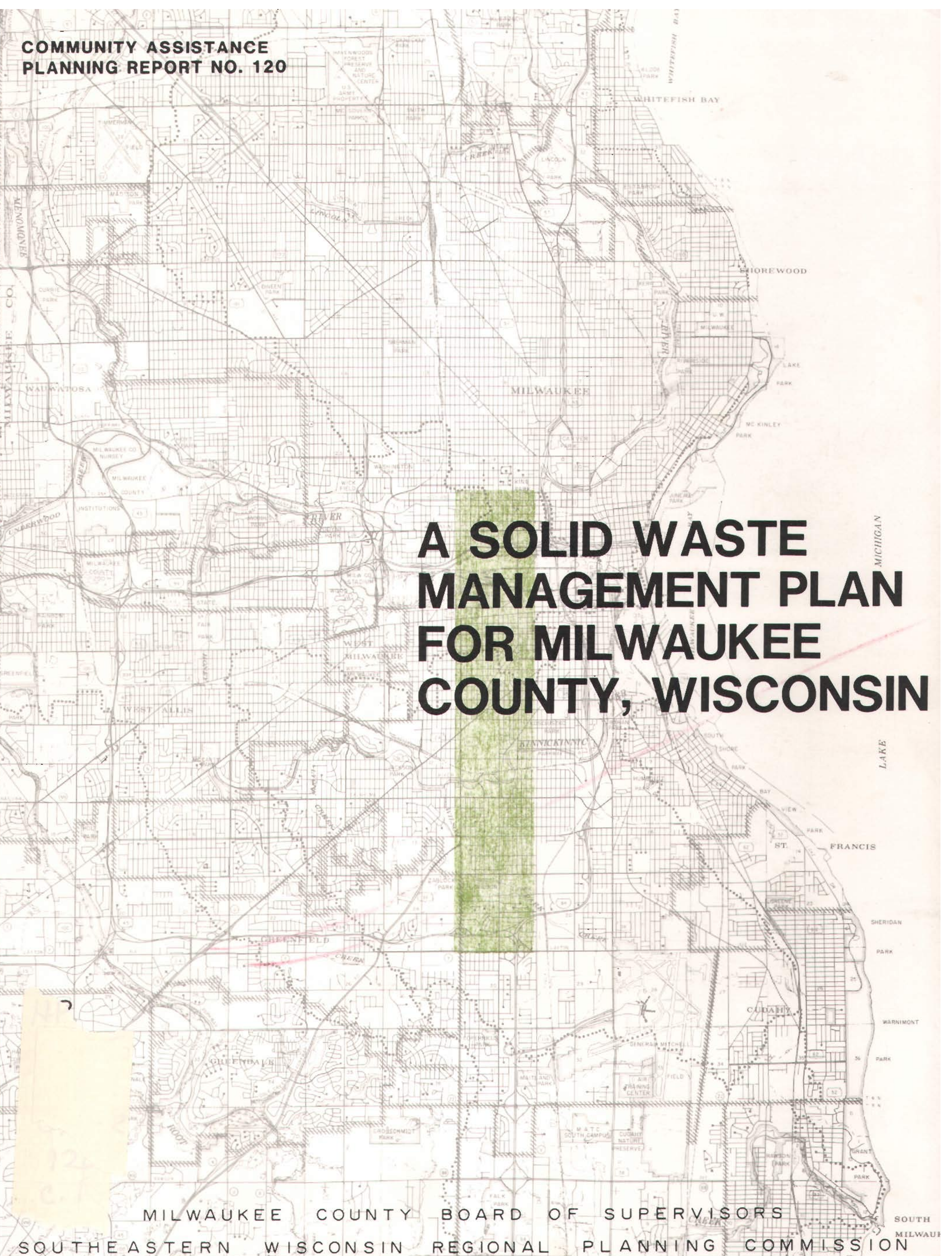
COMMUNITY ASSISTANCE
PLANNING REPORT NO. 120

A SOLID WASTE MANAGEMENT PLAN FOR MILWAUKEE COUNTY, WISCONSIN



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COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 120

A SOLID WASTE MANAGEMENT PLAN FOR MILWAUKEE COUNTY, WISCONSIN

Prepared by the
Milwaukee County Department of Public Works
Courthouse Annex
907 N. 10th Street
Milwaukee, Wisconsin 53233

In Cooperation with the
Southeastern Wisconsin Regional Planning Commission
P. O. Box 1607
Old Courthouse
916 N. East Avenue
Waukesha, Wisconsin 53187-1607

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July 1987

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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July 4, 1987

TO: Gerald Schwerm, Director, Milwaukee County Department of Public Works

In July of 1984, the Milwaukee County Department of Public Works requested that the Southeastern Wisconsin Regional Planning Commission assist the Department in the preparation of a solid waste management plan for the County. The plan was to be based upon an assessment of the existing and probable future solid waste management needs and was to recommend a strategy for meeting those needs, while providing for the protection of the public health and of the overall quality of the environment from the potential adverse effects of improper solid waste disposal. Following the preparation of a study design and receipt of a grant from the Wisconsin Department of Natural Resources, work was initiated on the plan in September 1984.

To provide for the active participation of the interests concerned, the plan was prepared under the guidance of an Intergovernmental Solid Waste Management Planning Task Force. The 38-member Task Force was composed of elected and appointed county and local officials, representatives of local industry and higher education, representatives of the Wisconsin Department of Natural Resources, and interested and concerned citizens.

The county and Commission staffs working with the Task Force have now completed, and are pleased to transmit herewith, this report setting forth a recommended plan for solid waste management in Milwaukee County. The plan is based upon a careful evaluation of the existing solid waste management systems within the County, an analysis of the present and probable future needs for solid waste management, and an examination of the costs and other considerations attendant to a number of alternative means of meeting those needs.

The selection of the recommended plan and the means to implement it followed an extensive review by the Task Force of the technical feasibility, economic viability, environmental impacts, potential public acceptance, and practicality of the various alternative solid waste management plans considered. A public hearing on a preliminary version of the plan was held in the County Courthouse on May 14, 1987. The record of that public hearing is included as an appendix to this report. The recommended plan addresses the seven basic solid waste management functions—storage, source separation, collection, transportation, transfer, processing, and disposal. Although the plan makes recommendations concerning all of these functions, the primary focus is on the processing and disposal functions.

The solid waste management plan presented in this report provides a sound guide which can assist county and local government officials in providing for solid waste management in the County, while protecting the public health of the County's residents and the environment. The report and plan are hereby respectfully submitted on behalf of the Task Force.

Sincerely,

Kurt W. Bauer

Kurt W. Bauer
Executive Director
Southeastern Wisconsin Regional
Planning Commission

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INTRODUCTION AND BACKGROUND

Because of the growing per capita generation of solid wastes and the heightened public awareness of the need to process and dispose of those wastes in an environmentally sound manner, solid waste management is becoming an increasingly important issue of concern to elected officials at the state, county, and local levels of government. In 1960, the total amount of residential and commercial solid wastes generated in the United States was about 2.7 pounds per person per day.[1] By 1970 this figure had risen to about 3.5 pounds per person per day,[2] and by 1980 to 3.9 pounds per person per day. The total amount of residential solid wastes generated in Milwaukee County was about 2.6 pounds per person per day, or about 447,500 tons per year, in 1984. Furthermore, about 585,400 tons per year, or about 3.4 pounds per person per day, of solid waste in the County consisting of commercial and industrial wastes, construction and demolition debris, bulk wastes, and trees and brush were generated in 1984. In 1984, transportation, disposal, and collection of these wastes in Milwaukee County cost about $60 per ton, or about $62 million per year.

Proper long-range planning can minimize the costs associated with the management of these wastes, as well as assure protection of the overall quality of the environment. This is especially important in Milwaukee County because of the large quantities of wastes generated, the growing concern about the availability, cost, and environmental problems related to the use of landfills for the long-term disposal of solid wastes, and the potential to make productive use of this resource.

Planning for solid waste management is presently carried out at the state level by the Wisconsin Department of Natural Resources. Such planning has, to date, been limited to a broad needs assessment, and has included surveys of solid waste management practices and existing disposal sites, identification of general areas for management of hazardous wastes, and assessment of the feasibility of establishing waste exchange between selected areas of the State. More comprehensive, as well as more detailed, planning for solid waste management has been delegated to the county level. State funding is available for conducting countywide solid waste management studies. Other single-purpose solid waste management studies have been conducted throughout the State by public and private agencies to evaluate specific project proposals. Recent landfill siting legislation adopted in 1983 and set forth in Chapter 144.44(2) of the Wisconsin Statutes apparently does not permit the Wisconsin Department of Natural Resources to consider the recommendations of adopted county plans when evaluating landfill siting feasibility proposals unless the recommendations in those plans have been implemented through at least the completed

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[1]American Public Works Association, Solid Waste Collection Practices, 1975.

[2]The Tenth Annual Report of the Council on Environmental Quality, December 1979.

feasibility report stage. There are efforts underway by public officials in southeastern Wisconsin to have this aspect of the landfill siting legislation revised to permit the Department to recognize the recommendations contained in adopted county plans.

Under a countywide solid waste management study, a practical, long-range plan for solid waste management can be developed which considers solid waste as a potential resource rather than as just a disposal problem. The solid waste management alternatives available offer choices which can minimize the long-term solid waste problems of the County, while maximizing long-range resource recovery benefits. The current solid waste management practices in the County should lend themselves to improvement through a positive, comprehensive countywide approach.

The development of a county solid waste management plan, as outlined in a project description prepared by the Commission in May 1984, was approved by the Milwaukee County Board in July 1984. A Wisconsin Fund grant application was submitted on December 21, 1983, pursuant to Chapters NR 185 and 186 of the Wisconsin Administrative Code. A state grant was received on June 25, 1984, and work was initiated on the study in September 1984. To provide for the more active participation of the interests concerned, the study was conducted under the guidance of a Technical Coordinating and Advisory Committee. This Committee is a subcommittee of the Countywide Solid Waste Task Force which was created in 1984 jointly by the Intergovernmental Cooperation Council, Milwaukee County, and the City of Milwaukee. The membership of the Technical Coordinating and Advisory Committee is set forth in Appendix A.

HISTORY OF SOLID WASTE MANAGEMENT IN MILWAUKEE COUNTY

The disposal of solid wastes in the City of Milwaukee first drew the attention of elected officials in 1856, when the Common Council of the City sought to prevent citizens from disposing of garbage in public streets. As the population of the urbanizing area increased, the City of Milwaukee contracted with private waste haulers to collect and dispose of garbage and refuse. Between 1878 and 1903, most of the refuse generated in the City was disposed of by feeding it to livestock, especially hogs, or disposed of at rendering plants, with only a limited amount dumped into landfills or into pits dug on farmlands in adjacent agricultural areas.[3] Public opposition to landfilling, coupled with the increasing amounts of solid waste, necessitated that an alternative means of disposal be found. Beginning in 1903, the first of 19 municipally owned incinerators in Milwaukee County was placed in service. That first incinerator, located in the City of Milwaukee on Jones Island, had a capacity of 120 tons per day, which was not adequate to process the estimated 200 tons per day of refuse generated in the City. In 1910, a second incinerator with a capacity of 300 tons per day was constructed on Erie Street, followed by an additional incinerator unit at the same location in 1930. Other local units of government in Milwaukee County that operated municipal incinerators between 1916 and 1972 included the Cities of Shorewood, South Milwaukee, Wauwatosa, and West Allis, and the Villages of Fox Point and Whitefish Bay. The Milwaukee

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[3]Bayrd Still, Milwaukee: The History of a City, Wisconsin Historical Society, 1948.

Metropolitan Sewerage Commissions operated a special-purpose incinerator for the disposal of sewage screenings. The more outlying suburban communities of the metropolitan area historically used landfilling to dispose of solid waste because of the availability of open land and lower cost.

During the 1950's, the population in the Milwaukee metropolitan area increased dramatically. Lifestyles changed, and the amount of refuse generated from all sources--residential, commercial, institutional, and industrial--also increased dramatically. The composition of the wastes also changed, resulting in the need for disposal methods other than incineration. These methods included primarily open dumping, hog feeding, garbage grinding by individual residents with disposal through the public sewerage system, and sanitary landfilling, in addition to incineration, with sanitary landfilling and incineration the principal disposal methods. In 1955, the Milwaukee County Board of Supervisors adopted an ordinance ordering the purchase and operation of a county landfill. The site purchased was a gravel pit located on S. Loomis Road in the City of Franklin. Dumping at this site began in 1956. As costs for the disposal of commercial and industrial wastes in landfills or in municipally operated incinerators began to increase during this period, some commercial establishments and industries began operating private incinerators. There was also extensive use of small private dumps and landfills in outlying areas of the County. Historic records indicate that there were 33 public and privately operated landfills in Milwaukee County prior to enactment of the licensing requirements of Chapter NR 180 of the Wisconsin Administrative Code in 1980. These landfill sites ranged in size from about one acre up to 70 acres. These landfills were generally small, privately owned facilities, although five were larger than 20 acres in areal extent.

Beginning in the late 1950's and continuing until 1972, municipally operated incinerators began to be closed down owing to obsolescence, increasing costs of operation, and air pollution emission problems. The last municipal incinerator used solely for the disposal of refuse, located in South Milwaukee, shut down in 1972. Costs for the disposal of solid wastes have increased dramatically over the last 25 years.[4] The costs of incineration of solid waste cost approximately \$3.90 per ton in the City of Milwaukee in 1948, or about \$17 in 1984 dollars. By 1958, the cost had risen to about \$6.00 per ton, or about \$23 in 1984 dollars. By 1965, municipal incineration costs ranged from \$8.00 to \$11 per ton, or \$26 to \$36 in 1984 dollars.[5] These costs compare with a 1984 transportation and disposal cost at sanitary landfills of about \$25 per ton of solid wastes. Collection costs increased from about \$13.40 per ton in 1948, or about \$59 in 1984 dollars, to about \$22.70 per ton in 1958, or about \$82 in 1984 dollars. These costs compare with a 1984 collection cost of about \$70 per ton, this reduced cost being attributable to more efficient collection procedures and equipment.

A number of studies, investigations, and analyses of the disposal of solid wastes generated within Milwaukee County have been completed over the last

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[4] Annual Report: City of Milwaukee Bureau of Garbage Collection and Disposal, 1958.

[5] Black & Veatch Consulting Engineers, Report on Refuse Disposal for Milwaukee County, Wisconsin, 1965.

25 years. The following summarizes the findings and recommendations of a selected number of these studies:

1. Refuse and Garbage Disposal in Milwaukee County, Report of the Refuse and Garbage Disposal Committee of the Metropolitan Study Commission, 1959.

   The purpose of this report was to examine refuse disposal practices in the Milwaukee metropolitan area and the degree of community satisfaction with present systems and services, and to probe the practical possibilities of a metropolitanwide system of refuse disposal. The report provided a historical perspective of past solid waste collection and disposal methods both in the City of Milwaukee and in outlying suburbs. In addition, contemporary refuse disposal practices and problems were evaluated. The report concluded that incineration was the best disposal method available, with the use of a county incinerator the most cost-effective means of disposal. Subsequent to this report, consideration was given to county-operated incinerator units; however, the report recommendations were not implemented.

2. Refuse Disposal in Milwaukee, Black & Veatch Consulting Engineers, 1959.

   The purpose of this report was to document the findings of a study of existing solid waste disposal operations and to consider all known methods of refuse disposal for the City of Milwaukee. The evaluations indicated that sizable cost savings could be realized by combining the services of the two bureaus responsible for refuse collection and disposal--the Bureau of Garbage Collection and the Bureau of Disposal and Street Sanitation--by collecting combined refuse on a once-per-week service schedule. To realize the potential savings, it was recommended that refuse be collected from portable containers only, eliminating the need for the collection crews to shovel out backyard ash boxes and carry refuse out of basements.

   The report concluded that incineration of combined refuse would require modification of the existing municipal incinerators. Since the older plants were relatively expensive to operate, the construction of one large central incinerator for the disposal of all refuse was found to be economical. The report concluded that the cost of incineration could be reduced to from $3.00 to $4.00 per ton in 1958 dollars, depending upon the capacity of the new plant, which in turn was dependent on how much commercial and industrial refuse would be brought to the plant for disposal. Preliminary estimates of the cost of sanitary landfills indicated that if a suitable site could be located within 30 miles of Milwaukee, the cost would be roughly comparable to the cost of incineration. The primary outcome of this study was a reevaluation of refuse disposal alternatives for Milwaukee County conducted by Black & Veatch in 1965.

3. Northeastern Milwaukee County, Wisconsin Report on Refuse Disposal, Greeley and Hansen, Engineers, 1964.

   The purpose of this report was to evaluate the feasibility, sizes, and costs of joint refuse disposal facilities for the City of Glendale and the Villages of Bayside, Brown Deer, Fox Point, River Hills, Shorewood, and Whitefish Bay. The report evaluated refuse types and quantities, collection and disposal practices, and alternative means for disposal of refuse generated in these contiguous communities, including incineration and landfilling. The report concluded that the most cost-effective means of solid waste disposal for the northeastern Milwaukee County communities would be either construction of a centrally located transfer station in the City of Glendale with disposal at a new landfill site, or construction of an incinerator in the City of Glendale with disposal of incinerator residue at a landfill. The report recommendations were not implemented.

4. Report on Refuse Disposal for Milwaukee County, Wisconsin, Black & Veatch Consulting Engineers, 1965.

The purpose of this report was to outline a practical program for the operation of county refuse incinerators and associated disposal facilities in Milwaukee County. The study found that approximately 50 percent of incinerable domestic refuse was disposed of in municipal incinerators. The remainder, and most commercial and industrial refuse, was disposed of in sanitary landfills and in open and burning dumps in the County and adjacent counties. Reported municipal incineration costs in Milwaukee County, inclusive of all capital, operation, maintenance, and overhead costs, were in the range of $8.00 to $11 per ton in 1965 dollars.

The report recommended that a county refuse disposal program include three incinerator plants for incinerable domestic refuse, two incinerator plants for tree refuse, and landfill sites for disposal of incinerator residue and nonincinerable domestic refuse. It was recommended that the initial incineration capacity be determined based upon firm negotiations with the municipalities that would use these facilities. The preliminary design and cost estimates were based on initial construction of one plant with three 300-ton-per-day incinerators installed at the central site and one plant with two 300-ton-per-day incinerators installed at each of two sites, one on the north side and one on the south side of the County.

Detailed construction plans and specifications for the north side incinerator facility were completed but were never sent out for bid proposals. An effort was made instead to develop a countywide rail haul system to transport municipal refuse to a landfill in a remote location outside Milwaukee County, as was proposed by the Chicago, Milwaukee, St. Paul & Pacific Railroad Company. The implementation of this alternative was contingent upon the railroad company securing a landfill site. The site was not secured, and the railroad company asked to be released from the contract. Following that experience, the County sought to enter into a long-term contract for the disposal of solid waste with a New York firm. The firm proposed to bale the refuse and stack it in a disposal site which would be converted to a ski hill in the southwestern corner of Milwaukee County. This contract was subject to the City of Milwaukee participating in the refuse disposal program. Participation was not secured and the contract was voided.

Based in part upon the recommendations contained in this study, an Incinerator Study Committee was created by County Board Resolution on

March 6, 1974. The Committee submitted a report to the County Board recommending that a consulting engineering firm be retained to evaluate the economic feasibility of an energy recovery, refuse-fired, steam generating system at the County Institutions grounds. The firm of Velzy Associates was retained in 1976. The firm submitted its final report, entitled Incinerator-Boiler Study, Milwaukee County Institutions, to the Committee in 1982. The report concluded that installation of a mass burning, refuse-fired steam generator at the Milwaukee County Institutions power plant could provide fuel for steam and power generation, as well as an alternative to refuse disposal at privately owned landfills.

A U. S. Environmental Protection Agency-funded pilot project was undertaken at the existing County Institutions facility in 1982 to evaluate the potential to co-fire refuse-derived fuel produced by the Americology facility, along with coal, in one of the three coal-fired boilers. Clogging of the traveling-grate-spreader stoker and other problems developed, however, which interfered with operation of the power plant, and the pilot project was discontinued.

5. Report on Solid Waste Disposal for the Southern Milwaukee County Garbage and Refuse Study Committee, Hartmann-Strass, Inc., Consulting Engineers, 1967.

   The purpose of this report was to advise and inform the Southern Milwaukee County Garbage and Refuse Study Committee of the present and future needs for solid waste disposal facilities. The report presented the anticipated requirements for solid waste disposal for the member communities, which included the Cities of Cudahy, Franklin, Greendale, Greenfield, Oak Creek, St. Francis, and South Milwaukee. The report recommended actions both on an individual community basis and on a joint community basis for cost-effective solid waste disposal. Incineration was found to be the most economical, long-range solution for the disposal of solid waste in the subject communities. The report recommendations were not fully implemented.

6. Phase Three Report on Evaluation of Proposals Submitted in Response to Official Notice No. 141 for a Solid Waste Management and Disposal System for Milwaukee, Wisconsin, Deleuw, Cather & Company Consulting Engineers, May 1974.

   The purpose of this report was to evaluate the merit of seven proposals from private industry innovative methods for solid waste management and disposal in the City. The report recommended that the City proceed with negotiations for the design, construction, and management of a resource recovery system designed for recovery of recyclable materials and production of refuse-derived fuel to be used in utility or industrial boilers.

   As a result of this report, a report was prepared by the City of Milwaukee, the Americology Division of the American Can Company, and the Wisconsin Electric Power Company describing the overall program schedule, operation, and environmental evaluations associated with start-up of the Americology Resource Recovery Project.

RECENT SOLID WASTE MANAGEMENT EVENTS

Americology

The Americology Division of the American Can Company completed construction of a refuse-derived fuel (RDF) facility in Milwaukee in 1977. The $18 million plant was designed to process 100 percent of the City of Milwaukee's residential waste, with the recovery of ferrous metals, aluminum, corrugated paper, newspaper, and glassy aggregate, and the production of a high-quality, refuse-derived fuel. This RDF was to be burned at the Wisconsin Electric Power Company Oak Creek power station. The plant provided RDF to the Oak Creek power plant under a short-term agreement with the Wisconsin Electric Power Company. Since this was the chief source of revenue to pay for the operating expenses of the plant, purchase of this material was an integral part of the continued operation of the facility. After initiating the burning of RDF at the Oak Creek facility, which was designed to burn coal, the walls of the boilers became coated with heavy accumulations of slag, making operation and maintenance of the boilers very difficult. Numerous attempts were made to solve this problem. No solutions were found. Consequently, the contract between Americology and the Wisconsin Electric Power Company was not renewed.

The unavailability of a reliable, long-term customer for the refuse-derived fuel generated at the plant, combined with a softening in energy prices and the adverse impact of inflation on operating costs, resulted in the closing of the Americology facility in 1982. The plant is not presently operated, but the grounds are used as a transfer station for refuse by the City of Milwaukee.

Ongoing Solid Waste Management Efforts

When it became apparent that the Americology project could not continue to operate under the constraints of an unreliable market for the RDF produced at the facility, the City of Milwaukee and the American Can Company in 1982 retained the firm of Lazard Freres & Company to investigate potential redevelopment strategies using the Americology RDF production plant. The findings of that investigation are documented in a report entitled, Preliminary Report Findings to the City of Milwaukee, Wisconsin, Relating to Potential Redevelopment Strategies Utilizing the Existing Americology RDF Production Facility, May 1982. The report recommended that the City appoint a qualified staff professional to direct and coordinate efforts for project redevelopment and that the City consider obtaining outside financial, legal, and technical assistance to aid in this effort.

The City appointed a staff person to coordinate solid waste management efforts in 1983, and in 1984 retained the firm of Black & Veatch to conduct a study of the feasibility of waste-to-energy resource recovery alternatives. These alternatives include using RDF or other forms of municipal solid waste incineration to produce steam that would be used to dry sludge for use in the Milorganite production process by the Milwaukee Metropolitan Sewerage District. In addition, other municipal solid waste combustion and energy generation alternatives were to be determined, and a study was to be conducted of the modifications and costs that would be required to rehabilitate the Americology plant. The results of this study were expected to be available by the end of 1985.

In 1981, a consortium of the City of Milwaukee, Milwaukee County, the Wisconsin Gas Company, Americology, Inc., and Rexnord, Inc., began an evaluation of the feasibility of converting RDF or other solid waste fuel products which may be produced at the Americology plant to methane gas. The study would evaluate the potential use of methane as fuel for city or county vehicles. The study was initiated in 1982 and was envisioned to be carried out in several phases, with the first phase to be completed in 1984.

In 1982, the City of West Allis contracted with a consulting firm to undertake a solid waste-energy recovery study for the City. The major focus of the study was an evaluation of the feasibility of using incineration to dispose of residential solid wastes generated in the City, along with a major portion of the City's commercial and industrial wasteload, while generating energy which could be sold to industrial, commercial, and institutional users in the area. The study included an inventory of solid waste sources and quantities and disposal practices, a market analysis of potential energy users, the development of alternatives and conceptual designs for the construction of an incinerator, a feasibility analysis, and the development of implementation strategies. The study concluded that a strong, long-term economic incentive existed for using incineration and energy recovery in the City if certain key elements were met, including guaranteed waste supplies, long-term contracts for the purchase of energy produced at the facility, and the development of suitable financing arrangements to pay for construction and operation of the facility.

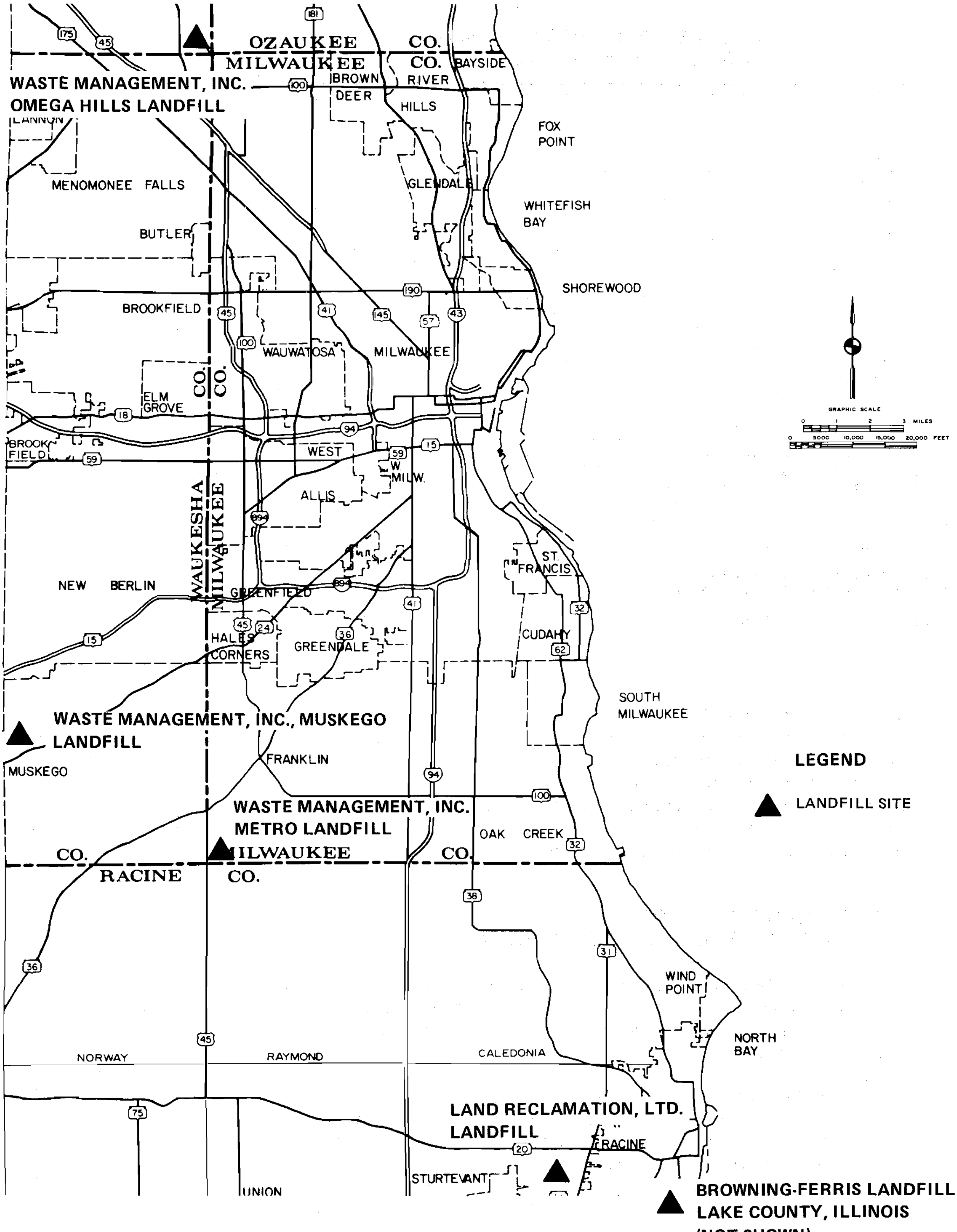
The Briggs & Stratton Corporation is presently evaluating the feasibility of expanding its present incineration facilities to dispose of a larger volume of the solid wastes generated in its manufacturing processes, and to produce energy which can be used in its plant operations. Moreover, Future Parkland Development, Inc., has recently proposed that a 120-acre landfill site be developed in the northern one-half of U. S. Public Land Survey Section 36, Township 5 North, Range 20 East, City of Muskego. This site would be used exclusively for the disposal of foundry wastes produced by Briggs & Stratton and perhaps other companies which produce similar wastes. The proposal calls for initially using 13 acres of the site for waste disposal over the next 15 years, with the potential to expand the site by an additional 16 acres. The City of Muskego and the Wisconsin Department of Natural Resources are presently evaluating the feasibility of the development of this landfill.

EXISTING SOLID WASTE MANAGEMENT FACILITIES

Solid wastes generated in Milwaukee County are presently disposed of primarily in four licensed sanitary landfills located in Milwaukee, Racine, Washington, and Waukesha Counties, and one additional landfill in Lake County, Illinois. The location of these facilities is shown on Map 1, and pertinent characteristics are presented in Table 1. In addition, there are 16 private and public special-use landfills which are used for the disposal of solid waste such as demolition debris, fly ash, foundry sand, and similar materials. Refuse from the City of Milwaukee is presently transported to one of three transfer stations prior to transport to one of the four above-referenced landfills. In addition, five other transfer stations are operated in the County which serve the Cities of Cudahy, Glendale, Wauwatosa, and West Allis, and the Villages of Shorewood, West Milwaukee, and Whitefish Bay. Limited amounts of municipal solid waste are recycled. These efforts include the separation of white goods

Map 1

ACTIVE LANDFILLS RECEIVING THE MAJORITY OF RESIDENTIAL AND COMMERCIAL SOLID WASTE FROM MILWAUKEE COUNTY SOURCES: 1984



Source: Wisconsin Department of Natural Resources and SEWRPC.

Table 1

ACTIVE SOLID WASTE DISPOSAL SITES RECEIVING WASTES FROM MILWAUKEE COUNTY SOURCES: 1984

Owner/Operator	Location	Estimated Site Life[a] (years)	Remaining Capacity (cubic yards)	Contiguous Property Available for Expansion
Waste Management of Wisconsin, Inc. Metro Disposal Landfill	T5N, R21E Section 31 City of Franklin	5.5	4,250,000	Yes
Land Reclamation, Ltd.	T3N, R22E Section 23 Town of Mt. Pleasant	12.0 to 33.0	4,000,000	Yes
Waste Management of Wisconsin, Inc. Muskego Landfill	T5N, R20E Section 18 City of Muskego	1.5	671,000	Yes
Waste Management of Wisconsin, Inc. Omega Hills Landfill	T9N, R20E Section 36 Village of Germantown	3.0	6,000,000	Yes
Browning-Ferris Industries	T46N, R12E Section 7 Town of Benton, Lake County, Illinois	25.0	10,700,000	Yes

[a]Estimated site life was based on the amount of material being disposed of, and on the size and remaining capacity of the facility.

Source: Wisconsin Department of Natural Resources and SEWRPC.

and similar recyclable materials and the operation of recycling operations in several communities. Commercial, institutional, and industrial solid waste generators also recycle some wastes. There are 47 privately owned and operated incinerators in Milwaukee County. These are mainly facilities operated by hospitals and industries for the disposal of special solid waste components produced onsite. Presently, there are no municipal- or county-owned and -operated incinerators in Milwaukee County.

LEGAL FRAMEWORK FOR, AND CONCEPTS INVOLVED IN, SOLID WASTE MANAGEMENT

Chapter NR 185 of the Wisconsin Administrative Code governs the development of comprehensive county solid waste management plans and establishes criteria for such plans. Below are the definitions of three basic terms used in Chapter NR 185:

- "Solid waste" means any garbage; refuse; sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and other discarded or salvageable material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Solid waste, as described herein, does not include solid or dissolved material collected from municipal sewage, or solid or dissolved materials in irrigation return flows or industrial discharges, which are point sources subject to permits under Chapter 147 of the Wisconsin Statutes, nor does it include source, special nuclear, or by-product material as defined under Section 140.52 of the Wisconsin Statutes.

- "Solid waste management" means the systematic administration of activities which provide for source reduction, source separation, storage, collection, transfer, transportation, processing, treatment, resource recovery, and disposal of solid waste.

- "Solid waste management functions" means source reduction, source separation, storage, collection, transportation, transfer, processing, treatment, resource recovery, and disposal of solid waste.

Concepts Involved in Solid Waste Management

Solid waste management includes all potential management steps, from generation to ultimate disposal. The solid waste management functions presently performed in Milwaukee County consist of storage at the point of generation; recycling principally by industrial generators, but also on a limited basis by some municipalities and community organizations; collection, transfer, and transportation; and disposal at conventional landfills located primarily within and adjacent to the County. Because of changing economic conditions and the relative value of materials commonly found in solid wastes, and owing to the increasing costs of disposal of such wastes and limited landfill capacities, processing to recover certain elements of the waste stream and reduce the bulk and overall volume of the solid waste materials may be expected to become more viable. Additional management steps which can be considered are source reduction, source separation, storage, processing and treatment, and resource recovery.

Source Reduction: Source reduction is the reduction of the consumption of materials in order to reduce the generation of solid wastes. One way in which source reduction can be achieved is through the enactment of special legislation designed to restrict the production of nonreturnable containers for soft drinks and beer. Source reduction for commercial or industrial operations may include the modification of an operation or process to control the amount of waste more effectively.

Source Separation: Source separation is a pre-collection form of resource recovery which may include the removal of certain materials such as newspaper, glass, waste oil, and metal beverage containers. The success of a source separation program is heavily dependent on public participation. For commercial and industrial users, source separation may be employed to remove certain materials that are not suited for the general waste stream, such as bulky materials or toxic and hazardous wastes that require special handling and disposal. Source separation may also be considered a form of source reduction if the material can be separated and removed from the waste stream for reuse.

Storage, Collection, and Transportation: Storage of solid waste occurs prior to collection, but can also be practiced following collection at a transfer station prior to transport to the disposal site. The collection operation can be divided into two operations--collection and transportation. The collection operation consists of removing solid waste from the storage point at the place of generation. This operation begins when the collection vehicle leaves the garage, and includes all time spent on the route. The transportation operation starts when the collection vehicle departs for the disposal site from the point where the last container of solid waste is loaded, and includes the time spent at the disposal site. It also includes the time it takes after leaving the site to return to the first container on the next collection route. Therefore, the transportation operation includes the total round-trip travel time from the collection route to the disposal site.

Transfer: A transfer station is a facility where solid waste is received from relatively small collection vehicles, and stored and/or placed into larger long-haul vehicles before being transported to the disposal site.

Processing and Treatment: Processing is a physical operation that is designed to reduce the amount of material, to improve its handling characteristics, or to improve its usefulness. Processing methods include classification of wastes, separation, baling, and shredding. Incineration is also sometimes classified as a processing operation. Treatment functions are generally considered to be biological or chemical processes, including such unit processes as composting and bioconversion.

Resource Recovery: Resource recovery can include low-technology recovery such as source separation, or post-collection recovery, which may consist of the recovery of newspapers, metals, or other materials prior to land disposal. Post-collection resource recovery most commonly refers to high-technology processes that are designed to extract marketable materials and combustible materials from the waste stream. One common by-product of a solid waste processing operation is refuse-derived fuel. Refuse-derived fuel is the combustible fraction of solid waste and is commonly co-fired with coal in conventional or modified boiler systems. Other by-products include ferrous and nonferrous metals and glass. A less intensive post-collection resource recovery system is simply solid waste incineration with heat recovery. This system places less emphasis on materials recovery; however, this system does significantly reduce the volume of solid waste to be disposed of in landfills, with significant heat recovery from combustible materials.

Disposal: Even under the most intense recovery process, there are still significant amounts of residual materials that must be disposed of in a solid waste landfill. Under a high technology resource recovery system, it may be possible to extract up to 70 percent by weight of resource materials for heat recovery or materials recycling. The remaining solid waste material is typically well-suited for land disposal. Landfills, therefore, are an essential part of all solid waste disposal systems. When used in conjunction with the most economically feasible resource recovery program, the optimum use of suitable landfill sites can be achieved.

Solid Waste Management Planning Steps

The solid waste management planning process applied in the Milwaukee County study consisted of the following seven steps: development of a public participation program; formulation of objectives and standards; inventory and analyses of pertinent basic data; preparation of forecasts of solid waste management needs and available resources; development of alternative solid waste management plans; selection of the best management plans from among the alternatives; and preparation of plan implementation strategies. The format of the report, as set forth in the Table of Contents, is organized to conform with the order of presentation required in Chapter NR 185 of the Wisconsin Administrative Code.

PURPOSE AND SCOPE

The comprehensive solid waste management plan for Milwaukee County is intended to provide an assessment of countywide solid waste management needs, and to provide a general strategy for meeting those needs while providing for the protection of public health and the environment from the potential adverse effects of improper solid waste disposal. The plan is intended to identify the existing solid waste management facilities and practices within the County; to evaluate the capability of the existing facilities and practices to meet the existing and probable future disposal needs; to evaluate alternative means for meeting those needs; and to recommend the most cost-effective means for adoption and subsequent implementation. The plan is also intended to identify the existing and potential roles of the various units and agencies of government operating within the County in the development of the most cost-effective and environmentally sound solid waste management system.

The planning area is defined by the boundaries of Milwaukee County. The study, however, recognizes and considers the existing and potential transfer of solid wastes into and out of the County.

The solid wastes generated in Milwaukee County can be classified by source as residential, commercial, institutional, and industrial. The planning effort requires determination of the relative contribution from each of these sources to assess the overall amounts and characteristics of the solid wastes to be processed and disposed of. Toxic and hazardous wastes were addressed in the study only to the extent necessary to ascertain the extent of the toxic and hazardous waste disposal problem based upon available information, but the management of these wastes will not be specifically planned for. In addition, this study will discuss the management requirements of septic tank wastes and holding tank wastes from onsite sewage disposal systems. However, the main focus of the report will not be directed toward these wastes.

The plan includes an inventory of existing solid waste generation rates, and of existing management facilities and operations. The inventory was conducted by mailing survey forms to all local units of government in the County, as well as to selected industrial, commercial, and institutional generators of solid waste. A telephone contact was made, where appropriate, to verify data and ensure a maximum return rate of survey information. Additional information was obtained by individual communication with the Wisconsin Department of Natural Resources, local units of government, commercial and industrial establishments, and private landfill operators and solid waste collection services. Special needs which were identified include the need to consider the effects of seasonal generation on the solid waste management requirements and the impact of present and potential future solid waste loads from outside the County.

Implementation of a long-term, comprehensive, solid waste management plan for Milwaukee County will require substantial public and private efforts and expenditures, as well as a commitment to the plan over a long period of time.

A planning period covering up to the year 2010 has been chosen for the alternatives presented, recognizing that the service life or operational utility of certain elements of the management program may be considerably more or less than the planning period. A planning period of about 25 years is considered to be necessary so that local, county, and private concerns can effectively organize existing operations to meet future solid waste disposal needs. The study is further intended to provide an appropriate technical basis for implementing a technically sound, cost-effective, and environmentally responsible system for solid waste management.

In view of the 1980 census data, the land use, economic, and population inventories and analyses will be based upon an approach termed "alternative futures." This approach attempts to deal with the uncertainty that currently exists about future conditions influencing public utility systems. Under this approach, the design, test, and evaluation of alternative systems is based upon a number of alternatives, which together define a wide range of possible future conditions and which identify those facilities which will perform well under this range.

SOLID WASTE MANAGEMENT OBJECTIVES

Planning is defined as a rational process for formulating and meeting objectives. The formulation of objectives is, therefore, an essential task which must be undertaken before plans can be prepared. To be useful in a comprehensive planning process, objectives must not only be logically sound, but must be related in a demonstrable and measurable way to alternative development proposals. Upon selection of sound development objectives and subsequent development of appropriate alternative plans, a plan can be selected which best meets the agreed-upon objectives. The development of objectives for the countywide solid waste disposal plan was based upon the knowledge and experience of the members of the technical advisory committee directing the study, the membership of which is set forth on the inside front cover of this report.

The following objectives have been selected to provide the basic framework within which alternative solid waste management plans can be formulated:

1. The development of a solid waste management system which will effectively protect the public health and welfare and quality of life within Milwaukee County.

2. The development of a solid waste management system which will effectively protect the quality of the groundwater and surface water resources and minimize the possibility of pollution and depletion.

3. The development of a solid waste management system which will be properly related to the natural resources and which will enhance the overall quality of the environment.

4. The development of a solid waste management system which will effectively serve existing and future land uses and promote implementation of sound land use planning concepts and zoning practices.

5. The development of a solid waste management system which will accommodate existing and future residential, commercial, institutional, and industrial development.

6. The development of a solid waste management system which will maximize the recovery and utilization of both material and energy resources contained in the solid waste stream.

7. The development of a solid waste management system which will be compatible with the waste management plans of adjoining counties and which will be adaptable to development of a regional solid waste management plan.

8. The development of a solid waste management system which will meet pertinent local, state, and federal regulations.

9. The development of a solid waste management system which will efficiently and effectively meet all of the other stated objectives at the lowest cost possible.

10. The development of a solid waste management system which will be flexible and readily adaptable to changing needs.

11. The development of a solid waste management plan which is compatible with major private resource recovery plans.

These objectives, while calling for the identification of the most cost-effective solid waste management system, do not address the issue of how the costs for this system should be allocated to the various users of the system. The objectives also do not address the issue of accessibility to the recommended facilities. Since the recommended plan may involve the use of privately owned and operated facilities, it will be difficult to fully consider these concerns in the plan development. However, it is recognized that these issues are important, and they will be considered further in Chapter VIII. Nevertheless, definitive recommendations regarding facility cost and use accessibility are not within the scope of this study, and will have to be addressed by other parties, including the full Countywide Solid Waste Management Task Force.

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Chapter II

INVENTORY AND ANALYSIS

INTRODUCTION

The man-made and natural features which together form the environment of Milwaukee County are important considerations in solid waste management planning. The principal features of the County which are relevant to solid waste management planning are the population and employment levels, the land use patterns, the topography, the public utility and transportation systems, the geology and soils, the surface- and groundwater resources, the climate, and the location and extent of environmentally significant areas. An understanding of these features, in addition to a knowledge of the existing solid waste sources, the quantity and character of the solid wastes generated, the existing solid waste management systems, and related legal constraints, is essential to sound solid waste management planning.

This chapter describes the man-made and natural features of Milwaukee County pertinent to solid waste management planning. The first section describes the County and its internal governmental boundaries. The second section describes the demographic and economic base of the County in terms of historic trends as well as existing conditions, providing pertinent data on the population size, distribution, and composition, and on employment levels and distribution. The third section describes the existing pattern of land use in the County. The fourth section describes the public utility and transportation systems of the County. The fifth section describes the spatial distribution and characteristics, and the extent of those elements of the natural resource base which must be considered in the preparation and implementation of a solid waste management plan for the County. The sixth section describes the existing solid waste sources and the quantity and character of the solid wastes, and the seventh section describes the solid waste management systems operating within the County and the legal regulations governing the location and operation of these systems and their component parts.

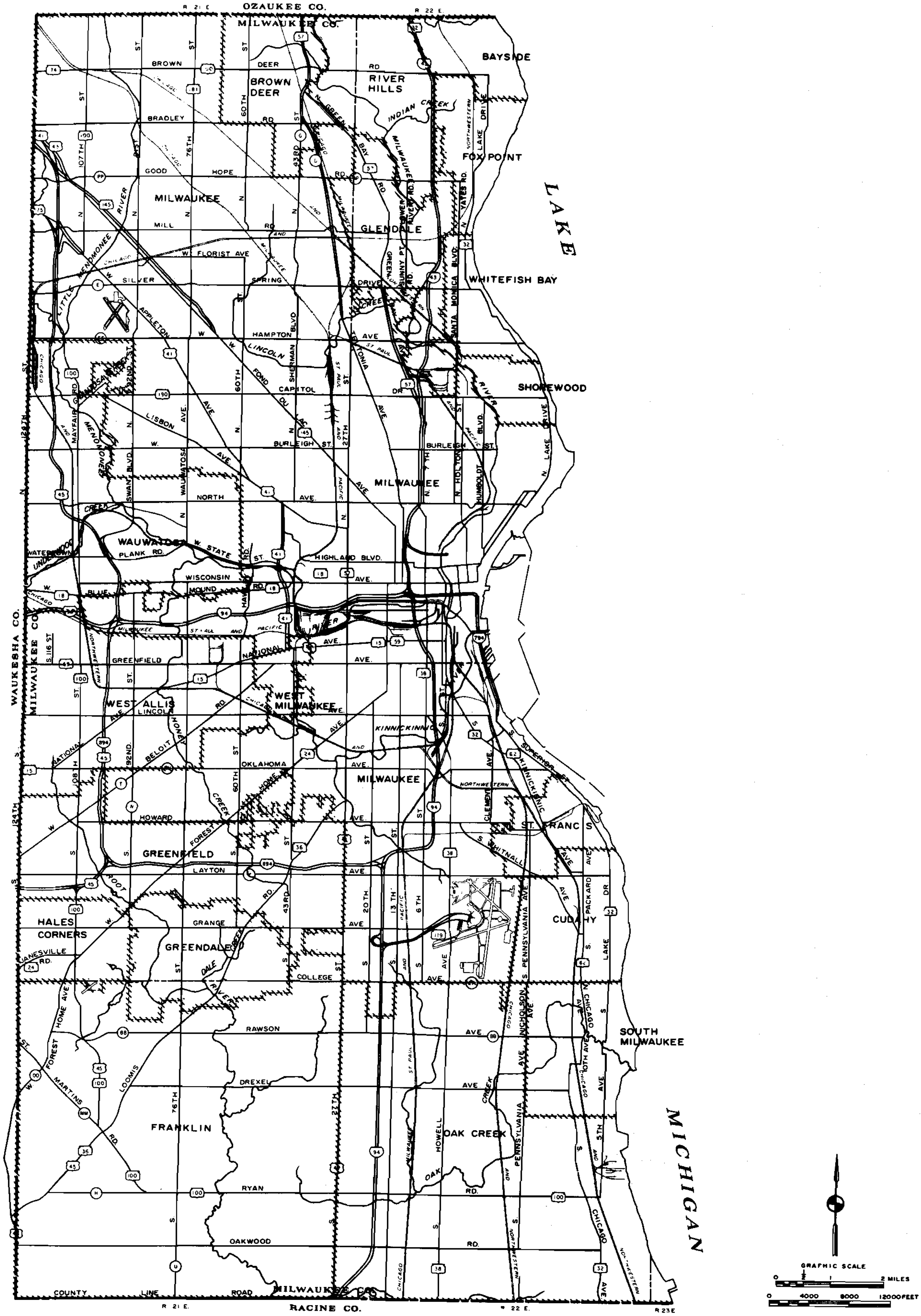
GEOGRAPHIC SETTING AND POLITICAL BOUNDARIES

The geographic area considered in the Milwaukee County solid waste management study was defined as all of Milwaukee County. The study area thus encompasses 242.5 square miles, as shown on Map 2.

The principal sources of the basic data required for the study were the Southeastern Wisconsin Regional Planning Commission; the Milwaukee County Department of Public Works, Division of Engineering, Environment and Energy Services; the public works departments of the municipalities in Milwaukee County; and selected industrial, commercial, and institutional generators of solid waste. Other sources of basic data included the Wisconsin Department of Natural Resources, the Wisconsin Department of Transportation, and the University of Wisconsin-Extension.

Map 2

MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLANNING AREA



Source: SEWRPC.

