducting Construction and Demolition Wastes Disposed as Type II Waste</i>	10,412,871 Tons	Adjustment to Type II Disposed

Table 15 shows the recycling rate using recycling data collected by MRC, and adjustments made to DEQ landfill data, described above.

Table 15: Recycling Rate Based on DEQ Landfill Data		
<i>Total MSW Disposed</i>	10,412,871 Tons	From Table 14 on Page 21
<i>Total MSW Recycled</i>	2,550,246 Tons	From Table 10 on Page 19
<i>Total MSW Generated</i>	12,963,117 Tons	Total Disposed + Total Recycled
<i>Calculated MSW Recycling Rate</i>	$\frac{2,550,246}{12,963,117} = 19.7\%$	EPA Model for rate: $\frac{\text{Total MSW Recycled}}{\text{Total MSW Generated}} = \text{MSW Recycling Rate}$

To provide a consistent method to evaluate MSW recycling activities, a second recycling rate is calculated based on the mean MSW disposal rate of several States in the Midwest. This second calculation provides a comparison to the rate generated using modified DEQ landfill data. These two approaches to calculate a recycling rate can be systematically replicated in future years to further understand MSW recycling trends in Michigan. Table 16 provides a summary of the states and rates that were used to develop a mean of 5.64 pounds of MSW generated per person per day for Mid-West States.

Table 16: MSW Disposal Rates in the Mid-West Region (pounds disposed/per person/per day)		
STATE	RATE	SOURCE
<i>Illinois</i>	6.9	Illinois EPA, Bureau of Land
<i>Indiana</i>	6.8	Indiana Dept. of Env. Mgmt., Office of Land Quality
<i>Minnesota</i>	4.96	Minnesota Office of Env. Asst.
<i>Michigan</i>	5.74	Michigan Recycling Coalition
<i>Ohio</i>	5.14	Ohio DNR, Division of Recycling and Litter Prevention
<i>Wisconsin</i>	4.27	Wisconsin DNR, Waste Mgmt.
AVERAGE MEAN	5.64	

Table 17 shows the recycling rate using recycling data collected by MRC, and a waste disposal number based on the mean MSW disposal rates for states in the Mid-West.

Table 17: Recycling Rate Based on Average Mean MSW Disposal for Mid-West States		
<i>Mean MSW Disposal Rate</i>	5.64 (lbs./person/day)	From Table 16 Above
<i>Total MSW Disposed</i>	10,229,640 Tons	MI 1999 Population (9,938,444) X 5.64 (lbs) X 365 (days) 2000 (to convert figure to tons)
<i>Total MSW Recycled</i>	2,550,246 Tons	From Table 10 on Page 19
<i>Total MSW Generated</i>	12,779,886 Tons	Total Disposed + Total Recycled
<i>Calculated MSW Recycling Rate</i>	$\frac{2,550,246}{12,779,886} = 19.9\%$	EPA Model for rate: $\frac{\text{Total MSW Recycled}}{\text{Total MSW Generated}} = \text{MSW Recycling Rate}$