Milwaukee County is the most heavily urbanized county in the State; however, there remains ample opportunity for continued growth and development. The County is the heart of the highly urbanized seven-county Southeastern Wisconsin Region and is bounded by Racine County and the Racine urbanized area on the south, the rapidly urbanized Waukesha County on the west, and rapidly urbanizing Ozaukee County on the north. Still largely rural, Washington and Walworth Counties lie to the northwest and southwest, respectively, while Kenosha County and the Kenosha urbanized area lie to the south beyond Racine County but within ready commuting distance. The large Chicago urbanized area lies about 85 miles to the south.

A total of 19 general-purpose local units of government and one special-purpose unit of government exist within Milwaukee County. The 19 general-purpose local units of government include 10 cities and nine villages. The special-purpose local unit of government is the Milwaukee Metropolitan Sewerage District. Presently, these 19 general-purpose units of government are primarily responsible for the public solid waste management functions in the County.

Superimposed upon these local units and agencies of government are the state and federal governments. Certain agencies of these governments also have important responsibilities for solid waste management and these are described in a later section of this chapter. These include the Wisconsin Department of Natural Resources and the U. S. Environmental Protection Agency.

DEMOGRAPHIC AND ECONOMIC BASE

Since the ultimate purpose of any solid waste management planning effort is the development of an environmentally sound solid waste management system to serve the residents of the planning area, an understanding of the size, characteristics, and spatial distribution of the resident population is basic to that planning effort. Resident population levels and associated commercial and industrial activity bear a direct relationship to the demand for solid waste collection, transportation, handling, and disposal services. The size and characteristics of the resident population of an area are greatly influenced by growth and change in economic activity. Population and economic activity must, therefore, be considered together.

From 1900 to 1930, the resident population of the County increased at a greater rate than did that of the Southeastern Wisconsin Region as a whole, or of the State of Wisconsin as a whole (see Figure 1 and Table 2). From 1930 to 1960, the resident population of Milwaukee County increased at a lesser rate than did that of the Region as a whole, but at a greater rate than did that of the State as a whole. From 1960 to 1980, the resident population of the County actually declined, while the population of the Region and the State continued to increase moderately.

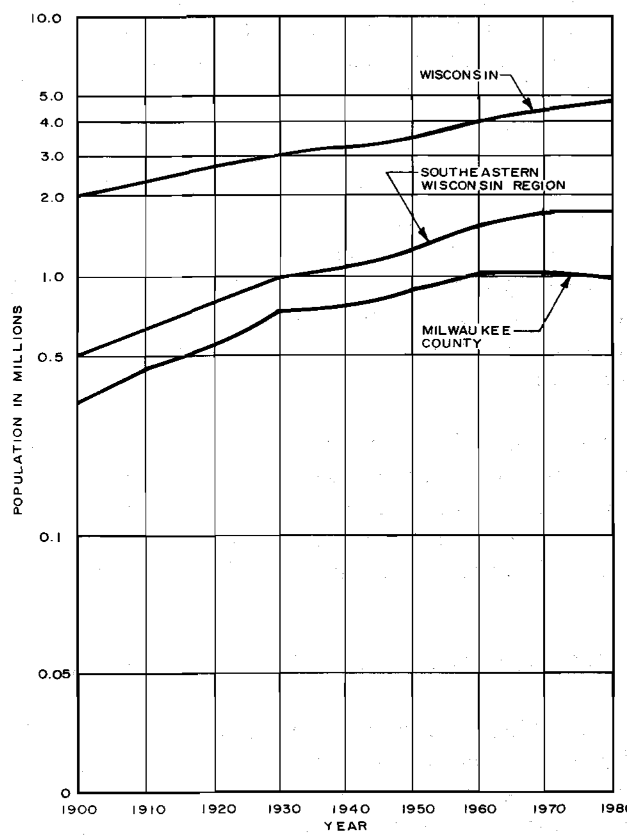
The distributions of resident population within the County by civil division for 1970 and 1980 are shown in Table 3. The largest increases in resident population between 1970 and 1980 occurred in the Cities of Franklin, Greenfield, and Oak Creek, with increases of 38 percent, 28 percent, and 22 percent, respectively. The largest decreases in resident population between 1970 and 1980 occurred in the Villages of West Milwaukee and Whitefish Bay and in the Cities of Wauwatosa, Cudahy, and Milwaukee, with decreases of 20 percent, 14 percent, 13 percent, 12 percent, and 11 percent, respectively.

This decline in the resident population of the County, and in the proportion which that population comprises of the regional population, is indicative of recent significant geographic population shifts. The dispersion of the urban population into the outlying counties of the Region has been an important factor in the decline of the resident population of the County.

In 1980, a total of 547,900 jobs were available in the County, as shown in Table 4. This was about 40,856, or 8 percent, more jobs than were available in the County in 1970. This percentage increase in jobs compares with the 8.5 percent decrease in population over the same time span. Economic activity within the County consists of a complex combination of various employment categories, as shown in Table 4. As of 1980, those industries employing the largest percentage of county workers included manufacturing, employing 28 percent of the total work force in the County; services, with about 23 percent; retail trade, with about 15 percent; and government, with about 10 percent of the total county work

Figure 1

POPULATION LEVELS IN MILWAUKEE COUNTY, SOUTHEASTERN WISCONSIN, AND THE STATE OF WISCONSIN: 1900-1980



Source: SEWRPC.

Table 2

RESIDENT POPULATION TRENDS IN MILWAUKEE COUNTY, SOUTHEASTERN WISCONSIN, AND THE STATE OF WISCONSIN: 1900-1980

Year	Population			County Population as a Percent of	
	Milwaukee County	Southeastern Wisconsin	Wisconsin	Southeastern Wisconsin	Wisconsin
1900	330,017	501,808	2,069,042	65.8	15.9
1930	725,263	1,006,118	2,939,006	72.1	24.7
1960	1,036,047	1,573,620	3,952,771	65.8	26.2
1970	1,054,249	1,756,086	4,417,933	60.0	23.9
1980	964,988	1,764,919	4,705,335	54.7	20.5

Source: U. S. Bureau of the Census, Wisconsin Department of Administration, and SEWRPC.

Table 3

POPULATION IN THE MILWAUKEE COUNTY SOLID WASTE MANAGEMENT STUDY AREA BY CIVIL DIVISION: 1970 AND 1980

Civil Division	Population		1970-1980 Change	
	1970	1980	Number	Percent
Cities				
Cudahy	22,078	19,547	-2,531	-11.5
Franklin	12,247	16,871	4,624	37.8
Glendale	13,426	13,882	456	3.4
Greenfield	24,424	31,353	6,929	28.4
Milwaukee[a]	717,372	636,295	-81,077	-11.3
Oak Creek	13,928	16,932	3,004	21.6
St. Francis	10,489	10,095	-394	-3.8
South Milwaukee	23,297	21,069	-2,228	-9.6
Wauwatosa	58,676	51,308	-7,368	-12.6
West Allis	71,649	63,982	-7,667	-10.7
Villages				
Bayside[b]	4,338	4,612	274	6.3
Brown Deer	12,582	12,921	339	2.7
Fox Point	7,939	7,649	-290	-3.7
Greendale	15,089	16,928	1,839	12.2
Hales Corners	7,771	7,110	-661	-8.5
River Hills	1,561	1,642	81	5.2
Shorewood	15,576	14,327	-1,249	-8.0
West Milwaukee	4,405	3,535	-870	-19.8
Whitefish Bay	17,402	14,930	-2,472	-14.2
Milwaukee County	1,054,249	964,988	-89,261	-8.5

[a]Milwaukee County portion only--total population of the City of Milwaukee in 1980 was 636,297, of which two resided in Washington County.

[b]Milwaukee County portion only--total population of the Village of Bayside in 1980 was 4,724, of which 112 resided in Ozaukee County.

Source: U. S. Bureau of the Census and SEWRPC.

force. The proportion of workers in most of these categories is about the same as for the Region and the State, with the exception of agriculture, which constitutes about 7 percent less of the total jobs in the County than in the State; and services, which constitutes about 6 percent more of the total jobs in the County than in the State.

Per capita income in the County increased from $3,490 in 1970 to $7,952 in 1980, an increase of 128 percent, as measured in real dollars. This 1980 per capita income for Milwaukee County compares with 1980 per capita incomes of $8,154 and $7,243 for the Southeastern Wisconsin Region and State of Wisconsin, respectively. It should be noted that this increased average per capita income reflects not only an increase in the earnings of the heads of each household, but also the tendency for additional household members to work to supplement the family income. The 128 percent increase in per capita income in the County may be compared to about a 121 percent increase in the cost of living over this same time span as measured by the consumer price index prepared by the U. S. Bureau of Labor Statistics.

Table 4

INDUSTRY EMPLOYMENT BY PLACE OF WORK IN MILWAUKEE COUNTY, SOUTHEASTERN WISCONSIN, AND WISCONSIN: 1970 AND 1980

Major Employment Category	1970 Employment by Place of Work					
	Milwaukee County		Southeastern Wisconsin Region		Wisconsin	
	Number	Percent	Number	Percent	Number	Percent
Agriculture...........	784	0.2	11,939	1.6	150,844	8.2
Construction..........	15,864	3.1	27,172	3.6	65,480	3.6
Manufacturing.........	166,307	32.8	252,318	33.5	504,184	27.5
Transportation, Communications, and Utilities........	28,734	5.7	36,739	4.9	81,227	4.4
Wholesale Trade.......	28,110	5.5	35,226	4.7	67,180	3.7
Retail Trade..........	79,519	15.7	115,741	15.4	270,748	14.7
Finance, Insurance, and Real Estate......	27,810	5.5	32,759	4.3	61,636	3.4
Services..............	84,733	16.7	119,547	15.9	256,248	13.9
Government............	54,029	10.7	83,329	11.0	250,688	13.6
Nonfarm Proprietors...	20,532	4.0	37,193	4.9	123,324	6.7
Miscellaneous.........	666	0.1	1,740	0.2	6,087	0.3
Total Jobs	507,088	100.0	753,743	100.0	1,837,696	100.0

Major Employment Category	1980 Employment by Place of Work					
	Milwaukee County		Southeastern Wisconsin Region		Wisconsin	
	Number	Percent	Number	Percent	Number	Percent
Agriculture...........	794	0.2	12,818	1.5	156,648	7.0
Construction..........	12,373	2.3	25,816	2.9	70,062	3.1
Manufacturing.........	154,191	28.1	261,754	29.6	560,200	24.8
Transportation, Communications, and Utilities........	28,243	5.2	39,610	4.5	92,625	4.1
Wholesale Trade.......	29,374	5.4	43,454	4.9	95,946	4.3
Retail Trade..........	81,092	14.8	131,866	14.9	341,240	15.1
Finance, Insurance, and Real Estate......	36,250	6.6	46,403	5.3	96,578	4.3
Services..............	125,695	22.9	177,971	20.1	384,043	17.0
Government............	57,103	10.4	95,736	10.8	297,972	13.2
Nonfarm Proprietors...	22,093	4.0	46,191	5.2	150,995	6.7
Miscellaneous.........	736	0.1	2,526	0.3	9,984	0.4
Total Jobs	547,944	100.0	884,145	100.0	2,256,293	100.0

Source: SEWRPC.

LAND USE AND ZONING

The type, intensity, and spatial distribution of the various land uses comprising the urban portion are important determinants of the solid waste management needs of an area. The amounts of land devoted to each of the various land uses in Milwaukee County in 1975 and 1980 are set forth in Table 5. Map 3 shows the land use pattern of Milwaukee County in 1980, including the principal residential, commercial, industrial, transportation, governmental, institutional, and recreational land use concentrations and the remaining rural land uses in the County. In 1980, urban land uses comprised about 164 square miles in the County, or about 68 percent of the total area of the County. This was an increase of four square miles, or 2.4 percent, from 1975 to 1980.

Table 5

LAND USE IN MILWAUKEE COUNTY: 1975 AND 1980

Land Use Category	1975			1980		
	Acres	Percent of Subtotal	Percent of County	Acres	Percent of Subtotal	Percent of County
Urban						
Residential[a]	45,927	44.9	29.6	47,196	44.9	30.4
Commercial	3,118	3.0	2.0	3,237	3.1	2.1
Industrial[b]	4,849	4.7	3.1	5,046	4.8	3.2
Transportation[c]	34,538	33.7	22.3	35,681	33.9	23.0
Governmental and Institutional	7,030	6.9	4.5	7,097	6.7	4.6
Recreational[d]	6,937	6.8	4.5	6,968	6.6	4.5
Urban Subtotal	102,399	100.0	66.0	105,225	100.0	67.8
Rural						
Agricultural	25,695	48.7	16.5	23,051	46.1	14.9
Surface Water	1,323	2.5	0.9	1,327	2.7	0.9
Wetlands	4,143	7.8	2.7	4,129	8.3	2.6
Woodlands	4,951	9.4	3.2	4,856	9.7	3.1
Other Open Lands[e]	16,682	31.6	10.7	16,605	33.2	10.7
Rural Subtotal	52,794	100.0	34.0	49,968	100.0	32.2
Total	155,193	--	100.0	155,193	--	100.0

[a]Includes residential areas under development.

[b]Includes wholesaling and storage.

[c]Includes off-street parking, airports, terminals, communication facilities, and utilities.

[d]Consists of intensively used outdoor recreation lands.

[e]Includes extractive uses, landfills, and unused lands.

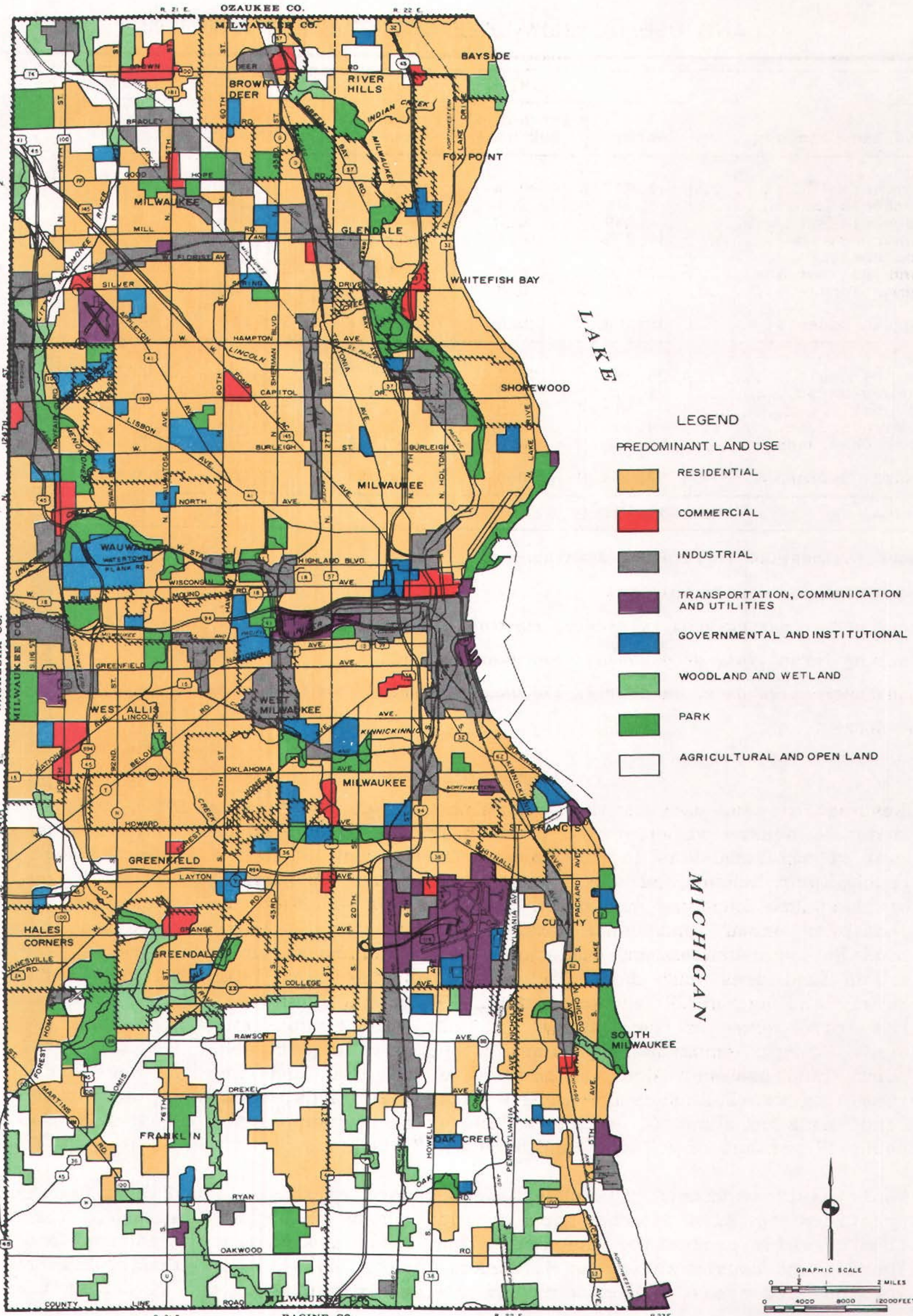
Source: SEWRPC.

Residential land use was the predominant urban land use in 1980, constituting about 74 square miles, or 45 percent of the urban land uses and about 30 percent of all land uses in the County. Transportation land use was the next most predominant urban land use, constituting about 56 square miles, or 34 percent of the urban land use and about 23 percent of all land use in the County. The remaining urban land uses--commercial, industrial, governmental and institutional, and recreational--made up about 34 square miles, or 21 percent of the urban land uses and about 15 percent of the total land uses in the County. Rural land use still occupied about 78 square miles, or about 32 percent of the total area of the County, in 1980. The predominant rural land use was agricultural, encompassing about 36 square miles, or about 46 percent of the rural land use and about 15 percent of all the land uses in the County. The remaining rural land uses--surface waters, wetlands, woodlands, and other open land--made up about 42 square miles, or 54 percent of the rural land uses and about 17 percent of all the land uses in the County.

Municipalities within Milwaukee County generally follow sound land use zoning practices to direct urban growth into those areas most suitable for such growth, while protecting the most significant environmental features present. There is no county zoning in Milwaukee County, as all of the County lies within incorporated areas. A review of the zoning ordinances of the 19 communities in

Map 3

EXISTING 1980 LAND USE IN MILWAUKEE COUNTY



Source: SEWRPC.

the County indicated that most do not presently have zoning districts which permit solid waste management facilities such as sanitary landfills or incinerators. However, five communities--the Cities of Franklin, Glendale, and West Allis and the Villages of Brown Deer and Hales Corners--have zoning districts which do permit solid waste disposal, processing, or incineration facilities. Examples include the M-2 General Industrial District of the City of Franklin, which permits as a conditional use sanitary landfills; and the M-1 Commercial and Light Manufacturing District of the City of Glendale, the MC Manufacturing District of the City of West Allis, the Manufacturing District of the Village of Brown Deer, and the M-1 Commercial and Light Manufacturing District of the Village of Hales Corners, all of which permit solid waste processing or incineration facilities.

The rapid conversion of farmland to urban use has become a matter of increasing public concern, and, in the adopted regional land use plan, it was recommended that the remaining prime farmlands of the Region be preserved in agricultural use. Since the preparation of the regional plan, the State Legislature has adopted Chapter 29, Laws of 1977, commonly called the "Farmland Preservation Act." The Act is designed to encourage individuals and local units of government to take action toward the preservation of farmland. Under the Act, owners of farmland zoned for exclusive agricultural use become eligible for tax relief in the form of a state income tax credit. The legislation has resulted in a broad interest in farmland preservation and, since the preparation of the regional land use plan, farmland preservation plans have been prepared by all but one of the seven counties comprising the Region--the exception being Milwaukee County. These plans provide a detailed delineation of prime agricultural lands proposed to be preserved in agricultural use. While large areas of the other six counties have been identified as prime agricultural lands, as might be expected, within Milwaukee County only a small area in the southern portion of the City of Franklin totaling about 1,355 acres, or about 1 percent of the County, has been identified as prime agricultural land. This identification was done by the Commission for the City of Franklin. That City has proposed to act to protect the remaining prime agricultural lands in the City through the use of the City A-2 Prime Agricultural District.

Chapter NR 117 of the Wisconsin Administrative Code requires the zoning of shoreland-wetlands within incorporated areas following receipt of final wetland maps by the respective communities from the Wisconsin Department of Natural Resources. Such zoning has not as yet been exercised in any of the municipalities within the County, but will have to be in the near future. The establishment of zoning in the applicable wetland areas will preclude the location of solid waste management facilities in those areas.

PUBLIC UTILITY AND TRANSPORTATION SYSTEMS

Public Utility Base

Urban development is highly dependent upon public utility systems which serve land uses with power, light, communications, heat, water, and sewerage. Of particular importance to solid waste management planning is the consideration of sanitary sewerage, because treatment facilities generate solid waste in the form of sludge, and because solid waste landfill siting requires consideration of leachate treatment and disposal which may involve conveyance to a municipal sewage treatment plant. The location and source of water supply systems is

Table 6

PUBLIC WATER SUPPLY UTILITIES IN MILWAUKEE COUNTY: 1984

Number on Map 5	Public Water Utility	Location
1	Cudahy Water Department[a]	City of Cudahy
2	Franklin Water Utility[b]	City of Franklin
3	Glendale Water Utility[a]	City of Glendale
4	North Shore Water Utility[a,c]	City of Glendale
5	Milwaukee Water Works[a,d]	City of Milwaukee
6	City of Oak Creek Water and Sewer Utility[a,e]	City of Oak Creek
7	South Milwaukee Water Utility[a]	City of South Milwaukee
8	Wauwatosa Water Works[a]	City of Wauwatosa
9	West Allis Water Utility[a]	City of West Allis
10	Brown Deer Municipal Water Utility[a]	Village of Brown Deer
11	Water Utility of the Village of Fox Point[a]	Village of Fox Point
12	Village of Greendale Water and Sewer Utility[a]	Village of Greendale
13	Shorewood Municipal Water Utility[a]	Village of Shorewood
14	Village of Whitefish Bay Water Utility[a]	Village of Whitefish Bay

[a]This utility utilizes Lake Michigan as the sole source of water supply.

[b]This utility utilizes groundwater as the sole source of water supply.

[c]The North Shore Water Utility provides no retail water service and exists only to sell water on a wholesale basis to the City of Glendale and Villages of Fox Point and Whitefish Bay.

[d]The Milwaukee Water Works provides retail water service to the Cities of Greenfield and St. Francis and the Village of West Milwaukee, and to a portion of the City of Franklin and a portion of the Village of Hales Corners, and provides wholesale water service to the Cities of Wauwatosa and West Allis and the Villages of Brown Deer, Greendale, and Shorewood.

[e]The City of Oak Creek Water and Sewer Utility provides retail service to a portion of the City of Franklin.

Source: Wisconsin Public Service Commission, Wisconsin Department of Natural Resources, and SEWRPC.

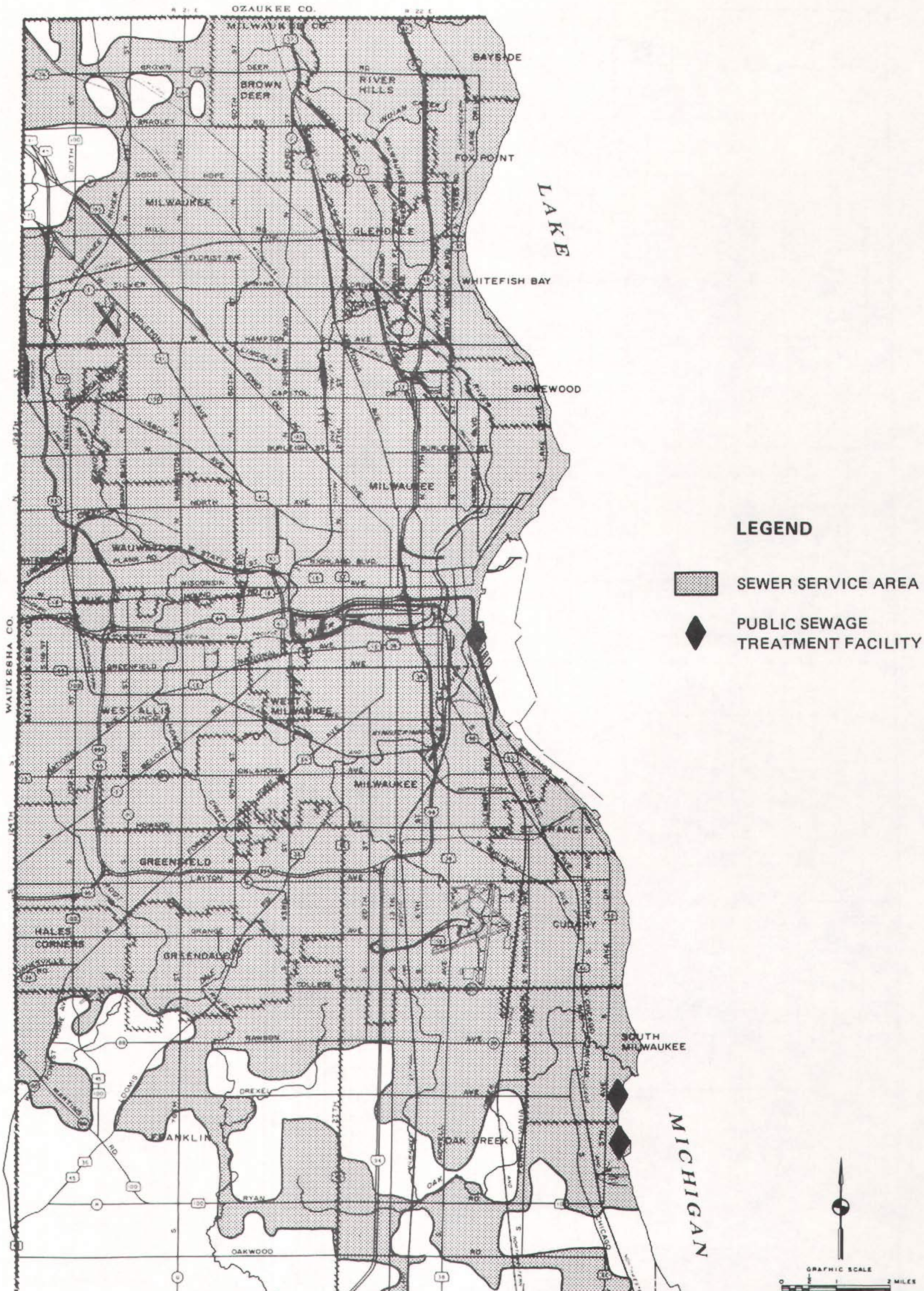
also a consideration in evaluating landfill sites in the County because of the potential for landfills to pollute the groundwater, thus precluding the use of that source for a good supply.

Sanitary sewage within the County is conveyed and treated by the Milwaukee Metropolitan Sewerage District (MMSD), which serves the entire area of Milwaukee County except South Milwaukee. The MMSD operates the Jones Island sewage treatment plant and the South Shore sewage treatment plant. South Milwaukee is served by a municipal sewage treatment facility owned and operated by the City. The existing public sanitary sewerage service areas, together with the location of the existing sewage treatment facilities within the County, are shown on Map 4.

Most of the water supply service within the County is provided by public water utilities. As shown in Table 6, in 1984 there were a total of 14 publicly owned water utilities in operation within the County, 13 of which used Lake Michigan as the sole source of water. The City of Franklin industrial park used groundwater as a source of water. The locations of these water utilities are shown on Map 5. In addition to the publicly owned water utilities, there were 36 known private water utilities in operation within the County, as shown on Map 5 and listed in Table 7. Many of these small, privately owned water systems serve isolated enclaves of residential development. All water supplied by the privately owned water utilities is drawn from one of the two distinct groundwater aquifers underlying the County.

Map 4

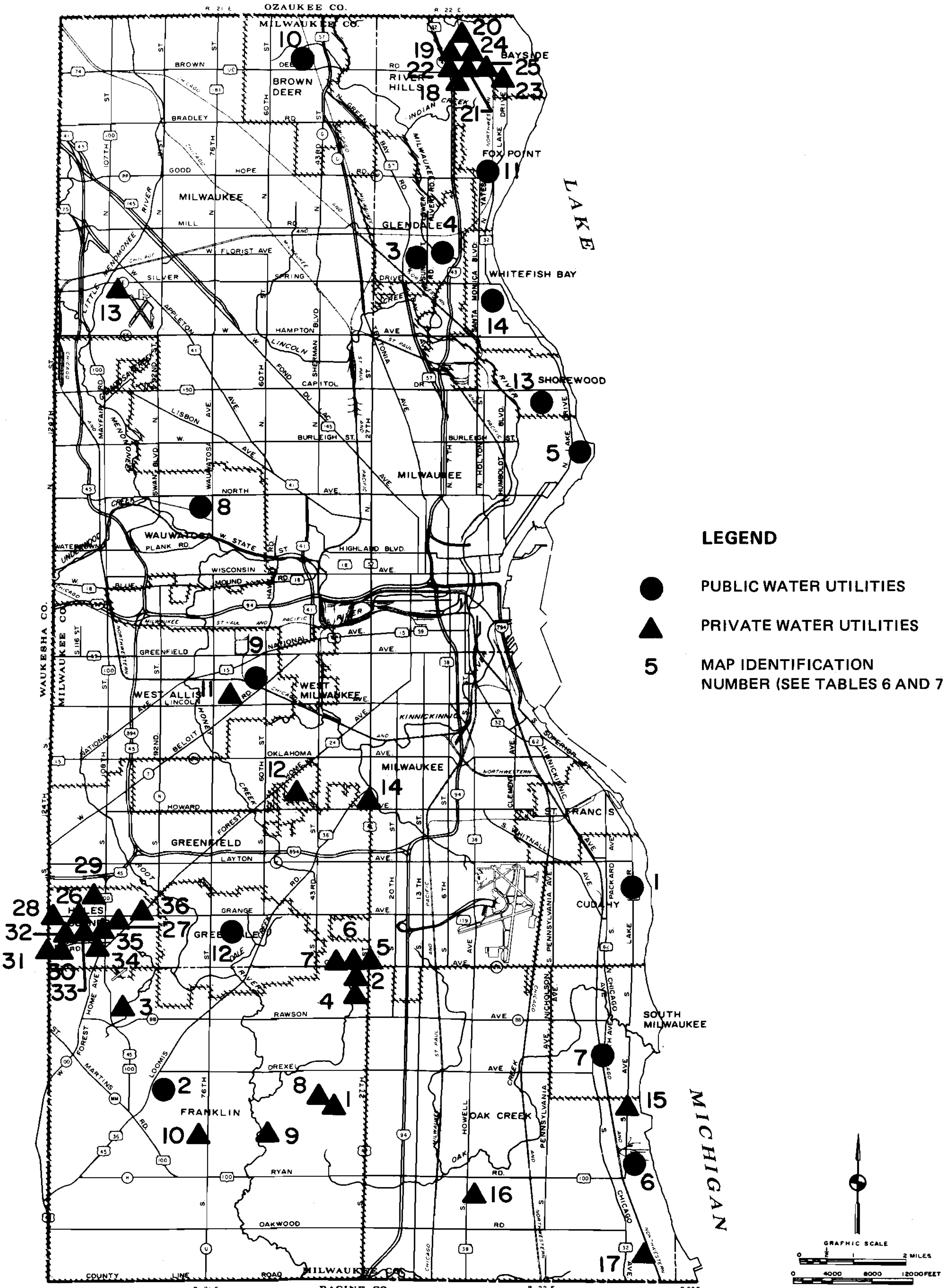
EXISTING PUBLIC SANITARY SEWER SERVICE AREAS IN MILWAUKEE COUNTY: 1984



Source: SEWRPC.

Map 5

PUBLIC AND PRIVATE WATER UTILITIES IN MILWAUKEE COUNTY: 1984



Source: SEWRPC.

Table 7

PRIVATE WATER UTILITIES IN MILWAUKEE COUNTY: 1984

Number on Map 5	Water Utility	Location
1	Acre Avenue Water Trust	City of Franklin
2	Badger Mobile Home Park	City of Franklin
3	Country Gate Apartments	City of Franklin
4	Dreamland Village	City of Franklin
5	Franklin Mobile Estates No. 1	City of Franklin
6	Franklin Mobile Estates No. 2	City of Franklin
7	Franklin Mobile Estates No. 3	City of Franklin
8	Mary Ann Drive Water Trust	City of Franklin
9	Milwaukee County House of Correction	City of Franklin
10	Security Acres Water Trust	City of Franklin
11	Whitnall Edge Subdivision	City of Franklin
12	Town View Water Co-operative Association	City of Greenfield
13	Robert Williams Park	City of Milwaukee
14	Wildenbergs Mobile Home Park	City of Milwaukee
15	Fifth Avenue Mobile Home Park	City of Oak Creek
16	Howell Avenue Estates Subdivision	City of Oak Creek
17	Oakview Subdivision No. 3	City of Oak Creek
18	Bayside Village Apartments	Village of Bayside
19	Bayside Woods Condominiums	Village of Bayside
20	North Shore East Subdivision	Village of Bayside
21	Northway Co-operative No. 1	Village of Bayside
22	Northway Co-operative No. 2	Village of Bayside
23	Pelham Heath Subdivision	Village of Bayside
24	Santa Monica Subdivision	Village of Bayside
25	Vista Del Mar Water Trust	Village of Bayside
26	Blossom Heath Water Trust	Village of Hales Corners
27	Forest Place Apartments	Village of Hales Corners
28	Grange Meadows Water Trust	Village of Hales Corners
29	Hales Happiness Homesites Subdivision	Village of Hales Corners
30	Hales Park Meadows	Village of Hales Corners
31	Hales Villa Apartments	Village of Hales Corners
32	Monaco Heights	Village of Hales Corners
33	Park Manor Apartments	Village of Hales Corners
34	Village Brook Condominiums	Village of Hales Corners
35	Village Park Apartments	Village of Hales Corners
36	Whitnall Garden Apartments	Village of Hales Corners

Source: Wisconsin Department of Natural Resources and SEWRPC.

Public gas service is provided to Milwaukee County in part by the Wisconsin Natural Gas Company and in part by the Wisconsin Gas Company. The Wisconsin Electric Power Company provides electric service to Milwaukee County. Both gas and electric service may be considered to be ubiquitous within the County, and neither constitutes a constraint on the location and intensity of urban development in the County, nor do they affect the analysis of alternative solid waste management facilities.

Transportation Base

The transportation systems of the County have a direct impact on the cost effectiveness and efficiency of alternative solid waste management plans.

Although Milwaukee County is served by intercity passenger bus and passenger and freight rail service, the highway system is the transportation network that is of the most direct concern to solid waste management planning. Milwaukee County is served by a well-developed and well-maintained, all-weather arterial street and highway system. There were a total of 2,845 miles of streets and highways open to traffic in the County in 1984, with 939 miles, or 33 percent, functioning as arterial streets and highways. Two of the primary variables in the configuration of any solid waste management system are the transportation distances and transportation times involved. These variables are dependent upon the allowable roadway loadings, vertical clearances, and roadway conditions, as well as upon pavement width and alignment. Careful evaluation of these conditions is necessary to minimize solid waste transportation costs. The jurisdictional classification of the arterial street and highway system in Milwaukee County is shown on Map 6.

The State of Wisconsin requires that all vehicles except agricultural vehicles and vehicles that have been granted a special permit not exceed an overall height of 13 feet 6 inches. The design practices of the Wisconsin Department of Transportation provide for a minimum vertical clearance under structures carrying highway and railroad facilities over state trunk highways and over highways directly interchanging with state trunk highways of 16 feet 3 inches, and a minimum vertical clearance for all other highways of 14 feet 9 inches.

The vehicles used in the transportation of solid waste typically require a vertical clearance of about 13 feet 6 inches, with some special vehicles being somewhat higher and requiring a special permit. For the purpose of maintaining safe vertical clearance for the movement of solid waste transportation vehicles, a minimum height of 15 feet has been selected as the height below which bridge clearance should be identified and reviewed further in selection of a solid waste disposal site. All bridges overpassing state trunk or county trunk highways with a vertical clearance of less than 15 feet are shown on Map 7. In addition, some bridges within the County have weight limitations for use. Such bridges on the state or county arterial system are shown on Map 7. The actual vertical clearances, where applicable, are listed in Table 8.

Chapter 348.15 of the Wisconsin Statutes requires that vehicles operating on Class A state trunk or county trunk highways not exceed a gross weight of 10,000 pounds imposed on the highway by any one wheel or wheels supporting one end of an axle; 20,000 pounds by any one axle; and 80,000 pounds by all the axles of one vehicle. All roads within Milwaukee County categorized as part of the arterial system (see Map 6) meet or exceed Class A highway standards.[1] Based on the weight restrictions noted above, there would be no constraint on the operation of solid waste transportation vehicles on the state trunk and county trunk arterial highway system in the County.

The State of Wisconsin requires that no person operate a vehicle in violation of special seasonal weight limitations imposed by the State or local authorities on particular highways or portions of highways so marked. Special seasonal vehicle weight limitations during spring thaw are imposed on county trunk highways routinely within the City of Franklin. However, most communities within the County have ordinances which allow the posting of seasonal weight limitations should conditions warrant such posting.

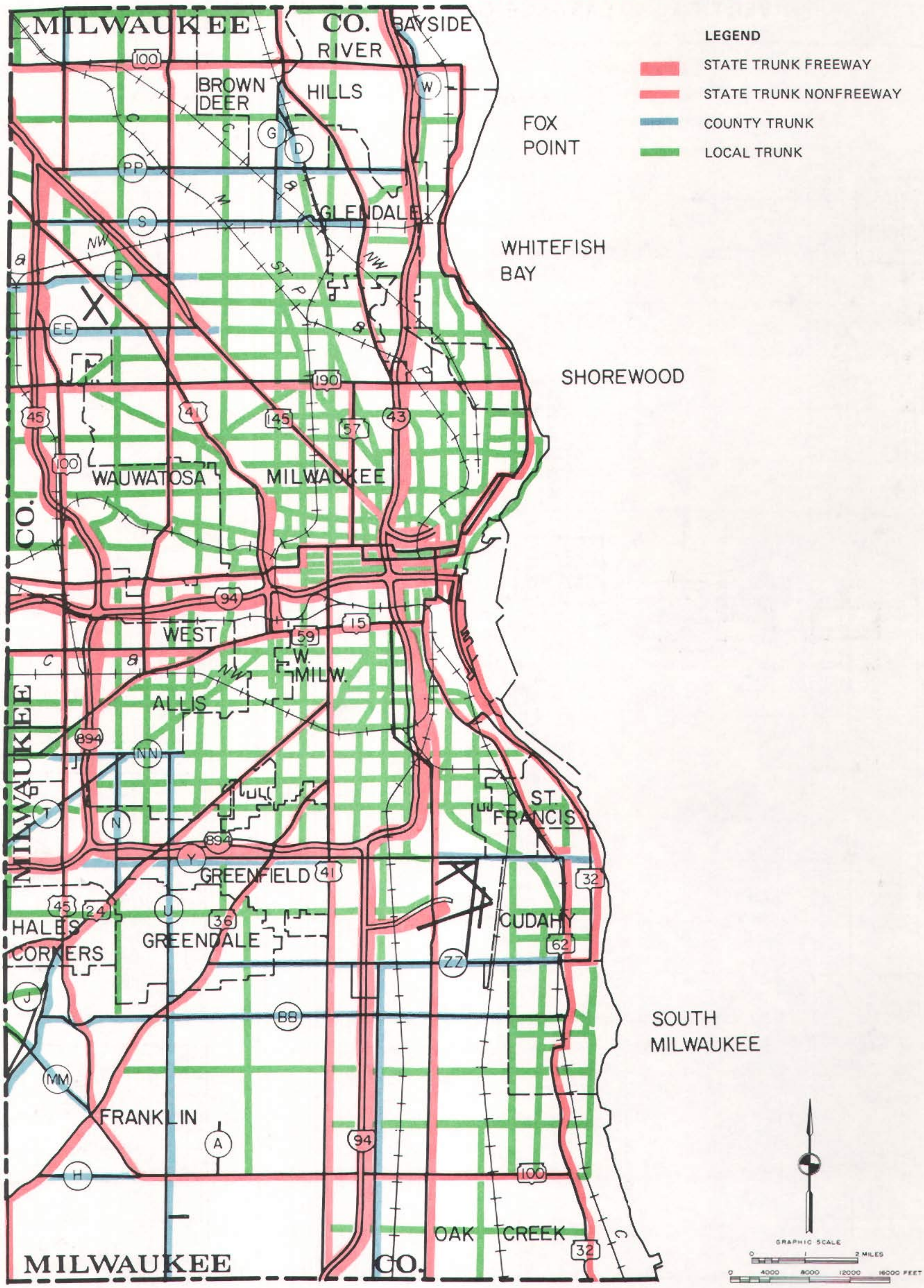
Airports

The present air transportation system in Milwaukee County includes a total of nine airports, of which three are general aviation facilities open for use by the general public. These airports are shown on Map 8. General Mitchell Field--an air carrier airport served by 16 airlines--provides scheduled airline service to the general public. General Mitchell Field constitutes a

[1]CTH H between STH 36 and Highway 100 has a 10-ton load limit at all times.

Map 6

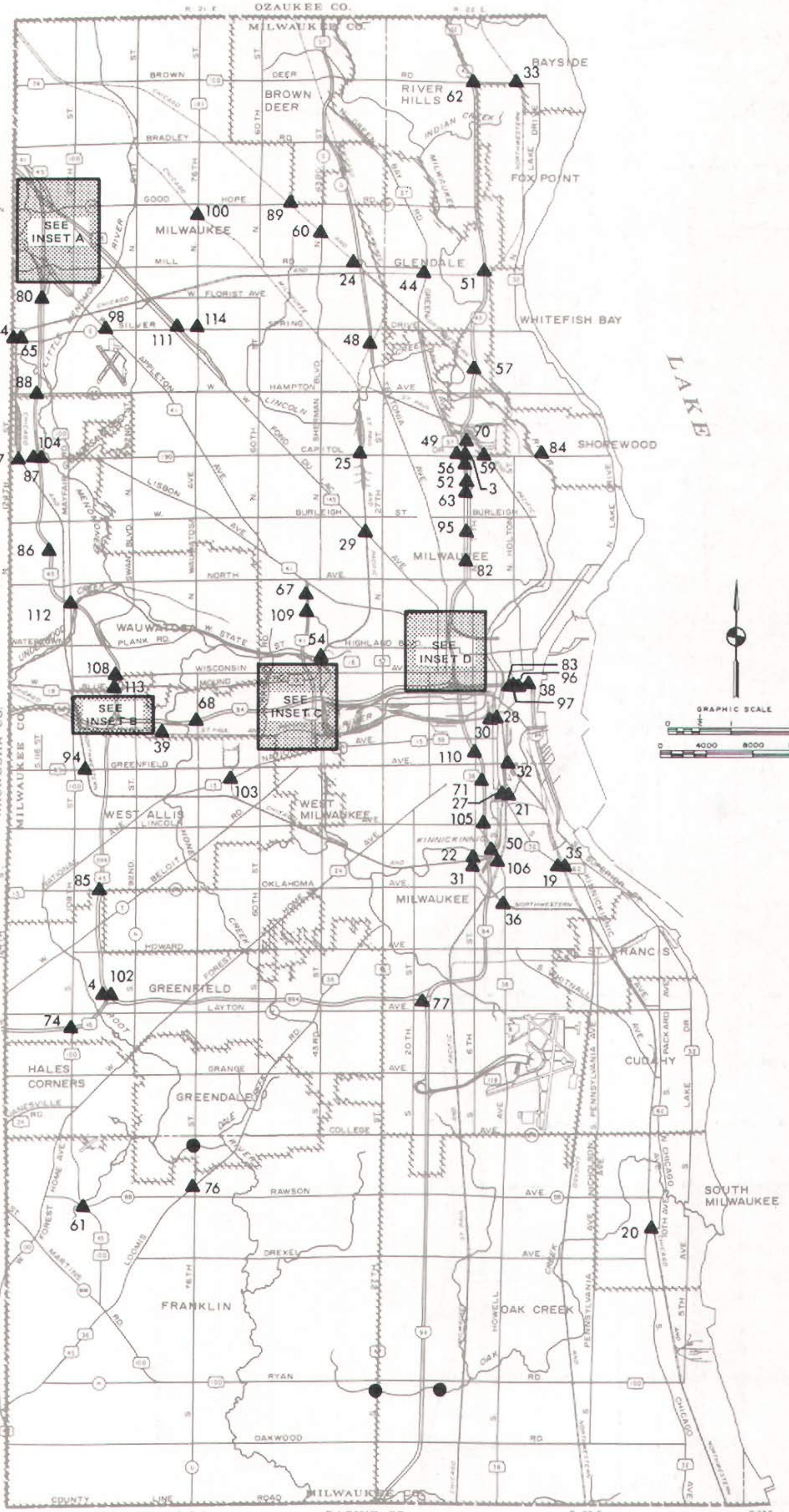
JURISDICTIONAL CLASSIFICATION OF THE ARTERIAL STREET AND HIGHWAY SYSTEM IN MILWAUKEE COUNTY: 1984



Source: SEWRPC.

Map 7

BRIDGES OVERPASSING THE STATE OR COUNTY ARTERIAL SYSTEM IN MILWAUKEE COUNTY WITH A VERTICAL CLEARANCE OF LESS THAN 15 FEET: 1984

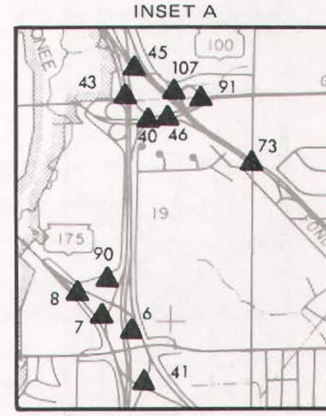


LEGEND

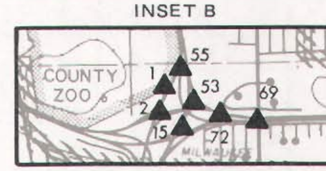
▲ LOCATION OF BRIDGES PROVIDING A VERTICAL CLEARANCE OF LESS THAN 15 FEET (SEE TABLE 8)

● LOCATION OF BRIDGES WITH WEIGHT RESTRICTIONS

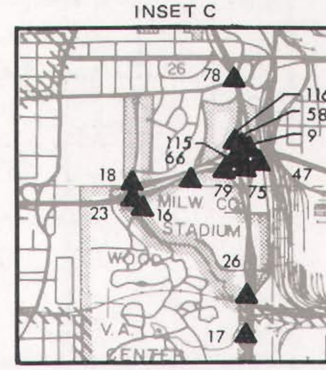
INSET A



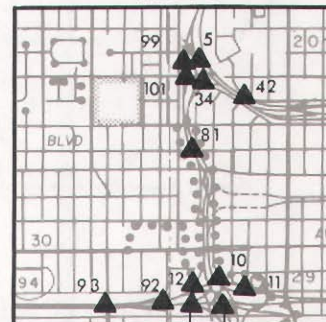
INSET B



INSET C



INSET D



Source: SEWRPC.

Table 8

STATE AND COUNTY ARTERIAL SYSTEM WITH OVERHEAD CLEARANCES OF 15 FEET OR LESS

Number on Map 7	Minimum Vertical Clearance	Direction	Minimum Vertical Clearance	Direction	Feature Under	Feature On
1	--	--	14.50	W	IH 94 Westbound-Zoo Interchange	USH 45 Southbound-Zoo Interchange
2	--	--	14.58	S	USH 45 Southbound-Zoo Interchange	IH 894 Westbound-Zoo Interchange
3	--	--	14.58	W	Ramp IH 43 Northbound Lane-STH 57	IH 43 North-South Freeway
4	--	--	14.50	S	Ramp IH 894 Westbound-USH 45 Southbound	USH 45 Northbound-STH 15 Eastbound
5	--	--	14.92	W	Ramp USH 141 Northbound-IH 43 Southbound	IH 43 Northbound--North-South Freeway
6	--	--	14.92	S	USH 41 Southbound	USH 45 Northbound-STH 100 Northbound
7	--	--	14.75	S	USH 41 Southbound	USH 45 Southbound-STH 100 Southbound
8	--	--	14.00	S	USH 41 Southbound	STH 175 Northbound
9	--	--	13.82	S	Ramp IH 94 Westbound Lane-USH 41 Southbound Lane	Ramp USH 41 Southbound Lane-IH 94 Eastbound Lane
10	--	--	14.84	W	Ramp IH 794 Westbound-IH 94 Eastbound	IH 43 Southbound-Marquette Interchange
11	--	--	14.84	S	Ramp IH 794 Westbound-IH 94 Eastbound	Ramp IH 43 Southbound-IH 794 Eastbound
12	--	--	14.58	S	IH 43 Southbound-Marquette Interchange	IH 94 Westbound-Marquette Interchange
13	--	--	14.75	S	IH 43 Southbound-Marquette Interchange	IH 794 Westbound-Marquette Interchange
14	--	--	14.84	W	Ramp IH 794 Westbound-IH 43 Northbound	IH 43 Northbound
15	--	--	14.42	W	IH 94 Westbound-Zoo Interchange	USH 45 Northbound-Zoo Interchange
16	10.86	N	--	--	Stadium Access Ramp B	Stadium Access Ramp A
17	12.42	E	--	--	S. Stadium Road	USH 41-Stadium Freeway
18	12.67	S	--	--	Mitchell Boulevard	IH 94 Westbound--East-West Freeway
19	13.00	N	13.33	S	STH 32-Kinnickinnic Street	C&NW Railway
20	13.09	N	13.09	S	STH 32-Marquette Avenue	C&NW Railway
21	13.25	N	13.25	S	STH 32-Kinnickinnic Street	Milwaukee Road Railroad
22	13.27	N	--	--	S. 6th Street	C&NW Railway
23	13.33	N	12.67	S	Mitchell Boulevard	IH 94 Eastbound--East-West Freeway
24	13.33	N	--	--	Mill Road	C&NW Railway
25	13.34	E	13.34	W	STH 190-Capitol Drive	Milwaukee Road Railroad
26	13.42	E	--	--	N. Stadium Access Road	USH 41 Northbound-Stadium Freeway
27	13.42	N	13.25	S	STH 32-Kinnickinnic Street	Milwaukee Road Railroad
28	13.50	N	11.00	S	STH 32-Milwaukee Street	Milwaukee Road Railroad
29	13.50	N	13.50	S	STH 145-W. Fond du Lac Avenue	Milwaukee Road Railroad
30	13.58	N	13.50	S	STH 32-Milwaukee Street	Milwaukee Road Railroad
31	13.58	N	--	--	S. 6th Street	C&NW Railway
32	13.67	E	--	--	E. Greenfield Avenue	C&NW Railway
33	13.92	N	13.92	S	STH 32-Brown Deer Road	C&NW Railway
34	14.00	E	--	--	Ramp IH 43 Northbound-USH 141 Southbound	W. Winnebago Avenue
35	14.00	N	14.08	S	STH 32-STH 62	C&NW Railway
36	14.08	N	14.08	S	STH 38-Chase Avenue	C&NW Railway
37	14.08	E	14.58	W	STH 190-Capitol Drive	C&NW Railway
38	14.08	E	--	--	Ramp IH 794 Eastbound-Lake Freeway	IH 794 Westbound-Lake Interchange
39	14.09	N	14.09	S	STH 181-S. 84th Street	Milwaukee Road Railroad
40	14.10	N	--	--	STH 145 Northbound-North Interchange	Spur USH 41 Southbound Lane-STH 145 Southbound
41	14.17	N	--	--	STH 175 Northbound	USH 41 Southbound
42	14.25	N	--	--	USH 141 Northbound	Sign Bridge
43	14.25	N	14.25	S	STH 145-North Interchange	USH 41 Northbound-USH 45 Northbound

Table 8 (continued)

Number on Map 7	Minimum Vertical Clearance	Direction	Minimum Vertical Clearance	Direction	Feature Under	Feature On
44	14.33	N	14.25	S	STH 57-Green Bay Avenue	C&NW Railway
45	14.42	N	14.17	S	STH 145-North Interchange	USH 41 Northbound-USH 45 Northbound
46	14.42	N	14.42	S	STH 145-North Interchange	Spur USH 41 Southbound Lane-STH 145 Southbound
47	14.42	N	--	--	USH 41 Northbound-Stadium Interchange	IH 94 Eastbound-Stadium Interchange
48	14.42	N	14.00	S	N. Teutonia Avenue	Milwaukee Road Railroad
49	14.42	N	14.79	S	IH 43 North-South Freeway	STH 190-Capitol Drive
50	14.47	N	--	--	S. 1st Street	Milwaukee Road Railroad
51	14.50	N	14.58	S	IH 43 North-South Freeway	C&NW Railway
52	14.50	N	14.67	S	IH 43 North-South Freeway	W. Atkinson Avenue
53	14.50	E	--	--	IH 94 Eastbound-Zoo Interchange	USH 45 Northbound-Zoo Interchange
54	14.50	E	--	--	W. State Street	Milwaukee Road Railroad
55	14.50	E	--	--	IH 94 Eastbound-Zoo Interchange	USH 45 Southbound-Zoo Interchange
56	14.54	N	14.58	S	IH 43 North-South Freeway	N. Green Bay Avenue
57	14.58	N	14.58	S	IH 43 North-South Freeway	C&NW Railway
58	14.58	N	--	--	USH 41 Northbound-Stadium Interchange	IH 94 Westbound-Stadium Interchange
59	14.58	E	14.67	W	STH 190-Capitol Drive	Milwaukee Road Railroad
60	14.58	N	14.58	S	N. Sherman Boulevard	C&NW Railway
61	14.58	E	--	--	W. Rawson Avenue	USH 45 Northbound-STH 100 Northbound
62	14.58	N	15.08	S	IH 43-STH 32 Southbound--North-South Freeway	STH 32 Southbound-STH 100 Northbound
63	14.59	N	15.84	S	IH 43 North-South Freeway	W. Keefe Avenue
64	14.66	E	14.66	W	E. and W. Silver Spring Drive	C&NW Railway
65	14.66	E	14.66	W	E. and W. Silver Spring Drive	C&NW Railway
66	14.67	N	--	--	Story Parkway	IH 94 Eastbound--East-West Freeway
67	14.67	N	14.75	S	USH 41-Stadium Freeway	W. Lloyd Street
68	14.67	E	17.67	W	IH 94 East-West Freeway	S. 76th Street
69	14.67	E	15.33	W	IH 94 East-West Freeway	S. 92nd Street
70	14.67	E	--	--	Ramp IH 43 Northbound-STH 57	Ramp IH 43 Southbound-STH 57
71	14.67	E	15.08	W	IH 94 North-South Freeway	W. Mitchell Avenue
72	14.67	N	--	--	USH 45 Northbound-Zoo Interchange	Ramp USH 45 Southbound Lane-IH 94 Eastbound Lane
73	14.67	N	14.83	S	STH 145-W. Fond du Lac Avenue	N. 107th Street
74	14.67	N	14.84	S	STH 100-S. 108th Street	USH 45 Southbound-STH 15 Westbound
75	14.67	E	--	--	IH 94 Eastbound-Stadium Interchange	Ramp IH 94 Westbound Lane-USH 41 Southbound Lane
76	14.67	N	15.00	S	STH 36-Loomis Road	Under S. 76th Street
77	14.70	N	--	--	Ramp IH 894 Eastbound-IH 94 Westbound	IH 894 Westbound-Mitchell Interchange
78	14.75	N	14.67	S	USH 41-Stadium Freeway	USH 18-W. Blue Mound Road
79	14.75	E	14.92	N	IH 94 Eastbound-Stadium Interchange	Ramp USH 41 Northbound Lane-IH 94 Westbound Lane
80	14.75	N	15.00	S	USH 45-STH 100	W. Florist Avenue
81	14.75	E	--	--	W. Highland Avenue	Pedestrian Walkway
82	14.75	N	15.12	S	IH 43 North-South Freeway	W. Wright Avenue
83	14.79	E	--	--	Ramp Broadway-IH 794 Eastbound	IH 794 Eastbound--East-West Freeway
84	14.82	E	14.75	W	STH 190-Capitol Drive	C&NW Railway
85	14.83	E	14.83	W	W. Oklahoma Avenue	IH 894 East-USH 45 South-STH 15 West
86	14.83	N	15.00	S	USH 45-Zoo Freeway	W. Center Street
87	14.83	E	14.42	W	Ramp USH 45 Northbound-STH 190 Westbound	USH 45 Northbound-Zoo Freeway

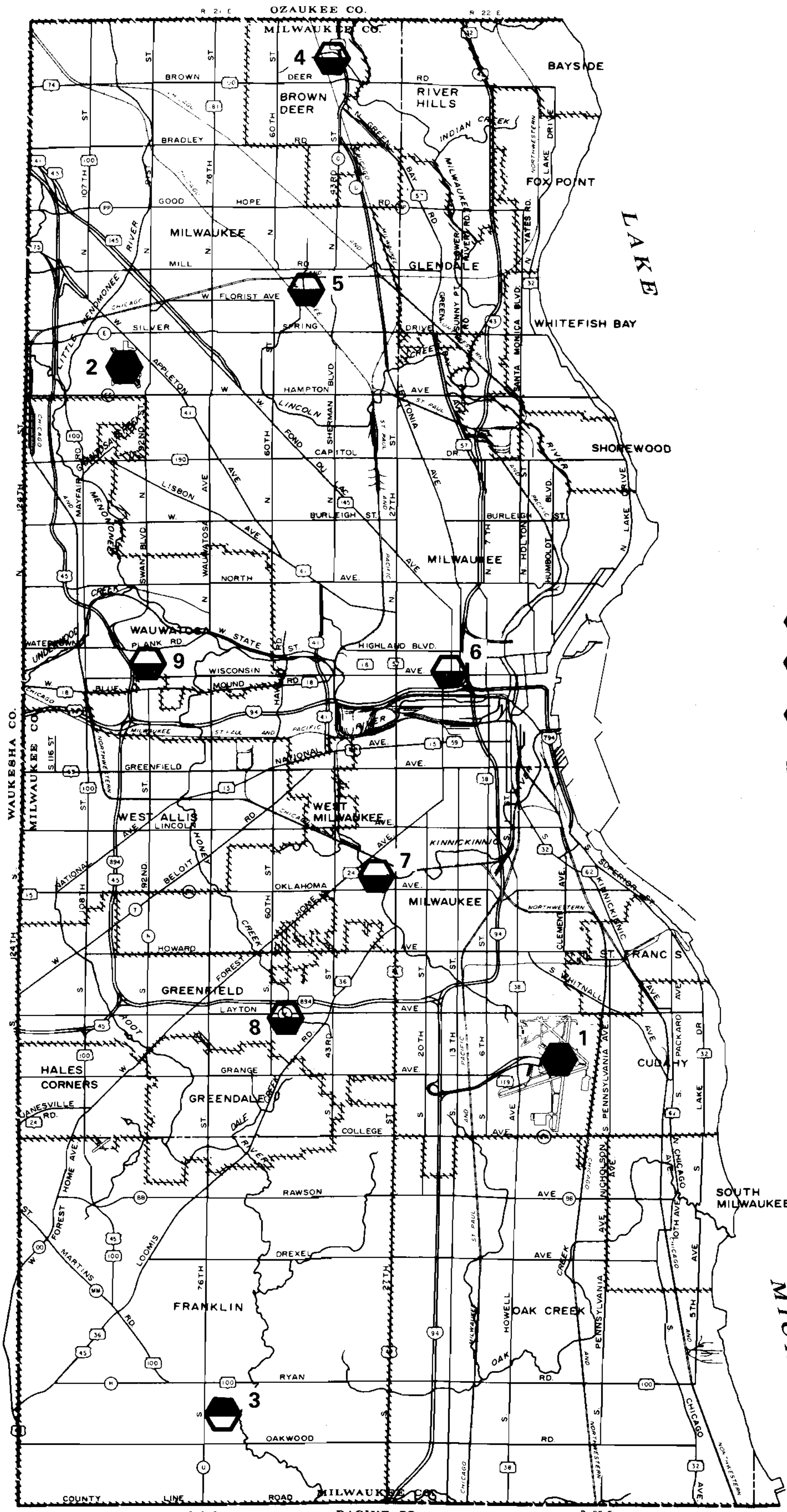
Table 8 (continued)

Number on Map 7	Minimum Vertical Clearance	Direction	Minimum Vertical Clearance	Direction	Feature Under	Feature On
88	14.83	N	15.33	S	USH 45-Zoo Freeway	W. Hampton Avenue
89	14.83	E	15.00	W	W. Good Hope Road	C&NW Railway
90	14.83	N	--	--	STH 175 Northbound- South Interchange	USH 45 Northbound- STH 100 Northbound
91	14.83	N	14.83	S	STH 145-W. Fond du Lac Avenue	STH 100 Northbound-Good Hope Road
92	14.83	E	--	--	IH 794-Marquette Interchange	Ramp IH 794 Westbound- IH 94 Eastbound
93	14.83	E	15.25	W	IH 94 East-West Freeway	N. 16th Street
94	14.84	E	14.58	W	STH 59-Greenfield Avenue	C&NW Railway
95	14.84	N	14.84	S	IH 43 North-South Freeway	W. Locust Avenue
96	14.84	E	14.84	W	USH 18-STH 32-Milwaukee Street	Ramp Jackson Street- IH 794 Westbound
97	14.84	E	14.84	W	USH 18-STH 32-Milwaukee Street	Ramp Broadway Street- IH 794 Eastbound
98	14.92	E	14.75	W	W. Silver Spring Drive	USH 41-Appleton Avenue
99	14.92	E	22.58	N	USH 141	Pedestrian Walkway
100	14.92	N	14.84	S	STH 181-N. 76th Street	Milwaukee Road Railroad
101	14.92	N	--	--	Park Freeway Westbound (not open)	North-South Freeway
102	14.98	E	14.69	W	STH 15 Westbound-STH 15 Eastbound	IH 894 Westbound-USH 45 Northbound
103	15.00	E	14.58	W	STH 15-W. National Avenue	C&NW Railway
104	15.00	E	14.75	W	STH 190-Capitol Drive	Interchange Road
105	15.17	E	14.83	W	IH 94 North-South Freeway	W. Lincoln Avenue
106	15.17	N	14.17	S	STH 38-Chase Avenue	Milwaukee Road Railroad
107	15.17	N	14.83	S	USH 41/45-STH 100 Southbound	STH 100 Southbound-Good Hope Road
108	15.25	N	14.42	S	USH 45-Zoo Freeway	W. Wisconsin Avenue
109	15.33	N	14.83	S	USH 41-Stadium Freeway	W. Washington Boulevard
110	15.75	E	14.75	W	IH 94 North-South Freeway	STH 38-6th Street
111	15.83	N	14.58	S	STH 145-W. Fond du Lac Avenue	Westbound Silver Spring Drive
112	16.00	N	14.59	S	STH 100-Mayfair Road	USH 45 Northbound-Zoo Freeway
113	16.50	N	14.16	S	USH 45-Zoo Freeway	USH 18 Eastbound- W. Blue Mound Road
114	16.50	E	14.83	W	W. Silver Spring Drive	STH 181-N. 76th Street
115	27.50	E	14.75	W	IH 94-Stadium Interchange	USH 41 Southbound- Stadium Interchange
116	29.75	N	14.25	W	IH 94 Westbound- Stadium Interchange	Ramp USH 41 Southbound Lane- IH 94 Eastbound Lane

Source: Wisconsin Department of Transportation.

Map 8

EXISTING AIRPORTS IN MILWAUKEE COUNTY: 1984



LEGEND

PUBLIC USE—PUBLIC OWNERSHIP

PUBLIC USE—PRIVATE OWNERSHIP

PRIVATE USE HELIPAD—PRIVATE OWNERSHIP

IDENTIFICATION NUMBER AND NAME

1 GENERAL MITCHELL FIELD

2 LAWRENCE J. TIMMERMAN FIELD

3 RAINBOW AIRPORT

4 WITI-TV STUDIO BUILDING

5 U. S. ARMY, 84TH DIVISION

6 WISN-TV, CHANNEL 12

7 ST. LUKES' S HOSPITAL

8 ALL-STATE EQUIPMENT COMPANY

9 MILWAUKEE COUNTY MEDICAL COMPLEX

Source: SEWRPC.

major regional transportation terminal, handling relatively large volumes of passengers, mail, and cargo in large, high-performance aircraft. Being served by its own freeway spur from IH 94, General Mitchell Field is readily accessible from the entire greater Milwaukee area.

Lawrence J. Timmerman Airport, located on the northwest side of the City of Milwaukee, is the second public use, general aviation airport in the County which is available for use by corporate business and other commercial users, as well as by recreational and other personal users. The third general aviation airport open to the general public is Rainbow Airport, located on the extreme southwest side of Milwaukee County. The remaining six airports in the County are privately owned and classified as heliports, providing special aviation service for vertical take-off and landing aircraft.

Chapter NR 180.13(3a) of the Wisconsin Administrative Code states that: "No person shall establish, construct, operate, maintain, or permit the use of property for a solid waste land disposal facility within 10,000 feet of any airport runway, used or planned to be used by turbojet aircraft, or within 5,000 feet of any airport runway used only by piston-type aircraft or within such other areas where a substantial bird hazard to aircraft would be created, unless a waiver is granted by the Federal Aviation Administration." This applies to all airports that are listed in the state and federal airport system plans.

This regulation was established to ensure that bird species that are typically attracted to, and gather at, landfill sites are kept away from airport traffic patterns and approaching and departing aircraft. Aircraft collision with birds has been shown to be a serious safety hazard. Turbo-powered aircraft are particularly susceptible to serious collision damage because of the sensitive nature of the exposed engine turbine to foreign objects and because of the extreme dependence of such aircraft on engine thrust to maintain flight. Turbojet aircraft also require generally higher airport approach and departure speeds, increasing the potential severity of damage. The Wisconsin law is patterned after the Federal Aviation Administration regulation which recommends that buffer zones be maintained between landfills and airports for the safety of air traffic.

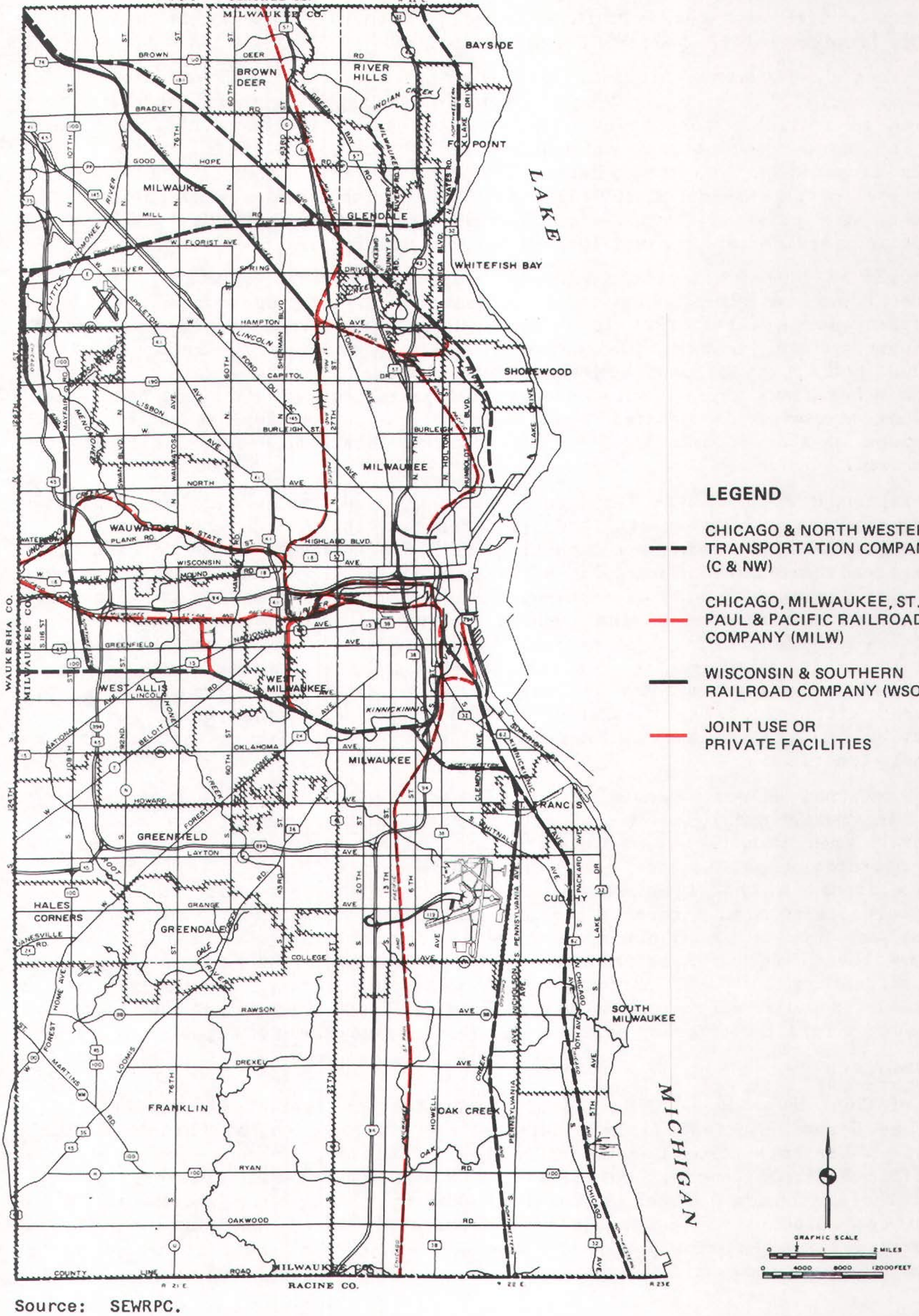
The regional airport system plan, as documented in SEWRPC Planning Report No. 21 (2nd Edition), A Regional Airport Plan for Southeastern Wisconsin, currently under preparation, recommends that General Mitchell Field continue to be operated as a Transport airport. General Mitchell Field constitutes the sole airport in the Region serving scheduled air carriers, significant levels of turbojet-powered aircraft, significant levels of military aviation activities, and important segments of general aviation activity. The plan also recommends that Lawrence J. Timmerman Field continue to be operated as a General Utility-Stage I (GU-I) airport, not ordinarily allowing the operation of turbojet-powered aircraft. However, Timmerman Field does permit the operation of such aircraft upon prior approval of the Milwaukee County Airport Director.

Railways

As of 1984, there were 108 miles of common carrier railway lines within Milwaukee County. Carload freight service was provided by the Chicago & North Western Transportation Company (C&NW); the Chicago, Milwaukee, St. Paul & Pacific Railroad Company (the Milwaukee Road); the Soo Line Railroad Company; and the Wisconsin & Southern Railroad Company; along with short pieces of trackage which are in joint use or are privately owned. Passenger service is provided by the National Railroad Passenger Corporation (Amtrak). These railroad lines are shown on Map 9.

Map 9

COMMON CARRIER RAILWAY FREIGHT LINES IN MILWAUKEE COUNTY : 1984



Source: SEWRPC.

Water Transportation Facilities

Bounded on the east by Lake Michigan, Milwaukee County has ready access to a major international transportation system--the Great Lakes-St. Lawrence Seaway--which extends from the Great Lakes to the Gulf of St. Lawrence on the Atlantic Ocean. Major harbor facilities, dockage, and heavy cargo-handling equipment are concentrated in the Port of Milwaukee to handle both bulk and containerized shipments. These facilities may be an important consideration in the evaluation of solid waste management alternatives because of the potential reduced transportation costs associated with the transport of, or receiving of, recyclable materials, refuse-derived fuel, or other products of solid waste management.

NATURAL RESOURCE BASE

The natural resource base is a primary determinant of the continued development potential of the County, as well as of its ability to provide a pleasant and habitable environment for all forms of life. The principal elements of the natural resource base which are related to solid waste management planning are climate, topography, geology, soils, vegetation, fish and wildlife, and water resources. Without a proper understanding and recognition of these elements and of their interrelationships, human use and alteration of the natural environment proceed at the risk of excessive costs in terms of both monetary expenditures and destruction of nonrenewable or slowly renewable resources.

Climate

Climate, especially the extreme variations in the three principal elements of climate--temperature, precipitation, and snow cover--directly affects the selection, construction, operation, and cost of solid waste management facilities. However, the range of conditions which occur in Milwaukee County is sufficiently small to not affect the siting of facilities.

Climate does have an impact on the operation of landfills. Snow removal requirements for access, low temperatures which affect heavy equipment operation, and potential frost penetration of soils make winter the most difficult season for operations. During warm weather, dry periods require dust control for access roads and landfill surfaces. A knowledge of the prevailing wind conditions is necessary for good sanitary landfill design and operation, since wind will affect dust distribution. Measures may also need to be taken to control blowing paper and other debris. Precipitation can affect access roads and landfill site operation. Additionally, precipitation which infiltrates the soil at the landfill can cause the formation of leachate.

Milwaukee County has a continental climate which spans four seasons, one season succeeding the other through varying time periods of unsteady transition. Summer generally spans the months of June, July, and August. The summers are relatively warm with occasional periods of hot, humid weather and sporadic periods of cool weather. Winter generally spans the months of December, January, and February, but it may, in some years, be lengthened to include parts of the months of November and March. Autumn and spring in the County are transitional times of the year between the dominant seasons and are usually periods of unsettled weather conditions. Temperatures are extremely varied, and long periods of precipitation are common in autumn and spring.

Table 9

PRECIPITATION AND TEMPERATURES RECORDED AT GENERAL MITCHELL FIELD: 1951-1980[a]

Month	Average Daily Maximum	Average Daily Minimum	Mean	Average Normal Precipitation	Average Snow and Sleet
January	26.0	11.3	18.7	1.64	13.5
February	30.1	15.8	23.0	1.33	10.5
March	39.2	24.9	32.1	2.58	10.1
April	53.5	35.6	44.6	3.37	2.1
May	64.8	44.7	54.8	2.66	Trace
June	75.0	54.7	64.9	3.59	0.0
July	79.8	61.1	70.5	3.54	0.0
August	78.4	60.2	69.3	3.09	0.0
September	71.2	52.5	61.9	2.88	Trace
October	59.9	41.9	50.9	2.25	0.2
November	44.7	29.9	37.3	1.98	3.4
December	32.0	18.2	25.1	2.03	11.4
Annual	54.6	37.6	46.1	30.94	51.2

[a]The 30-year period 1951-1980 is the "standard normal" period which conforms to the World Meteorological Organization standard for climatological normals.

Source: National Climatic Center and SEWRPC.

Air temperatures within the County are subject to great seasonal change and yearly variation, as well as diurnal variations. Data for temperature observations in the County, as recorded at General Mitchell Field from 1951 through 1980, are presented in Table 9. These data indicate the variations in temperature which may be anticipated within the County. Summer temperatures throughout the County, as reflected by monthly means for July and August, are about 70°F. Winter temperatures, as reflected by monthly means for January and February, are in the range of 19°F and 23°F.

Daily precipitation data for observations recorded at General Mitchell Field in Milwaukee County are shown in Table 9. The total average annual precipitation based on these observation stations is about 30.9 inches, expressed as water equivalent. Monthly averages range from a February low of 1.3 inches to a June high of 3.6 inches. Snowfall is most likely to occur in the County during the months of December, January, and February and totals about 51 inches annually.

Prevailing winds in southeastern Wisconsin are northwesterly in the late fall and winter, northeasterly in the spring, and southwesterly in the summer and early fall. Wind velocities are less than 5 miles per hour about 25 percent of the year, between 5 and 15 miles per hour about 65 percent of the year, and greater than 15 miles per hour about 10 percent of the year.

Ambient Air Quality

Air quality is affected by such activities as solid waste burning, earth moving and wind erosion at landfill sites, and the transportation of waste. Thus, air quality conditions in the planning area should be identified in order to plan for maintenance of federal and state air quality standards.

The adopted regional air quality attainment and maintenance plan for southeastern Wisconsin[2] recommends actions that should be taken by federal, state, and local units of government, businesses and industries, and individuals to attain and maintain the air quality standards established by the federal and state governments for pollutants in the air.

As part of that study, air quality samples were collected throughout southeastern Wisconsin, measuring levels of ozone, carbon monoxide, sulfur dioxide, and particulate matter in the ambient air. Federal regulations have been established for standards which are intended to protect human health and the public welfare by preventing damage to vegetation and real and personal property, and improving visibility. These standards have been set for the pollutants referenced above by the U. S. Environmental Protection Agency. All of Milwaukee County has been designated as an ozone nonattainment area. In addition, portions of Milwaukee County have been designated as nonattainment areas for sulfur dioxide, carbon monoxide, and particulate matter. Solid waste management facilities should be planned and designed to maintain, protect, and enhance existing air quality.

Physiographic and Topographic Features

As already noted, Milwaukee County encompasses an area of approximately 242.5 square miles, or about 155,193 acres. The County extends approximately 24 miles north to south and, at its maximum width, about 11 miles east to west. Milwaukee County is bounded on the north by Ozaukee County, on the west by Waukesha County, and on the south by Racine County. The irregularly shaped eastern boundary of the County is the result of erosion by wind and rainfall, groundwater discharge, and Lake Michigan wave action.

Physiographic features, or surficial land forms, have been determined largely by the underlying bedrock and the overlying glacial deposits of the watershed. The major surficial land forms of the County resulting from this glaciation are shown on Map 10. There is evidence of four major stages of glaciation in southeastern Wisconsin. The last and most influential in terms of present physiography and topography was the Wisconsin stage, which is believed to have ended about 11,000 years ago. The Lake Michigan lobe, or tongue, of the last continental glacier completely covered Milwaukee County.

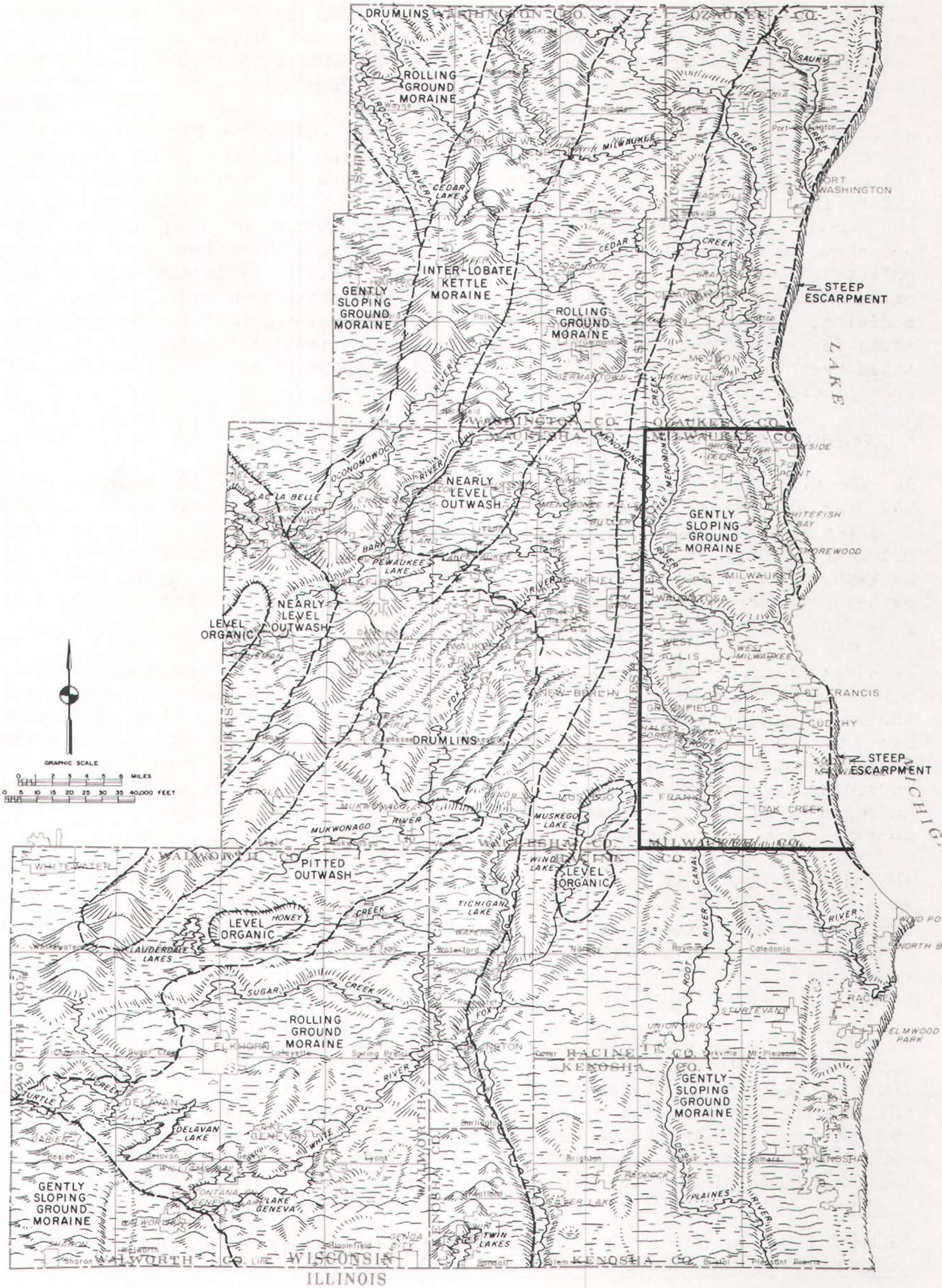
The Niagara cuesta on which the County lies is a gently eastward sloping bedrock surface, with the eastern border of the watershed being generally about 150 feet to 200 feet lower in elevation than the western border. Glacial deposits overlying the bedrock formations form the irregular surface topography of the watershed, characterized by rounded hills or groups of hills, ridges, broad undulating plains, and poorly drained wetlands.

As shown on Map 11, surface elevations within the County range from a high of approximately 850 feet above National Geodetic Vertical Datum (NGVD)--Mean Sea Level Datum--near the Village of Hales Corners to approximately 580 feet above NGVD at the mouth of the Milwaukee River as it enters Lake Michigan. Most of the County is covered by gently sloping ground moraine--heterogeneous material deposited beneath the ice--and moraines consisting of material deposited at the forward margins of the ice sheet, and outwash plains formed by the action

[2]SEWRPC Planning Report No. 28, A Regional Air Quality Attainment and Maintenance Plan for Southeastern Wisconsin: 2000, June 1980.

Map 10

PHYSIOGRAPHIC FEATURES OF MILWAUKEE COUNTY



Source: SEWRPC.

Map 11

SURFACE ELEVATIONS IN MILWAUKEE COUNTY

Source: U. S. Geological Survey and SEWRPC.

of flowing glacial meltwater. Glacial land forms have economic significance because some are prime sources of sand and gravel needed for highway and other construction purposes. Topography is also an important consideration in the evaluation of areas which may be considered for the construction of landfills.

Geology

The bedrock formations underlying the unconsolidated surficial deposits of Milwaukee County consist of Precambrian crystalline rocks; Cambrian sandstone; Ordovician dolomite, sandstone, and shale; and Silurian and Devonian dolomite. Many of these rocks underlie only parts of the County. All of these rock units slope toward the east. The bedrock geology of the County is shown on Map 12, a map of the surface of the bedrock, and is supplemented by Figure 2, which presents two vertical sections through the County. The uppermost bedrock unit throughout most of the County is Silurian dolomite, primarily Niagara dolomite underlain by a relatively impervious layer of Maquoketa shale. In northeastern Milwaukee County it is primarily Devonian dolomite and shale of the Milwaukee Formation. In addition, in some of the pre-Pleistocene valleys in the southwestern portion of the County, the Niagara dolomite has been removed by erosion, and the uppermost bedrock unit is Maquoketa shale.

Bedrock topography was shaped by preglacial and glacial erosion of the exposed bedrock. The consolidated bedrock underlying Milwaukee County generally dips eastward at a rate of 25 to 30 feet per mile. The bedrock surface ranges from 750 feet NGVD in the northeastern corner of the City of Franklin to less than 400 feet NGVD at the mouth of the Milwaukee River. The glacial deposits above the bedrock include end moraine, ground moraine, outwash, and lake-basin deposits. Generally, morainal areas have the relatively impermeable soils most suitable for landfill construction, while glacial outwash areas have soils with too high a permeability for use in landfill construction.

End moraines are formed by deposition at the margin of a glacier at a time when melting equals the rate of advance. End moraines consist of unsorted debris ranging in size from clay to boulders. End moraine topography typically consists of a ridge with a rolling to hummocky surface, often with internal drainage.

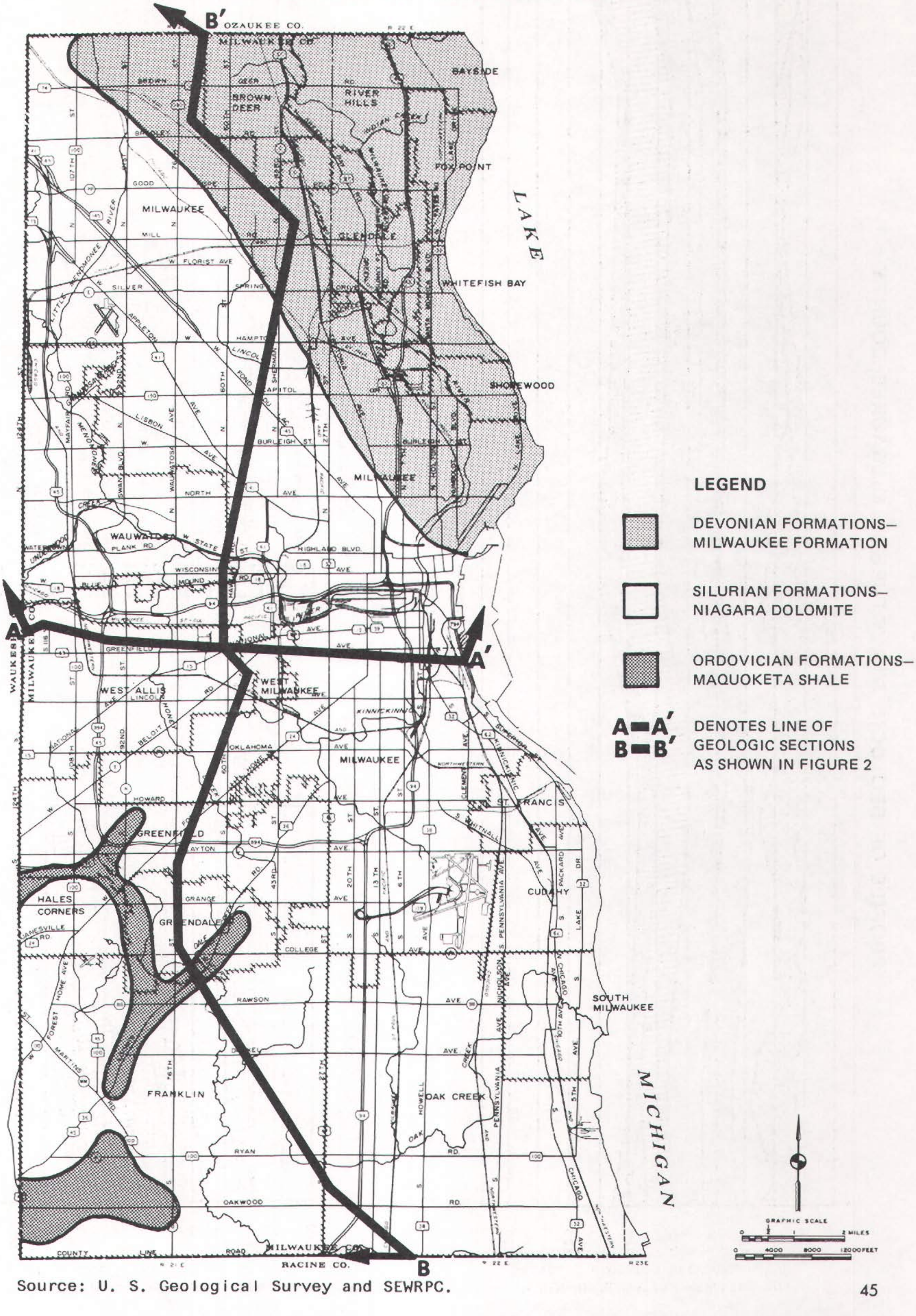
Ground moraine is deposited beneath glacial ice during its advance or retreat. It is deposited as a blanket of unsorted rock debris of irregular thickness, ranging in size from clay to boulders, and may be buried by later glacial deposits. Ground moraine usually has moderate relief and forms a gently undulating plain with no definite alignment to the undulation. In some areas, however, elongated hills of ground moraine, called drumlins, are aligned along the direction of ice movement.

Outwash plains are stratified deposits, consisting of gravel, sand, silt, and clay, laid down by water from melting ice fronts. Buried outwash deposits from earlier glaciation are apparent from drill-hole logs, but are difficult to map accurately. Lake-basin deposits are composed of materials derived from glaciers and laid down in fresh-water lakes. Alluvium is a deposit of unconsolidated materials laid down by running water. Marsh deposits are formed by decaying vegetation.

The combined thickness of unconsolidated glacial deposits, alluvium, and marsh deposits is generally less than 100 feet in most of the northern one-half of

Map 12

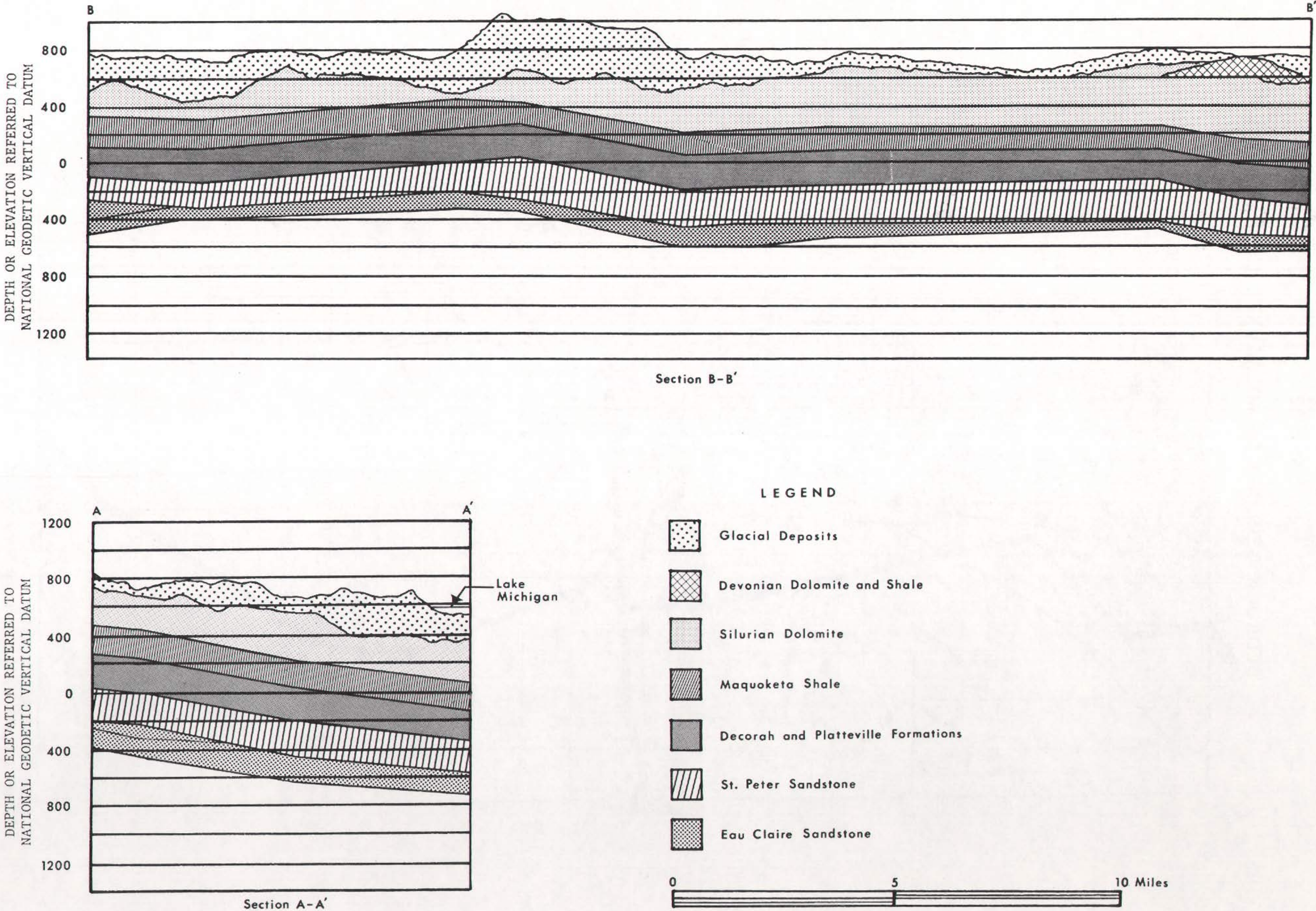
BEDROCK GEOLOGY OF MILWAUKEE COUNTY



Source: U. S. Geological Survey and SEWRPC.

Figure 2

PROFILE OF GEOLOGIC STRUCTURE IN MILWAUKEE COUNTY



Source: U. S. Geological Survey and SEWRPC.

the County, except in the eastern portion along Lake Michigan where the deposits exceed 100 feet. Thicknesses are greatest where glacial materials fill the bedrock valleys and in areas of topographic highs formed by end moraines. Map 13 indicates the spatial variation of the thickness of the unconsolidated deposits overlying the bedrock in Milwaukee County.

Soils

The nature of soils within Milwaukee County has been determined primarily by the interaction of the parent glacial deposits covering the County and by topography, climate, plants, animals, and time. In selecting areas for landfill sites, soils are an important consideration.

To assess the significance of the diverse soils found in southeastern Wisconsin, the Southeastern Wisconsin Regional Planning Commission in 1963 negotiated a cooperative agreement with the U. S. Soil Conservation Service under which detailed operational soil surveys were completed for the entire Planning Region. The results of the soil surveys are published in SEWRPC Planning Report No. 8, Soils of Southeastern Wisconsin. The regional soil surveys have resulted in the mapping of the soils within the Region in great detail. At the same time, the surveys have provided data on the physical, chemical, and biological properties of the soils and, more importantly, have provided interpretations of the soil properties for planning, engineering, agricultural, and resource conservation purposes. Interpretations of the soil properties for landfill construction are available. Both generalized soils and detailed soils maps are available for use in the evaluation of potential landfill sites.

The soils in the County have a wide range of properties--from organic, poorly drained soils to loamy, well-drained soils. There are six major soils association groups in the County as identified by the U. S. Department of Agriculture, Soil Conservation Service. A soil association is an area that has a distinctive proportional pattern of soils. The distribution of these soils in the County is indicated on Map 14. The six soil associations are briefly described below.

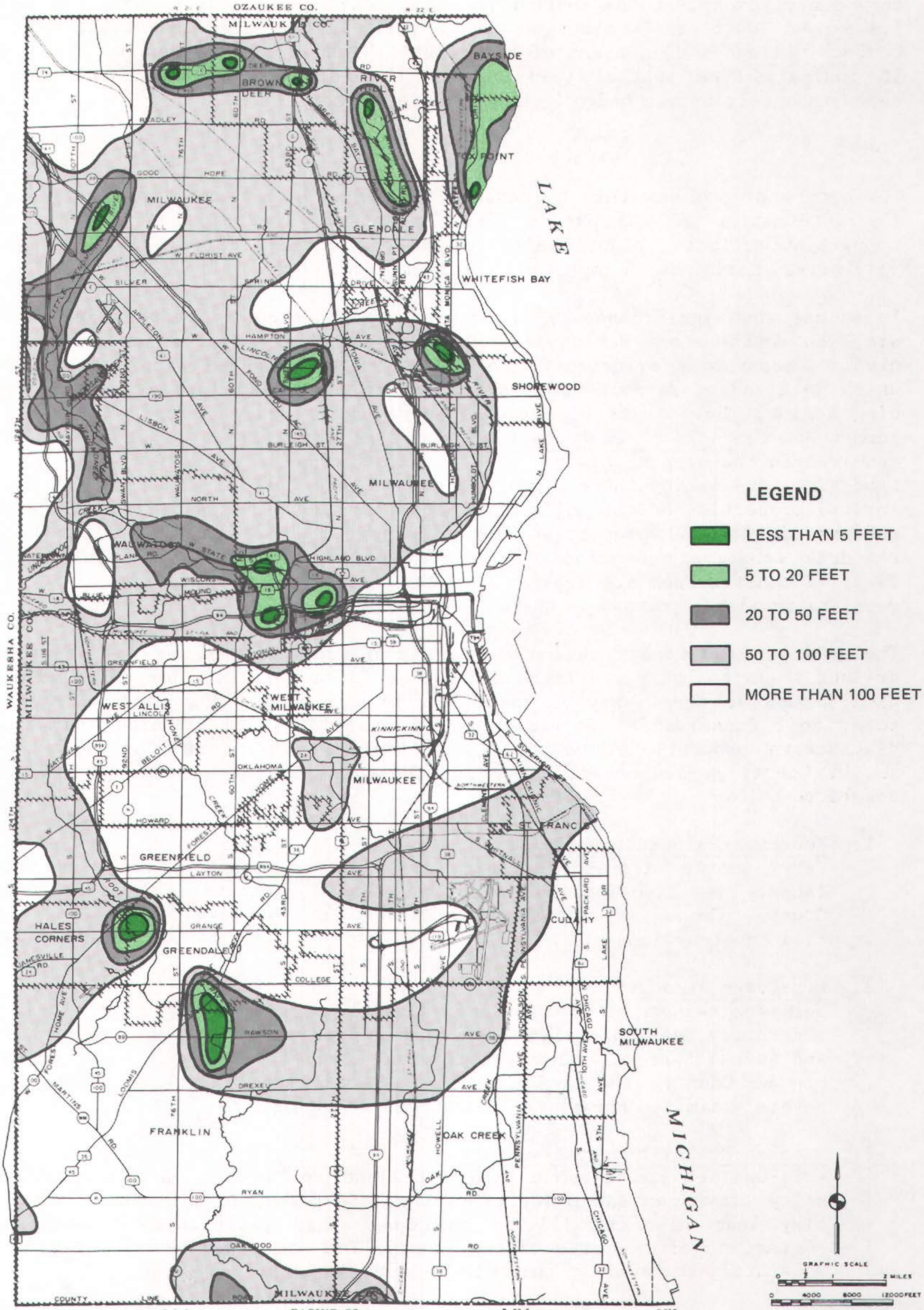
1. Houghton-Palms-Adrian Association
   Very poorly drained organic soils in depressions and on bottom lands. This association covers less than 1 percent of the area of the County. The soils in this association are severely limited for landfill construction.

2. Fox-Casco Association
   Well-drained soils that have a subsoil of silty clay loam which are moderately deep to shallow over sand and gravel, found on outwash plains and stream terraces. This association covers about 5 percent of the area of the County. The soils in this association are either moderately or severely limited for landfill construction.

3. Ozaukee-Morley-Mequon Association
   Well-drained to somewhat poorly drained soils that have a subsoil of silty clay loam and silty clay; they are formed in thin layers of silty clay loam glacial till on moraines. This association covers about 84 percent of the area of the County. The soils in this association are moderately to severely limited for landfill construction.

Map 13

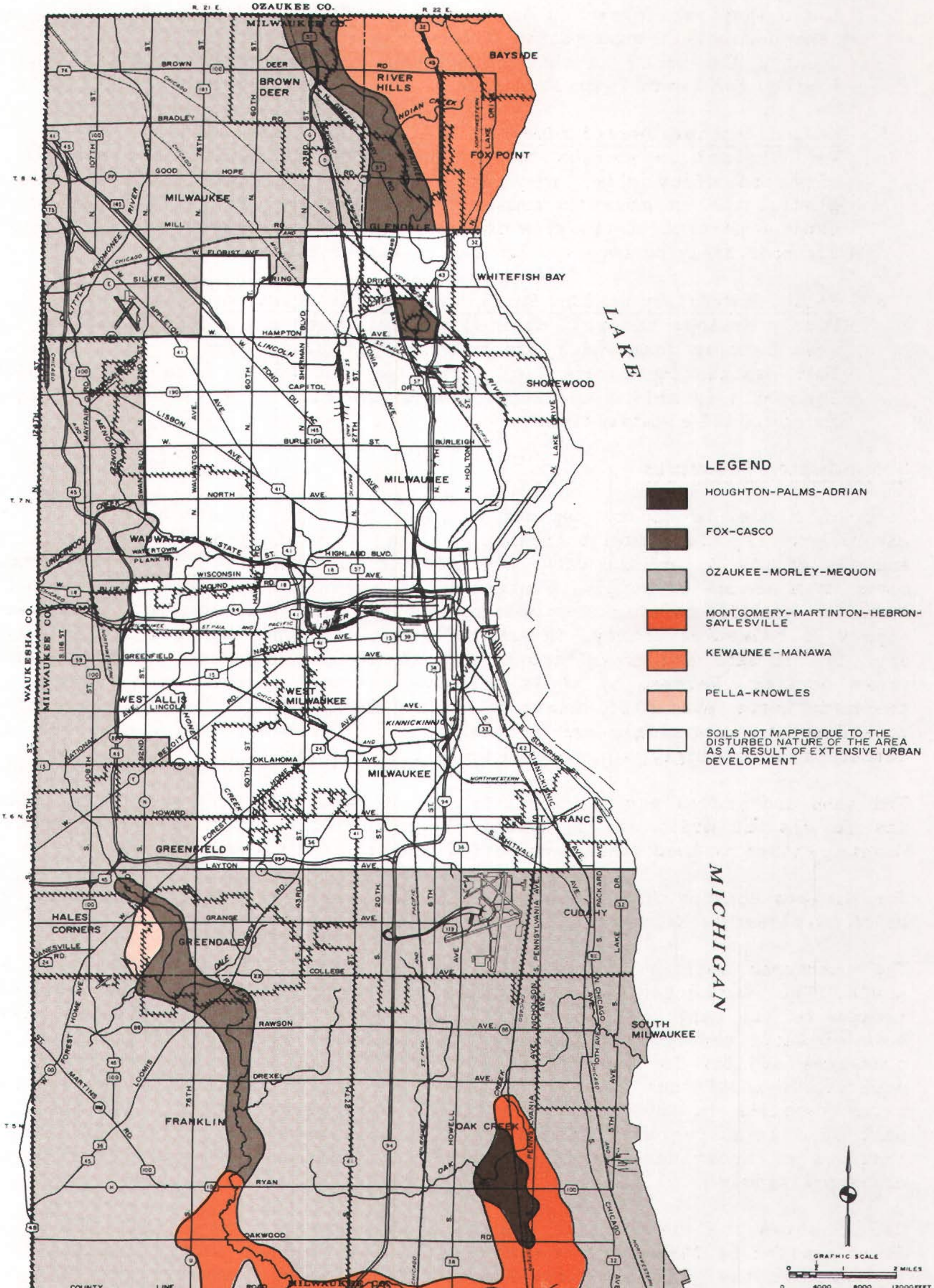
THICKNESS OF UNCONSOLIDATED MATERIALS IN MILWAUKEE COUNTY



Source: U. S. Geological Survey and SEWRPC.

Map 14

SOIL ASSOCIATIONS IN MILWAUKEE COUNTY



Source: U. S. Soil Conservation Service; and SEWRPC.

4. <u>Montgomery-Martinton-Hebron-Saylesville Association</u>
   Poorly drained to well-drained soils that have a subsoil of clay or clay loam; they are formed in silty clay or silty clay loam sediments in old lake beds. This association covers about 3 percent of the area of the County. The soils in this association are moderately to very severely limited for landfill construction.

5. <u>Kewaunee-Manawa Association</u>
   Well-drained to somewhat poorly drained soils that have a subsoil of clay and silty clay; they are formed in thin loess and silty clay glacial till on moraines and in depressed areas. This association covers about 8 percent of the area of the County. The soils in this association are moderately to severely limited for landfill construction.

6. <u>Pella, Moderately Shallow Variant Knowles Association</u>
   Poorly drained and well-drained soils that have a subsoil of silty clay loam or clay loam which are moderately shallow over dolomite bedrock. This association covers less than 1 percent of the area of the County. The soils in this association are moderately to very severely limited for landfill construction.

Groundwater Resources

Most of Milwaukee County depends on Lake Michigan as a source of potable water. However, the Franklin Industrial Park (a publicly owned water utility) and all of the 36 private water utilities in the County still rely on groundwater as a source of supply. Protection of groundwater is a major consideration in landfill siting and design. The principal sources of groundwater supply in Milwaukee County, in general order from the land surface downward, are: 1) the sand and gravel aquifer, 2) the Niagara aquifer, and 3) the sandstone aquifer. Because of their relative nearness to the land surface and their intimate hydraulic interconnection, the first two aquifers are often considered to be a single aquifer commonly known as the "shallow aquifer." The latter is, accordingly, commonly known as the "deep aquifer."

The sand and gravel aquifer consists of unconsolidated sand and gravel deposits in glacial drift and alluvium. These deposits occur over much of the County, either at land surface or buried beneath less permeable drift.

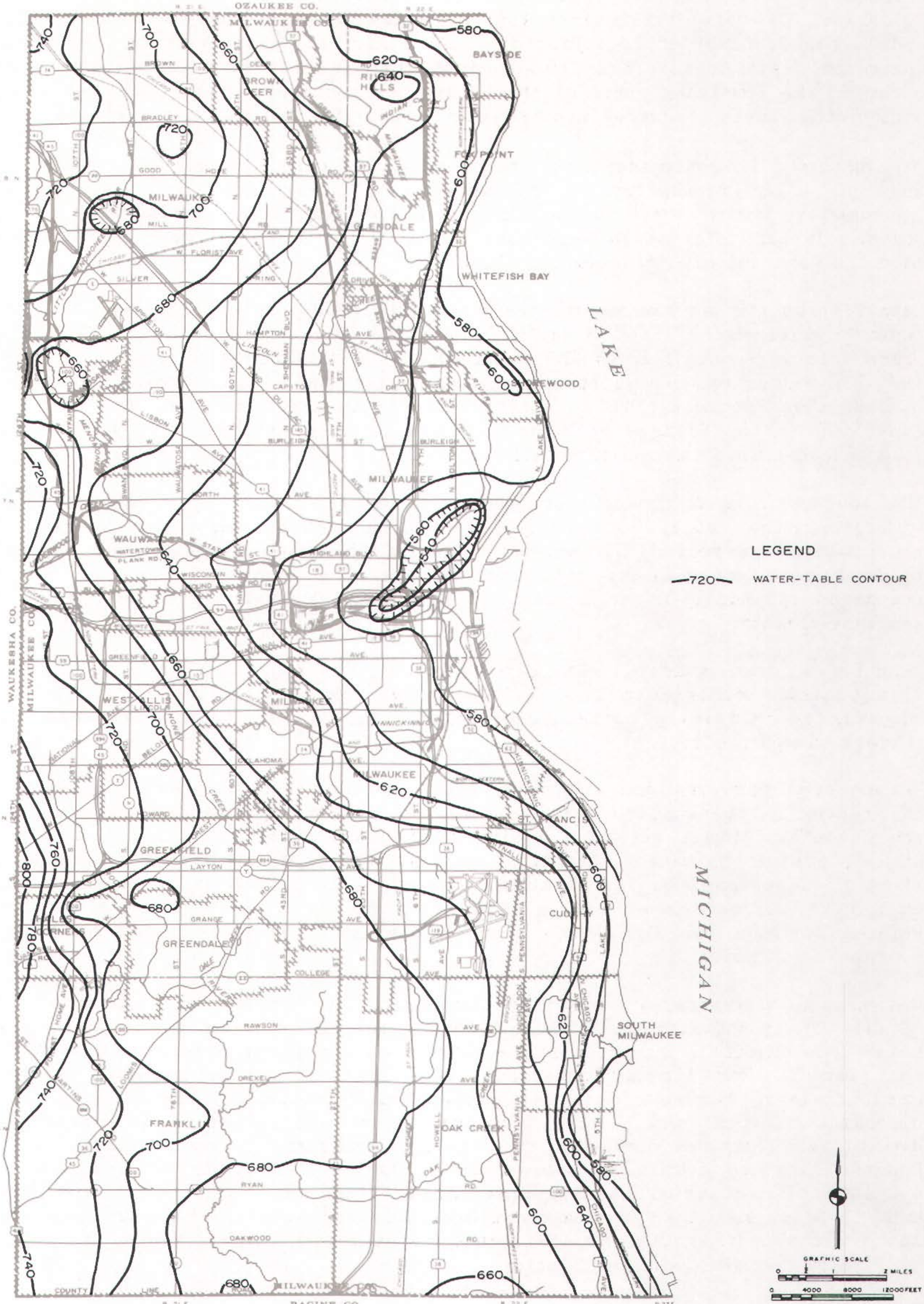
The Niagara aquifer in Milwaukee County consists of dolomite of Silurian Age, which overlies the Maquoketa shale throughout most of the County.

The sandstone aquifer includes all sedimentary bedrock below the Maquoketa shale. The Maquoketa shale separates the Niagara and sandstone aquifers. Because of its very low permeability, the shale restricts the vertical movement of water and confines water in the sandstone aquifer. The bottom of the sandstone aquifer is the surface of the impermeable Precambrian rocks. The aquifer is continuous over the County. This aquifer is the source of most water supplies in the County which rely on groundwater. The aquifer is a part of a large regional aquifer which is used as a supply for major concentrations of urban development throughout southeastern Wisconsin and northeastern Illinois.

Map 15 shows the elevation of the top of the zone of saturation in the unconfined aquifer by 20-foot contour intervals. For the most part, the water table lies within the glacial drift. The elevation ranges from more than 800 feet

Map 15

ELEVATION OF THE GROUNDWATER TABLE
IN MILWAUKEE COUNTY: 1979



Source: U. S. Geological Survey and SEWRPC.

NGVD along the extreme western border of the County in the Village of Hales Corners to less than 540 feet NGVD in the northeastern part of the City of Milwaukee. The water table generally is a subdued replica of the land surface and is higher under topographic highs and lower under topographic lows. Areas where the depth to water is less than 10 feet for at least part of the year occur in the low-lying parts of the County along streams, lakes, and wetlands, and in other areas characterized by heavy clay soils with slow permeability.

Map 16 shows the estimated depth to seasonal high groundwater for the County. Seasonal high groundwater is defined as the average of the highest annual groundwater levels over the period of record available. Soils mapping and soils moisture information were used by the U. S. Geological Survey to determine the seasonal high groundwater levels.

Map 17 shows the potentiometric surface of the sandstone aquifer, or the altitude to which water rose in wells in the sandstone aquifer, as of 1973-1974. These data were obtained by SEWRPC and the U. S. Geological Survey in 1973 and 1974. In Milwaukee County, the potentiometric surface ranged from an elevation of less than 550 feet NGVD in northwestern Milwaukee County to less than 400 feet NGVD in the Village of West Milwaukee. The general slope of the surface is downward toward the center of the County.

The source of most groundwater which is contained in the shallow aquifer underlying the County is precipitation which infiltrates and recharges the groundwater reservoir. The amount that infiltrates depends mainly on the type of rock material at the land surface. The deep sandstone aquifer is recharged primarily in areas west of Milwaukee County, where the Maquoketa shale is absent.

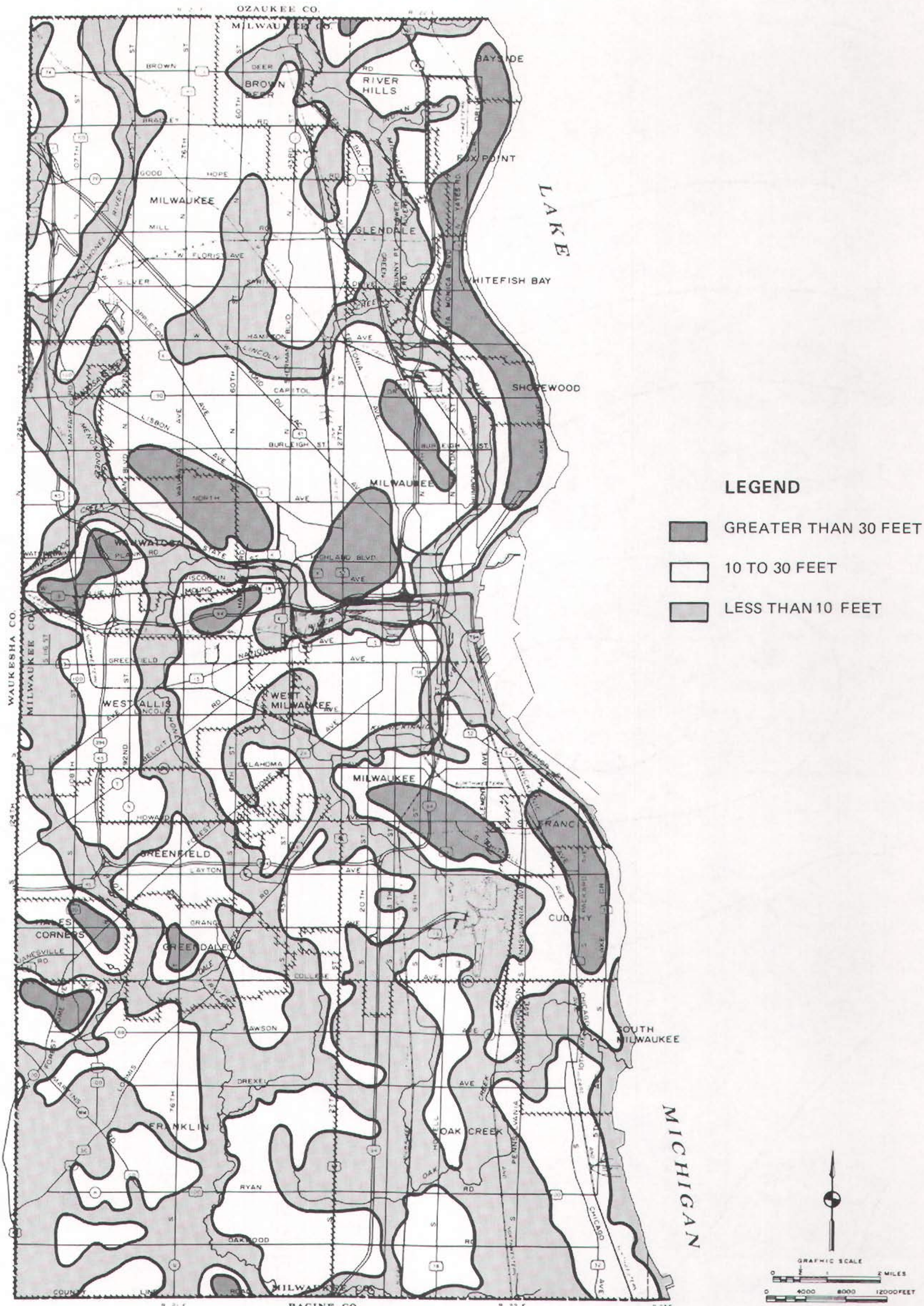
Recharge to each aquifer is largely controlled by the permeability of the overlying units. Recharge to the shallowest bedrock aquifer is high where the aquifer is overlain by outwash and end moraine, and low where water must pass through clay or silty till.

Water seeps downward and recharges the sandstone aquifer because the head is greater in the shallow units. A limited amount of recharge occurs through the Maquoketa shale, but most occurs west of the limit of occurrence of the shale outside Milwaukee County. In most of Milwaukee County, discharge from the sandstone aquifer is through wells, with little or no natural discharge to surface water bodies. Water in the sandstone aquifer also moves regionally from the County to pumping centers in southeast Wisconsin and northeast Illinois.

Based upon a review of water quality data, it may be concluded that the quality of groundwater in Milwaukee County generally is good; however, some water has chemical characteristics that make it objectionable or unsuitable for certain domestic and industrial uses. Most of the groundwater is very hard. However, hardness does not cause health problems. It can cause scale deposits on piping and heating equipment. Iron and manganese concentrations are higher than desirable in the shallow aquifers throughout most of the County. Elevated levels of these two metals can result in staining during domestic or industrial washing operations. Since most of the potable water used in Milwaukee County comes from Lake Michigan, such concerns are generally not a problem in the County. Nitrates and dissolved solids levels are generally below recommended upper limits.

Map 16

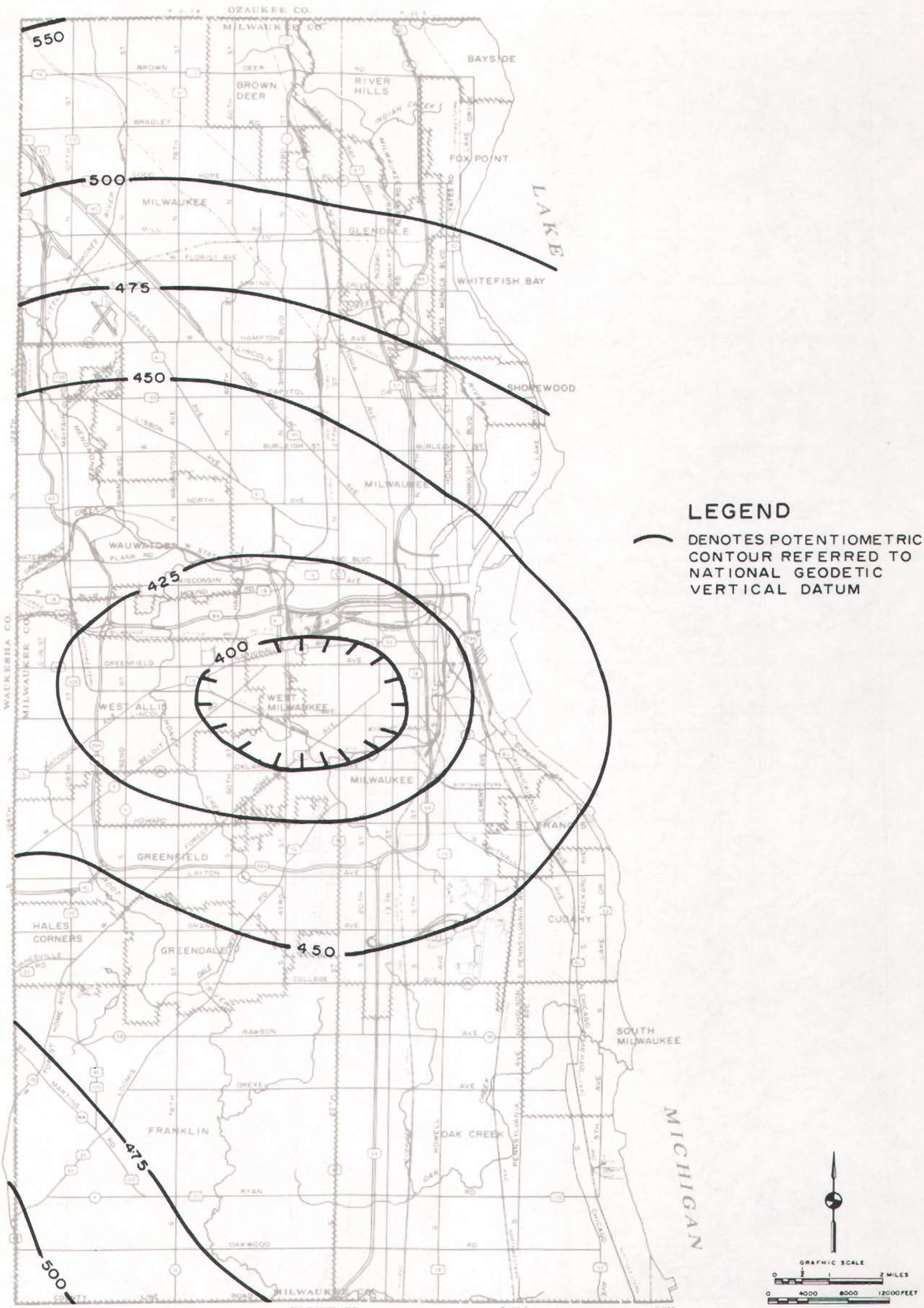
DEPTH TO SEASONAL HIGH GROUNDWATER IN MILWAUKEE COUNTY: 1976



Source: U. S. Geological Survey and SEWRPC.

Map 17

POTENTIOMETRIC SURFACE OF THE SANDSTONE AQUIFER IN MILWAUKEE COUNTY: 1973-1974



Source: U. S. Geological Survey and SEWRPC.

Surface Water Resources

Lakes and streams of the County constitute focal points for water-related recreational activities popular with the inhabitants of the County, provide attractive sites for properly planned residential development, and--when viewed in the context of open space areas--greatly enhance the aesthetic quality of the environment. Surface waters are an important consideration in the siting of solid waste landfills. State regulations preclude the siting of a landfill within 300 feet of a navigable stream, river, or floodplain, or within 1,000 feet of a lake.

The surface waters in Milwaukee County are depicted on Map 18. There are 1,327 acres of surface water in the County, or about 0.9 percent of the County. This area is divided among 15 streams with a combined length of about 103 miles, and 40 lakes each having 50 acres or less of surface water area.

Environmentally Significant Areas

The siting of solid waste management facilities requires consideration of environmentally significant areas. Any new landfill site or expansion of an existing site should be accomplished in strict conformance with state criteria regarding environmentally significant areas. Environmentally significant areas include environmental corridors, woodlands, wetlands, floodlands, designated natural areas, park and open space sites, and historic sites.

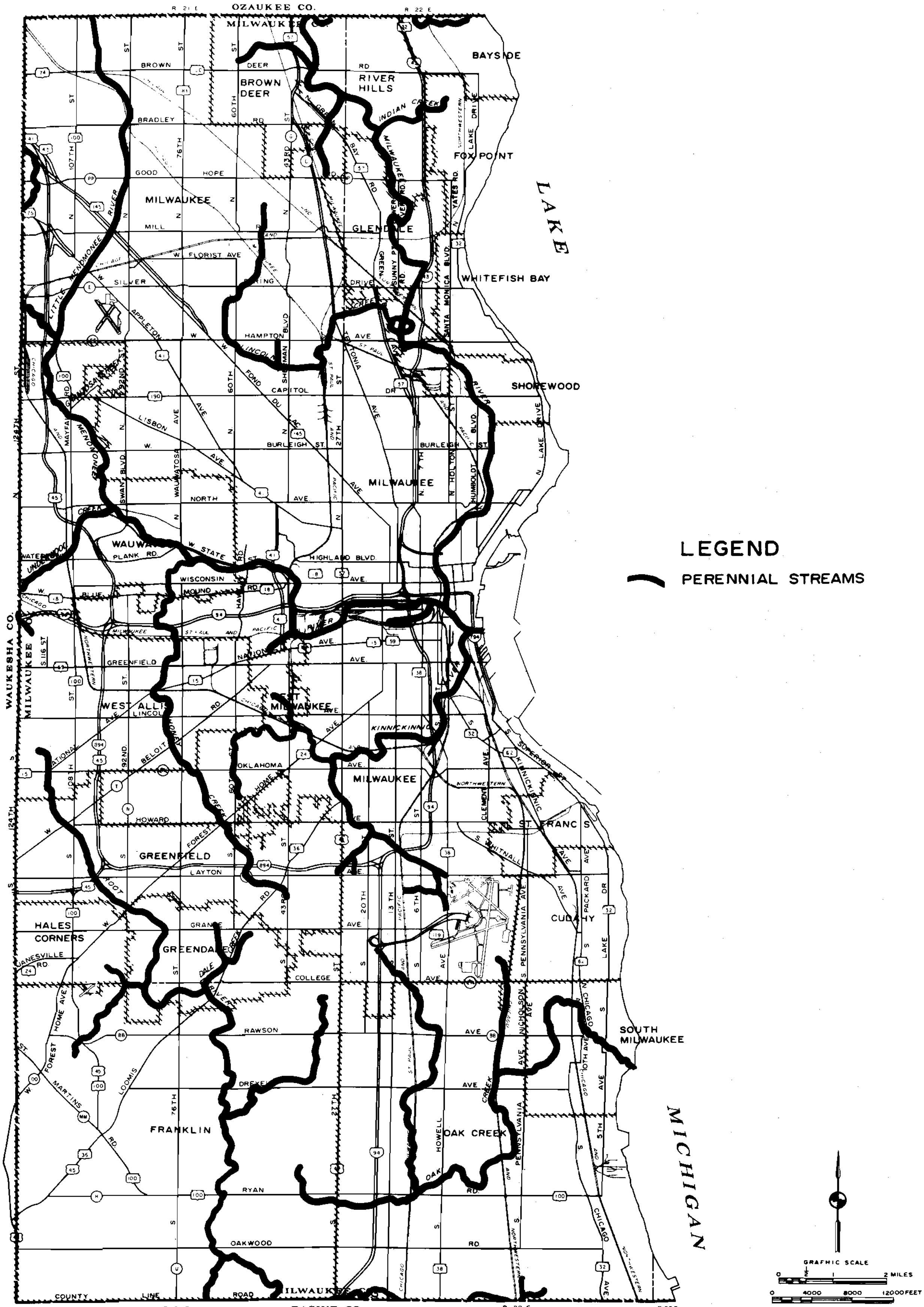
Environmental Corridors: As part of the regional land use planning effort, environmental corridors were identified and delineated within the Southeastern Wisconsin Region. Such corridors are defined as elongated areas encompassing the best remaining elements of the natural resource base. These areas should be preserved in essentially natural, open uses in order to maintain a sound ecological balance, protect the overall quality of the environment, and preserve the unique natural beauty of the County. The corridors by definition include one or more of the following seven elements of the natural resource base: 1) lakes, rivers, and streams and their associated undeveloped shorelands and floodlands, 2) wetlands, 3) woodlands, 4) wildlife habitat areas, 5) rugged terrain and high-relief topography, 6) significant geological formations and physiographic features, and 7) wet or poorly drained soils.

Although the foregoing elements comprise the integral parts of the natural resource base, there are five additional elements which, although not a part of the natural resource base per se, are closely related to, or centered on, that base and are a determining factor in identifying and delineating the environmental corridors. These additional elements are: 1) existing outdoor recreation and related open space sites, 2) potential outdoor recreation and related open space sites, 3) historic sites and structures, 4) significant scenic areas and vistas, and 5) natural and scientific areas.

The delineation of these natural resource and natural resource-related elements results in an essentially linear pattern of narrow, elongated areas which have been termed "environmental corridors." Primary environmental corridors are defined as those areas which encompass three or more of the above 12 elements, whereas secondary environmental corridors are contiguous areas exhibiting one or two of the 12 necessary elements.

Map 18

SURFACE WATER RESOURCES OF MILWAUKEE COUNTY



Source: SEWRPC.

The preservation of the primary environmental corridors from further degradation is one of the principal objectives of the adopted regional land use plan; and other important plan elements such as the areawide water quality management plan are based on such preservation. These corridors should be considered inviolate; their preservation in a natural, open state or in park and related open space uses, including limited agricultural and country estate-type uses, will serve to maintain a high level of environmental quality in the County and protect its unique natural beauty. As urban development proceeds in an area, secondary environmental corridors should be considered for retention in open space by using them as the basis for, or by integrating them into, the greenways, drainageways, stormwater retention basins, parks, and open spaces needed in developing areas of the County.

The primary environmental corridors located in Milwaukee County encompass about 9,726 acres, or about 6.3 percent of the County, as shown on Map 29 in Chapter IV. Delineations are available on 1 inch equals 400 feet scale aerial photographs for all of Milwaukee County. These important inventory data should be consulted and carefully considered in any landfill siting analysis.

Woodlands: Woodlands in Milwaukee County have both economic and ecological values, and with proper management can serve a variety of uses which provide multiple benefits. Woodlands encompass approximately 4,856 acres in the County, or about 3.1 percent of the County. The quality of life within an area is greatly influenced by the overall condition of the environment as measured by clean air, clean water, scenic beauty, and ecological diversity. Primarily located on ridges and slopes, along lakes and streams, and in wetlands, woodlands provide an attractive natural resource of immeasurable value. Not only is the beauty of the lakes, streams, and glacial land forms of the County accentuated by woodlands, but woodlands are essential to maintaining the overall quality of the environment. Woodlands can and should be maintained for their total values--scenic, wildlife, educational, recreational, and watershed protection--as well as for their forest products. Under balanced use and sustained yield management, woodlands can serve many of these benefits simultaneously. Generally, solid waste facilities should not be sited in woodlands. However, wooded areas, either existing or planned, should be considered as possible buffer zones for such facilities.

Wetlands: Water and wetland areas are an important landscape feature within the County, and can serve to enhance proximate uses. Wetlands represent a variety of stages in the natural filling of lake and pond basins and floodplain areas. Wetlands are considered herein as areas in which the water table is at or near the land surface. Such areas are generally unsuited or poorly suited for most agricultural or urban development purposes. Wetlands, however, have important ecological value in a natural state. Wetlands contribute to flood control and stream purification, since such areas naturally serve to store excess runoff temporarily, and thereby tend to reduce peak flood flows. It has been found that, except during periods of unusually high runoff, concentrations of nutrients in waters leaving such areas can be considerably lower than in waters entering the wetlands.

Wetlands within Wisconsin have been classified by the Wisconsin Department of Natural Resources according to the national wetland classification system. Under this system, seven major classes of wetlands are recognized: potholes, fresh meadows, shallow marshes, deep marshes, shrub swamps, timber swamps, and bogs. Wetlands in southeastern Wisconsin, including Milwaukee County, were mapped in 1981 by the Commission under an agreement with the Wisconsin Department of Natural Resources as part of the state wetlands mapping program. Detailed information concerning the type and extent of wetlands in the County is available from the Commission or the Wisconsin Department of Natural Resources. The wetlands located in Milwaukee County encompass about 4,129 acres, or about 2.6 percent of the County.

Those wetlands with standing water are well-suited for waterfowl and for marsh furbearers, while drier wetland types support upland game because of the protection afforded by vegetative cover. Shallow-water wetlands are subject to winter freeze and summer drought and, therefore, are considered of lower value than the deep-water types of wetlands.

Floodlands: The floodlands of a river or stream are the wide, gently sloping areas contiguous with, and usually lying on both sides of, a river or stream channel. Rivers and streams occupy their channels most of the time. However, during even minor flood events, stream discharges increase markedly so that the channel is not able to convey all the flow. As a result, stages increase and the river or stream spreads laterally over the floodlands. The periodic flow of a river onto its floodlands is a normal phenomenon and, in the absence of major, costly structural flood control works, will occur regardless of whether urban development occurs on the floodlands.

For planning and regulatory purposes, floodlands are normally defined as those areas, excluding the channel, subject to inundation by the 100-year recurrence interval flood event. This is the event that would be reached or exceeded in severity on the average of once every 100 years. Stated another way, there is a 1 percent chance that this event will be reached or exceeded in severity in any given year. Studies conducted by the Regional Planning Commission indicate that 7 to 10 percent of the total land area of any given watershed will be within the 100-year floodplain area of the Region's rivers and streams. The 100-year recurrence interval floodplain contains within its boundaries those areas inundated by floods of less severe but more frequent occurrence such as the 50-, 25-, and 5-year recurrence interval events.

Floodland areas are generally not suited for the development of solid waste management facilities because of flood hazards, high water tables, and inadequate soils. However, floodland areas are generally prime locations for much needed park and open space areas, and, therefore, within the context of regional land use planning, every effort should be made to discourage indiscriminate urban development in the floodplain while encouraging open space uses. Floodlands delineated in Milwaukee County are shown on Map 28 in Chapter IV and encompass approximately 9,152 acres, or about 5.9 percent of the County.

Scientific and Natural Areas: Areas with significant natural or geological features unique to Wisconsin are designated as state scientific areas by the Scientific Areas Preservation Council. Such areas are classified into the following five categories.

- NA-1. Natural areas that contain nearly intact native plant and animal communities believed to be representative of the presettlement landscape. These areas are of statewide or greater significance.

- NA-2. Natural areas slightly modified by man's activities and of county or regional significance.

- NA-3. Natural areas modified by man's disturbance, but which maintain a moderate degree of natural cover and are suitable for preservation. Many of these lower quality areas play an important role in watershed protection and as environmental corridors.

- Rare Species Habitat. Areas where one or more rare, threatened, or endangered species are known to exist.

- Geological Sites. Areas where outcrops, and structural and glacial features of geological interest, are located. These areas can be of state or county significance.

Map 19 identifies the locations of areas designated as scientific or natural areas in Milwaukee County.[3] These areas are also listed in Table 10.

Existing Park and Open Space Sites: The Milwaukee County park and parkway system has long been recognized as one of the finest such systems in the country. As indicated in Table 11 and shown on Map 20, the county park and parkway system in 1984 consisted of 137 sites encompassing a total of 14,742 acres, or about 9 percent of the total area of the County. Of the total, 124 county sites, or about 91 percent, and 7,040 acres, or about 48 percent, have been classified by Milwaukee County as parks--including regional parks, metropolitan parks, community parks, neighborhood parks, central business district parks, and greenspots; while the remaining 13 county sites, or about 9 percent, and 7,702 acres, or about 52 percent, have been classified as parkways. As further indicated in Table 11, Milwaukee County parks range in size from the less than one acre Gilman Triangle to the 638-acre Whitnall Park. Milwaukee County parkways range in size from the 10-acre Grantosa Creek Parkway to the 3,953-acre Root River Parkway.

As shown on Map 20, large county parks--those parks classified as regional parks or special regional parks by Milwaukee County, such as Brown Deer Park, Dretzka Park, Grant Park, Lincoln Park, and Whitnall Park--are well distributed throughout the County. As further shown on Map 20, the largest Milwaukee County parkway--the Root River Parkway--is located in the southern and southwestern portions of the County. Other large parkways include the Little Menomonee and Menomonee River Parkways located in the northwestern portion of the County; the Oak Creek Parkway located in the southeastern portion of the County; the Kinnickinnic River Parkway located in the central portion of the County; and the Milwaukee River Parkway located in the northeastern portion of the County. It is important to note that these parkways, in addition to providing opportunities for a variety of outdoor recreational activities, serve to protect many of the remaining important natural resource features in Milwaukee County.

In addition to the sites within the Milwaukee County-owned park and parkway system, there were 576 other public parks and open space sites, school outdoor recreation sites, and private outdoor recreation sites in the County in 1984. These sites combined encompassed about 5,319 acres. More specifically, in Milwaukee County in 1984 there were 160 city- and village-owned park and open space sites encompassing 1,181 acres; 253 public school outdoor recreation

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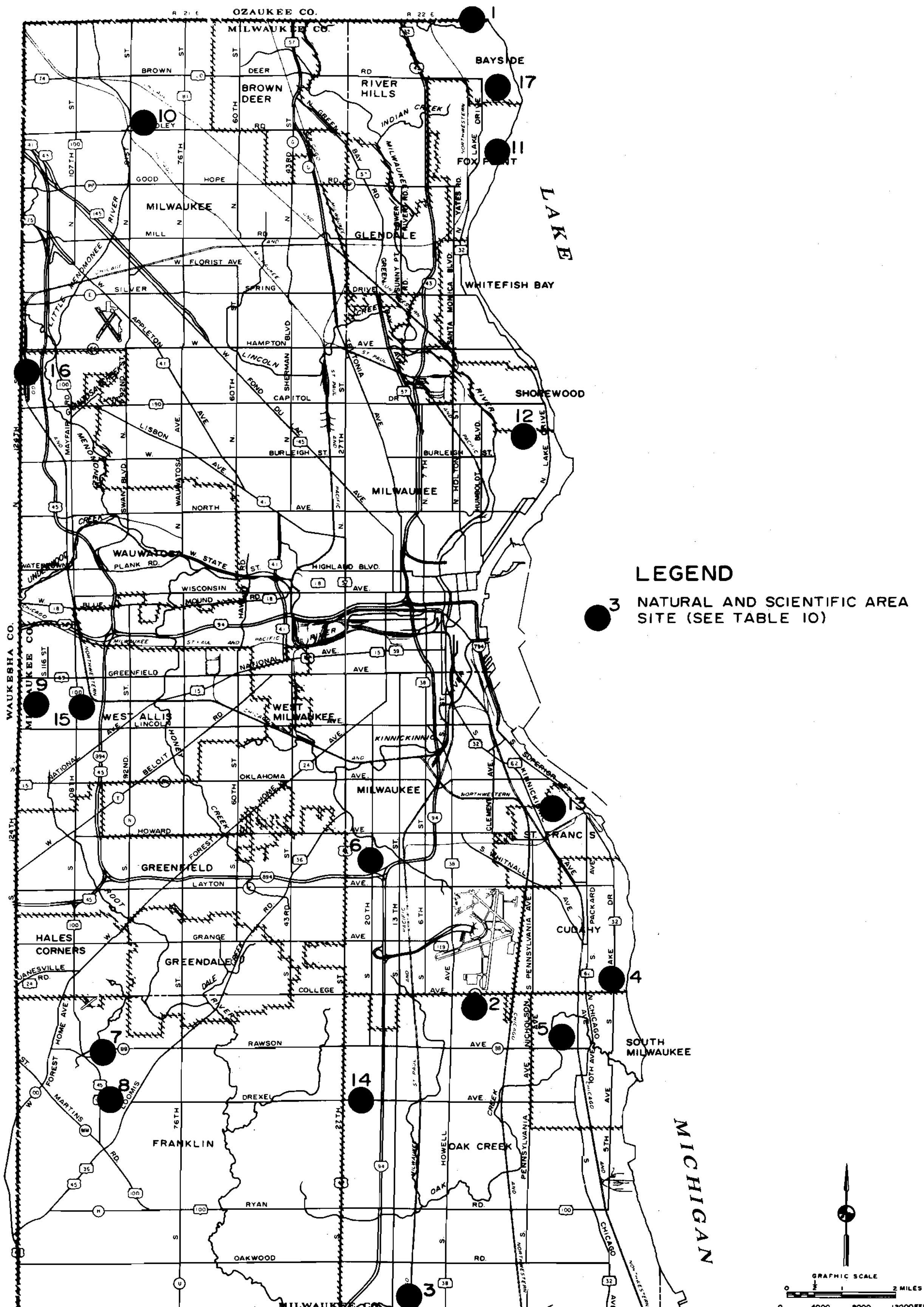
[3]Office of Coastal Management, Wisconsin Department of Administration; Scientific Areas Section, Wisconsin Department of Natural Resources; and SEWRPC.

Map 19

NATURAL AND SCIENTIFIC AREA SITES IN MILWAUKEE COUNTY: 1984



Source: SEWRPC.

Table 10

KNOWN NATURAL AND SCIENTIFIC AREAS LOCATED IN MILWAUKEE COUNTY: 1984

Number on Map 19	Classification Code[a]	Area Name	Size (acres)	Ownership	Community Type, Description, and Comments
1	SA	Fairy Chasm	60	The Nature Conservancy and private	An 80- to 100-foot-deep wooded ravine which extends approximately 1¼ miles west from its confluence with Lake Michigan. The steep slopes support white pine, white cedar, and yellow birch on the north facing slopes and dry hardwoods on the more exposed south facing slope. Several species, notably Dirca palustris and the conifers, give the ravine special significance in that these plants occur this far south only in the cold air ravines adjacent to Lake Michigan. Critical plant species such as the Wisconsin-endangered pine-drops (Pterospora andromedea) are present at this site.
2	NA-1	Cudahy Woods	60	Milwaukee County	One of the best remaining southern dry-mesic and old growth southern mesic hardwood forests in the area. The dry-mesic forest is dominated by red and white oaks, with black cherry and shagbark hickory; while the mesic forest contains American beech, ironwood, white ash, sugar maple, and red oak. This site is also a critical habitat for the Wisconsin-endangered blue-stemmed goldenrod (Solidago caesia).
3	NA-1	Root River Forest	40	Milwaukee County	A southern wet to wet-mesic hardwood forest containing a gravel-bottom stream which is tributary to the Root River. This site is a critical habitat for the Wisconsin-endangered heart-leaved plaintain (Plantago cordata).
4	NA-1	Warnimont Park Clay Bluff and Fen	16	Milwaukee County	Outstanding clay bluffs with spring seepages located along the Lake Michigan shoreline. The spring seepages support a calcareous fen which contains the Wisconsin-threatened false asphodel (Tofieldia glutinosa).
5	NA-2	South Milwaukee Hardwoods	25	City of South Milwaukee	A good-quality stand of southern mesic hardwoods dominated by sugar maple, American beech, and red oak. This site is critical habitat for the Wisconsin-endangered blue-stemmed goldenrod (Solidago caesia). This site is used for field study by Milwaukee high school students.
6	NA-2	Meyer's Woods	30	Private	A southern mesic hardwood forest remnant containing red oak, sugar maple, basswood, black cherry, shagbark hickory, and some American beech. Disturbance to the tree canopy has resulted in several dense stands of saplings. The woodlot contains a diverse ground layer of spring ephemerals.
7	NA-2	Monastery Lake Wetland Complex	64	Nature Foundation	A diverse wetland plant community consisting of deep and shallow marsh, southern sedge meadow, fresh (wet) meadow, shrub carr, and the last remaining tamarack swamp in Milwaukee County.

Table 10 (continued)

Number on Map 19	Classification Code[a]	Area Name	Size (acres)	Ownership	Community Type, Description, and Comments
8	NA-2	Mission Hills Wetland Complex	16	Private	A diverse wetland plant community consisting of shallow marsh, southern sedge meadow, fresh (wet) meadow, wet prairie, and shrub carr. Wet prairies are rare wetland plant communities in southeastern Wisconsin.
9	NA-2	Greenfield Park Woods	56	Milwaukee County	A good stand of southern dry-mesic hardwoods, including red and white oak, sugar maple, and basswood. The intact tree canopy has maintained a sparse ground and shrub layer.
10	NA-2	Bradley Woods	30	City of Milwaukee and Private	An old growth, southern dry-mesic hardwood forest dominated by sugar maple and American beech. The woodlot contains a rich and showy ground layer. The area is presently threatened by encroaching industrial development.
11	GEO-2	Fox Point Clay Bluffs and Beach	50	Private	An essentially natural reach of Lake Michigan coastline which includes a naturally nourished beach and off-shore bars. No shoreline structures or modifications are present. The shoreline at this site contains a classic example of a terraced coastline. The clay banks above support several regionally rare plant species, including buffalo berry (Sheperdia canadensis), bush honeysuckle (Diervilla lonicera), and snowberry (Symphoricarpos alba).
12	NA-3	Downer Woods	15	University of Wisconsin-Milwaukee	A second growth southern dry-mesic hardwood forest containing basswood, hawthorn, white ash, bur oak, and white oak. Native shrubs include choke cherry and dogwood. Many exotic shrubs have invaded the woodlot. Included because of its field study use by UWM students.
13	NA-3	St. Francis Seminary Woods	140	City of St. Francis and St. Francis Seminary	A southern mesic hardwood forest dominated by old growth sugar maple, American beech, basswood, and paper birch. Some native prairie plants persist on the forest fringe. The area is divided by a gravel road, a small stream tributary to Lake Michigan, and numerous trails.
14	NA-3	Esch Woods	10	Private	A small stand of southern mesic hardwoods dominated by sugar maple and American beech. A rare shrub, black haw (Viburnum prunifolium), occurs in this woodlot. The woodlot is presently threatened by encroaching residential development.
15	NA-3	Biwer Woods	17	City of West Allis	Southern dry-mesic hardwoods dominated by red oak. The woodlot also contains a small shallow marsh.

Table 10 (continued)

Number on Map 19	Classification Code[a]	Area Name	Size (acres)	Ownership	Community Type, Description, and Comments
16	NA-3	Harley-Davidson and Menomonee River Parkway Woods	40	Milwaukee County and private	A southern mesic hardwoods dominated by sugar maple and basswood grading into southern wet hardwoods in the Menomonee River floodplain. The forest contains a rich ground layer. The U. S. 41 Freeway bisects the woods.
17	Not ranked	Schlitz Audubon Center[b]	164	National Audubon Society	Features include a nature center, prairie restoration, ornamental plantings, wooded ravine, and bluff and lake terrace. A resident naturalist is present, and the Center is active in local conservation education.

[a]Natural and scientific area sites are classified as follows: Natural area sites contain nearly intact native plant and animal communities believed to be representative of the presettlement landscape. Natural areas can be of statewide or greater significance (NA-1), regional or county significance (NA-2), and local significance (NA-3). Areas having one or more rare, threatened, or endangered species are classified as rare species habitat (RSH). Areas of significant geological interest are classified as geological sites and can be of statewide significance (GEO-1) and county significance (GEO-2).

[b]This site was identified in the natural area inventory as an unranked natural area in Milwaukee County. It was included in the inventory because of its relatively large size and its educational and natural resource values.

Source: Office of Coastal Management, Wisconsin Department of Administration Scientific Areas Section, Wisconsin Department of Natural Resources, Natural Area Inventory, Wisconsin's Great Lakes Coast Revised 1980; and SEWRPC.

Table 11

MILWAUKEE COUNTY PARKS AND PARKWAYS: 1984

Number on Map 20	Site Name	Acres	County Classification[a]	Number on Map 20	Site Name	Acres	County Classification[a]
1	Alcott	17	NP	73	Lindsay	10	NP
2	Algonquin	10	NP	74	Little Menomonee River Parkway	883	MPW
3	Armour	16	NP	75	Lyons	13	NP
4	Atkinson	1	SNP	76	Madison	59	CP
5	Baran	32	SMP	77	Maintenance	4	SA
6	Barnard	11	NP	78	Maitland	27	SMP
7	Bay View[b]	31	SRP	79	Manitoba	5	NP
8	Bender	308	SRP	80	Marquette (Pere)	2	BDP
9	Big Bay	8	SRP	81	McCarty	61	CP
10	Bluff	7	SNP	82	McGovern	70	CP
11	Brown Deer	365	SRP	83	McKinley	90	SRP
12	Burns Triangle	1	GS	84	Meaux	24	SCP
13	C&NW Railway Right-of-Way	15	CPW	85	Menomonee River Parkway	643	MPW
14	Caesar's	2	SNP	86	Metcalfe	8	
15	Cannon	9	SC	87	Milwaukee River Parkway	117	MPW
16	Carver	20	SC	88	Mitchell	61	SRP
17	Cathedral Square	2	BDP	89	Mitchell Airport	19	NP
18	Center	5	NP	90	Mitchell Boulevard	16	SCP
19	Chippewa	10	NP	91	Moody	4	SCP
20	Clarke Square	2	SNP	92	Morgan Triangle	1	GS
21	Clas	1	BDP	93	Nash	7	NP
22	Columbus	8	NP	94	Noyes	81	CP
23	Cooper	8	SC	95	Oak Creek Parkway	1,027	MPW
24	Copernicus	22	NP	96	Oakwood	278	SRP
25	Cudahy	18	NP	97	Parksite 56	17	CP
26	Cudahy Nature Preserve	42	NAT. PRES.	98	Parksite 59	9	NP
27	Currie	209	SRP	99	Parksite 64	5	SNP
28	Dale Creek	45	NPW	100	Parksite 65	8	SNP
29	Dineen	59	CP	101	Parksite 71	200	MP
30	Doctors	49	SRP	102	Pleasant Valley	7	SNP
31	Doyne	35	SMP	103	Prospect Triangle	1	GS
32	Dretzka	327	SRP	104	Pulaski (Cudahy)	17	NP
33	Estabrook	115	MP	105	Pulaski (Milwaukee)	18	SNP
34	Euclid	9	NP	106	Rainbow	26	SMP
35	Falk	216	MP	107	Rawson	28	SCP
36	Franklin	10	MP	108	Red Arrow	1	BDP
37	Franklin Nursery Site	165	NP	109	Riverfront Launch Site	1	SRP
38	Froemming	73	CP	110	Riverside	22	SCP
39	Garden Homes Square	2	SNP	111	Root River Parkway	3,953	RPW
40	Gilman Triangle	--[c]	GS	112	Rose	9	SCP
41	Gordon	14	SCP	113	Saveland	4	SNP
42	Grant[b]	374	SRP	114	Schoenecker	18	SMP
43	Grantosa Parkway	11	NPW	115	Scout Lake	72	SCP
44	Granville	11	NP	116	Sheridan[b]	78	SRP
45	Greene	38	SCP	117	Sherman	21	SCP
46	Greenfield	295	SRP	118	Smith	20	SCP
47	Grobschmidt	155	MP	119	South Shore[b]	48	SRP
48	Hales Corners	35	SCP	120	St. Martin's	19	NP
49	Hanson	14	NP	121	Tiefenthaler	11	SCP
50	Highland	3	SNP	122	Tippecanoe	15	NP
51	Holler	16	SMP	123	Trimborn Farm	8	SRP
52	Holt	24	SCP	124	Underwood Creek Parkway	386	MPW
53	Honey Creek Parkway	160	CPW	125	Valley	2	SNP
54	Hoyt	35	CP	126	Vogel	12	NP
55	Humboldt	71	CP	127	Wahl	14	NP
56	Jackson	117	MP	128	Walker Square	2	SNP
57	Jacobus	33	SCP	129	Warnimont[b]	302	SRP
58	Johnson's	11	NP	130	Washington	135	MP
59	Johnstone	13	NF	131	Wedgewood	6	NP
60	Juneau	18	SRP	132	West Milwaukee	20	SCP
61	Kern	28	SCP	133	Whitnall	640	RP
62	King	21	SCP	134	Wilson	78	MP
63	Kinnickinnic River Parkway	237	MPW	135	Wilson Recreational Center	58	SMP
64	Kletzsch	119	MP	136	Wisconsin Avenue	18	SNP
65	Kops	8	NP	137	Wyrick	20	NP
66	Kosciuszko	35	CP	138	Zablocki	47	SMP
67	La Follette	18	SCP	139	Zeidler	1	BDP
68	Lake	137	SRP		Total Site Area	14,775	--
69	Lake Michigan-North	96	RPW				
70	Lincoln	324	SRP				
71	Lincoln Creek Parkway	129	CPW				
72	Lindbergh	3	SNP				

[a]The Milwaukee County Department of Parks, Recreation and Culture has placed each county park and parkway site in one of the following classifications: regional park-RP; regional parkway-RPW; special regional park-SRP; metropolitan park-MP; metropolitan parkway-MPW; special metropolitan park-SMP; community park-CP; community parkway-CPW; special community park-SC; neighborhood park-NP; neighborhood parkway-NPW; special neighborhood park-SNP; central business district park-BDP; greenspot-GS; service area-SA; and Nature Preserve-NAT. PRES.

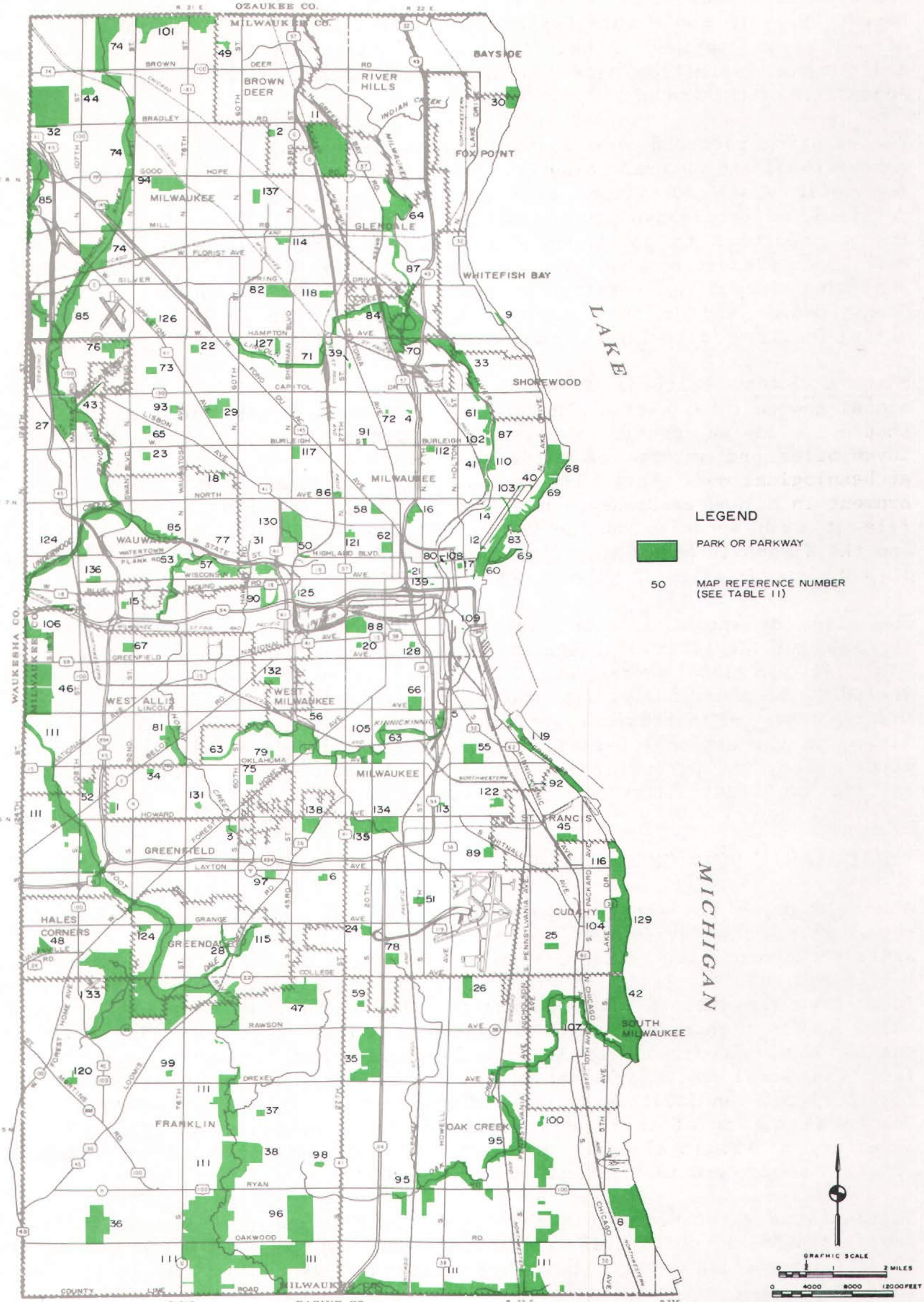
[b]Bay View, Grant, Sheridan, South Shore, and Warnimont Parks comprise Lake Michigan-South. The total area of these five sites is 833 acres. This site is classified as a regional parkway (RPW).

[c]Less than one acre.

Source: SEWRPC.

Map 20

MILWAUKEE COUNTY PARK AND PARKWAY SYSTEM



Source: SEWRPC.

sites encompassing 1,712 acres; and 163 privately owned outdoor recreation sites, including nonpublic school sites, encompassing 2,426 acres. State-owned outdoor recreation sites in the County in 1984 included the Havenwoods Forest Preserve and Nature Center and State Fair Park, encompassing a total of 451 acres combined. A detailed list of the other public and private park and outdoor recreation sites in Milwaukee County in 1984 is presented in Appendix B of this report.

The existing park and open space sites in the County constitute an important recreational and natural resource, and an evaluation of the impacts of locating solid waste facilities near parklands would have to be a part of any detailed, site-specific studies of the overall suitability of various sites. It is important to point out that lands formerly utilized for landfilling have, upon closure and reclamation, been converted to uses such as ballfields and other intensive recreational uses. One such site, located on Milwaukee County-owned land in the City of Franklin, is planned for conversion to a skiing facility following the completion of landfill operations.

Historic Sites: Historic sites in Milwaukee County have important educational and cultural values. Therefore, solid waste management planning efforts should include an identification of the important historic sites. A variety of inventories and surveys of sites that possess architectural, cultural, and archaeological merit have been conducted by various units and agencies of government in Milwaukee County. The results of these inventories and surveys--on file at such agencies as the City of Milwaukee Historic Preservation Office and the Wisconsin State Historical Society--indicate that there were more than 10,000 historic sites in Milwaukee County in 1984.

The sites of known historic significance in Milwaukee County are listed on the National Register of Historic Places. As shown on Map 21 and listed in Table 12, in 1984 there were 102 sites listed on the National Register, including 91 individual sites and 11 historic districts. Importantly, additional sites of historic significance may be identified in the future and listed on the National Register. Thus, during the detailed site feasibility study phase, the potential impacts of the location of a specific solid waste facility on historic sites must be investigated.

SOLID WASTE SOURCES, QUANTITY, AND CHARACTER

A knowledge of the amount, characteristics, and sources of solid waste is necessary to the development of an efficient and environmentally sound solid waste management plan. This portion of the report describes the existing quantities and characteristics of the solid waste generated in the study area, and identifies the sources of these wastes. The information in this section was based on data obtained from the Wisconsin Solid Waste Recycling Authority, the Wisconsin Department of Natural Resources, and inventory data collected from the local units of government, industries, commercial establishments, institutions, landfill operators, and solid waste collection operations in the County as a part of the study. Copies of the questionnaires utilized in the inventory of the local units of government and county industries, commercial establishments, and institutions are provided in Appendix C.

Solid wastes generated within the County may be classified into five categories: residential, commercial, industrial, agricultural, and a special category for all other solid wastes. These five categories may be described as follows.

Residential--Solid wastes which are generated by both urban and rural households, including households residing in multifamily dwelling units within the County, and consist mainly of food wastes, ashes, and rubbish. Rubbish includes paper, cardboard, garden and lawn trimmings, plastics, textiles, and dirt. These wastes do contain limited amounts of hazardous materials such as paints, cleaning compounds, and pesticides. These wastes are sometimes referred to as domestic, municipal, or household wastes.

Commercial--Solid wastes which are generated by wholesale, retail, and service establishments such as stores, offices, restaurants, and hotels, as well as wastes generated by public institutions and recreational land uses. These wastes are variable in character, but when taken as a category are normally composed of materials similar to residential wastes.

Industrial--Solid wastes which are generated by a variety of light and heavy manufacturing and processing operations, lumbering, and chemical plants. These wastes are highly variable in character. Toxic and hazardous wastes, and wastewater treatment sludges which require special consideration in processing and disposal, are not included in this category but are included in the special solid waste category.

Agricultural--Solid wastes which are generated by the agricultural industry and consist primarily of livestock and poultry manure, crop residue, and dead animals.

Special--Solid wastes which consist of all wastes other than the above categories. This category includes construction/demolition wastes, hazardous wastes, wastewater treatment sludges, and septic tank and holding tank wastes. These wastes usually require special handling and disposal techniques.

Each of these waste categories is discussed in the following paragraphs, which are followed by a summary of the quantity and characteristics of the total solid waste stream generated in Milwaukee County.

Residential Wastes

Residential wastes include all wastes normally generated by household activities. Several studies have been conducted to identify the amount of such wastes generated. In 1981, the Wisconsin Department of Natural Resources (DNR) developed a state solid waste management plan[4] which examined statewide solid waste management practices. That study indicated that the unit volume of residential solid waste generated within the State varies with community size. The average generation rates associated with four different community size categories were as follows:

- 2.0 pounds per capita per day for civil divisions having resident populations of fewer than 2,500 people,

- 2.7 pounds per capita per day for civil divisions having resident populations of between 2,500 and 10,000 people,

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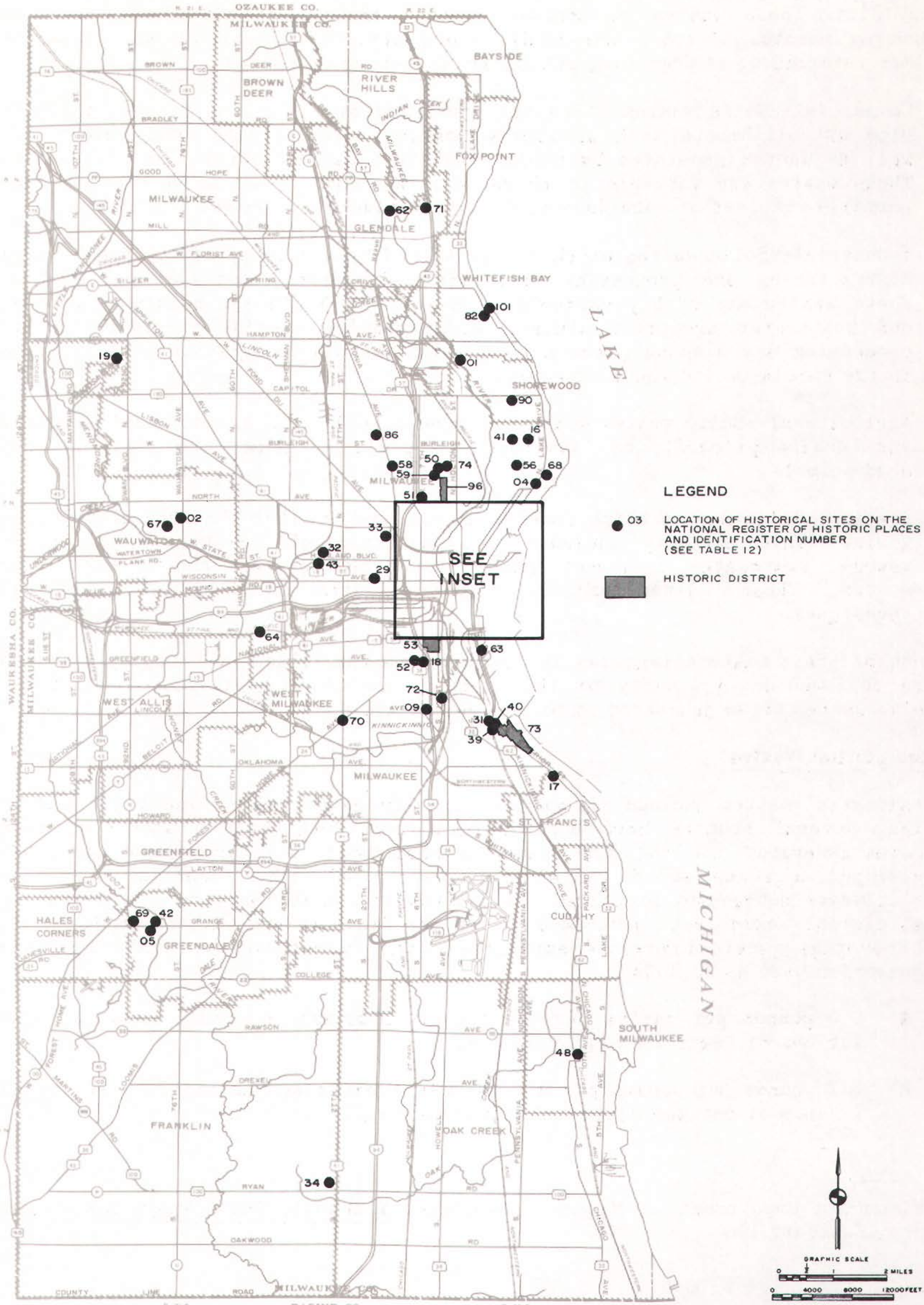
[4]Wisconsin Department of Natural Resources, Wisconsin Solid Waste Management Plan, February 1981.

Map 21

SITES OF KNOWN HISTORICAL SIGNIFICANCE IN MILWAUKEE COUNTY LISTED ON THE NATIONAL REGISTER OF HISTORIC PLACES



Source: SEWRPC.

Map 21 (continued)

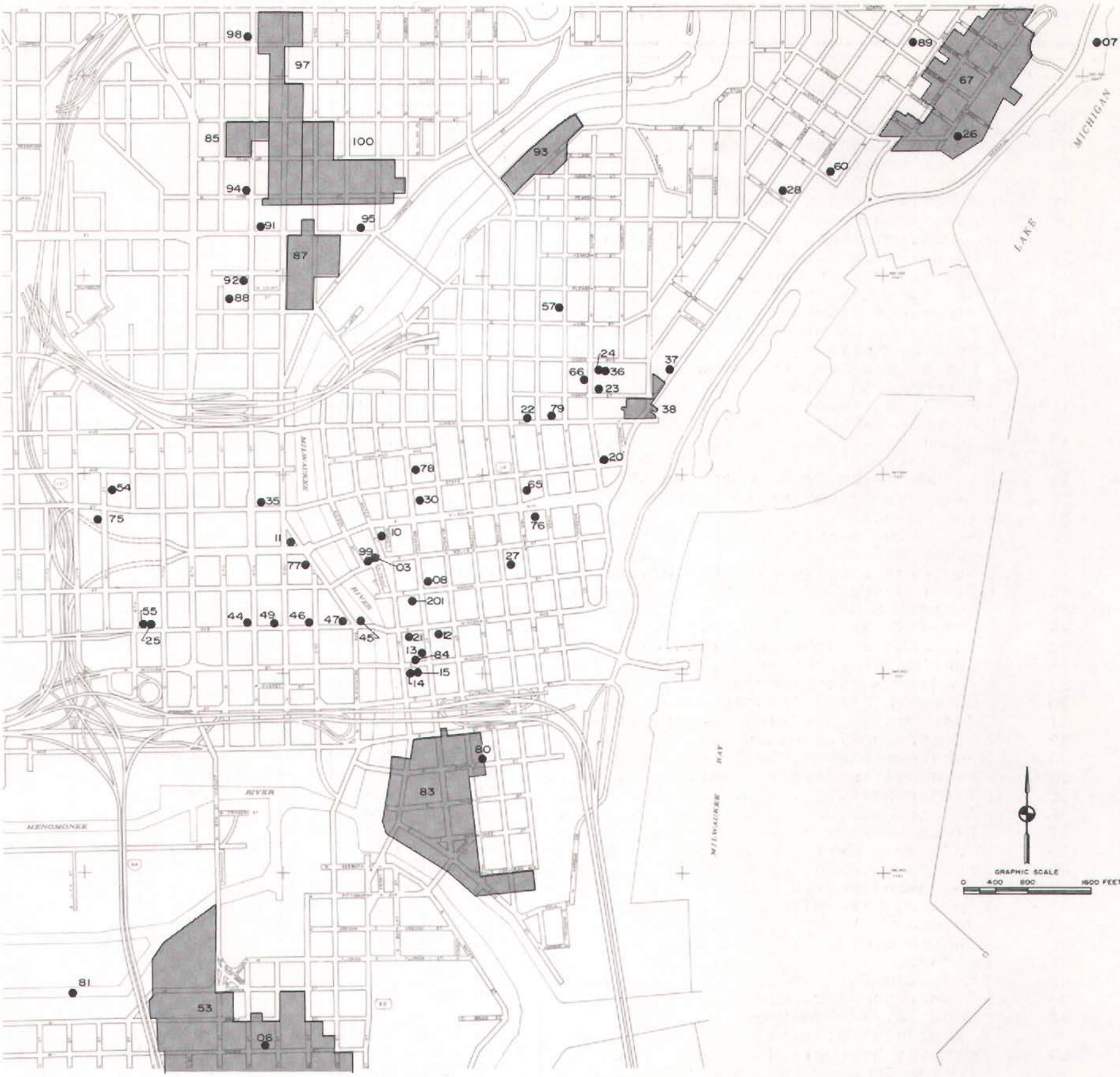


Table 12

HISTORIC SITES IN MILWAUKEE COUNTY LISTED ON THE NATIONAL REGISTER OF HISTORIC PLACES: 1984

Number on Map 21	Site Name	Location	Level of Significance[a]	Year Listed
01	Benjamin Church House	T7N R22E, Section 4	State	1972
02	Lowell Damon House	T7N R21E, Section 21	Local	1972
03	Pabst Theatre	T7N R22E, Section 29	Local	1972
04	Frederick C. Bogk House	T7N R22E, Section 15	State	1972
05	Jeremiah Curtin House	T6N R21E, Section 33	Local	1972
06	Holy Trinity--Our Lady of Guadalupe Roman Catholic Church	T7N R22E, Section 32	Local	1972
07	North Point Water Tower	T7N R22E, Section 22	Local	1973
08	Old St. Mary's Church	T7N R22E, Section 28	Local	1973
09	St. Josaphat Basilica	T6N R22E, Section 5	State	1973
10	Milwaukee City Hall	T7N R22E, Section 29	Local	1973
11	Milwaukee County Historical Center	T7N R22E, Section 11	Local	1973
12	Federal Building	T7N R22E, Section 29	Local	1973
13	611 N. Broadway Building	T7N R22E, Section 29	Local	1973
14	Mitchell Building	T7N R22E, Section 29	Local	1973
15	Mackie Building	T7N R22E, Section 29	Local	1973
16	Milwaukee-Downer "Quad"	T7N R22E, Section 10	State	1974
17	Henni Hall	T6N R22E, Section 15	State	1974
18	St. Patrick's Catholic Church	T7N R22E, Section 32	Local	1974
19	Annunciation Greek Orthodox Church	T7N R21E, Section 5	National	1974
20	Immanuel Presbyterian Church	T7N R22E, Section 28	Local	1974
21	Iron Block	T7N R22E, Section 29	National	1974
22	All Saint's Episcopal Cathedral Complex	T7N R22E, Section 21	National	1974
23	St. Paul's Episcopal Church	T7N R22E, Section 21	Local	1974
24	First Unitarian Church	T7N R22E, Section 21	Local	1974
25	Central Library	T7N R22E, Section 29	State	1974
26	Lloyd R. Smith	T7N R22E, Section 22	State	1974
27	St. John's Catholic Cathedral	T7N R22E, Section 28	State	1974
28	Charles Allis House	T7N R22E, Section 21	State	1975
29	Frederick Pabst House	T7N R22E, Section 30	State	1975
30	German-English Academy	T7N R22E, Section 28	Local	1977
31	Jos. Schlitz Brewing Company Saloon	T6N R22E, Section 9	Local	1977
32	Victor Schlitz House	T7N R21E, Section 25	Eligible	1977
33	Robert Machek House	T7N R22E, Section 19	Local	1977
34	Painesville Chapel	T5N R21E, Section 24	Local	1977
35	Turner Hall	T5N R22E, Section 29	Local	1977
36	Abbott Row	T7N R22E, Section 21	Eligible	1983
37	Edward Elwell House	T7N R22E, Section 21	National	1977
39	Puddler's Hall	T6N R22E, Section 9	Eligible	1977
40	Edward Richards House	T6N R22E, Section 9	Eligible	1977
41	Englemann Hall	T7N R22E, Section 10	Eligible	1978
42	Furlong Lime Kiln	T6N R21E, Section 28	Eligible	1978
43	Joseph W. Kalvelage House	T7N R21E, Section 25	Local	1978
44	Boston Store	T7N R22E, Section 29	Eligible	1978
45	Gimbels	T7N R22E, Section 29	Eligible	1978
46	Majestic Building	T7N R22E, Section 29	Eligible	1978
47	Plankinton Arcade	T7N R22E, Section 29	Eligible	1978
48	South Milwaukee Depot Passenger Station	T5N R22E, Section 11	Local	1978
49	Mathews Brothers Building	T7N R22E, Section 29	Eligible	1978
50	Engine Company No. 18 Firehouse	T7N R22E, Section 17	Eligible	1978
51	Chief Henry Lippert Chemical Engine House No. 1	T7N R22E, Section 17	Eligible	1978
52	St. Vincent's Asylum	T6N R22E, Section 5	Eligible	1978
54	Trinity Evangelical Lutheran Church	T7N R22E, Section 29	State	1979
55	St. James Episcopal Church	T7N R22E, Section 29	Local	1979
56	Charles Quarles House	T7N R22E, Section 15	Local	1979
57	Graham Row	T7N R22E, Section 21	Local	1979
58	Teutonia Avenue State Bank	T7N R22E, Section 18	Eligible	1979
59	H. Geibisch Building	T7N R22E, Section 17	Eligible	1979
60	B. A. Middough House	T7N R22E, Section 21	Eligible	1979
62	Spring Grove Site	T8N R22E, Section 19	State	1979
63	Milwaukee Metropolitan Sewage Treatment Plant	T7N R22E, Section 33	Eligible	1979
64	Wood National Home for Disabled Volunteer Soldiers and National Cemetery	T7N R21E, Section 35	Eligible	1980

Table 12 (continued)

Number on Map 21	Site Name	Location	Level of Significance[a]	Year Listed
65	Sixth Church of Christ Scientist	T7N R22E, Section 28	Local	1980
66	Knapp-Astor House	T7N R22E, Section 21	Local	1980
67	Sunnyhill Home	T7N R21E, Section 21	Local	1980
68	North Point Lighthouse	T7N R22E, Section 15	Local	1984
69	Trimborn Farm	T6N R21E, Section 28	Local	1980
70	Forest Home Cemetery and Chapel	T6N R22E, Section 7	State	1980
71	Elderwood	T8N R22E, Section 20	Local	1980
72	Milwaukee Fire Department High Pressure Pumping Station	T6N R22E, Section 5	Local	1981
74	East Center Street Natatorium	T7N R22E, Section 17	Eligible	1982
75	Milwaukee County Courthouse	T7N R22E, Section 29	Local	1982
76	Women's Club of Wisconsin	T7N R22E, Section 28	National	1982
77	Germania Building	T7N R22E, Section 29	National	1983
78	Valentin Blatz Brewing Company Office Building	T7N R22E, Section 29	National	1983
79	Astor on the Lake	T7N R22E, Section 28	Local	1984
80	Baumbach Building	T7N R22E, Section 28	Local	1983
81	South 11th Street Bridge	T7N R22E, Section 32	Eligible	1983
82	Herman Uilein House	T8N R22E, Section 33	Local	1983
84	State Bank of Wisconsin/Bank of Milwaukee	T7N R22E, Section 28	State	1984
86	St. John De Nepomuc Rectory	T8N R22E, Section 7	Eligible	1984
88	William Steinmayer House	T7N R22E, Section 29	Eligible	1984
89	Shorecrest Hotel	T7N R22E, Section 22	Local	1984
90	Shorewood Village Hall	T7N R22E, Section 10	Local	1984
91	Baasen House-German YMCA	T7N R22E, Section 20	Local	1984
92	Fourth Street School	T7N R22E, Section 20	National	1984
94	Frederick Ketter Warehouse	T7N R22E, Section 20	Local	1984
95	Mayer Boot and Shoe Company Building	T7N R22E, Section 20	Local	1984
98	Public School No. 27	T7N R22E, Section 20	Local	1984
99	Oneida Street Station	T7N R22E, Section 29	National	1984
101	Ward Memorial Hall	T8N R22E, Section 33	State	1983
201	Milwaukee News Building and Milwaukee Abstract Association Building	T7N R22E, Section 28	Local	1982
Number on Map 21	**Site Name**	**Location**	**Level of Significance[a]**	**Year Listed**
	Historic Districts			
38	First Ward Triangle	T7N R22E, Section 21	Eligible	1977
53	Walker's Point	T7N R22E, Section 32	Local	1978
61	North Point South	T7N R22E, Section 22	Local	1979
73	Bay View	T6N R22E, Section 9-10	Local	1982
83	Historic Third Ward	T7N R22E, Section 28-29, 32-33	State	1984
85	St. Francis of Assisi	T7N R22E, Section 20	Eligible	1984
87	Joseph Schlitz Brewing Company	T7N R22E, Section 20	Eligible	1984
93	Gallun Tannery	T7N R22E, Section 21	Local	1984
96	N. First Street	T7N R22E, Section 17	Local	1984
97	N. Third Street	T7N R22E, Section 20	Local	1984
100	Vine/Reservoir	T7N R22E, Section 20	Local	1984

[a]Sites listed as "eligible" meet the requirements for nomination to, and listing on, the National Register of Historic Places. However, the property owners of such sites have filed notarized objections to the listing of the property. In such cases, under federal regulation, determinations of eligibility are made in lieu of listing in the National Register. At such time as the owners withdraw their objections to listing, the properties may then be listed on the National Register.

Source: The State Historical Society of Wisconsin and SEWRPC.

- 3.2 pounds per capita per day for civil divisions having resident populations of between 10,000 and 30,000 people, and

- 3.6 pounds per capita per day for civil divisions having resident populations of greater than 30,000 people.

The total annual residential solid waste load in the County during 1984 was estimated using information provided in a solid waste management questionnaire which was completed by each municipality in the County. A copy of the questionnaire is presented in Appendix C. Based on this information, it was estimated that in 1984, 447,500 tons of residential solid waste were generated in the County. This quantity does not include that portion of residential solid wastes which is recycled. It was estimated that 13,000 tons per year, or 0.08 pound per capita per day, are recycled. These recycled materials are comprised of paper, metal, and glass.

Seasonal variations in residential solid waste production were also evaluated. Normal changes in solid waste generation due to seasonal activities such as initial yard cleanup activity in spring and leaf raking in fall increase the volume of solid waste. As is discussed below, this factor causes fluctuations in the rate of solid waste generation.

Residential waste contains a variety of components, with paper products generally making up slightly more than half of the weight, and food and yard wastes constituting the next largest components of waste. There have been many studies conducted to determine the composition of residential waste. Data provided by the Governor's Recycling Task Force on Solid Waste[5] and the Wisconsin Solid Waste Recycling Authority[6,7] pertaining to the average composition of residential wastes were used to estimate the residential solid waste composition in Milwaukee County. Based on this information, the average composition of residential solid waste is as follows:

Component	Percent by Weight
Paper	47
Food	12
Yard Wastes	10
Glass	7
Metals	7
Plastics	6
Textiles	4
Wood	2
Unclassified and Miscellaneous	5

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[5]Board of Engineering Consultants, Wisconsin Solid Waste Recycling--Predesign Report, Governor's Recycling Task Force on Solid Waste, May 1973.

[6]Wisconsin Solid Waste Recycling Authority, Preliminary Engineering Report for Recycling in Region II, 1981.

[7]Wisconsin Solid Waste Recycling Authority, Final Report for Implementation of Recycling for Region I, March 1981.

Commercial Wastes

Commercial solid waste is generated by transportation, communications, wholesale trade, retail trade, finance, and service industry establishments, including stores, restaurants, offices, hotels, motels, and warehouses. This category also includes solid wastes generated by governmental and institutional establishments, including hospitals and nursing homes, except special items such as pathological wastes and chemicals. Demolition and construction solid wastes are not included in the commercial wastes category but rather in the special wastes category.

The 1981 study by the DNR estimated that 1.1 pounds per capita per day of commercial solid waste is generated within the State. Economic activity, as measured by the proportion of workers employed in each major industrial category, is one means of relating commercial activity within the County to that within the State. In 1980, about 65 percent of the workers in Milwaukee County were employed in activities generating commercial solid wastes, including transportation, communication, utilities, trade, finance, insurance, real estate, services, and government. This compares to 60 percent of the employment being related to these commercial activities statewide.

The annual amount of commercial solid waste generated in the County was determined using data provided by local officials in the municipal solid waste questionnaire, information provided in a separate solid waste questionnaire mailed to the 40 largest generators of commercial and institutional solid wastes in the County, and the above-referenced DNR per capita commercial solid waste generation rate.

Based on these determinations, it was estimated that 135,675 tons of commercial waste are generated in the County per year. This quantity does not include an estimated 55,000 tons per year, or 0.3 pound per capita per day, of commercial solid wastes which are recycled or incinerated. These recycled materials are comprised primarily of paper and cardboard. The total commercial solid waste load was allocated spatially among the civil divisions in the County on the basis of the distribution of commercial land uses in the County.

The composition of commercial solid waste varies with the individual source. However, overall, the components of commercial wastes are similar to the components of residential wastes. The previously referenced studies prepared for the Governor's Recycling Task Force on Solid Waste, and information provided by the Wisconsin Recycling Authority regarding the composition of commercial solid wastes, were used to estimate the commercial solid waste composition in Milwaukee County. Based on this information, the average composition of commercial solid wastes is as follows:

Component	Percent by Weight
Paper	56
Food	10
Metals	9
Glass	6
Plastics	6
Unclassified and Miscellaneous	13

Industrial Wastes

Industrial waste consists of the residue from a variety of manufacturing and processing activities. The waste from industries is primarily scrap paper, wood, metals, glass, sands, textiles, plastics, and sludges. This category does not include toxic and hazardous wastes, oils, solvents, or chemical sludges, which are included in the special solid waste category. The type of industries located in the County are diverse and include those involved in the manufacturing and/or processing of nonelectrical and electrical machinery; fabricated metal products, equipment, and supplies; food; textiles; wood products; plastics; chemicals; precision instruments; and printed materials.

In Milwaukee County, approximately 28 percent of the employed labor force is employed in some type of manufacturing industry. The waste generated from industrial sources in the County can be estimated by applying per capita or per manufacturing employee factors to the resident population or the manufacturing employment in the County, or can be determined from surveys conducted of major industries.

The Wisconsin Solid Waste Management Plan provides estimates of industrial solid waste generation for each industrial classification. The estimated waste generated by each industry, segregated by the Standard Industrial Classification (SIC) code, is shown in Table 13. A solid waste survey was conducted of 150 industries in the study area to evaluate further the amount of industrial solid waste being generated in the County, with 41 industries, or about 27 percent of the industries, responding. The industries surveyed represented a cross-section of the industrial employment and concomitant waste generation in the County.

Based on these sources of information, it was estimated that 346,800 tons of industrial solid waste were generated in the County in 1984. This quantity does not include an estimated 250,000 tons per year, or 1.5 pounds per capita per day, of industrial wastes which are recycled or incinerated. These recycled materials are comprised primarily of paper, cardboard, metal, wood, glass, and miscellaneous materials.

Agricultural Wastes

Agriculture is not a major industry in Milwaukee County, accounting for only about 0.2 percent of the total employment in the County in 1980. Solid wastes result from agricultural activities such as the planting and harvesting of row, field, tree, and vine crops; the production of milk; and the production of animals for meat, including the operation of feed lots.

Most of the agricultural wastes that are produced are naturally recycled, and returned to the soil. The agricultural wastes are generally recycled on the agricultural fields of the farm where they are generated. Agricultural wastes are high in organic content and valuable for the maintenance of soil productivity. Data on the amounts of agricultural waste are provided in the state solid waste management plan, including waste generation rates associated with various crop acreage and numbers of livestock. Table 14 indicates the solid waste production rates based upon that DNR report and upon analyses conducted by the Regional Planning Commission as a part of its regional water quality management planning effort.

Table 13

WASTE GENERATION RATES FOR INDUSTRIES BY STANDARD INDUSTRIAL CLASSIFICATION

Standard Industrial Classification Code Number	Industry	Estimated Waste Generation Rate (pounds per employee per day)
20-39	All manufacturing	26.7
20	Food products	1.7
22	Textile mill products	1.3
23	Apparel	89.0
24	Lumber and wood products, except furniture	6.8
25	Furniture and fixtures	81.7
26	Paper and allied products	6.2
27	Printing and publishing	45.0
28	Chemicals	159.2
29	Petroleum refining	6.1
30	Rubber and plastics products	1.1
31	Leather and leather products	--
32	Stone, clay, glass, and concrete products	125.0
33	Primary metals	36.8
34	Fabricated metal products	20.4
35	Machinery, except electrical	19.9
36	Electrical and electronic machinery	14.7
37	Transportation equipment	7.1
38	Precision instruments	1.9
39	Miscellaneous manufacturing industries	6.6

Source: Wisconsin Department of Natural Resources.

Based upon the solid waste production rates provided in Table 14, 1980 agricultural land use data collected by the Regional Planning Commission, and information contained in the 1984 Wisconsin Agricultural Statistics report, it is estimated that 27,205 tons of agricultural waste were generated in Milwaukee County in 1983. Of this total, about 8,275 tons, or 30 percent, were animal wastes. Animal wastes can be a solid waste management problem in areas where certain agricultural practices result in the concentrated generation of these wastes. However, such wastes are generally not produced in large enough quantities in Milwaukee County to be a problem. There are three major alternatives for processing and/or disposal of animal wastes--landfilling, digestion to stabilize the waste, and land application. It is reasonable to assume that most agricultural and animal wastes generated in the County will be recycled by application on agricultural lands. Accordingly, this study does not address the management of agricultural wastes generated in the County.

Special Wastes

Special wastes include bulky wastes, such as appliances, trees and brush, street sweepings, demolition and construction wastes, sewage sludge, septic and holding tank wastes, and hazardous wastes, such as chemicals, solvents, and oils. These wastes appear in the waste stream and pose special disposal problems. In general, these wastes should not be mixed with residential, commercial, and nonhazardous industrial wastes, but rather are intended to be collected and disposed of separately.

Bulky Wastes: This subcategory includes discarded appliances (white goods) and items of furniture. The white goods are increasingly finding their way to scrap dealers for metal recovery. These items, because of their size and

Table 14

AGRICULTURAL SOLID WASTE PRODUCTION IN MILWAUKEE COUNTY: 1983

Crop	Acres[a]	Annual Waste Production Factor per Year[b] (tons per acre)	Solid Waste Generated (tons per acre)
Corn	1,100	3.00[c]	3,300
Soybeans	5,500	1.50	8,250
Grain Crops	2,370	1.50	3,555
Hay	1,700	2.25	3,825
Subtotal	--	--	18,930

Livestock	Number[a]	Annual Waste Production Factor per Year[d] (tons)	Solid Waste Generated (tons per year)
Dairy Cattle	300	21.7	6,510
Beef Cows	150	11.3	1,695
Calves for Slaughter	400	Not available	--
Poultry	700	0.1	70
Subtotal	--	--	8,275
Total	--	--	27,205

[a]Data are from Wisconsin Agricultural Statistics, 1984.

[b]Annual waste production crop data are from the Wisconsin Department of Natural Resources report, Wisconsin Solid Waste Management Plan, February 1981.

[c]Annual waste production crop data for corn are from the U. S. Soil Conservation Service.

[d]Annual waste production livestock data are from SEWRPC Technical Report No. 21, Sources of Water Pollution in Southeastern Wisconsin, September 1978.

Source: SEWRPC.

weight, cannot normally be handled on regular residential and commercial collection systems. Rather the transport of these wastes is generally by the homeowner or, as needed, by special municipal arrangements or by private collectors. These items may be handled in packer trucks or in special open vehicles. The generation of these items varies seasonally.

Bulky wastes require special consideration in landfilling since they can cause voids and take up considerable space. Most landfills set bulky wastes aside for pickup by private recycling operators. The Recycling Task Force on Solid Waste study indicates a bulky waste generation rate of 0.1 pound per capita per day, or about 17,040 tons per year, for the study area in 1984. Similar per capita generation rates for bulky materials have been found in other studies conducted in southeastern Wisconsin. This total does not include an estimated 500 tons of the white goods generated in the County which, according to information provided by communities in the County, are presently recycled. Additional recycling by private contractors and landfill operators also occurs.

Trees and Brush: The 1973 Recycling Task Force on Solid Waste study indicated that communities with fewer than 7,500 persons generate about 0.1 pound per capita per day of tree and brush waste, and larger communities, about 0.3 pound per capita per day. Since that study was completed, there has been an increased use of wood as a supplementary fuel. Based upon observations within the County, it appears that most log-size tree wood is now salvaged for use as fuel, and that wastes are mainly limbs and brush. For this reason, the generation rates found in the earlier study were reduced by 50 percent in estimating the quantity of solid waste generated in the study area. Supplementary information was also provided by some communities in the County on the generation rate of trees and brush. Based on these two sources of information, it was estimated that 25,875 tons of tree and brush solid waste were generated in Milwaukee County in 1984. This total does not include an estimated 5,200 tons per year, or about 0.03 pound per capita per day, which are recycled through the use of mulch and compost piles or other means.

Construction and Demolition Wastes: This subcategory includes residues generated by the building industries. Because of the size and weight of construction and demolition residue, firms have found it economically advantageous at times to dispose of this material on their own sites rather than pay the generally higher landfill fees. The Recycling Task Force on Solid Waste study estimated the construction and demolition waste generation rate to be 0.7 pound per capita per day for communities with a population greater than 10,000, and 0.3 pound per capita per day for communities of fewer than 10,000 people. Based upon the resident population of the County, about 60,000 tons of construction and demolition wastes were generated in the County in 1984. This quantity does not include an estimated 56,800 tons per year, or 0.3 pound per capita per day, of construction and demolition debris which is recycled or reused or not disposed of in licensed sanitary landfills.

Scrapped and Abandoned Automobiles: This subcategory is not presently a solid waste management concern in the County, because scrapped automobiles are currently handled by private processors. The most prevalent public concern is over the unsightly appearance of discarded vehicles along roadways and on private properties, and the storage of junked vehicles at commercial salvage yards.

Discarded tires originate from a variety of sources, including scrap yards, commercial sales outlets, reprocessors, and all types of tire users. Generally, the majority of the tires requiring disposal are from automobiles. Truck, bus, and other more costly, specially designed heavy equipment tires are usually reused. Disposal of discarded tires is a significant problem. Whole tires do not compact well in landfills and have a tendency to "float" to the surface; shredding is impeded by the wire reinforcement contained in many tires; open burning results in smoke, odor, and air pollution problems; and reclaiming is often more expensive than the manufacturing of new tires.

Inventory information provided by the Wisconsin Department of Natural Resources regarding the number of waste tires discarded annually was used to determine the number of tires being discarded annually in the County. Supplementary information provided by some communities was also evaluated. Based upon these two sources of information, it was estimated that 830,000 tires were discarded in Milwaukee County in 1984.

Toxic and Hazardous Wastes: Toxic and hazardous wastes are those wastes which, because of physical, chemical, or infectious characteristics, may pose a substantial threat to human health or safety or to the environment when improperly treated, stored, or disposed of. Characteristics of hazardous wastes include toxicity, flammability, corrosivity, reactivity, carcinogenicity, and bioaccumulation. These wastes occur in many forms, including solids, liquids, sludges, and gases.

The federal and state levels of government are playing an increasingly important role in the regulation of the handling and disposal of these wastes. Toxic and hazardous wastes are presently regulated by the DNR under Chapter NR 181 of the Wisconsin Administrative Code. Further information on the regulation of these wastes is provided later in this chapter.

Hazardous wastes are generally generated by three major sources: 1) manufacturing industries; 2) end users of finished products such as paints and pesticides; and 3) institutions. All three of these types of generating sources are located within the County.

Households can also be considered to be sources of toxic and hazardous wastes. Automotive supplies, pesticides, paints, solvents, cleaning products, and many other compounds used by residents can collectively be a significant source of potentially dangerous materials. Typically, these materials are disposed of by discharge into household drains or by discard with residential solid wastes. This source of toxic and hazardous material in the County, which is estimated to generate between 200 and 250 tons per year, is an important consideration in the evaluation of alternative solid waste management practices. A statewide program for assisting communities in the disposal of these materials is described in the "Laws and Regulations Concerning Solid Waste" section of this chapter. The management of household toxic and hazardous wastes is discussed in Chapter VII.

Information was provided by the DNR on the amount and type of toxic and hazardous wastes being generated in the County in 1984. This information is presented in Table 15. Also evaluated were data provided by the industrial survey undertaken as a part of this study on the major types of toxic and hazardous waste that were generated in the County in 1984 by the industrial sector. Based on these information sources, it was estimated that 35,615 tons of toxic and hazardous waste were generated in Milwaukee County in 1984.

Presently, there are no licensed landfills within the State of Wisconsin for the disposal of these materials. As shown in Table 15, approximately 23,444 tons of corrosives, or about 66 percent of the toxic and hazardous wastes generated in the County, consisted of pickle liquors used in a variety of manufacturing processes. Most of this material is recycled at treatment plants where it is used as an agent in the removal of phosphorus from wastewater prior to discharge. The remaining toxic and hazardous wastes are either recycled through a variety of chemical processes, incinerated at approved sites within Wisconsin, or disposed of at approved sites outside Wisconsin. The disposal of toxic and hazardous materials is of growing concern in highly industrialized areas such as Milwaukee County. It is becoming increasingly more difficult and expensive to properly dispose of these materials. Because of the costly and highly specialized character of the facilities required, an area larger than the County must be considered when identifying the best means for the disposal of such materials. Accordingly, it was concluded that toxic and hazardous wastes generated by industrial and commercial operations would be

Table 15

ESTIMATED TOXIC AND HAZARDOUS WASTES GENERATED IN MILWAUKEE COUNTY: 1984

Toxic and Hazardous Waste Category	Toxic and Hazardous Waste Generated	
	Tons per Year	Pounds Per Capita per Day
Ignitables[a]	5,639.0	0.03
Halogenated Toxic Solvents[b]	955.5	0.006
Heavy Metals[c]	3,812.5	0.02
Corrosives[d]	23,444.0	0.14
Reactives[e]	987.5	0.006
Acute Hazardous Wastes and Toxic Products[f]	776.5	0.004
Total	35,615.0	0.21

[a]Ignitables are wastes with a flash point of less than 140°F and include substances such as acetone and mineral spirits.

[b]Halogenated toxic solvents include, but are not limited to, chemicals generally used as degreaser agents, and include substances such as trichloroethylene and tetrachloroethylene.

[c]Heavy metals are generally sludges which contain heavy metals such as lead, mercury, and cadmium, which are present in leachable quantities.

[d]Corrosives are materials which have a pH of less than 2.0 (acids) or greater than 12.5 (bases), and include substances such as pickle liquors used in steel finishing processes.

[e]Reactives are materials which react violently with air or water, and include substances such as cyanide and sulfur-bearing wastes and explosives.

[f]Acute hazardous wastes and toxic products are substances which are acutely toxic, and include materials such as pesticides and arsenic acid.

Source: Wisconsin Department of Natural Resources and SEWRPC.

addressed in this study only to the extent necessary to ascertain the extent of the toxic and hazardous disposal problem based upon available data. The management of these special wastes will not be specifically planned for; rather, it will be assumed that the disposal of such materials will be considered at a geographically broader level, such as the Region or the State.

Sewage Treatment Plant Sludge: As noted earlier in this chapter, there were three public and one privately owned sewage treatment plants located in Milwaukee County in 1984. Based upon data obtained from the Milwaukee Metropolitan Sewerage District (MMSD) and the City of South Milwaukee, it is estimated that 110,000 tons of sewage sludge on a dry-weight basis were generated by these three sewage treatment plants in 1984. Wastes generated at the Wisconsin Electric Power Company's (WEPCo's) Oak Creek power plant sewage treatment facility is insignificant and will not be considered further. Sewage sludge generated in the County by the MMSD is either converted into Milorganite, a commercial fertilizer, or spread on agricultural lands at approved sites in southeastern Wisconsin. Sewage sludge generated by the South Milwaukee sewage treatment plant is disposed of primarily by spreading on agricultural lands at approved sites in southeastern Wisconsin. The adopted regional sludge management plan recommends that provisions be made for short-term emergency disposal of sewage treatment plant sludges as a backup capability to the manufacture of Milorganite or land application of sludges on farmlands. Landfilling would be a logical method of providing sludge disposal backup capability.

It is important to note that present DNR policies generally prohibit the disposal of sludges in landfills unless the facility is engineered and constructed with a clay liner, and a leachate collection and treatment system. Furthermore, in landfills used for disposal of a combination of residential, commercial, and industrial wastes, the quantity of sludge landfilled cannot exceed 10 percent of the waste deposited. In addition, the sludge must have a solids content of at least 40 percent. Sludge generated at the public sewage treatment plants in Milwaukee County presently do not have a solids content of 40 percent or more. Consequently, a limitation on sludge disposal in landfills does exist. The restriction limiting sludges with less than 40 percent solids has been specifically imposed upon the Waste Management-Omega Hills Landfill, the Waste Management-Metro Landfill, and the Land Reclamation, Ltd., Landfill. However, the Administrative Code, concerning solid waste management, documented in NR 180, is undergoing revisions which will address the disposal of these materials in landfills.

Septic and Holding Tank Wastes: In 1984 there were an estimated 5,000 onsite sewage disposal systems in operation in Milwaukee County, including septic tank systems, mound systems, and holding tanks. Based upon data contained in the adopted regional sludge management plan, it is estimated that these onsite sewage disposal systems produce 145 tons of solids per year on a dry-weight basis and 290 tons per year on a wet-weight basis. It is generally recommended that septic and holding tank wastes be disposed of by discharge to a municipal sewerage system for treatment at a public sewage treatment plant.

Summary

The quantities of solid waste estimated to be generated in Milwaukee County in 1984 are summarized by type of waste in Table 16. The total solid waste generated in the study area is shown to be about 1,178,795 tons per year. Of this total, approximately 1,032,890 tons, or 88 percent, are generated from residential, commercial, and industrial sources, and from special waste sources designated as bulky wastes, construction and demolition debris, and trees and brush. Within these categories, the per capita solid waste production rate is 6.0 pounds per capita per day, based upon the 1984 resident population of the study area. Individually, 447,500 tons per year of residential wastes are generated, or 2.6 pounds per capita per day; 135,675 tons of commercial wastes, or 0.8 pound per capita per day; 346,800 tons of industrial wastes, or 2.0 pounds per capita per day; and 102,915 tons of special wastes, including bulky wastes, construction and demolition debris, and trees and brush, or about 0.5 pound per capita per day. The quantities of solid waste to be considered in this study, as generated by civil division within the County, are summarized in Table 17. As previously discussed, the remaining 145,905 tons, or 12 percent per year, of wastes entering the solid waste stream, consisting of toxic and hazardous wastes, sewage sludge, and septic and holding tank wastes, will not be considered in detail in this study.

When considering the feasibility of solid waste management alternatives such as resource recovery, knowledge is required of not only the quantities of solid wastes generated but of the characteristics of the wastes as well. It is

Table 16

ESTIMATED SOLID WASTE QUANTITIES GENERATED IN MILWAUKEE COUNTY: 1984

Solid Waste Category	Solid Waste Generated: Tons per Year	Solid Waste Generated: Pounds Per Capita per Day
Residential[a]	447,500	2.6
Commercial[b]	135,675	0.8
Industrial[c,d]	346,800	2.0
Special Wastes Considered as Part of the Solid Waste Stream		
Bulk[e]	17,040	0.1
Construction and Demolition Debris[f]	60,000	0.3
Trees and Brush[g]	25,875	0.15
Subtotal	1,032,890	6.0
Other Solid and Liquid Wastes to be Treated Separately from the Solid Waste Stream		
Hazardous Wastes	35,615	0.2
Sewage Sludge	110,000	0.7
Septic and Holding Tank Wastes	290	Less than 0.1
Subtotal	145,905	0.9
Total	1,178,795	6.9

[a] This quantity does not include approximately 13,000 tons per year, or 0.08 pound per day, of residential wastes comprised primarily of paper, glass, and metal which are recycled.

[b] This quantity does not include approximately 55,000 tons per year, or 0.3 pound per capita per day, of commercial wastes comprised primarily of paper and cardboard which are recycled or incinerated.

[c] This quantity does not include approximately 250,000 tons per year, or 1.5 pounds per capita per day, of industrial wastes comprised primarily of paper, cardboard, metal, wood, glass, and miscellaneous materials which are recycled or incinerated.

[d] Industrial solid wastes do not include fly ash produced by the Wisconsin Electric Power Company as a result of the burning of coal for generation of electricity.

[e] This quantity does not include approximately 500 tons per year, or 0.003 pound per capita per day, of white goods which are recycled.

[f] This quantity does not include approximately 56,800 tons per year, or 0.3 pound per capita per day, of construction and demolition debris which is recycled or used as rubble fill and not disposed of in sanitary landfills.

[g] This quantity does not include approximately 5,200 tons per year, or 0.03 pound per capita per day, of trees and brush which are recycled through mulching or composting or used by individuals for firewood.

Source: Wisconsin Department of Natural Resources, Wisconsin Solid Waste Recycling Authority, and SEWRPC.

Table 17

ESTIMATED SOLID WASTE QUANTITIES IN TONS GENERATED IN MILWAUKEE COUNTY: 1984

Civil Division	1984 Population[a]	Residential	Commercial	Industrial[b]	Special Wastes: Bulk	Special Wastes: Construction and Demolition	Special Wastes: Trees and Brush	Total
Cities								
Cudahy...........	19,272	7,560	3,982	16,719	352	1,440	527	30,580
Franklin..........	18,449	6,550	4,766	2,172	337	1,350	505	15,680
Glendale..........	14,003	6,700	3,678	12,905	255	789	383	24,710
Greenfield........	32,412	13,200	4,464	473	591	2,141	887	21,756
Milwaukee.........	602,932	299,450	70,170	210,740	11,003	34,925	16,505	642,793
Oak Creek.........	17,854	6,133	3,814	16,806	326	1,281	489	28,849
St. Francis.......	9,990	3,183	1,380	988	182	547	273	6,553
South Milwaukee...	20,712	8,000	1,950	8,695	378	1,646	567	21,236
Wauwatosa.........	50,936	24,000	18,652	26,020	929	4,807	1,000	75,408
West Allis........	65,138	30,500	12,900	27,000	1,189	5,821	1,783	79,193
Villages								
Bayside...........	4,594	3,090	268	--	84	252	126	3,820
Brown Deer........	12,819	6,970	1,760	5,450	234	938	350	15,702
Fox Point.........	7,328	5,000	848	24	134	401	201	6,608
Greendale.........	16,614	8,200	2,020	926	300	1,122	455	13,023
Hales Corners.....	6,922	3,690	1,264	263	126	379	189	5,911
River Hills.......	1,663	730	385	16	30	91	750	2,002
Shorewood.........	14,510	5,560	1,200	49	265	954	397	8,425
West Milwaukee....	3,636	914	1,500	17,448	66	199	99	20,226
Whitefish Bay.....	14,220	8,070	674	106	259	917	389	10,415
Total	934,004	447,500	135,675	346,800	17,040	60,000	25,875	1,032,890

[a]Estimated 1984 population was obtained from the Wisconsin Department of Administration.

[b]Industrial solid wastes do not include fly ash produced by the Wisconsin Electric Power Company as a result of the burning of coal for generation of electricity.

Source: SEWRPC.

thus important that information be compiled on waste composition by material category, waste combustion characteristics, and seasonal variation of waste composition.

Based upon the data presented herein, the composition of the solid waste stream components which are to be the main focus of the study is set forth in Table 18.

Solid waste energy recovery processes require the combustion of the waste. Consequently, it is necessary to know the combustion characteristics of the waste in order to design an appropriate energy recovery device. The most important combustion characteristics are heating value, moisture content, and ash content. These three characteristics may vary widely depending on the sources of the waste and the degree and type of processing to which the waste is subjected.

Based upon a review of the waste stream components and an analysis of the combustion characteristics of each component, the following combustion characteristics were estimated for the Milwaukee County solid waste stream:

Heating Value of Total Waste Stream (British thermal units per pound)	4,500
Moisture Content of Total Waste Stream (percent by weight)	27
Ash Content of Total Waste Stream (percent by weight)	22

These estimates are based on the assumptions that the solid waste is not processed and that certain readily segregated wastes such as bulky waste and industrial materials with a low combustibility will be segregated out of the waste stream.

Seasonal variation in solid waste quantities is a significant factor in Milwaukee County. As shown in Figure 3, the greatest quantities of solid wastes are usually generated during the summer and fall, with lesser amounts produced in the winter. For example, solid wastes generated in May, June, and August totaled 107 percent, 116 percent, and 109 percent, respectively, of the monthly average; while quantities generated in December, January, and February totaled about 89 percent, 89 percent, and 87 percent, respectively, of the monthly average. However, if just residential wastes are considered, the solid waste quantities ranged from 145 percent of the monthly average in June to 70 percent of the monthly average in February.

EXISTING SOLID WASTE MANAGEMENT SYSTEMS

Solid waste management functions performed in the study area include source separation and recycling, collection, transportation, transfer, processing, and disposal. Each of these functions, as performed in Milwaukee County, is discussed below.

Source Separation and Recycling

Resource recovery programs can be divided into pre-collection and post-collection categories. Pre-collection programs entail the separation of recyclable solid waste materials such as newspaper, glass, oil, and aluminum by the generator before these materials are collected with the other waste components. These source separation programs are low-cost methods which reduce the need

Table 18

COMPOSITION OF SOLID WASTES GENERATED IN MILWAUKEE COUNTY: 1984

Component	Residential		Commercial		Industrial		Construction and Demolition, Bulk, Trees and Brush		Total	
	Waste Generated[a] (tons)	Percentage by Weight	Waste Generated[a] (tons)	Percentage by Weight	Waste Generated[a] (tons)	Percentage by Weight	Waste Generated[a] (tons)	Percentage by Weight	Waste Generated[a] (tons)	Percentage by Weight
Paper	210,325	47	75,980	56	113,000	32	--	--	399,305	39
Foundry sand	--	--	--	--	95,800	28	--	--	95,800	9
Metal	31,325	7	12,210	9	43,000	12	--	--	86,535	8
Food	53,700	12	13,570	10	--	--	--	--	67,270	7
Construction and Demolition Debris	--	--	--	--	--	--	60,000	59	60,000	6
Glass	31,325	7	8,140	6	10,000	3	--	--	49,465	5
Plastic	26,850	6	8,140	6	13,000	4	--	--	47,990	5
Yard	44,750	10	--	--	--	--	--	--	44,750	4
Wood	8,950	2	--	--	23,000	7	--	--	31,950	3
Trees and Brush	--	--	--	--	--	--	25,875	25	25,875	2
Textiles	17,900	4	--	--	5,000	1	--	--	22,900	2
Bulk	--	--	--	--	--	--	17,040	16	17,040	2
Unclassified and Miscellaneous	22,375	5	17,635	13	44,000	13	--	--	84,010	8
Total	447,500	100	135,675	100	346,800	100	102,915	100	1,032,890	100

[a]These quantities do not include material which is recycled or incinerated.

Source: SEWRPC.

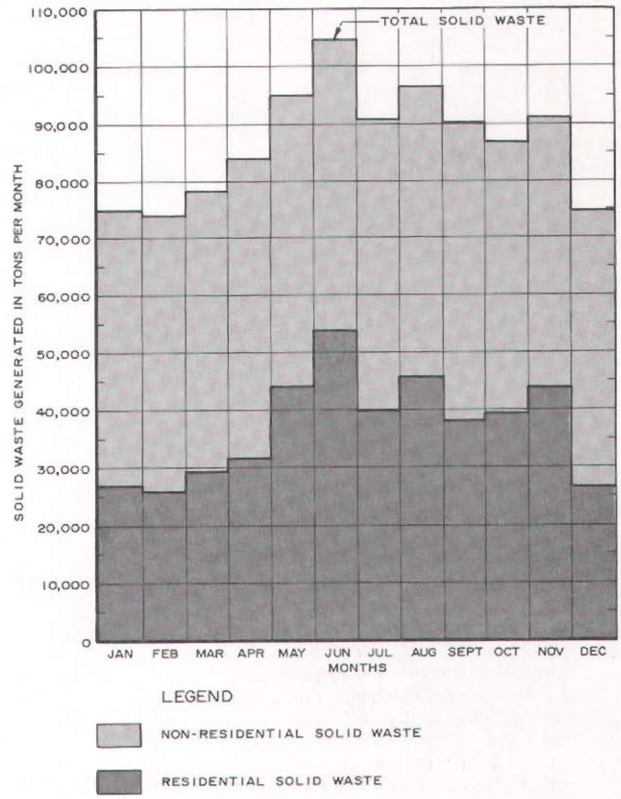
for further transport, processing, and disposal. However, such programs require a high level of public cooperation and, therefore, must rely heavily upon public education. Postcollection materials recovery, or recovery of materials after they have been mixed in collector vehicles, has higher technology requirements and greater initial capital and operating costs.

Source separation and recycling are significant elements of the existing solid waste management functions in Milwaukee County. The known recycling operations serving the County are listed in Table 19.

Solid wastes are recycled in several ways within the County. The most significant are the recycling programs which are routinely carried out by many of the industries in the County. As previously discussed, based upon the industrial survey conducted, it is estimated that 250,000 tons per year, or about 42 percent of the solid waste generated by industries, is recycled or incinerated. Of the 41 industries that completed the survey, 34 practiced some type of recycling. The major industrial wastes recycled by the industries in the County are paper and cardboard, scrap aluminum, steel and other metals, oil and grease, chemicals, glass, wood, and miscellaneous materials. These wastes are recycled both by internal manufacturing processes and by transportation to recycling centers, both within and outside the County. Commercial generators of solid wastes are also conducting a significant amount of recycling operations. Based on information from major paper and cardboard recycling operations in Milwaukee County and data from the commercial solid waste questionnaire, it was estimated that 55,000 tons per year, or about 29 percent of the solid wastes generated by the commercial sector, are recycled or incinerated.

Figure 3

MONTHLY GENERATION OF SOLID WASTE IN MILWAUKEE COUNTY: 1984



Source: SEWRPC.

A third type of recycling which is conducted in the County is source separation of paper, aluminum, glass, steel cans, and oil by the citizens and by collection by local community groups. Most of these recycling activities are carried out by private nonprofit groups such as the Jaycees, Boy and Girl Scouts, community rescue squads, and high school classes. Programs to collect paper, aluminum, and glass are being carried out by nonprofit groups in the Villages of Brown Deer and Hales Corners. Recycling programs for materials such as newspaper and oil are being conducted by the Cities of Cudahy, Glendale, Greenfield, Oak Creek, South Milwaukee, Wauwatosa, and West Allis, and the Villages of Bayside, Fox Point, Greendale, River Hills, Shorewood, West Milwaukee, and Whitefish Bay. It is estimated that 13,000 tons per year, or about 3 percent, of the residential solid wastes generated in Milwaukee County are recycled through these programs and through individual recycling.

Table 19

SOLID WASTE RECYCLING OPERATIONS SERVING MILWAUKEE COUNTY: 1984

Recycling Operation	Location	Waste Accepted
A. Lakin & Sons, Inc.	Chicago, IL	Tires
A-1 Paper Recycling	Milwaukee	Paper, metal, batteries, precious metals, pallets
Ace Auto Salvage	Milwaukee	Batteries, glass, tires
Acme Scrap Iron & Metal Corp.	Sturtevant	Metal, batteries
Acme Solvents Reclaiming	Rockford, IL	Waste oil, solvents
Action Salvage	Milwaukee	Metal
Advance Salvage	Milwaukee	Metal, batteries
AEF Salvage, Inc.	Milwaukee	Metal
Afram Brothers Co.	Milwaukee	Metal
Al's Auto Salvage	Franklin	Miscellaneous
Alternatives International, Inc.	Grandville	Metal, plastic, solvents, rags, rendering
AM Wiper & Supply Co.	Milwaukee	Rags
American Recycling, Inc.	Milwaukee	Paper, metal, batteries
Anderson Peat/Organic Compost	Germantown	Compost
Auto Ambulance	Milwaukee	Metal
B & J Recycling	Milwaukee	Tires
Badger Paper Excelsior Corp.	Milwaukee	Paper, metal, batteries
Badger Salvage & Wrecking Corp.	Milwaukee	Metal, batteries
Bay View Tire Co.	Milwaukee	Tires
Ben'o Salvage & Supply Co.	Milwaukee	Paper, metal, tires, precious metals, pallets
Berger Bros. Scrap Iron & Metal	Milwaukee	Metal
Bremer Consolidated Industrial Supplies	Milwaukee	Paper, metal, batteries
Brown Deer Junior Women's Club	Brown Deer	Paper, metal, waste oil, glass
Chudnow Iron & Metal Co.	Milwaukee	Metal, batteries
Continental Recycling Center	Milwaukee	Metal
Crest Plastics, Inc.	Milwaukee	Plastic
Cudahy, City of	Cudahy	Metal, waste oil
D & E Truck & Auto Salvage	Milwaukee	Metal, batteries
D R C Pallet Broker	Waukesha	Pallets
Dan's Battery Service	Milwaukee	Batteries
Darling & Co.	Fond du Lac	Rendering
Darling & Co.-Rockford	Rockford, IL	Rendering
Dombek Metals, Inc.	Milwaukee	Metal
Ed's Auto Salvage	Milwaukee	Miscellaneous
Eddy's Rubbish Removal Service	Milwaukee	Metal, paper, glass
Environmental Reclamation, Ltd.	West Bend	Precious metals
Felix Bandos Waste Materials	Milwaukee	Paper, metal
Firestone Retread Shop-Madison	Madison	Tires, pallets
Forman Metal Company	Milwaukee	Metal
Foster Forbes Glass Co.	Burlington	Metal, glass
Fox Valley Grease Co., Inc.	Huntley, IL	Rendering
Framitized Steel Co. of Milwaukee	Milwaukee	Metal
General Pallet Service	Milwaukee	Pallets, wood
Goeman Wood Products	Hartford	Pallets, wood
Grossman Brothers Co.	Milwaukee	Metal
Gus Holman Co.	Sheboygan	Metal, batteries, precious metals, barrels and drums
H & R Scrap Metals Co., Inc.	Milwaukee	Paper, metal, batteries, plastic, precious metals, barrels and drums
Haupt Barrel & Cooperage Co.	Milwaukee	Barrels and drums
Henning Pallet Service	Racine	Pallets, wood
Jacob's Auto Salvage Co.	Milwaukee	Metal
Jacobs Scrap & White Metals Co.	Milwaukee	Metal
Jacobson Barrel Corp.	Milwaukee	Barrels and drums
John Lee Pallet Service	Milwaukee	Pallets
Kard Recycling Service, Inc.	New Berlin	Paper, pallets
Keiding, Inc.	Milwaukee	Paper
Klein Industrial Co.	Milwaukee	Metal
Kohne Salvage	Muskego	Paper, metal, batteries

Table 19 (continued)

Recycling Operation	Location	Waste Accepted
Lake Disposal	Milwaukee	Paper, metal, batteries
Lerman Tire Service, Ltd.	Milwaukee	Tires
Lewinsky Iron & Metal Co., Inc.	Milwaukee	Metal, precious metals
Liberty Iron & Metals, Inc.	Milwaukee	Metal
McKinley's Dismantling, Inc.	Milwaukee	Metal, batteries
Mid-America Steel Drum Co., Inc.	Oak Creek	Barrels and drums
Midwest Iron & Metal, Inc.	Milwaukee	Metal, batteries
Miller Brewing Co. Reclamation	Milwaukee	Metal
Miller Reclamation Center	Milwaukee	Metal, glass
Milwaukee Scrap Metal Co.	Milwaukee	Metal, batteries
Milwaukee Waste Paper Co.	Milwaukee	Paper
National Salvage, Ltd.	West Allis	Paper, metal, batteries, precious metals
Northside Salvage	Milwaukee	Paper, metal, batteries
P L Salvage & Trucking	Milwaukee	Metal, batteries
Paper Processing, Inc.	Green Bay	Paper
Parks Iron & Metal Co., Inc.	Milwaukee	Metal, batteries, precious metals
Peck Metals, Inc.	Milwaukee	Metal
PECO	Milwaukee	Paper
Peltz Bros. Waste Material Corp.	Milwaukee	Paper, metal, batteries, precious metals, pallets
Peter Wolin Co., Inc.	Milwaukee	Metal, batteries
Pioneer Iron & Metal Co.	Milwaukee	Metal
Pomp's Tire Service, Inc.	Green Bay	Tires
Reclaimed Pallet Service, Inc.	Butler	Pallets, wood
Recycling World, Inc.	Milwaukee	Paper, metal, batteries, precious metals, pallets
Reynold's Aluminum Recycling	West Allis	Metal
Reynolds Aluminum	Milwaukee	Metal
Rowe Oil Service, Inc.	Waukegan, IL	Waste oil, solvents
Ruby's H&F Scrap Metals Co., Inc.	Milwaukee	Paper, metal, batteries, plastic, precious metals, barrels and drums
S & H Iron & Metal, Inc.	Milwaukee	Metal, batteries, barrels and drums
Sadoff Iron & Metal Co.	Milwaukee	Metal
Scherr Meyer	Milwaukee	Metal, batteries, solvents, precious metals
Schlitz Audubon Center	Milwaukee	Paper
Schreiner's Waste Oil Service	Oak Creek	Waste oil
Schuster Metals, Inc.	Milwaukee	Metal, batteries, precious metals
Secondary Petroleum Products	Milwaukee	Miscellaneous
Shapiro Paper & Metal Recycling	Milwaukee	Paper, metal, batteries
Shorewood Village Hall	Shorewood	Paper, metal, waste oil, glass
South Side Waste Materials	Milwaukee	Paper, metal, batteries
Spring City Salvage Co.	Waukesha	Paper, metal, batteries, precious metals, barrels and drums
St. Francis Auto Wreckers, Inc.	Milwaukee	Metal, batteries, waste oil
Standard Scrap Metal, Ltd.	Racine	Paper, metal, batteries
State Metals Corp.	Milwaukee	Metal, batteries, precious metals
Stimac Bros Corp.	Milwaukee	Metal
W. Yudin Scrap Metal Co.	Milwaukee	Metal, batteries
West Allis Salvage Co., Inc.	West Allis	Paper, metal, batteries precious metals
Western Iron & Metal Co.	Milwaukee	Metal
Whitefish Bay, Village of	Whitefish Bay	Paper, waste oil
Wisconsin Barrel & Drum Co., Inc.	Oak Creek	Barrels and drums
Wisconsin Paperboard Corp.	Milwaukee	Paper
Wolinsky Salvage, Inc.	Milwaukee	Paper, metal, batteries, rags, precious metals
Zinkel Enterprises	Manitowoc	Paper

Source: Wisconsin Department of Natural Resources.

Another type of source separation recycling which is conducted in the County is the separation of bulky white goods which are then recycled. This is done both by individuals prior to collection and by communities following collection. Recycling of these goods is being conducted in the Cities of Cudahy, Glendale, Greenfield, Oak Creek, South Milwaukee, and Wauwatosa, and in the Villages of Bayside, Greendale, Shorewood, West Milwaukee, and Whitefish Bay.

Other methods of recycling utilized in the County involve the mulching and composting of yard wastes by communities and the use of trees and brush for fireplace wood by individual residents.

Storage, Collection, and Transport

Solid waste storage may be defined as the temporary holding of the material in containers either prior to collection or following collection at a transfer or processing station. Private contractors provide the majority of collection and transportation services in Milwaukee County for large multifamily residences, commercial establishments, and industries with two- to four-cubic-yard containers for storage of solid waste. Larger industries may use bulk containers for storage with capacities of up to 40 cubic yards. Most individual residents in the County, who typically generate smaller amounts of solid waste, store such waste in metal or plastic garbage cans or in heavy-duty plastic bags. Carts are used for residential wastes in the Villages of Brown Deer and Shorewood and a portion of the City of Milwaukee.

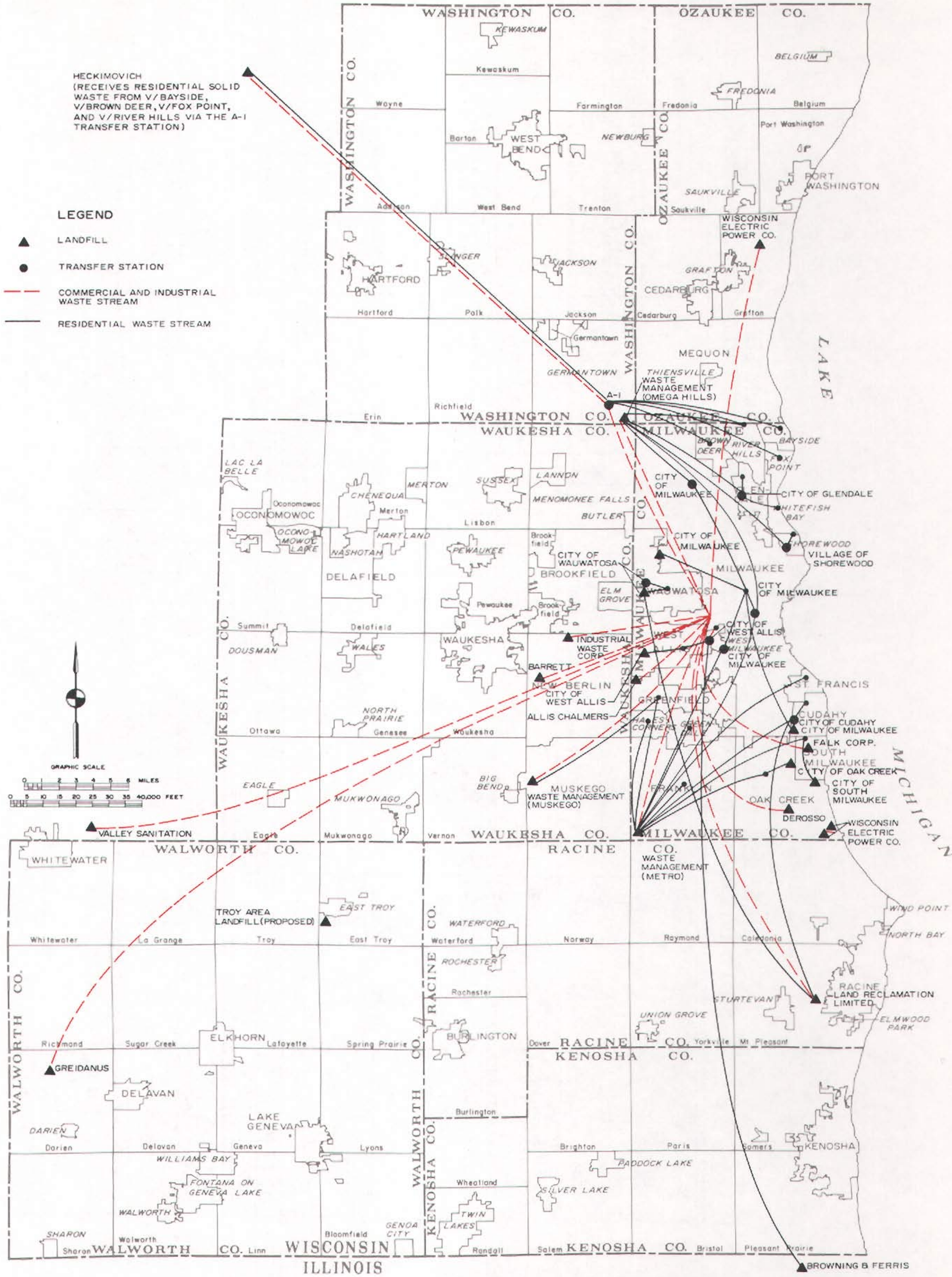
Collection and transportation includes the gathering or picking up of solid wastes from the various sources and the hauling of these wastes to where the contents of the vehicles are emptied. Collection and transport of solid wastes in Milwaukee County is provided primarily by one of two methods: municipally operated collection and transportation services, which provide the majority of the residential waste collection service, and private collection services, which provide the majority of the commercial and industrial solid waste collection services in the County. The municipalities themselves provide the majority of the residential solid waste collection and transportation services in Milwaukee County in the Cities of Cudahy, Glendale, Milwaukee, Oak Creek, South Milwaukee, Wauwatosa, and West Allis, and the Villages of Bayside, Fox Point, Greendale, River Hills, Shorewood, West Milwaukee, and Whitefish Bay. Private collection and transportation contractors haul residential wastes in the Cities of Franklin, Greenfield, and St. Francis, and in the Villages of Brown Deer and Hales Corners. The existing solid waste disposal facilities and transportation pattern for the residential and commercial solid wastes generated in and around the County are shown on Map 22.

As discussed above, private industry provides the vast majority of the collection and transportation services for commercial and industrial wastes in Milwaukee County. There are 115 licensed private collection services operating in the County, as shown in Table 20. Private collection services are arranged for either on an individual contract basis with each commercial establishment and industry, or by contracts with municipalities to collect and transport residential and, in some cases, commercial solid waste generated within that municipality. Individual agreements are usually the basis for industrial solid waste collection and transportation.

Residential and some commercial solid wastes are collected by municipally operated and private collection services once per week in the County except in

Map 22

EXISTING RESIDENTIAL, INDUSTRIAL, AND COMMERCIAL SOLID WASTE TRANSPORTATION PATTERNS AND DISPOSAL SITES FOR MILWAUKEE COUNTY: 1985



Source: SEWRPC.

Table 20

LICENSED COLLECTION AND TRANSPORTATION SERVICES IN SOUTHEASTERN WISCONSIN THAT OPERATE IN MILWAUKEE COUNTY: 1984

Name	License Number	Portion of Study Area Served	A	B	C	D	E	F	Other	Disposal Site (s)[a]
Kenosha County										
ABS Services, Inc.[b,c]	10778	Milwaukee County		X	X			X	Solvents, oil, PCB's, foundry sand	Land Reclamation, Ltd.-Mt. Pleasant; Browning & Ferris, Zion, Illinois; Waste Research & Reclamation-Eau Claire
Industrial Waste Haulers, Inc.	11153	Milwaukee County						X	Solvents, oil, PCB's	Land Reclamation, Ltd.-Mt. Pleasant
Industrial Pumping, Inc.[b]	10898	Milwaukee County						X	Hazardous/non-hazardous liquids	Browning & Ferris, Zion, Illinois; Waste Management, Inc.-I and II
Milwaukee County										
A. O. Smith Corporation	11229	A. O. Smith Corporation						X	Steel finishing pickle liquor	Jones Island Sewage Treatment Plant, South Shore Sewage Treatment Plant, Milwaukee County
A-C Trucking Company, Inc.[b]	10754	Milwaukee County	X		X			X	Foundry sand	Waste Management, Inc.-II; DeRosso Landfill-Oak Creek; Barrett Landfill-New Berlin
AAA Environmental Industries	11066	Milwaukee County	X					X	Gas, oil, PCB's	Waste Management, Inc.-I, II; Land Reclamation, Ltd.-Mt. Pleasant
Ace Tank & Pump Service[b]	10933	Milwaukee County	X					X	Oils	Waste Management, Inc.-I, II
Aldrich Chemical Company Inc.[b]	11091	Aldrich Chemical Company, Inc.	X					X	Organics, inorganics	Aldrich Chemical Company, Inc.-Milwaukee
Allen-Bradley Company[b]	11228	Allen-Bradley Company						X	Solvents	Hydrite Chemical Company-Milwaukee
Almar Disposal, Inc.	10744	Cities of Milwaukee and Wauwatosa		X	X				--	Waste Management, Inc.-II
Amber Oil Company	10909	Milwaukee County							Waste and industrial oils	Motor Oils Refining, Illinois
Apollo Trucking Removal Service	10760	Milwaukee County	X	X	X				--	Waste Management, Inc.-II
Arrow Disposal Service	10608	Milwaukee County	X	X	X				--	Waste Management, Inc.-I, II
Art's Disposal Service	10520	City of Milwaukee	X		X				--	Waste Management, Inc.-I
Ashland Chemical Company[b]	11230	Milwaukee County						X	Solvent degreasers	Waste Research & Reclamation-Eau Claire; Waste Management, Inc.-II; Chemical Waste Management-Illinois
Atlas Disposal Service	10702	Milwaukee County			X				--	Unknown
Baron Blakeslee-Division of Purex Corporation	10982	Milwaukee County						X	Hazardous liquids	Baron Blakeslee-Cicero, Illinois
Benlo Chemicals, Inc.[b]	11227	City of Milwaukee						X	Liquids, sludge	Waste Research & Reclamation-Eau Claire
Best Disposal Systems Company[d]	10561	Milwaukee County	X	X	X				Sludge	Waste Management, Inc.-II, III, Pheasant Run
Briggs & Stratton Corporation	11095	Briggs & Stratton Corporation						X	Oils, liquids	Briggs & Stratton Incinerator; Briggs & Stratton Storage Area
Budget Disposal Service, Inc.	11429	Milwaukee County			X				--	Waste Management, Inc.-I, II, III
Busy Bee Disposal Company	10710	City of Milwaukee	X	X	X				--	Waste Management, Inc.-I
C & W Trucking Company	11044	AmpCo Metal	X						Foundry sand	Waste Management, Inc.-I
CW Purpero Excavating	10812	Milwaukee County	X						--	WEPCo Landfill-Mequon
C.T.S.	11226	Milwaukee County	X	X	X		X		--	Waste Management, Inc.-II; City of Glendale Transfer Station
Chem-Bio Corporation, Aquasearch Division	11536	Milwaukee County						X	Hazardous liquids and solids	Chemical Waste Management- Emelle, Alabama; Fondessy Enterprises-Toledo, Ohio
Commerce Industrial Chemicals[b]	11134	Milwaukee County						X	Toxic and hazardous solvents	Commerce Industrial Chemicals-Milwaukee; Hamilton-Two Rivers, Wisconsin; Custom Organics-Chicago, Illinois
Commercial Rubbish Collection	10218	Milwaukee County	X	X	X				--	Waste Management, Inc.-I
City of Cudahy	10048	City of Cudahy	X	X	X				--	City of Cudahy Transfer Station, Waste Management, Inc.-I; City of Cudahy Landfill

Table 20 (continued)

Name	License Number	Portion of Study Area Served	A	B	C	D	E	F	Other	Disposal Site (s)[a]
Milwaukee County (continued)										
City of Glendale	10460	City of Glendale	X		X				--	City of Glendale Transfer Station; Waste Management, Inc.-II
City of Greenfield	10227	City of Greenfield	X	X	X				--	Waste Management, Inc.-I
City of Milwaukee	10144	City of Milwaukee	X		X				--	Waste Management, Inc.-I, II
City of Milwaukee Public Schools	10852	City of Milwaukee Public Schools	X		X		X		--	Waste Management, Inc.-I, II; City of Milwaukee NW Transfer Station
City of Oak Creek	10077	City of Oak Creek	X	X					--	Waste Management, Inc.-I; City of Oak Creek Landfill
City of South Milwaukee	10136	City of South Milwaukee	X	X	X				--	City of Cudahy Transfer Station, City of South Milwaukee Landfill-Oak Creek
City of St. Francis	10428	City of St. Francis	X	X					--	Waste Management, Inc.-I
City of Wauwatosa	10294	City of Wauwatosa	X	X	X				--	City of Wauwatosa Transfer Station; Waste Management, Inc.-I; City of Wauwatosa Landfill
City of West Allis	10509	City of West Allis	X	X	X				--	City of West Allis Transfer Station; Browning & Ferris-Zion, Illinois
DN Grober Services	10726	Cities of Glendale and Milwaukee	X	X	X				--	Waste Management, Inc.-II; City of Glendale Transfer Station
D. Sorce & Sons Trucking, Inc.	10781	Milwaukee County	X	X					--	Waste Management, Inc.-III
Dependable Disposal, Inc.	10355	Cities of Milwaukee and Glendale, Village of Greendale	X	X	X				--	Waste Management, Inc.-I
Duffy's Trucking & Grading	11463	Tri-Chemical					X		--	Land Reclamation, Ltd.-Mt. Pleasant
Dugger's Rubbish Service	10767	Milwaukee County		X	X				--	Waste Management, Inc.-II
Ed's Masonry & Trucking, Inc.	10378	Cities of Milwaukee and West Allis, Village of Shorewood	X	X	X				--	Unknown
Eddy's Rubbish Removal Service	10283	City of Milwaukee			X				--	Waste Management, Inc.-II
Fulton Manufacturing Corporation[b]	11018	Fulton Manufacturing Corporation	X					X	Paint, sludge, oil, trichloroethylene	Waste Management, Inc.-II
G. Clasen Mason Contractors, Inc.	10846	City of South Milwaukee	X	X					--	Waste Management, Inc.-I; DeRosso Landfill-Oak Creek
G. Radtke & Sons Cartage Company	11215	City of Milwaukee							Iron and steel	Chemical Waste Management-Emelle, Alabama
Guardian Disposal	10103	Milwaukee County	X	X	X				--	Waste Management, Inc.-I, II, III
Hal-Cor Trucking Company	11507	Peter Cooper Corporation							Tankage	Waste Management, Inc.-I
Harnischfeger Corporation[b]	11225	Harnischfeger Corporation	X					X	Paint waste	Harnischfeger Corporation main plant
Hydrite Chemical Company[b]	11237	Milwaukee County						X	Solvents	Hydrite Chemical Company
Industrial Waste Corporation[b]	10249	Milwaukee County	X	X	X		X	X	Sludge	Industrial Waste Corporation; Waste Management, Inc.-II
J-M Vacuum Service[b]	10965	Milwaukee County, Falk Corporation, Mead Containers						X	Coolants, oil sludge	Waste Management, Inc.-I, II
Johnson Controls[b]	11110	Johnson Controls	X					X	--	Johnson Controls-Humboldt Avenue plant (storage)
Kenway Company Vacuum Pumping Service[b]	10938	Milwaukee County	X					X	Catch basin debris	Waste Management, Inc.-I, II
Lake Disposal Company	10405	Cities of Milwaukee, Cudahy, Franklin, Oak Creek, and South Milwaukee	X	X	X				Oil, sludge	Waste Management, Inc.-I
Mandella Disposal Company	10457	Milwaukee County			X				--	Waste Management, Inc.-II
McKesson Chemical Company[b]	11001	City of Milwaukee						X	Ignitable liquids	McKesson Chemical Company-Kentucky
Miller Compressing Company[b]	10761	Miller Compressing Company			X			X	Oil sludge	Barrett Landfill-New Berlin; Waste Management, Inc.-II
Milport Chemical Company[b]	11324	Milwaukee County						X	Toxic liquids	Safety-Kleen--Elgin, Illinois; Hydrite Chemical Company-Milwaukee
Milwaukee Metropolitan Sewerage District	11243	Milwaukee Metropolitan Sewerage District						X	--	Land Reclamation, Ltd.-Mt. Pleasant

Table 20 (continued)

Name	License Number	Portion of Study Area Served	A	B	C	D	E	F	Other	Disposal Site (s)[a]
Milwaukee County (continued)										
Moore Oil Company, Inc.[b]	11343	Milwaukee County						X	--	Waste Research & Reclamation-Eau Claire
Morisse Excavating	10792	Milwaukee County	X						--	DeRosso Landfill-Oak Creek
National Tank Service of Wisconsin, Inc.	10848	Milwaukee County						X	--	Waste Management, Inc.-I; National Tank Service
North Star Demolition, Ltd.	11124	Milwaukee County					X		--	Waste Management, Inc.-II
North-Town Rubbish Removal	10762	City of Milwaukee			X				--	Waste Management, Inc.-I
Northwestern Lumber & Wrecking	10763	Milwaukee County	X	X					Asbestos	Land Reclamation, Ltd.-Mt. Pleasant; Waste Management, Inc.-I, II
Overnite Transportation Company[b]	11306	Milwaukee County						X	--	ENSCO-Eldorado, Arkansas
Parliament Industrial Vacuum	10913	Milwaukee County						X	Foundry sand	Allis Chalmers Corporation
Peltz Brothers Waste Material Corporation	10280	Milwaukee County	X	X					--	Waste Management, Inc.-II
Peter Wolin Company, Inc.	10267	City of Milwaukee	X	X	X				--	Waste Management, Inc.-II
R. Hodge Company, Inc.	10237	Milwaukee County	X	X	X				--	Waste Management, Inc.-I
Ray Jakubiak Disposal	10514	Milwaukee County			X				--	Waste Management, Inc.-I
RBP Chemical Corporation[b]	11540	Milwaukee County						X	Toxic liquids	Envirite-Harvey, Illinois
Roto Sewer Cleaners[b]	10817	Milwaukee County	X					X	Car wash debris	Waste Management, Inc.-I, II
Schreiner's Waste Oil Service[a,c]	10979	City of Milwaukee						X	Waste oil, PCB's	Waste Management, Inc.-II
Shell Oil Company-Milwaukee Plant[b]	11205	Milwaukee County	X		X			X	Sludge	Waste Management, Inc.-II
Suds City Scavenger Service[b]	10669	Milwaukee County	X	X	X			X	Paint sludge, oil	Waste Management, Inc.-I, II
Taylor Industrial Vac., Inc.[b]	11006	Milwaukee County	X		X			X	Industrial sludge	Waste Management, Inc.-I, II
The Babcock & Wilcox Company[b]	11177	Babcock & Wilcox Company						X	Steel finishing pickle liquor	Babcock & Wilcox Company, South Shore Sewage Treatment Plant
The Falk Corporation	11241	Falk Corporation						X	--	Chemical Waste Management of Wisconsin-Germantown; Waste Research and Reclamation-Eau Claire
Titus Owens Rubbish Collection[b]	10780	Milwaukee County						X	Paint sludge, oils	Waste Management, Inc.-II
Togo Disposal, Inc.	10697	City of Milwaukee			X				--	Waste Management, Inc.-I, II
Transcology, Inc.[b,c]	11293	Milwaukee County						X	PCB's	Cecos-Cincinnati, Ohio; Rollins Environmental Serv-Tex
Village of Bayside	10423	Village of Bayside	X						--	Waste Management, Inc.-II
Village of Fox Point	10204	Village of Fox Point	X	X	X				--	Waste Management, Inc.-II
Village of Greendale	10883	Village of Greendale	X		X				--	Waste Management, Inc.-I
Village of River Hills	10179	Village of River Hills	X	X	X				--	Waste Management, Inc.-II
Village of Shorewood	10134	Village of Shorewood	X	X	X				Oil	Waste Management, Inc.-II
Village of West Milwaukee	10479	Village of West Milwaukee		X	X				--	City of Milwaukee Transfer Station-Lincoln Avenue
Village of Whitefish Bay	10229	Village of Whitefish Bay	X		X				--	City of Glendale Transfer Station
VIT Enterprises, Inc.	11510	Jones Island Sewage Treatment Plant, Milwaukee County							Oil, soil	Waste Management, Inc.-I
W. H. Brady Company[b]	11208	W. H. Brady Company						X	Solvents, sludges	W. H. Brady Company-Glendale
Waste Management of Milwaukee	10616	City of Milwaukee, Village of Whitefish Bay	X	X	X				--	Waste Management, Inc.-I, II, III
Water Blasting, Inc.[b]	11298	Milwaukee County	X	X	X			X	Foundry sand, paint chips	Browning & Ferris Landfill-Zion, Illinois
Wisconsin Wrecking Company	10826	Milwaukee County		X					--	Unknown
Ozaukee County										
A. Marchesi Company, Inc.	10310	Wisconsin Electric Power Company							Fly ash	WEPCo Landfill-Mequon
Aqua-Tech, Inc.[b]	11056	Milwaukee County						X	--	Aqua-Tech-Ft. Wayne, Indiana; Waste Management, Inc.-II; Fondessy Enterprises-Toledo, Ohio

Table 20 (continued)

Name	License Number	Portion of Study Area Served	A	B	C	D	E	F	Other	Disposal Site (s)[a]
Ozaukee County (continued)										
Cedar Disposal, Inc.	11389	Milwaukee County			X		X		--	Waste Management, Inc.-I, II; Valley Sanitation Landfill-Koshkonong
Cermatics, Inc.[b]	11459	Milwaukee County						X	Solvents	Waste Management, Inc.-II
GW, Inc.[b]	11481	Milwaukee County						X	Toxic and hazardous liquids, sludges	Fondessy Enterprises-Ohio
Preferred Disposal	10769	Cities of Milwaukee and Glendale	X	X	X				--	Waste Management, Inc.-II; City of Glendale Transfer Station
Racine County										
GO of Wisconsin, Inc.[b]	11193	Milwaukee County	X	X	X		X	X	Leachate	Land Reclamation, Ltd.-Mt. Pleasant; Racine Wastewater Treatment Plant
Jung & Carreno Contractors[b]	11473	Milwaukee County	X	X			X	X	--	Land Reclamation, Ltd.-Mt. Pleasant
Washington County										
A-1 Service Company, Inc.[h]	11279	Milwaukee County	X		X				--	Waste Management, Inc.-II; Heckimovich Landfill-Mayville, Wisconsin
Alliance Transportation Service[b,c]	11416	Milwaukee County	X		X			X	Sludges, PCB's	Waste Management, Inc.-I
Tall Trucking	10794	Milwaukee County	X						--	Waste Management, Inc.-II
Urgent Removal, Inc.[b]	10709	Milwaukee County	X					X	Foundry sand	Waste Management, Inc.-I, II
Waste Management, Inc.-Controlled Waste Division[b]	10900	Milwaukee County	X					X	Corrosives	Waste Management, Inc.-II; Chemical Waste Management-Alabama, Illinois, Ohio
Wisconsin Waste Alliance, Inc.	11458	Milwaukee County	X	X	X		X		Sludge, ash	Waste Management, Inc.-II
Waukesha County										
B. R. Equipment, Inc.	11472	Milwaukee County					X		--	Waste Management, Inc.-II; Barrett Landfill-New Berlin
Barrett Landfill, Inc.	10577	Cities of Milwaukee, West Allis, and Wauwatosa	X	X	X				Sludge, foundry sand	Barrett Landfill-New Berlin
Chemcentral Corporation[b]	11035	Chemcentral Corporation						X	--	Hamilton, Industries/Hydrite Chemical Corporation-Cottage Grove, Wisconsin
Economy Disposal, Inc.[e]	11408	Milwaukee County	X	X	X		X		--	Waste Management, Inc.-I, II
Filmite Oil Corporation	10981	Milwaukee County							Waste oil	Waste Management, Inc.-II
General Cartage Company[b]	11352	Milwaukee County						X	Batteries	Sander's Lead Company-Troy, Alabama
Gosa Pumping Service, Inc.[b]	11307	Milwaukee County						X	Oil, sludge	Waste Management, Inc.-II
High Voltage Maintenance Corporation[b,c]	10832	Milwaukee County						X	Askeral, PCB's	Chemical Waste Management-Emelle, Alabama
Master Disposal Landfill, Inc.	10840	Milwaukee County	X	X	X		X		--	Waste Management, Inc.-I, II
Milwaukee Solvents & Chemicals[b]	10861	Milwaukee County						X	--	E. S. L., Inc.-Elmwood, Illinois; American Chemical-Griffith, Indiana; Milwaukee Solvents & Chemicals-Menomonee Falls
Moeller Disposal, Inc.	10364	City of Milwaukee	X	X	X				--	Waste Management, Inc.-III
Sanitary Disposal Service[f]	10563	Milwaukee County		X	X				--	Heckimovich Landfill-Mayville
Schneider Excavating, Inc.	11078	City of Milwaukee		X					--	Waste Management, Inc.-II, III; Barrett Landfill-New Berlin
SED, Inc.[b,c]	10952	Milwaukee County						X	PCB's	SED, Inc.-Ohio and North Carolina; Cecos-Ohio
Shepherd Enterprises, Inc.[b]	11337	Milwaukee County	X	X	X		X	X	--	Ansul Fire Protection-Marinette
Star Line Trucking Corporation	10691	Milwaukee County	X				X		Sewage sludge	Barrett Landfill-New Berlin; Waste Management, Inc.-II
Tank Transport, Inc.[b]	11261	Milwaukee County						X	Used oil	Oil Refinery-Chicago, Illinois
Town & Country Waste Service[b,g]	10370	Milwaukee County	X	X	X			X	Oil, ink, sludge	Waste Management, Inc.-I, III; Greidanus Landfill-Delavan
United Waste Systems, Inc.[b]	10439	Milwaukee County	X	X	X			X	Paint, oil	Waste Management, Inc.-II, III

Table 20 (continued)

Name	License Number	Portion of Study Area Served	A	B	C	D	E	F	Other	Disposal Site (s)[a]
Waukesha County (continued)										
Visu-Sewer Clean & Seal, Inc.[b]	10935	Milwaukee County	X	X				X	--	Waste Management, Inc.-II
Walter's Excavating, Inc.	10869	City of Milwaukee	X	X					--	Unknown
Westinghouse Electric Corporation[b,c]	11492	Milwaukee County						X	PCB's	Westinghouse Corporation

NOTE: Waste type indicators mean:
A - Noncombustible
B - Wood matter
C - Trash and refuse
D - Garbage
E - Demolition
F - Toxic and hazardous

[a]Waste Management, Inc.: I - Franklin Landfill; II - Omega Hills Landfill; III - Muskego Landfill.

[b]Licensed to haul toxic and hazardous wastes, except PCB's.

[c]Licensed to haul all waste materials.

[d]Presently under contract with the City of St. Francis for the collection and disposal of residential wastes.

[e]Presently under contract with the City of Franklin for the collection and disposal of residential wastes.

[f]Presently under contract with the Village of Hales Corners for the collection and disposal of residential wastes.

[g]Presently under contract with the City of Greenfield for the collection and disposal of residential wastes.

[h]Presently under contract with the Village of Brown Deer for the collection and disposal of residential wastes.

Source: Wisconsin Department of Natural Resources.

the Villages of Bayside, Fox Point, and River Hills, where residential wastes are collected once every two weeks. The frequency of industrial, commercial, and multifamily waste collection depends on quantities generated and capacity of storage containers.

Transfer and Transportation

Transfer and transportation refers to the means, facilities, and equipment used to transfer wastes from small collection vehicles to larger vehicles and to transport the wastes to either processing centers or disposal sites. Transfer operations are used to remove and transfer wastes from collection vehicles and other small vehicles to transport equipment, which generally has a larger capacity than the collection vehicles.

Transportation of the majority of residential solid wastes and some commercial solid wastes in Milwaukee County is a two-step process. The first step begins when the collection vehicle leaves the last loading point and travels to a transfer station or landfill. This is carried out mainly by municipal vehicles in Milwaukee County. The second step, if needed, is the transportation of the solid waste from the transfer station to the landfill, and this is carried out mainly by private collection services in the County.

Transfer stations are an important aspect of solid waste management efforts in Milwaukee County. As shown in Table 21, there are presently eight transfer stations operated in the County. An additional reserve transfer station owned by the City of Milwaukee is located at Hawley Road. This facility was not operational in 1984. These eight stations serve as temporary disposal and consolidation points for all or part of the residential, and some commercial, refuse collected in the Cities of Cudahy, Glendale, Milwaukee, Wauwatosa, and West Allis, and the Villages of Shorewood, West Milwaukee, and Whitefish Bay. In addition, small compactors are used to consolidate a portion of the solid wastes generated in the City of Greenfield and the Village of Greendale. It is estimated that 390,000 tons, or about 87 percent, of the residential solid wastes generated in Milwaukee County are transported to one of these eight transfer stations. Additional solid wastes generated within Milwaukee County are consolidated at transfer stations operated outside the County by private contractors that operate in Milwaukee County.

Processing

Processing of solid waste means the transformation of the physical or chemical characteristics of the waste by mechanical, chemical, or biological processes. Processing accomplishes three objectives. First, processing improves the efficiency of subsequent solid waste management functions by reducing storage requirements and hauling costs. One example of this is the baling of wastepaper to reduce hauling costs to the disposal site. Second, processing may be used to recover materials for recycling or reuse. Items such as paper, plastic, glass, ferrous metals, and aluminum are valuable and can be recovered for recycling or reuse. Finally, combustible organic materials can be converted to intermediate products and/or to energy by incineration or biodigestion.

As defined above, processing of solid waste is an important management element within the study area. One form of processing practiced in many communities in the County is the use of chippers to reduce the volume of trees and brush,

Table 21

ACTIVE TRANSFER STATIONS IN THE MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN STUDY AREA: 1984

Owner/Operator	License Number	Location	User or Users	A	B	C	D	E	F
Transfer Stations[a]									
City of Cudahy.......	2571	5631 S. Pennsylvania Avenue	City of Cudahy	--	X	X	--	--	--
City of Glendale.....	2658	6201 N. Flint Road	City of Glendale and Village of Whitefish Bay	--	X	X	--	--	--
City of Milwaukee.... Northwest	2737	6710 N. Industrial Drive	City of Milwaukee	--	X	X	X	--	--
City of Milwaukee.... Lincoln Avenue	2062	4025 W. Lincoln Avenue	City of Milwaukee	X	X	X	X	--	--
City of Milwaukee.... Mt. Vernon	2985	11313 W. Mt. Vernon	City of Milwaukee	X	X	X	X	--	--
City of Wauwatosa....	2452	11100 W. Walnut Road	City of Wauwatosa	--	--	X	--	--	--
City of West Allis...	3009	5032 W. Rogers Street	City of West Allis and Village of West Milwaukee	--	X	X	X	--	--
Village of.......... Shorewood	2578	3801 N. Morris Road	Village of Shorewood	--	X	X	X	--	--

NOTE: A Noncombustible B Wood matter C Trash refuse D Garbage E Demolition F Toxic and hazardous

[a]One additional reserve transfer station is located at Hawley Road. This facility was not operational in 1984.

Source: SEWRPC.

with subsequent disposal for deposition in compost piles. As previously discussed, recylable bulk items and white goods are separated in selected communities following collection. Within the industrial sector, solid wastes which are to be recycled are often bundled or packaged in order to make subsequent handling and transportation more manageable. In addition, as shown in Table 22, there are 44 active and four inactive incinerators in the County which process a wide variety of solid and liquid wastes. However, there are presently no active county-owned or municipally owned and operated incinerators in the study area.

Disposal

As already noted, landfilling is the primary method of disposal of solid wastes in Milwaukee County. As of 1984, there were 21 licensed active landfills within and adjacent to the Southeastern Wisconsin Region receiving wastes from Milwaukee County. These sites, together with a licensed but presently unused site owned by the Wisconsin Electric Power Company, are listed in Table 23. Of these 21 active landfills, 12 are located in Milwaukee County. A brief description of each of these landfills follows.

Allis Chalmers Landfill: The Allis Chalmers Company owns and operates a landfill located in the southwest one-quarter of Section 18, Township 6 North, Range 17 East, City of Greenfield. This private, special-use landfill is used to dispose of noncombustible materials including foundry sand generated in the operation of Company business. The licensed area of the landfill is 21.2 acres in areal extent. In 1983, 13 tons of material were disposed of at the site. The remaining service life of the site is less than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

Table 22

SELECTED CHARACTERISTICS OF KNOWN MUNICIPAL AND PRIVATE SOLID WASTE INCINERATORS IN SOUTHEASTERN WISCONSIN: 1980[a]

Civil Division	Location by U. S. Public Land Survey Section	License Number	Operator	Use Classification	Status	Solid Waste Type Accepted						Average Tons per Gallon per Year	Rated Capacity (pounds per hour)	Actual Capacity (pounds per hour)	Percent Combustible
						Wood Matter	Trash and Refuse	Garbage	Pathological[b]	Toxic and Hazardous	Other				
Kenosha County															
City of Kenosha	NW¼, Section 6, T1N, R23E	0830	Anaconda American Brass Company	Private general use	Inactive	X	X	X	- -	- -	- -	- -	1,000	1,000	99
City of Kenosha	NE¼, NE¼, Section 6, T1N, R22E	2539	Kenosha Memorial Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils, liquid waste, excretory waste	N/A	N/A	N/A	N/A
Kenosha County Proposed															
Town of Somers	SE¼, NE¼, Section 10, T2N, R22E	N/A	Ocean Spray Cranberries, Inc.	Private general use	Proposed	- -	X	- -	- -	- -	Organic wastes from canning and bottling processes	- -	- -	- -	- -
Milwaukee County															
City of Cudahy	NE¼, SE¼, Section 35, T6N, R22E	2300	Trinity Memorial Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
City of Glendale	NE¼, Section 30, T8N, R22E	2301	Glen Field Health Care Center	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
City of Glendale	Section 29, T8N, R22E	2380	Lakeside Animal Hospital	Private general use	Active	- -	X	X	X	X	- -	N/A	N/A	N/A	N/A
City of Milwaukee	NE¼, SW¼, Section 33, T7N, R22E	1528	Milwaukee Metropolitan Sewerage District	Private special use	Inactive	- -	- -	- -	- -	- -	Screening and grit from wastewater treatment	N/A	N/A	N/A	N/A
City of Milwaukee	SE¼, SE¼, Section 32, T7N, R22E	2722	Allen-Bradley Company	Private general use	Active	X	X	X	- -	- -	Commercial wastes, liquid wastes	1,750	1,080	1,080	95
City of Milwaukee	NE¼, SE¼, Section 29, T8N, R22E	2830	Goodwill Industries	Private general use	Active	X	X	- -	- -	- -	- -	N/A	N/A	N/A	N/A
City of Milwaukee	Section 13, T7N, R21E	2223	St. Mary's Nursing Home	Private general use	Active	- -	X	X	- -	- -	Disposable diapers	N/A	N/A	N/A	N/A
City of Wauwatosa	Section 29, T7N, R21E	2226	Lakeview Hospital	Private general use	Active	- -	X	X	- -	X	Disposable utensils	N/A	N/A	N/A	N/A
City of Milwaukee	Section 5, T6N, R22E	2228	City of Milwaukee Johnston Community Health Center	Private special use	Active	- -	X	X	- -	- -	- -	N/A	N/A	N/A	N/A
City of Milwaukee	Section 18, T6N, R22E	2229	St. Francis Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils, liquid waste, excretory waste	N/A	N/A	N/A	N/A
City of Milwaukee	NE¼, NE¼, Section 33, T8N, R21E	2232	Northwest Health Center	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
City of Milwaukee	Section 25, T7N, R21E	2237	Family Hospital	Private special use	Active	- -	- -	- -	X	X	Disposable utensils	N/A	N/A	N/A	N/A
City of Milwaukee	Section 30, T7N, R22E	2238	Lutheran Hospital	Private special use	Active	- -	- -	- -	X	X	Disposable utensils, excretory waste	1	50	5	99

Table 22 (continued)

Civil Division	Location by U. S. Public Land Survey Section	License Number	Operator	Use Classification	Status	Solid Waste Type Accepted: Wood Matter	Trash and Refuse	Garbage	Pathological[b]	Toxic and Hazardous	Other	Average Tons per Gallon per Year	Rated Capacity (pounds per hour)	Actual Capacity (pounds per hour)	Percent Combustible
Milwaukee County (continued)															
City of Milwaukee	NW¼, Section 29, T7N, R22E	2241	Mount Sinai Medical Center	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of Milwaukee	SE¼, NE¼, Section 29, T7N, R21E	2244	Bel Air Health Care Center, Inc.	Private general use	Active	- -	X	X	X	X	Disposable diapers	N/A	N/A	N/A	N/A
City of Milwaukee	Section 12, T6N, R21E	2274	St. Luke's Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils, liquid waste, excretory waste	N/A	N/A	N/A	N/A
City of Milwaukee	Section 16, T6N, R22E	2302	Bradley Convalescent Center	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
Village of Bayside	SW¼, Section 4, T8N, R22E	2303	North Shore Health Care Center	Private special use	Active	- -	- -	- -	X	X	Disposable utensils	N/A	N/A	N/A	N/A
City of Milwaukee	NE¼, Section 8, T7N, R21E	2305	St. Anne's Home for the Elderly	Private special use	Active	- -	X	X	- -	- -	- -	N/A	N/A	N/A	N/A
City of Milwaukee	Section 31, T8N, R22E	2306	St. Michael Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, liquid waste	N/A	N/A	N/A	N/A
City of Milwaukee	SW¼, Section 10, T7N, R22E	2346	Columbia Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils, liquid waste, excretory waste	457	725	425	95
City of Milwaukee	SW¼, Section 2, T8N, R21E	2347	Northwest General Hospital	Private general use	Active	- -	X	X	X	X	- -	N/A	N/A	N/A	N/A
City of Milwaukee	Section 30, T7N, R22E	2381	Marion Catholic Home	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
City of Milwaukee	NE¼, Section 14, T7N, R21E	2556	St. Joseph's Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils, excretory waste	22,000	800	600	80
City of Milwaukee	NW¼, Section 25, T8N, R21E	2669	Plymouth Manor	Private special use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
City of Milwaukee	Section 30, T7N, R22E	2670	Deaconess Hospital	Private general use	Active	- -	X	X	X	X	- -	N/A	N/A	N/A	N/A
City of Milwaukee	NE¼, Section 25, T7N, R21E	2800	West Side Hospital	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of Milwaukee	NW¼, NW¼, Section 29, T7N, R22E	2236	St. Anthony Hospital	Private special use	Inactive	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of Milwaukee	SW¼, SE¼, Section 24, T7N, R21E	2383	St. Mary's Hill Hospital	Private general use	Inactive	- -	X	X	- -	- -	Disposable utensils	N/A	N/A	N/A	N/A
City of Milwaukee	SE¼, NE¼, Section 30, T7N, R22E	2824	Marquette University Schroeder Health Services	Private general use	Active	- -	X	X	X	X	Excretory wastes	N/A	N/A	N/A	N/A

Table 22 (continued)

Civil Division	Location by U. S. Public Land Survey Section	License Number	Operator	Use Classification	Status	Solid Waste Type Accepted: Wood Matter	Trash and Refuse	Garbage	Pathological[b]	Toxic and Hazardous	Other	Average Tons per Gallon per Year	Rated Capacity (pounds per hour)	Actual Capacity (pounds per hour)	Percent Combustible
Milwaukee County (continued)															
City of Milwaukee	SE¼, SW¼, Section 21, T8N, R21E	2257[c]	Avon Manor Nursing Home	Private special use	Active	- -	X	- -	- -	- -	- -	N/A	N/A	N/A	N/A
City of Milwaukee	NW¼, Section 12, T7N, R21E	N/A	A. O. Smith Company	Private general use	Inactive[d]	- -	- -	- -	- -	- -	Commercial and industrial wastes	N/A	N/A	N/A	N/A
City of Wauwatosa	SW¼, Section 7, T7N, R21E	2745	Briggs & Stratton	Private general use	Active	X	X	X	- -	- -	Commercial wastes	N/A	N/A	N/A	N/A
City of Wauwatosa	Section 30, T7N, R21E	2243	St. Camillus Health Center	Private general use	Active	- -	X	X	- -	- -	- -	N/A	N/A	N/A	N/A
City of Wauwatosa	Section 28, T7N, R21E	2717	Medical College of Wisconsin	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of West Allis	SW¼, Section 9, T6N, R21E	2304	Methodist Manor Health Center	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of West Allis	T6N, R21E, and T7N, R21E	2360	Villa Clement	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of West Allis	NW¼, Section 11, T6N, R21E	2385	St. Joseph's Home for the Aged	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of West Allis	Section 9, T6N, R21E	2596	Methodist Manor	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of Milwaukee	SE¼, Section 34, T7N, R21E	- -	U. S. Veterans Administration	Private special use	Active	- -	X	X	- -	- -	- -	2,100	2,000	1,500	99
City of Milwaukee	SE¼, Section 12, T6N, R21E	- -	The Heil Company—Truck Equipment Division	Private general use	Active	X	X	- -	- -	- -	- -	3	250	32	49
City of Milwaukee	SE¼, Section 12, T6N, R21E	- -	Maynard Steel Casting Company	Private general use	Active	X	X	- -	- -	- -	- -	91	350	350	95
City of Milwaukee	SW¼, Section 1, T6N, R21E	- -	Falk Corporation Plant 1	Private general use	Active	X	X	- -	- -	- -	- -	145	500	250	96
Village of West Milwaukee	SW¼, Section 1, T6N, R21E	- -	Inryco, Inc. Burnham Street	Private general use	Active	X	X	- -	- -	- -	- -	200	667	667	99
City of Milwaukee	NW¼, Section 33, T7N, R22E	- -	Afram Brothers Company	Private general use	Active	X	- -	- -	- -	- -	Rubber, plastic	1,250	2,000	2,000	30
City of South Milwaukee	NE¼, Section 14, T5N, R22E	- -	Appleton Electric Company—Foundry Division	Private general use	Active	X	X	- -	- -	- -	- -	30	200	100	98
City of Milwaukee	NE¼, Section 21, T6N, R21E	- -	St. Joseph's Convent	Private special use	Active	X	X	- -	- -	- -	- -	100	625	165	90
Milwaukee County Proposed															
City of Milwaukee	SW¼, NW¼, Section 32, T7N, R22E	N/A	Hydrite Chemical Company	Private general use	Proposed	- -	- -	- -	- -	- -	Flammable liquids, commercial product waste	- -	- -	- -	- -

Table 22 (continued)

Civil Division	Location by U. S. Public Land Survey Section	License Number	Operator	Use Classification	Status	Solid Waste Type Accepted						Average Tons per Gallon per Year	Rated Capacity (pounds per hour)	Actual Capacity (pounds per hour)	Percent Combustible
						Wood Matter	Trash and Refuse	Garbage	Pathological[b]	Toxic and Hazardous	Other				
Ozaukee County															
Village of Grafton	Section 24, T10N, R21E	1785	Village of Grafton	Public general use	Inactive	X	X	X	- -	- -	Licensed to burn municipal and commercial solid waste—presently used only to destroy drugs and other material confiscated by law enforcement agencies	N/A	N/A	N/A	N/A
City of Port Washington	Section 28, T11N, R22E	2384	Heritage Nursing Homes	Private special use	Active	- -	- -	- -	- -	- -	Disposable diapers	N/A	N/A	N/A	N/A
Racine County															
City of Burlington	NE¼, SW¼, Section 32, T3N, R19E	2307	Memorial Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
City of Racine	NW¼, SW¼, Section 7, T3N, R23E	2222	St. Mary's Medical Center, Inc.	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of Racine	SW¼, NE¼, Section 16, T3N, R23E	2235	St. Luke's Hospital	Private special use	Active	- -	- -	- -	X	X	- -	N/A	N/A	N/A	N/A
City of Racine	NE¼, SW¼, Section 9, T3N, R23E	2308	St. Catherine's Infirmary	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
City of Racine	SW¼, Section 16, T3N, R23E	- -	S. C. Johnson & Son—Racine Plant	Private general use	Active	X	X	- -	- -	- -	- -	16	450	60	80
Village of Sturtevant	NE¼, Section 22, T3N, R22E	- -	S. C. Johnson & Son—Waxdale Plant	Private general use	Inactive	- -	- -	- -	- -	X	By-products gaseous wastes, liquid wastes, semi-liquid wastes	- -	167	- -	95
Village of Sturtevant	NE¼, Section 22, T3N, R22E	- -	S. C. Johnson & Son—Waxdale Plant	Private general use	Active	- -	- -	- -	- -	X	By-products, gaseous wastes	1,200	335	335	95
Walworth County															
Village of Elkhorn	NE¼, SW¼, Section 4, T2N, R17E	2309	Lakeland Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils	N/A	N/A	N/A	N/A
Washington County															
City of Hartford	Section 20, T10N, R18E	2231	Hartford Memorial Hospital	Private general use	Active	- -	X	X	X	X	Disposable utensils	- -	- -	- -	- -
City of West Bend	NE¼, NW¼, Section 14, T11N, R19E	2239	St. Joseph's Community Hospital	Private general use	Active	- -	X	X	X	X	Disposable utensils, disposable diapers	- -	- -	- -	- -
City of West Bend	SE¼, Section 12, T11N, R19E	2279	The Samaritan Home	Private general use	Active	- -	X	X	X	X	Disposable diapers	- -	- -	- -	- -
Town of West Bend	Section 29, T11N, R19E	2663	Cedar Lake Home Fellowship Hospital	Private general use	Active	- -	X	X	- -	- -	- -	- -	- -	- -	- -
Town of West Bend	Section 29, T11N, R19E	2664	Cedar Lake Home Fellowship Hospital	Private general use	Active	- -	X	X	- -	- -	- -	- -	- -	- -	- -

Table 22 (continued)

Civil Division	Location by U. S. Public Land Survey Section	License Number	Operator	Use Classification	Status	Solid Waste Type Accepted						Average Tons per Gallon per Year	Rated Capacity (pounds per hour)	Actual Capacity (pounds per hour)	Percent Combustible
						Wood Matter	Trash and Refuse	Garbage	Pathological[b]	Toxic and Hazardous	Other				
Waukesha County															
City of Brookfield	NW¼, NE¼, Section 20, T7N, R20E	2233	Elmbrook Memorial Hospital	Private special use	Active	- -	- -	- -	X	X	Disposable diapers, disposable utensils, liquid waste	- -	- -	- -	- -
Village of Menomonee Falls	SE¼, SW¼, Section 9, T8N, R20E	2281	Community Memorial Hospital	Private special use	Active	- -	- -	- -	X	X	- -	- -	- -	- -	- -
City of New Berlin	SW¼, SW¼, Section 14, T6N, R20E	2794	New Berlin Animal Hospital	Private special use	Active	- -	- -	- -	X	X	- -	- -	- -	- -	- -
City of New Berlin	NW¼, NW¼, Section 13, T6N, R20E	2242	New Berlin Memorial Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers	- -	- -	- -	- -
City of Oconomowoc	Section 4, T7N, R17E	2258	Oconomowoc Memorial Hospital	Private general use	Active	- -	X	X	X	X	- -	- -	- -	- -	- -
Town of Pewaukee	SE¼, Section 28, T7N, R19E	2245	Northview Home	Private general use	Active	- -	X	X	- -	- -	Disposable diapers	- -	- -	- -	- -
City of Waukesha	NW¼, SE¼, Section 9, T6N, R19E	306	City of Waukesha	Public special use	Inactive	- -	- -	- -	- -	- -	Liquids	21,562	14,500	14,000	85
City of Waukesha	NE¼, SE¼, Section 9, T6N, R19E	2860	City of Waukesha	Public general use	Active	X	X	X	- -	- -	Commercial wastes, animal carcasses	7,188	14,500	14,000	85
City of Waukesha	Section 3, T6N, R19E	2225	Waukesha Memorial Hospital	Private general use	Active	- -	X	X	X	X	Disposable diapers, disposable utensils, excretory waste	- -	- -	- -	- -
City of Waukesha	Section 34, T6N, R19E	2809	Humane Animal Welfare Society of Waukesha County, Inc.	Private general use	Active	- -	X	X	X	X	- -	- -	- -	- -	- -
City of Brookfield	SE¼, Section 25, T7N, R20E	- -	W. A. Krueger Company	Private general use	Active	X	X	- -	- -	- -	- -	1	650	180	99

NOTES: Incinerators in the Village of Menomonee Falls owned and operated by Briggs & Stratton Corporation and in the Village of Saukville owned and operated by Freeman Chemical Company also process solid wastes generated in Milwaukee County.

N/A: Indicates data not available.

[a] *Information obtained from SEWRPC inventories conducted under the areawide water quality management planning program and from the Wisconsin Department of Natural Resources files.*

[b] *The pathological waste category includes all or part of the following waste types: laboratory wastes, pathological specimens, surgical wastes, infectious wastes, and/or animal carcasses. These wastes are considered toxic and hazardous.*

[c] *The incinerator operation of the Avon Manor Nursing Home no longer meets the criteria which are required in order to obtain a license from the Wisconsin Department of Natural Resources.*

Source: SEWRPC.

Table 23

ACTIVE SOLID WASTE DISPOSAL SITES RECEIVING WASTES FROM THE MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN STUDY AREA: 1984

Owner/Operator of Landfill	License Number	Location	Facility Type	Licensed Area (acres)	User Classification	Estimated Remaining Service Life (years)	DNR Capacity Category (cubic yards x 10^3)	Cover Frequency	A	B	C	D	E	F	Other
Allis Chalmers	0293	Southwest one-quarter, Section 18 T6N, R21E, City of Greenfield	Noncombustible landfill	21.2	Private Special Use	<3	>500	As needed	X	--	--	--	--	--	Foundry sand
City of Milwaukee	0428	Southwest one-quarter, Section 34 T6N, R22E, City of Milwaukee	Noncombustible landfill	45.0	Private Special Use	>3	>500	As needed	X	--	--	--	X	--	--
City of Milwaukee (Old Hartung Quarry)	1501	Southwest one-quarter, Section 8 T7N, R21E, City of Wauwatosa	Noncombustible landfill	17.0	Private Special Use	>3	>500	As needed	X	--	--	--	X	--	--
City of Oak Creek	0414	Southwest one-quarter, Section 10 T5N, R22E, City of Oak Creek	Sanitary landfill	7.0	Public Special Use	>3	50-500	As needed	X	X	--	--	X	--	--
City of South Milwaukee	0232	Southeast one-quarter, Section 14 T5N, R22E, City of South Milwaukee	Sanitary landfill	10.7	Private Special Use	>3	50-500	As needed	X	X	--	--	X	--	--
City of Wauwatosa	0525	Southeast one-quarter, Section 19 T7N, R21E, City of Wauwatosa	Sanitary landfill	100.0	Public Special Use	>3	>500	As needed	X	X	--	--	--	--	--
City of West Allis	1718	Northeast one-quarter, Section 7 T6N, R21E, City of West Allis	Noncombustible landfill	18.0	Private Special Use	>3	50-500	As needed	X	--	--	--	--	--	--
Falk Corporation	1882	Southwest one-quarter, Section 2 T5N, R22E, City of South Milwaukee	Noncombustible landfill	17.6	Private Special Use	>3	>500	As needed	X	--	X	--	--	--	--
Gordon DeRosso Landfill	1979	Northwest one-quarter, Section 27 T5N, R22E, City of Oak Creek	Noncombustible landfill	45.0	Private Special Use	<3	>500	As needed	X	--	--	--	--	--	Foundry sand
Waste Management of Wisconsin (Metro)	1099	Southwest one-quarter, Section 31 T5N, R21E, City of Franklin	Sanitary landfill	96.0	Commercial Landfill	<5	>500	Daily	X	X	X	X	X	--	--
Wisconsin Electric Power Company Landfill	2357	Southwest one-quarter, Section 36 T5N, R22E, City of Oak Creek	Noncombustible landfill	130.0	Private Special Use	>3	>500	As needed	X	--	--	--	--	--	Fly ash
Wisconsin Electric Power Company Landfill	2801	Southwest one-quarter, Section 8 T10N, R22E, Town of Grafton Ozaukee County	Noncombustible landfill	85.0	Private Special Use	>3	>500	As needed	--	--	--	--	--	--	Fly ash

Table 23 (continued)

Owner/Operator of Landfill	License Number	Location	Facility Type	Licensed Area (acres)	User Classification	Estimated Remaining Service Life (years)	DNR Capacity Category (cubic yards x 10^3)	Cover Frequency	A	B	C	D	E	F	Other
Wisconsin Electric Power Company	0349	Northeast one-quarter, Section 36 T5N, R22E, City of Oak Creek	Noncombustible landfill	42.0	Private Special Use	--[a]	N/A	As needed	X	--	--	--	--	--	Fly ash
Barrett Landfill	1940	Southeast one-quarter, Section 18 T6N, R20E, City of New Berlin Waukesha County	Sanitary landfill	40.0	Private General Use	<3	500	Daily	X	X	X	--	X	--	Foundry sand
Browning and Ferris Landfill	--[b]	Northwest one-quarter, Section 7 T46N, R12E, Town of Benton Lake County, Illinois	Sanitary landfill	140.0	Commercial General Use	>10	500	Daily	X	X	X	X	X	X	--
Greidanus Enterprises Landfill	0140	Northwest one-quarter, Section 9 T2N, R15E, Town of Darien Walworth County	Sanitary landfill	20.0	Commercial General Use	>3	500	Daily	X	X	X	X	X	--	Foundry sand
Heckimovich Landfill	1118	Southwest one-quarter, Section 35 T12N, R16E, Town of Williams Dodge County	Sanitary landfill	25.0	Commercial General Use	>3	500	Daily	X	X	X	X	X	--	--
Valley Sanitation Landfill	2686	Northeast one-quarter, Section 35 T5N, R15E, Town of Koshkonong Jefferson County	Sanitary landfill	29.0	Commercial General Use	>3	500	Daily	X	X	X	X	X	--	--
Waste Management of Wisconsin (Omega Hills)	1678	South one-half Section 36, T9N, R20E, Village of Germantown, Washington County	Sanitary landfill	166.0	Commercial General Use	<3	500	Daily	X	X	X	X	X	--	--
Waste Management of Wisconsin (Muskego)	2895	Southwest one-quarter, Section 18 T5N, R20E, City of Muskego Waukesha County	Sanitary landfill	29.8	Commercial	<1	500	Daily	X	X	X	X	X	--	--
Land Reclamation, Ltd.	0572	Northeast one-quarter, Section 23 T3N, R22E, Town of Mt. Pleasant, Racine County	Sanitary landfill	81.7	Commercial General Use	>3	500	Daily	X	X	X	X	X	--	--
Industrial Waste Corporation	0374	Northwest one-quarter, Section 4, T6N, R20E, City of New Berlin, Waukesha County	Noncombustible landfill	25.0	Commercial Special Use	<1.5	50-500	As needed	X	--	--	--	--	--	--

NOTES: A - Noncombustible, B - Wood matter, C - Trash refuse, D - Garbage
E - Demolition, F - Toxic and hazardous
N/A indicates data not available.

[a]This landfill is abandoned and is no longer used for disposal of fly ash. The Wisconsin Electric Power Company maintains the license on this facility.

[b]Licensed under jurisdiction of the Illinois Environmental Protection Agency.

Source: Wisconsin Department of Natural Resources.

City of Milwaukee Landfill: The City of Milwaukee owns and operates a landfill located in the southwest one-quarter of Section 34, Township 6 North, Range 22 East, City of Milwaukee. This private, special-use landfill is used to dispose of noncombustible materials and demolition debris generated by the City of Milwaukee. The licensed area of the landfill is 45 acres in areal extent. In 1983, 4,128 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

City of Milwaukee Landfill (Old Hartung Quarry): The City of Milwaukee owns and operates a landfill located in the southwest one-quarter of Section 8, Township 7 North, Range 21 East, City of Wauwatosa. This private, special-use landfill is used to dispose of noncombustible materials and demolition debris generated by the City of Milwaukee. The licensed area is 17 acres in areal extent. In 1983, 38,127 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

City of Oak Creek Landfill: The City of Oak Creek owns and operates a landfill located in the southwest one-quarter of Section 10, Township 5 North, Range 22 East, City of Oak Creek. This public, special-use landfill is used to dispose of small amounts of noncombustible materials and demolition debris generated by the City of Oak Creek. The licensed area of the landfill is 7.0 acres in areal extent. In 1983, 119 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

City of South Milwaukee Landfill: The City of South Milwaukee owns and operates a landfill located in the southeast one-quarter of Section 14, Township 5 North, Range 22 East, City of South Milwaukee. This private, special-use landfill is used to dispose of noncombustible materials and demolition debris generated by the City of South Milwaukee. The licensed area of the landfill is 10.7 acres in areal extent. In 1983, 360 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

City of Wauwatosa Landfill: The City of Wauwatosa owns and operates a landfill located in the southeast one-quarter of Section 19, Township 7 North, Range 21 East, City of Wauwatosa. This public, special-use landfill is used to dispose of noncombustible materials, wood matter, and clean fill materials generated by the City of Wauwatosa. The licensed area of the landfill is 100 acres in areal extent. In 1983, 450 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

City of West Allis Landfill: The City of West Allis owns and operates a landfill located in the northwest one-quarter of Section 7, Township 6 North, Range 21 East, City of West Allis. This private, special-use landfill is used to dispose of noncombustible materials generated by the City of West Allis. The licensed area of the landfill is 18 acres in areal extent. In 1983, 2,150 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

Falk Corporation Landfill: The Falk Corporation owns and operates a landfill located in the southwest one-quarter of Section 2, Township 5 North, Range 22 East, City of South Milwaukee. This private, special-use landfill is used to dispose of noncombustible materials, including foundry wastes and sludges generated in the operation of the Corporation business. The licensed area of the landfill is 17.6 acres in areal extent. In 1983, 8,624 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is conducted at the site; however, there have been no reported incidences of groundwater contamination in the area.

Gordon DeRosso Landfill: A Mr. Gordon DeRosso owns and operates a landfill located in the northwest one-quarter of Section 27, Township 5 North, Range 22 East, City of Oak Creek. This private, special-use landfill is used to dispose of foundry sand generated by private industry in and around the Milwaukee County study area. The licensed area of the landfill is 45 acres in areal extent. In 1983, 51,810 tons of material were disposed of at the site. The remaining service life of the site is less than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is required at the site, and some groundwater contamination has been reported in the area. The Wisconsin Department of Natural Resources (DNR) has reported that the source of this contamination is not necessarily the DeRosso Landfill because of its proximity to other pre-law landfills which could be the cause of the contamination.

Waste Management of Wisconsin-Metro Landfill: Waste Management of Wisconsin owns and operates a landfill located in the southwest one-quarter of Section 31, Township 5 North, Range 21 East, City of Franklin. This commercial, general-use landfill is used to dispose of a variety of materials, including noncombustible wastes, wood matter, trash refuse, garbage, and demolition debris originating from residential, commercial, and industrial sources throughout southeastern Wisconsin. This landfill is a major disposal area for Milwaukee County wastes. The licensed area of the landfill is 96 acres in areal extent. In 1983, 381,685 tons of material were disposed of at the site. The remaining service life of the site is less than five years. However, proposals for expansion of the site are anticipated to be submitted to the Wisconsin Department of Natural Resources prior to the end of the existing service life. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and some groundwater contamination has been reported in the older areas of the site. The DNR reports that actions taken by Waste Management to correct such contamination, including collection, have generally reduced further groundwater contamination in the area.

Wisconsin Electric Power Company Landfill: The Wisconsin Electric Power Company owns and operates a landfill located in the southwest one-quarter of Section 36, Township 5 North, Range 22 East, City of Oak Creek. This private, special-use landfill is used to dispose of fly ash produced as a result of burning coal for electrical power generation by the Company. The licensed area of the landfill is 130 acres in areal extent. In 1983, 246,645 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are covered as necessary following deposition. Groundwater monitoring is required at the site; however, there have been no reported incidences of groundwater contamination in the area.

Wisconsin Electric Power Company Landfill: The Wisconsin Electric Power Company owns and operates a landfill located in the southwest one-quarter of Section 8, Township 10 North, Range 22 East, Town of Grafton, Ozaukee County. This private, special-use landfill is used to dispose of fly ash produced as a result of burning coal for electrical power generation by the Company. The licensed area of the landfill is 85 acres in areal extent. In 1983, 110,700 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site; however, there have been no reported incidences of groundwater contamination in the area.

Wisconsin Electric Power Company Landfill: The Wisconsin Electric Power Company owns an abandoned landfill located in the northeast one-quarter of Section 36, Township 5 North, Range 22 East, City of Oak Creek. This private, special-use landfill was formerly used for the disposal of fly ash produced as a result of burning coal for electrical power generation, but has been closed and properly abandoned. The Company retains a license on the 42-acre site. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

Barrett Landfill: A Mr. Thomas Barrett owns and operates a landfill located in the southeast one-quarter of Section 18, Township 6 North, Range 20 East, City of New Berlin. This private, special-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, demolition debris, and foundry sand generated primarily in Milwaukee and Waukesha Counties. The licensed area of the landfill is 40 acres in areal extent. In 1983, 149,306 tons of material were disposed of at the site. The remaining service life of the site is less than three years. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and some groundwater contamination has been reported in the area. In addition, there is evidence that methane gas is accumulating at the site, which may also be of environmental concern. Consequently, the DNR has begun to restrict the amounts and types of wastes which can be deposited at this site, and has ordered that steps be taken to minimize further contamination.

Browning and Ferris Landfill: Browning and Ferris, Inc., owns and operates a landfill located in the northwest one-quarter of Section 7, Township 46 North, Range 12 East, Town of Benton, Lake County, Illinois. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, demolition debris, and toxic and hazardous waste. Residential and commercial refuse generated in the City of West Allis and the Village of West Milwaukee, as well as toxic and hazardous materials from industries in southeastern Wisconsin, are disposed of at this site. The licensed area of the landfill is 140 acres in areal extent. This landfill is regulated by the Illinois Environmental Protection Agency. In 1984, 180,000 tons of material were disposed of at the site. The remaining service life of the site is greater than 10 years. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site.

Greidanus Enterprises Landfill: Greidanus Enterprises owns and operates a landfill located in the northeast one-quarter of Section 9, Township 2 North, Range 15 East, Town of Darien, Walworth County. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, demolition debris, and foundry sand. The solid waste materials from Milwaukee County deposited at this site are collected by private contractors serving selected communities, commercial establishments, and industries. The licensed area of the landfill is 20 acres in areal extent. In 1983, 17,500 tons of material were disposed of at the site. The remaining service life of the site is greater than three years. The site recently received a plan of operation approval for expansion by the Wisconsin Department of Natural Resources. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site; however, there have been no reported incidences of groundwater contamination in the area.

Heckimovich Landfill: The Heckimovich landfill is located in the southwest one-quarter of Section 35, Township 12 North, Range 16 East, Town of Williams, Dodge County, Wisconsin. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. The solid waste materials from Milwaukee County deposited at this site are collected by private contractors serving commercial establishments and industries. The licensed area of the landfill is 25 acres in areal extent. In 1983, 112,500 tons of material were disposed of at the site. The remaining service life of the site is less than one year; however, a feasibility study for expansion of the site, which has been approved by the Wisconsin Department of Natural Resources, could lead to an extension of the life of the site to greater than three years. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and limited groundwater contamination has occurred.

Valley Sanitation Landfill: The Valley Sanitation landfill is located in the northeast one-quarter of Section 35, Township 5 North, Range 16 East, Town of Koshkonong, Jefferson County, Wisconsin. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. The solid waste materials from Milwaukee County deposited at this site are collected by private contractors serving commercial establishments and industries. The licensed area of the landfill is 29 acres in areal extent. In 1983, no material was disposed of at the site. However, in 1984 some commercial and industrial waste from Milwaukee County was disposed of at this landfill. The remaining service life of the site is greater than three years. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site; however, there have been no reported incidences of groundwater contamination in the area.

Waste Management of Wisconsin Landfill (Omega Hills): Waste Management of Wisconsin owns and operates a landfill located in the southern one-half of Section 36, Township 9 North, Range 20 East, Village of Germantown. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. This site is a major disposal area for much of the residential, commercial, and industrial solid waste generated in Milwaukee County. The licensed area of the landfill is 166 acres in areal extent. In 1983, 380,013 tons of material were disposed of at the site. The remaining service life of the site is about three years. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and some groundwater contamination has been reported in the area. As a result of this contamination, Waste Management has undertaken a number of engineering modifications, including the pumping and treatment of leachate originating from the site, to preclude further groundwater contamination.

Waste Management has submitted a proposal to the DNR for expansion of the Omega Hills (South) landfill. The expansion would extend the life of the landfill by approximately 4.8 years and would accommodate the disposal of approximately 4.5 million cubic yards of material. The DNR is presently reviewing the plans for the proposed expansion.

Waste Management of Wisconsin Landfill (Muskego Landfill): Waste Management of Wisconsin owns and operates a landfill located in the southwest one-quarter of Section 18, Township 5 North, Range 20 East, City of Muskego. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. The solid waste materials from Milwaukee County deposited at this site are collected by private contractors serving commercial establishments and industries. The licensed area of the landfill is 29.8 acres in areal extent. In 1983, 66,190 tons of material were disposed of at the site. The remaining service life of the site is about one year. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and some groundwater contamination has been reported in the area, including contamination of private wells. Waste Management has undertaken steps to reduce further groundwater contamination, and has replaced several residential wells which have been affected.

Land Reclamation, Ltd., Landfill: The Land Reclamation, Ltd., landfill is located in the northeast one-quarter of Section 23, Township 3 North, Range 22 East, Town of Mt. Pleasant, Racine County. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. The solid waste materials from Milwaukee County deposited at this site are collected by private contractors serving commercial establishments and industries. The licensed area of the landfill is 81.7 acres in areal extent. In 1983, 127,623 tons of material were disposed of at the site. A revised plan of operation for this landfill was approved by the DNR in December 1984, which will extend the service life of this site. The remaining service life of the site is greater than three years. Disposed of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and some groundwater contamination has been reported in the sand and gravel aquifer due to the presence of sand and gravel lenses near the disposal area.

Industrial Waste Corporation Landfill: Industrial Waste Corporation owns and operates a landfill located in the northwest one-quarter of Section 4, Township 6 North, Range 20 East, City of New Berlin, Waukesha County. This commercial, special-use landfill is used to dispose of noncombustible materials, primarily from Milwaukee and Waukesha Counties. The solid waste materials from

Milwaukee County deposited at this site are collected by private contractors serving industries. The licensed area of the landfill is 25 acres in areal extent. In 1983, 2,500 tons of material were disposed of at the site. The remaining service life of the site is about one year. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination.

Equipment and Personnel Available for Plan Implementation

Operating equipment utilized for collection, transportation, and disposal of solid waste in Milwaukee County is owned and operated by both municipalities and private contractors. However, the majority of residential solid waste in Milwaukee County is collected and transported by municipalities, and disposed of by private contractors. Existing county departments, such as the Milwaukee County Department of Public Works, the City of Milwaukee Department of Public Works, and public works departments in the other municipalities in the County, could provide the County with the expertise required for the administration, operation, and maintenance of a county solid waste management system, and were considered in the development of the alternative solid waste management plans. Any recommendations in this report which call for public ownership and operation of collection, transportation, or disposal facilities are accompanied by estimates of the cost of acquisition of appropriate equipment and technical expertise.

Cost of Solid Waste Management

Utilizing the inventory data collected, the costs of existing solid waste management in the County were estimated. Table 24 indicates by civil division the estimated cost in 1984 of the collection, transportation, and disposal of residential, commercial, and industrial wastes in the study area. The total annual cost is estimated to be $56,162,242, or about $60.39 per ton of residential, commercial, and industrial solid waste collected, transported, and disposed of, or about $60.13 per capita per year.

LAWS AND REGULATIONS CONCERNING SOLID WASTE

Within Milwaukee County, the public regulation of solid waste management functions lies with the federal, state, and local levels and units of government. A brief discussion of the present laws, regulations, and institutional arrangements governing solid waste management in Milwaukee County follows.

Federal Laws and Regulations

Public Law 94-580, the Federal Resource Conservation and Recovery Act, was signed into law in 1976 and reauthorized in 1984, replacing previous solid waste legislation. Public Law 94-580 (RCRA) relates to solid waste management planning in the following ways:

1. Establishment of Regulations--RCRA authorizes the U. S. Environmental Protection Agency to establish and enforce solid waste management guidelines. These guidelines can relate to all solid waste management functions. The Act also calls for the designation of state agencies for solid waste management planning and regulation.

Table 24

ESTIMATED COSTS FOR RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL WASTE COLLECTION AND DISPOSAL IN MILWAUKEE COUNTY: 1984

Civil Division	1984 Population[a]	Residential Solid Waste[b] (tons)	Cost per Ton[c]	Cost	Commercial Solid Waste (tons)	Cost[d]	Industrial Solid Waste (tons)	Cost[d]	Total Waste (tons)	Total Cost	Cost
Cities											
Cudahy............	19,272	7,560	$39.07	$ 295,366	3,982	$ 179,190	16,719	$ 752,355	28,261	$ 1,226,911	$43.41
Franklin..........	18,449	6,550	42.48	278,253	4,766	214,470	2,172	97,740	13,488	590,463	43.78
Glendale..........	14,003	6,700	52.17	349,540	3,678	165,510	12,905	580,725	23,283	1,095,775	47.06
Greenfield........	32,412	13,200	48.86	645,000	4,464	200,880	473	21,285	18,137	867,165	47.81
Milwaukee.........	602,932	299,450	89.82	26,896,715	70,170	3,157,650	210,740	9,483,300	580,360	39,537,665	68.13
Oak Creek.........	17,854	6,133	49.81	305,470	3,814	171,630	16,806	756,270	26,753	1,233,370	46.10
St. Francis.......	9,990	3,183	45.47	144,729	1,380	62,100	988	44,460	5,551	251,289	45.27
South Milwaukee...	20,712	8,000	40.00	320,000	1,950	87,750	8,695	391,275	18,645	799,025	42.85
Wauwatosa.........	50,936	24,000	60.75	1,458,000	18,652	839,340	26,020	1,170,900	68,672	3,468,240	50.50
West Allis........	65,138	30,500	51.85	1,581,564	12,900	580,500	27,000	1,215,000	70,400	3,377,064	47.97
Villages											
Bayside...........	4,594	3,090	$59.19	$ 183,081	268	$ 12,060	--	$ --	3,358	$ 195,141	$58.11
Brown Deer........	12,819	6,970	50.11	349,264	1,760	79,200	5,450	245,250	14,180	673,714	47.52
Fox Point.........	7,328	5,000	48.54	242,700	848	38,160	24	1,080	5,872	281,940	48.01
Greendale.........	16,614	8,200	41.90	343,600	2,020	90,900	926	41,670	11,146	476,170	42.72
Hales Corners.....	6,922	3,690	40.96	114,235	1,264	56,880	263	11,835	5,217	182,950	35.07
River Hills.......	1,663	730	56.03	40,900	385	17,370	16	720	1,131	58,990	52.16
Shorewood.........	14,510	5,560	55.14	306,710	1,200	54,000	49	2,205	6,809	362,915	53.30
West Milwaukee....	3,636	914	92.78	84,800	1,500	67,500	17,448	785,160	19,862	937,460	47.20
Whitefish Bay.....	14,220	8,070	63.29	510,895	674	30,330	106	4,770	8,850	545,995	61.69
Total	934,004	447,500	$76.98	$34,450,822	135,675	$6,105,420	346,800	$15,606,000	929,975	$56,162,242	$60.39

[a]Estimated 1984 population was obtained from the Wisconsin Department of Administration.

[b]These waste quantities do not include previously discussed material which is recycled or incinerated.

[c]Cost per ton is a weighted average of the costs of each of the individual solid waste components in the other columns.

[d]Information provided by private contractors and additional data provided by the responses to the municipal solid waste questionnaires were used to determine a disposal cost of approximately $45 per ton for commercial and industrial wastes.

Source: SEWRPC.

2. Solid Waste Management Planning--The RCRA requires the U. S. Environmental Protection Agency (EPA) to assist state governments in developing and implementing solid waste management plans. Such plans must be approved by the EPA. The State of Wisconsin plan was completed in February 1981, and approval by the EPA is expected.

3. Toxic and Hazardous Waste Management--The RCRA requires toxic and hazardous wastes to be regulated by the states following EPA guidelines. The federal guidelines identify types of wastes that are toxic and hazardous, and call for control of the generation, collection, transportation, storage, treatment, and disposal of these wastes. A manifest system, requiring the maintenance of records relating to the production, transport, and ultimate fate of toxic and hazardous wastes, is presently being phased into use.

4. Financial and Technical Assistance--RCRA will provide federal assistance to be allocated among the states, supplementing local funds for solid waste management. The law also provides for technical assistance from federal consultants to be available to state and local governments to improve solid waste management practices.

State Authority

A state level regulatory program for solid waste management was established with the passage of Chapter 83, Laws of 1967. This legislation designated the Department of Resource Development (now the Department of Natural Resources) as the state agency responsible for the regulation of solid waste management in the State. This authority was extended to include the disposal of sludges from a treatment facility by the passage of Chapter 74, Laws of 1973, which established the Wisconsin Pollutant Discharge Elimination System (WPDES). Chapter 377, Laws of 1977, established a hazardous waste management program under the Department of Natural Resources. State level regulatory authority for all types of solid waste generated in the State lies with the Department of Natural Resources.

Chapter 144 of the State Statutes authorizes the Wisconsin Department of Natural Resources to establish minimum standards for solid waste management functions. This chapter also provides for the preparation of county and regional solid waste management plans. Chapter 144 provides for the identification of hazardous wastes, for an analysis of the hazardous waste situation in the State, and for regulation of the transport, storage, treatment, and disposal of hazardous wastes. This chapter also grants the DNR authority to develop standards regulating the disposal of hazardous wastes. These standards must be consistent with the EPA regulations governing hazardous wastes. Finally, Chapter 144 also provides the authority and mechanisms to enforce requirements developed under the law, and sets forth the site approval process used to license land disposal facilities.

Chapter NR 180 of the Wisconsin Administrative Code contains definitions relating to, and provides fees and specifies requirements for, storage sites, collection and transportation services, transfer facilities, processing facilities, incineration, air curtain destructors, and long-term environmental protection measures. Waste types which are regulated under this code include garbage, refuse, demolition material, sludges, and fly ash. Dredge spoils are regulated under Chapter NR 347 of the Wisconsin Administrative Code.

Chapter NR 181 of the Wisconsin Administrative Code establishes criteria for identifying the characteristics of hazardous waste to be used in the establishment of a list of such wastes which shall be used by the generator, transporter, or owner or operator of a solid waste facility to determine if the waste handled is hazardous and subject to regulation. This legislation also establishes minimum standards defining acceptable hazardous waste management practices, and sets standards for the review of plans and the issuance of licenses. Furthermore, the closure and long-term care responsibilities of hazardous waste facilities are described.

Chapter NR 187 of the Wisconsin Administrative Code establishes general conditions and eligibility requirements for grant applications, application procedures, approval criteria, and a priority system for the issuance of household hazardous waste collection and disposal grants. Through this program, financial assistance is made available to municipalities to create and operate "local clean sweep" programs for collection and disposal of household hazardous waste.

County and Local Government

Chapter 130, Laws of 1971, grants counties the authority to plan, organize, finance, and implement programs to effect the storage, collection, transportation, processing, recycling, or final disposal of solid waste. One particularly important provision of this law is that counties cannot compel facility use by member communities, although capital expenditures may still be financed on a countywide basis. Additionally, Chapter 105, Laws of 1973, gives counties the power to create a solid waste management board and retain a solid waste manager to operate a county system. Counties and municipalities also have the authority to establish a regulatory program as provided under Chapter 144 of the Statutes.

Recycling Legislation

Amendments to Chapter 144 of the Wisconsin Statutes transferred solid waste flow control powers from the abolished Wisconsin Solid Waste Recycling Authority to local units of government. The legislation provides solid waste flow control powers to all counties, cities, villages, and towns with populations of 10,000 or more. Further amendments to this legislation established state policy for solid waste management, emphasizing waste reduction, reuse, recycling, composting, and energy recovery. These amendments provide for planning grants to regional planning commissions and counties at a 50 percent cost-share rate for recycling projects. In addition, these legislative amendments require that municipalities provide a minimum number of recycling collection facilities by July 1, 1986. In Milwaukee County, cities and villages must establish collection centers according to the following criteria: no facilities if the population is under 10,000; one facility if the population is 10,000 to 50,000; two facilities if the population is 50,000 to 100,000; and three facilities if the population is over 100,000; plus one additional facility per every additional 100,000 population.

Using these criteria, it is estimated that 23 recycling centers would need to be established by municipalities in Milwaukee County. The Department of Natural Resources may reduce the number of required facilities if other collection facilities exist in the area, or if it is determined that the specified number of facilities is not economically feasible.

Regional Solid Waste Management Authority

In its role as a coordinating agency for water pollution control activities within southeastern Wisconsin, the Regional Planning Commission utilizes the locally adopted and certified regional plan elements as a basis for review of federal and state grants-in-aid, discharge permits, and sanitary sewer extensions. The Commission provides technical assistance pertaining to water quality management topics, which includes solid waste management planning services as appropriate, and further promotes plan implementation through community assistance planning services.

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Chapter III

ANTICIPATED GROWTH AND CHANGE

INTRODUCTION

The Milwaukee County solid waste management planning effort is intended to identify the solid waste management needs of the County through the year 2010, and to propose the best means of meeting those needs. The formulation of such a long-range solid waste management plan requires information regarding anticipated future population, household, and employment levels in the study area to assess the probable quantity, character, and spatial distribution of the solid wastes to be collected, transported, and recycled or disposed of, and the size, characteristics, and location of the facilities necessary to properly manage these wastes. Accordingly, this chapter presents forecasts of those facets of the socioeconomic development of the County essential to the sound development of a long-range solid waste management plan.

The population, household size and distribution, and employment forecasts presented in this chapter are based upon demographic information presented in SEWRPC Technical Report No. 11 (2nd Edition), The Population of Southeastern Wisconsin, 1984, and SEWRPC Technical Report No. 10 (2nd Edition), The Economy of Southeastern Wisconsin, 1984. The forecast conditions presented in these reports attempt to deal with the uncertainty concerning probable future conditions by evaluating birth, death, and migration rates, changing lifestyles, and the changing age distribution of the population, and by postulating alternative future population and economic development conditions in the Region.

This chapter is divided into three sections. The first section describes a set of alternative futures relating to population, household size, and employment that provide a range of conditions for which plan components can be designed and against which alternative plans can be evaluated. The second section sets forth the future conditions within the range of the alternative futures selected for use in the plan design. The third section sets forth estimated future solid waste quantities, characteristics, and sources to be utilized in the plan design, test, and evaluation.

CONSIDERATION OF FUTURE CONDITIONS

Traditionally, long-range system planning has involved the preparation of a single forecast of future levels of population, economic activity, and land use demand, and the use of these forecasts in the design, test, and evaluation of alternative system plans. This approach worked well in periods of relative stability, when historic trends in the factors underlying and influencing changes in population and economic activity levels could be reasonably expected to extend over the plan design period. During periods of major changes in social and economic conditions, however, when there is great uncertainty as to whether historic trends will continue, an alternative to this traditional approach may be required. One such alternative approach proposed in recent years is termed "alternative futures."

Under this approach, the development, test, and evaluation of alternative plans is based not upon a single most probable forecast of future conditions, but rather upon a number of futures chosen to represent a range of conditions which may be expected to occur over the plan design period. The purpose of this approach is to permit the evaluation of alternative plans over a variety of possible future conditions so as to identify those alternatives that perform well under a wide range of such conditions. The alternative futures used under this approach are selected to represent the reasonable extremes of a range of conditions on the assumption that alternative plans which perform well under the extremes of a range will also perform well at intermediate points in the range. In this way, "robust" plans which can be expected to remain viable under greatly varying future conditions can be identified.

The Commission utilized the "alternative futures" approach to develop the series of projections presented herein. Using this approach, three alternative future scenarios were postulated, two intended to identify extremes and one intended to identify an intermediate future--that is, a future that lies between the extremes. Critical social and economic factors that could be expected to impact mortality, fertility, and migration rates over the next 25 years within the United States, the State, and the Region were examined, and a reasonably extreme range of values was established for each component of population change by logically linking various rates of component change to the critical social and economic factors. This provided "most reasonably optimistic" and "most reasonably pessimistic" scenarios of population change by combining all factors that were internally consistent and would create favorable conditions for economic and population growth within the Region, and by similarly combining all factors that would create unfavorable conditions for economic and population growth within the Region.

Resident Population

Historic and anticipated future resident populations for the Region and Milwaukee County are shown in Figure 4. Regional population is anticipated to increase from 1980 levels by about 551,100 persons, or about 31 percent, under the optimistic future; and by about 107,200 persons, or about 6 percent, under the intermediate future, by the year 2010. Under the pessimistic future, regional population is anticipated to decline by about 247,800 persons, or about 14 percent, by the year 2010.

The alternative future conditions described above may be expected to result in year 2010 resident population levels in Milwaukee County of 1,010,000 persons under the optimistic future, 911,000 persons under the intermediate future, and 818,000 persons under the pessimistic future. In comparison to the 1980 resident population level of 964,988 persons, these alternative futures indicate an increase of about 45,000 persons, or about 5 percent, under the optimistic future, and decreases of about 54,000 persons, or about 6 percent, and 147,000 persons, or about 15 percent, under the intermediate and pessimistic futures, respectively.

Households

The number of households in the Region is anticipated to increase over 1980 levels by about 230,600, or about 37 percent, under the optimistic future;

145,000, or about 23 percent, under the intermediate future; and 78,000, or 12 percent, under the pessimistic future. The number of households in Milwaukee County in the year 2010, however, would be approximately 403,000 under all three scenarios, with the different household sizes under each of the alternative futures offsetting the effects of the different population sizes.

Employment

As shown in Figure 4, regional employment is anticipated to increase over 1980 levels by about 367,400 jobs, or about 42 percent, under the optimistic future; and 167,100 jobs, or about 19 percent, under the intermediate future by the year 2010. Under the pessimistic future, regional employment would decline by about 13,300 jobs, or about 2 percent, by the year 2010. Future employment levels are a particularly important consideration in the determination of future industrial and commercial solid waste quantities. As shown in Table 25 and Figure 5, regional employment in the commercial sector is anticipated to increase over 1980 levels by about 229,600 jobs, or about 33 percent, under the optimistic future; 115,500 jobs, or about 22 percent, under the intermediate future; and 13,700 jobs, or about 3 percent, under the pessimistic future by the year 2010. Regional employment in the industrial sector is anticipated to increase over 1980 levels by about 85,200 jobs, or about 26 percent, under the optimistic future, and 24,700 jobs, or about 9 percent, under the intermediate future; and to decrease by 23,600 jobs, or 11 percent, under the pessimistic future by the year 2010.

As shown in Figure 4, employment levels in the year 2010 in Milwaukee County would be 625,800 jobs under the optimistic future, an increase of 77,900 jobs, or about 14 percent, over the 1980 level of 547,900 jobs; 552,000 jobs under the intermediate future, an increase of 4,100 jobs, or less than 1 percent; and 479,000 jobs under the pessimistic future, a decrease of 68,900 jobs, or about 13 percent.

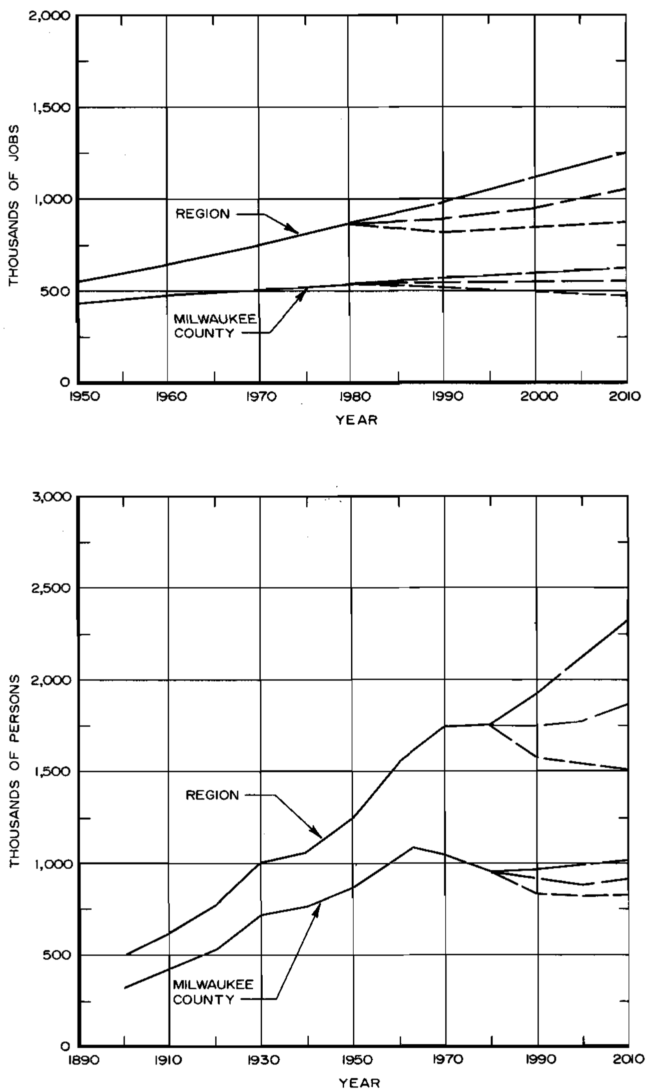
Based upon regional trends, employment in the commercial sector in Milwaukee County is anticipated to increase over 1980 levels by about 20 percent under the optimistic future, and about 5 percent under the intermediate future by the year 2010. Under the pessimistic future, commercial sector employment would decline by about 10 percent by the year 2010. Based upon regional trends, industrial sector employment in Milwaukee County is anticipated to increase very slightly over 1980 levels under the optimistic future by the year 2010. Industrial sector employment is anticipated to decline by about 10 percent under the intermediate future, and by about 20 percent under the pessimistic future by the year 2010.

Selection of Alternative Future Conditions

Following review of these three sets of potential future conditions, it was concluded by the Technical Coordinating and Advisory Committee that the development of alternative solid waste management plans should be based upon the intermediate future population and employment levels. Using this alternative, the solid waste management plan would be based upon a year 2010 resident county population of about 911,300 persons, a level slightly below the 1980 resident population level, but a reasonable indication of possible future conditions given efforts to halt the continued decline of population levels in

Figure 4

EXISTING AND PROJECTED REGIONAL AND MILWAUKEE COUNTY EMPLOYMENT AND POPULATION LEVELS



LEGEND

ACTUAL EMPLOYMENT

SEWRPC ALTERNATIVE FUTURE PROJECTIONS

OPTIMISTIC

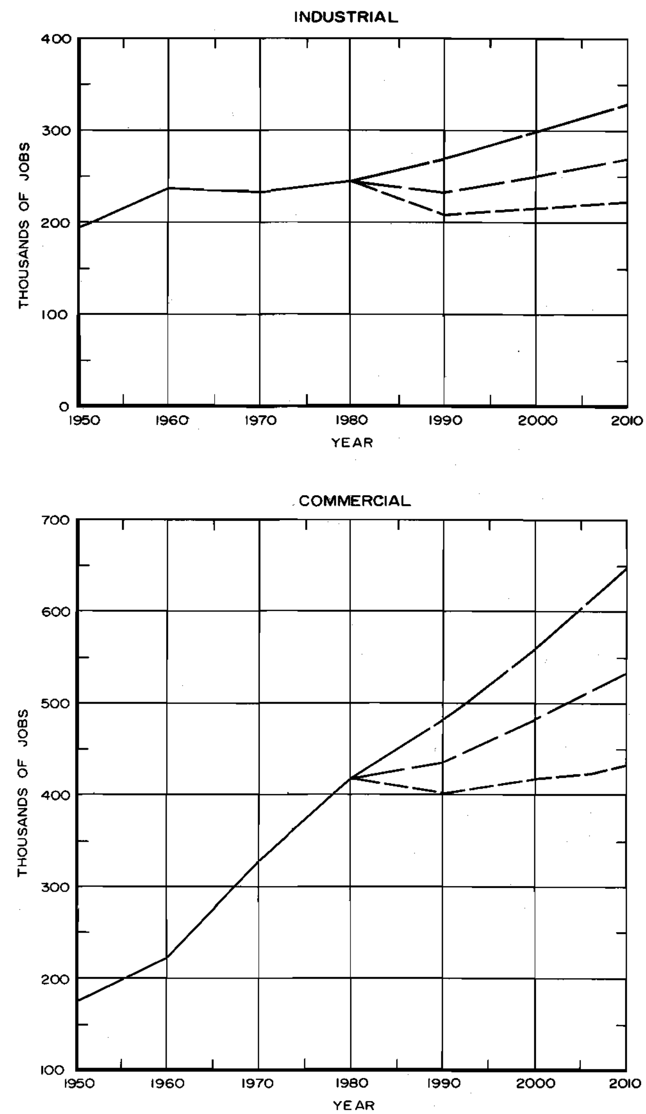
INTERMEDIATE

PESSIMISTIC

Source: U. S. Bureau of the Census and SEWRPC.

Figure 5

EXISTING AND PROJECTED INDUSTRIAL AND COMMERCIAL EMPLOYMENT IN THE REGION: 1950, 1960, 1970, 1980, 1990, 2000, AND 2010



LEGEND

ACTUAL EMPLOYMENT

SEWRPC ALTERNATIVE FUTURE PROJECTIONS

OPTIMISTIC

INTERMEDIATE

PESSIMISTIC

Source: SEWRPC.

Table 25

EXISTING 1980 AND ALTERNATIVE YEAR 2010 COMMERCIAL AND INDUSTRIAL EMPLOYMENT IN THE REGION

Employment Category	1980 (thousands of jobs)	2010 (thousands of jobs)	Number Change (thousands of jobs)	Percent Change
Commercial	419.9	Pessimistic: 433.6 Intermediate: 535.4 Optimistic: 649.5	13.7 115.5 229.6	3.2 21.6 33.4
Industrial	246.1	Pessimistic: 222.5 Intermediate: 270.8 Optimistic: 331.3	- 23.6 24.7 85.2	-10.6 9.1 25.7

Source: SEWRPC.

the County, and providing a reasonably conservative approach to facility sizing. Furthermore, use of this alternative would result in a plan based upon a year 2010 employment level of about 552,000 jobs, an increase of about 4,100 jobs over 1980 levels.

It was further concluded that it would be desirable to also consider the range of solid waste quantities expected under optimistic and pessimistic future conditions.

FUTURE RESIDENT POPULATION, HOUSEHOLD, AND EMPLOYMENT LEVELS CONSIDERED IN THE DESIGN OF ALTERNATIVE SOLID WASTE MANAGEMENT PLANS

Resident Population

For solid waste management system planning purposes, the County was divided into six planning analysis areas, as shown on Map 23. The existing and probable future resident population levels of each of these areas under the intermediate growth scenario are indicated in Table 26. Historic and anticipated future resident population levels for the Region and Milwaukee County are shown in Figure 4. These population data were utilized as the basis for estimating future solid waste quantities and in the design of alternative solid waste management plans.

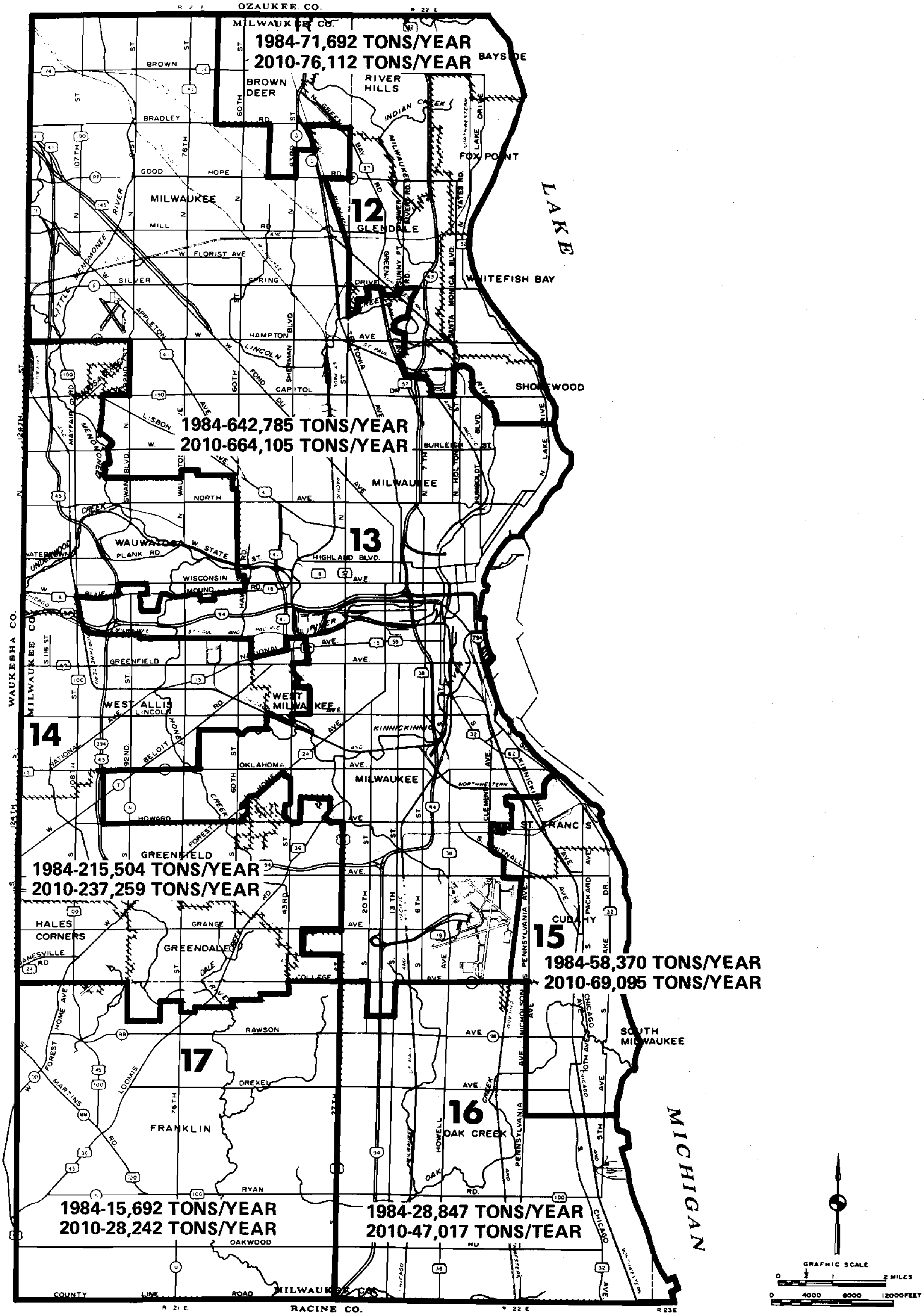
Household and Employment Levels

Anticipated future population and lifestyle trends may be expected to result in an increase in the number of households, even in the absence of an increase in population. Forecasts of increases in the number of households have particularly important implications for long-range planning, since it is the household which generates residential solid wastes. The number of households in the study area is expected to increase from about 363,700 in 1980 to about 403,000 by 2010, an increase of about 11 percent.

As previously discussed, total employment in Milwaukee County under the intermediate future is anticipated to remain relatively stable, with a slight increase from about 548,000 jobs in 1980 to about 552,000 jobs by the year

Map 23

PLANNING ANALYSIS AREAS WITH ESTIMATED 1984 AND FORECAST YEAR 2010 SOLID WASTE GENERATION QUANTITIES FOR MILWAUKEE COUNTY



Source: SEWRPC.

Table 26

ACTUAL AND FORECAST POPULATION LEVELS IN THE MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN STUDY AREA BY PLANNING ANALYSIS AREA: 1970-2010

Planning Analysis Area	Actual 1970		Actual 1980		Forecast 1990		Forecast 2000		Forecast 2010	
	Population	Percent of Total	Population	Percent of Total	Population	Percent of Total	Population	Percent of Total	Population	Percent of Total
12	72,824	6.9	69,963	7.2	68,082	7.4	66,915	7.5	70,000	7.7
13	717,372	68.0	636,295	65.9	599,996	64.3	560,302	62.8	558,500	61.3
14	182,014	17.3	174,216	18.1	170,056	18.4	166,841	18.7	174,100	19.0
15	55,864	5.3	50,711	5.3	49,897	5.4	49,071	5.5	50,700	5.6
16	13,928	1.3	16,932	1.8	21,254	2.3	24,982	2.8	30,000	3.3
17	12,247	1.2	16,871	1.7	20,015	2.2	24,089	2.7	28,000	3.1
Study Area	1,054,249	100.0	964,988	100.0	924,300	100.0	892,200	100.0	911,300	100.0

Source: SEWRPC.

2010. Commercial sector employment is anticipated to increase by about 23,600 jobs, or about 6 percent, and industrial sector employment is anticipated to decline by about 18,000 jobs, or about 11 percent, by the year 2010. The increase in commercial sector jobs is an important consideration in determining future commercial solid waste quantities both at the county level and within the six planning analysis areas. Generally, it is anticipated that the number of jobs in the commercial sector and associated commercial solid waste quantities will increase by the greatest amount in the planning analysis areas which include the Cities of Franklin and Oak Creek, while the commercial solid waste quantities in the remaining planning analysis areas will increase only slightly. Furthermore, while the number of jobs in the industrial sector will decrease, the amounts of industrial solid waste will remain about the same both at the county level and within each planning analysis area.

SOLID WASTE TYPES, QUANTITIES, AND SOURCES TO BE UTILIZED IN ALTERNATIVE PLAN DESIGN

The type and quantity of solid waste generated within the County in 1984, and the sources of that waste, are described in Chapter II. This section of the report provides estimates of the quantities of solid wastes which may be expected to be generated within the study area over the planning period, and the characteristics of that waste under the intermediate growth alternative future. In addition, the range of solid waste quantities expected under the optimistic and pessimistic alternative futures is also estimated for use in the evaluation of alternatives. The quantities of solid waste utilized in the development of alternative plans are estimates of only those wastes generated in the study area--that is, within Milwaukee County. It should be noted that the alternative scenarios herein described assume changes in the proportion of the solid waste based on changes in economic activity in the commercial and industrial sectors.

Table 27 summarizes the solid waste quantities which may be expected to be generated in each of the six geographic planning analysis areas of the study area in 1984 and the year 2010. These data are also presented on Map 23. The estimated characteristics of the solid waste stream for the year 2010 are indicated in Table 28. The methodology utilized to estimate the quantities of each type of solid waste is described below, along with a range of solid waste quantities estimated to be generated under the optimistic and pessimistic alternative futures.

Table 27

ESTIMATED SOLID WASTE QUANTITIES GENERATED IN MILWAUKEE COUNTY ACCORDING TO WASTE TYPE: 1984 AND PLAN YEAR 2010

Planning Analysis Area	Resident Population	Residential Wastes (tons per year)	Commercial Wastes (tons per year)	Industrial Wastes (tons per year)	Special Wastes: Bulk Wastes (tons per year)	Special Wastes: Construction and Demolition (tons per year)	Special Wastes: Trees and Brush (tons per year)	Total (tons per year)
EXISTING 1984								
12	69,140	36,130	8,810	18,550	1,260	4,342	2,600	71,692
13	602,930	299,450	70,170	210,740	11,000	34,925	16,500	642,785
14	175,660	80,500	40,800	72,130	3,200	14,469	4,405	215,504
15	49,970	18,740	7,315	26,402	910	3,633	1,370	58,370
16	17,850	6,130	3,810	16,806	330	1,281	490	28,847
17	18,450	6,550	4,770	2,172	340	1,350	510	15,692
Total	934,000	447,500[a]	135,675[a]	346,800[a]	17,040[a]	60,000[a]	25,875[a]	1,032,890[a]
PLAN YEAR 2010								
12	70,000	39,600	9,760	18,550	1,530	4,342	2,330	76,112
13	558,500	315,970	71,660	210,740	12,230	34,925	18,580	664,105
14	174,100	98,500	42,560	72,130	3,810	14,469	5,790	237,259
15	50,700	28,680	7,580	26,402	1,110	3,633	1,690	69,095
16	30,000	16,970	10,300	16,806	660	1,281	1,000	47,017
17	28,000	15,840	7,340	2,172	610	1,350	930	28,242
Total	911,300	515,560[a,b]	149,200[a,b]	346,800[a,b]	19,950[a,b]	60,000[a,b]	30,320[a,b]	1,121,830[a,b]

[a]These quantities do not include 250,000 tons of industrial wastes, 56,800 tons of construction and demolition debris, 55,000 tons of commercial wastes, 13,000 tons of residential wastes, 5,200 tons of trees and brush, and 500 tons of bulk materials which are reused, recycled, and incinerated and do not enter the solid waste stream.

[b]Additional reuse, recyling, and incineration of solid wastes which may occur during the plan period will be addressed in the alternatives analysis and, if appropriate, the recommended plan.

Source: SEWRPC.

When considering the feasibility of solid waste management alternatives such as resource recovery, knowledge is required of not only the quantities of solid wastes generated, but also the characteristics of the wastes. It is important that information be compiled on waste composition by material category, waste combustion characteristics, and seasonal variation. Based upon the data presented herein, the future composition of the solid waste stream components which are to be the main focus of the study was estimated as set forth in Table 28. It should again be noted that the solid waste stream under consideration does not include the portion of the solid waste stream which is recycled, incinerated, or reused; fly ash; sewage sludge; septic and holding tank wastes; or hazardous wastes. About 65 percent of the solid waste stream is anticipated to be combustible. The most important combustion characteristics are heating value, moisture content, and ash content. These three characteristics may vary widely depending on the sources of the waste and the degree and type of processing to which the waste is subjected. Based upon a review of the waste stream components and analysis of the combustion characteristics of each component, the following combustion characteristics were estimated for the future Milwaukee County solid waste stream:

Heating Value of Total Waste Stream (British thermal units per pound)	4,500
Moisture Content of Total Waste Stream (percent by weight)	27
Ash Content of Total Waste Stream (percent by weight)	22

Seasonal variation in solid waste quantities is a significant factor in Milwaukee County, and thus is an important consideration in the design of alternative solid waste management systems. The main factor contributing to seasonal waste generation is the normal variation in activities from season to

Table 28

COMPOSITION OF SOLID WASTE GENERATED IN MILWAUKEE COUNTY: 2010

Component	Total: Waste Generated (tons)[a,b]	Total: Percent by Weight
Paper	438,860	39
Foundry sand	95,800	9
Metal	92,520	8
Food	76,790	7
Construction and Demolition Debris	60,000	5
Glass	55,040	5
Plastic	52,880	5
Yard	51,560	4
Wood	33,310	3
Trees and Brush	30,320	3
Textiles	25,620	2
Bulk	19,950	2
Unclassified and Miscellaneous	89,180	8
Total	1,121,830	100

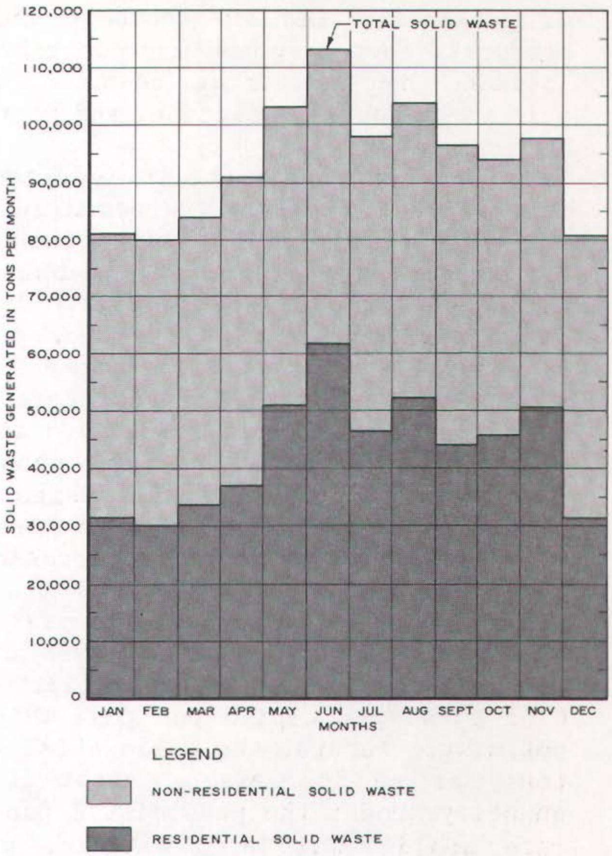
[a]These quantities do not include 250,000 tons of industrial wastes, 56,800 tons of construction and demolition debris,55,000 tons of commercial wastes, 13,000 tons of residential wastes, 5,200 tons of trees and brush, and 500 tons of bulk material which are reused, recycled, and incinerated and do not enter the solid waste stream.

[b]Additional reuse, recycling, and incineration of solid wastes which may occur during the plan period will be addressed in the alternatives analysis and, if appropriate, the recommended plan.

Source: SEWRPC.

Figure 6

MONTHLY GENERATION OF SOLID WASTE IN MILWAUKEE COUNTY: 2010



Source: SEWRPC.

season. Figure 6 illustrates the estimated monthly seasonal distribution of solid waste generation in the study area under existing and future conditions.

Residential Solid Waste

As described in Chapter II, the existing residential solid waste quantities were estimated utilizing waste production data from local units of government, and by comparing these data to previously developed generation rates. Numerous attempts have been made at estimating possible future changes in solid waste generation rates. Historically, solid waste per capita generation rates have increased steadily in the United States. Between 1968 and 1979, the annual quantity of solid waste generated per capita increased every year except 1974 and 1975, both recession years.[1] This indicates, as might be expected, a direct correlation between the levels of economic activity and the rate of solid waste generation. Studies conducted for the Wisconsin Solid Waste Recycling Authority[2] in the early 1970's estimated a moderate rate of

[1]The Tenth Annual Report of the U. S. Council on Environmental Quality, December 1979.

[2]Board of Engineering Consultants, Wisconsin Solid Waste Recycling-Predesign Report, Governor's Recycling Task Force on Solid Waste, May 1973.

increase in residential solid waste generation of about 2 percent per capita per year. However, the economic and other forces which may affect solid waste generation are not well understood. Review of various data sources indicates that there has been an actual increase in the amount of residential waste generated in Milwaukee County. Factors which may contribute to increased rates of generation include economic growth and the increased use of disposable products. Factors which may contribute to declining rates of waste generation include the increasing costs of disposal, increased recycling, increased efforts at source reduction, and decreasing affluence.

Over the last 10 years, it is estimated that the per capita generation rate for residential waste increased in Milwaukee County by about 20 percent. During that period of time, the household size decreased from about 3.1 to about 2.6 persons per household, a decrease of 17 percent. The household size in Milwaukee County is projected to continue to decrease but at a much slower rate, reaching about 2.3 persons per household by the year 2010--a reduction of about 15 percent. Based upon a review of the projected change in household size, and consideration that there will likely be additional emphasis placed upon recycling, it was concluded that a per capita generation rate of about 3.1 pounds per capita per day should be used to approximate the solid waste generation rate by the plan design year 2010. This represents an increase of about 20 percent, or slightly less than 1 percent a year. This is somewhat less than what appears to have taken place historically. As shown in Table 27, about 515,600 tons per year of residential solid waste are anticipated under the intermediate future in the year 2010. This represents an increase of about 68,000 tons, or 15 percent, over the amount generated in 1984. This quantity does not include an estimated 13,000 tons per year of residential wastes, or 0.08 pound per capita per day, which is anticipated to be recycled. Under the optimistic future, the residential solid waste quantity would be about 571,300 tons, or an increase of about 123,800 tons, or 28 percent, over the 1984 quantity. Under the pessimistic future, the residential solid waste generation rate would remain at 2.6 pounds per capita per day. The residential solid waste quantity under the pessimistic future would be 388,200 tons, or a decrease of about 59,300 tons, or 13 percent, from the 1984 quantity.

Commercial Solid Waste

Existing commercial solid waste quantities were estimated, as described in Chapter II, using a 1981 Wisconsin Department of Natural Resources (DNR) study[3] which estimated a per capita generation rate of 1.1 pounds per day, and where available, using commercial solid waste quantity information obtained from the municipal solid waste questionnaire survey conducted for the Milwaukee County solid waste study. Based on these data sources, a per capita generation rate of 0.8 ton per year was selected for use in estimating existing 1984 commercial solid waste loads. It is expected that employment within the commercial sectors will increase by about 6 percent over the plan design period, given the shift in employment from the industrial to the commercial sector. Thus, it was concluded that the amount of commercial solid waste generated within the County in the plan design year 2010 could increase by about 10 percent over the 1984 level. As shown in Table 27, about 149,200 tons per year of commercial solid waste may be expected to be generated in the year

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[3]Wisconsin Department of Natural Resources, Wisconsin Solid Waste Management Plan, February 1981.

2010. This represents an increase of 13,500 tons per year, or 10 percent, over the 135,675 tons generated in 1984. This quantity does not include an estimated 55,000 tons per year, or 0.3 pound per capita per day, of commercial solid wastes which are anticipated to be recycled or incinerated. It was further estimated that under the optimistic future, the commercial solid waste quantity would be 162,800 tons, or an increase of about 27,130 tons, or about 20 percent, over the 1984 quantity. The commercial solid waste quantity under the pessimistic future would be 122,100 tons, or a decrease of about 13,570 tons, or 10 percent, from the 1984 quantity.

Industrial Solid Waste

Existing industrial solid waste quantities were estimated, as described in Chapter II, by using the 1981 DNR study which estimated per-employee industrial solid waste generation rates for a wide variety of industrial classifications. The per-employee generation rates were used in conjunction with Commission file information pertaining to the number of persons employed in the various industrial occupations, and with information obtained through the industrial solid waste questionnaire survey conducted under this study, to estimate existing industrial solid waste quantities. Employment in the industrial category is expected to decrease by about 10 percent over the plan design period. However, even though employment is expected to decrease, it was concluded that the industrial waste load may be expected to remain essentially the same as it is under existing conditions, given historic trends in per-employee generation rates. As shown in Table 27, about 346,800 tons per year of industrial solid waste may be expected to be generated in the year 2010. This quantity does not include an estimated 250,000 tons per year, or 1.5 pounds per capita per day, of industrial wastes which are anticipated to be recycled or incinerated. This total is about the same as was generated in 1984. It was estimated that under the optimistic future, the industrial solid waste quantity would also be about the same amount as was generated in 1984. The industrial solid waste quantity under the pessimistic future would be 257,100 tons, or a decrease of about 89,700 tons, or about 15 percent, from the 1984 quantity.

Special Wastes

Bulky Wastes: As described in Chapter II, the existing (1984) estimates of bulky wastes quantities are based on a per capita generation rate of about 0.1 pound per day which was developed by the Wisconsin Recycling Task Force on Solid Waste. The per capita generation rate for residential wastes was assumed to increase by about 20 percent by the design year 2010. It was assumed that the per capita generation rate of bulk materials would increase by a similar amount. As shown in Table 27, about 19,950 tons per year of bulky wastes may be expected to be generated in the year 2010. This represents an increase of 2,900 tons, or 17 percent, over the amount generated in 1984. It was further estimated that under the optimistic future, the bulky solid waste quantity would be 22,100 tons, or about 5,060 tons, or 30 percent, greater than the 1984 quantity. Under the pessimistic future, it was assumed that the per capita generation rate of bulky materials would not increase over existing levels. The bulky solid waste quantity under the pessimistic future would be 15,000 tons, or a decrease of about 2,000 tons, or 12 percent, from the 1984 quantity.

Construction and Demolition Wastes: As described in Chapter II, the Wisconsin Recycling Task Force on Solid Waste estimated the construction and demolition solid waste generation rate to be 0.7 pound per capita per day for communities with a population greater than 10,000, and 0.3 pound per capita per day for communities of fewer than 10,000 people. The year 2010 forecast was based upon the same per capita rate used to estimate 1984 construction and demolition waste quantities. Although the gross population of the County is projected to decrease slightly by the year 2010, the amount of construction and demolition debris may be expected to remain the same as in 1984. As shown in Table 27, about 60,000 tons per year of construction and demolition wastes may be expected to be generated in the year 2010. This quantity does not include an estimated 56,800 tons per year, or 0.3 pound per capita per day, of construction and demolition debris which is anticipated to be recycled or reused or not disposed of in licensed sanitary landfills. It was further estimated that under the optimistic future, the construction and demolition solid waste quantity would be 72,200 tons, or an increase of about 12,200 tons, or 10 percent, over the 1984 quantity. The construction and demolition solid waste quantity under the pessimistic future would be 47,700 tons, or a decrease of about 12,300 tons, or 10 percent, from the 1984 quantity.

Trees and Brush: As described in Chapter II, the existing quantity of tree and brush waste was estimated based on a generation rate of 0.1 pound per capita per day for communities with fewer than 7,500 persons, and 0.3 pound per capita per day for larger communities. These generation rates were developed by the Wisconsin Recycling Task Force on Solid Waste. Since those estimates were prepared, however, there has been an increase in the domestic use of wood as a fuel. Accordingly, the generation rates were reduced by 50 percent for use in estimating the 1984 quantity of tree and brush wastes. The revised generation rate was supported by limited data available from the local municipalities. This rate, however, was also increased by 20 percent to the design year. As shown in Table 27, about 30,320 tons per year of trees and brush are expected to be generated in the year 2010. This represents an increase of about 4,400 tons, or 17 percent, over the amount generated in 1984. It was further estimated that under the optimistic future, the tree and brush waste quantity would be 33,600 tons, or an increase of about 7,700 tons, or about 29 percent, over the 1984 quantity. The tree and brush waste quantity under the pessimistic future would be 23,000 tons, or a decrease of about 2,900 tons, or 12 percent, from the 1984 quantity.

Sewage Treatment Plant and Onsite Septic System Wastes: The amount of sewage treatment plant sludge expected to be generated in the study area was estimated under the regional wastewater sludge management planning effort and as part of several locally prepared sewage treatment plant facility planning efforts. In 1984, a total of three public and one private sewage treatment plants were in operation in the County. The one remaining private plant is proposed to be abandoned in 1985. It is estimated that 110,000 tons per year of sewage sludge on a dry-weight basis were generated by these sewage treatment plants in 1984. By the year 2010, these sewage treatment plants will generate about 150,000 tons per year of sewage sludge on a dry-weight basis. This represents an increase of approximately 40,000 tons, or 36 percent, over the estimated 1984 total. Most sewage sludge generated in the study area is expected to continue to be disposed of by being converted into Milorganite, by application on agricultural lands, or by landfilling.

The adopted regional sludge management plan recommends that provision be made for short-term emergency disposal of sewage treatment plant sludges as a backup capability to the land application of sludges on farmlands. Landfilling would be a logical method of providing sludge disposal backup capability. The Milwaukee Metropolitan Sewerage District (MMSD) sewage treatment facilities--Jones Island and South Shore--may be expected to generate 149,300 tons of sewage sludge in the year 2010, or over 99 percent of the total sewage sludge anticipated to be produced in Milwaukee County in the year 2010. The remaining 700 tons, or less than 1 percent, will be generated at the City of South Milwaukee sewage treatment facility, and will probably continue to be disposed of by land spreading or used by local residents as a source of organic material. The MMSD presently is implementing a long-term program to ensure proper disposal of sewage treatment plant sludge, which includes construction of a new landfill, continued production of Milorganite, and continued spreading of materials on suitable agricultural lands. Therefore, this solid waste management planning effort will not need to address disposal of sludge anticipated to be generated in Milwaukee County in the year 2010, but rather will consider this waste source only as necessary to coordinate total solid waste disposal efforts within the County.

Based upon data contained in the adopted regional wastewater sludge management plan, it is estimated that 2,000 onsite sewage disposal systems will produce about 60 tons of solids per year on a dry-weight basis--or 120 tons per year on a wet-weight basis--by the year 2010. It is generally recommended that septic and holding tank wastes be disposed of by discharge to a municipal sewerage system for treatment at a public sewage treatment plant. Accordingly, the solid waste quantity forecasts do not reflect any septic or holding tank wastes, these being reflected in the municipal sewage treatment plant sludge generation.

Hazardous Wastes: Data on the present toxic and hazardous waste generation levels in the County are set forth in Chapter II. It is indicated in that chapter that approximately 35,600 tons of toxic and hazardous wastes were generated in Milwaukee County in 1984. Recent federal and state regulations regarding the handling and disposal of these wastes have resulted in expanded efforts to reduce the generation and increase the recycling or reuse of such wastes. These changing conditions will likely result in significant reductions in the amounts of these materials entering the solid waste stream during the plan period. However, the amount of this change is difficult to forecast at this time. Of the quantities of material which could be classified as "hazardous," and which were reported to be generated by industries in the County as of 1984, over 50 percent were recovered and recycled. As discussed in Chapter II, this plan will not specifically develop a recommended plan for the management of toxic and hazardous wastes generated by the industrial or commercial operations, but rather will consider this waste source only as necessary to coordinate total solid waste disposal efforts within the County. A discussion of household toxic and hazardous waste management is presented in Chapter VII.

SUMMARY AND CONCLUSIONS

To prepare a technically sound and viable plan for solid waste management in Milwaukee County, it is necessary to forecast the quantities and types of solid wastes which may be expected to be generated over the planning period. As shown in Table 29, the quantity of solid waste estimated to be generated in

Table 29

ESTIMATED SOLID WASTE QUANTITIES GENERATED IN MILWAUKEE COUNTY: 2010

Solid Waste Category	Solid Waste Generated: Tons per Year	Solid Waste Generated: Pounds Per Capita per Day
Residential[a]	515,560	3.1
Commercial[b]	149,200	0.9
Industrial[c,d]	346,800	2.1
Special Wastes Considered as Part of the Solid Waste Stream		
Bulk[e]	19,950	0.1
Construction and Demolition Debris[f]	60,000	0.3
Trees and Brush[g]	30,320	0.2
Subtotal[h]	1,121,830	6.7
Solid and Liquid Wastes to be Treated Separately from the Solid Waste Stream		
Hazardous Wastes	35,600	0.2
Sewage Sludge	150,000	0.9
Septic and Holding Tank Wastes	120	Less than 0.1
Subtotal	185,720	1.1
Total	1,307,550	7.9

[a]This quantity does not include approximately 13,000 tons per year, or 0.08 pound per capita per day, of residential wastes comprised primarily of paper, glass, and metal which are recycled.

[b]This quantity does not include approximately 55,000 tons per year, or 0.3 pound per capita per day, of commercial wastes comprised primarily of paper and cardboard which are recycled or incinerated.

[c]This quantity does not include approximately 250,000 tons per year, or 1.5 pounds per capita per day, of industrial wastes comprised primarily of paper, cardboard, metal, wood, glass, and miscellaneous materials which are recycled or incinerated.

[d]Industrial solid wastes do not include fly ash produced by the Wisconsin Electric Power Company as a result of the burning of coal for generation of electricity.

[e]This quantity does not include approximately 500 tons per year, or 0.003 pound per capita per day, of white goods which are recycled.

[f]This quantity does not include approximately 56,800 tons per year, or 0.3 pound per capita per day, of construction and demolition debris which is recycled or used as rubble fill and not disposed of in sanitary landfills.

[g]This quantity does not include approximately 5,200 tons per year, or 0.03 pound per capita per day, of trees and brush, which are recycled through mulching or composting or used by individuals for firewood.

[h]Additional reuse, recycling, and incineration of solid wastes which may occur during the plan period will be addressed in the alternatives analysis and, if appropriate, the recommended plan.

Source: Wisconsin Department of Natural Resources, Wisconsin Solid Waste Recycling Authority, and SEWRPC.

the study area in the year 2010, and for which facilities are to be considered in this study, is 1,121,830 tons per year. This represents an increase of 88,940 tons, or 9 percent, over the estimated 1,032,890 tons generated in 1984. These quantities do not include approximately 13,000 tons of residential wastes, 250,000 tons of industrial wastes, 56,800 tons of construction and demolition debris, 55,000 tons of commercial solid waste, 500 tons of bulk materials, and 5,200 tons of trees and brush which are anticipated to be recycled, incinerated, or reused annually. The estimated year 2010 per capita solid waste production rate for these waste sources is 6.7 pounds per capita per day, based upon the year 2010 resident population of the study area. This is an increase of 0.7 pound per capita, or 12 percent, over the 1984 rate of 6.0 pounds per capita.

As previously discussed, solid waste quantities were also developed for the optimistic and pessimistic year 2010 conditions. Total solid waste quantities were estimated to be 1,209,000 tons in the year 2010 under the optimistic future, and 853,300 tons under the pessimistic future. These waste quantities will be analyzed further in the alternative plan evaluation to ensure that alternative solid waste management facilities can adequately handle the range of solid waste quantities which could occur over the plan period.

The following amounts of solid wastes may be expected to be produced in the year 2010: about 515,560 tons of residential wastes, or 3.1 pounds per capita per day, representing 40 percent of the total; 149,200 tons of commercial wastes, or 0.9 pound per capita per day, representing 11 percent of the total; 346,800 tons of industrial wastes, or 2.1 pounds per capita per day, representing 27 percent of the total; and 110,270 tons of special wastes--including bulky wastes, construction and demolition debris, and trees and brush--or 0.6 pound per capita per day, representing 8 percent of the total. It was also estimated that hazardous wastes, sewage sludge, and septic and holding tank wastes would total 185,720 tons annually, or 1.1 pounds per capita per day, representing 14 percent of the total waste stream.

The monthly variation of solid wastes, and the combustibility of solid wastes, are important considerations in the development and evaluation of solid waste management alternatives. Generally, the greatest quantities of solid wastes are generated during the summer and fall, with lesser amounts produced in the winter. For example, in May, June, and August, solid waste quantities are projected to be 107 percent, 116 percent, and 109 percent, respectively, of the monthly average; while in December, January, and February, solid waste quantities are projected to be about 89 percent, 89 percent, and 87 percent, respectively, of the monthly average. However, if only residential solid wastes are considered, solid waste quantities are anticipated to range from 145 percent of the monthly average in June, to 70 percent of the monthly average in February. The heating value of the total solid waste stream was estimated to be 4,500 British thermal units (BTU's) per pound, with a moisture content of 27 percent by weight and an ash content of 22 percent by weight.

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Chapter IV

LANDFILL AND INCINERATOR SITING ANALYSIS

INTRODUCTION

A sanitary landfill is a necessary component of any county solid waste management system. Even alternative solid waste management systems incorporating a high degree of resource recovery, including incineration of waste for the generation of energy, require landfill disposal of incinerator ash and of materials which cannot be removed from the waste stream and otherwise recycled. Landfill disposal is also required as a backup system during periods when the resource recovery systems are not operational. Accordingly, a general siting analysis designed to identify areas with high, moderate, or low potential suitability for landfill siting is an important part of any solid waste management planning effort. An important aspect of the Milwaukee County solid waste management planning effort is the development of an alternative solid waste management plan based upon incineration of combustible wastes. As discussed in Chapter II, in 1984 there were no publicly owned incinerators operating within the County. The incinerators which were operated by some industries and institutions within the County were used to dispose of relatively small amounts of waste. Consequently, the planning effort must include analyses relative to the siting and construction of incinerators as well as sanitary landfills.

A general siting analysis consists of an evaluation of the available data on the cultural and natural resource base of the planning area in relation to pertinent environmental protection, engineering, and regulatory criteria. The purpose of such an analysis is to identify lands with high, moderate, and low potential for the siting of the facilities concerned. Separate siting analyses are required for the siting of sanitary landfills and for the siting of incineration facilities. The information from the analyses can be utilized in developing the recommended plan components as described in Chapters VII and IX of this report.

The system planning level siting analyses are designed to be followed by more site-specific analyses of the best sites within Milwaukee County, if it is determined that new landfill or incinerator facilities are to be a component of the recommended plan. The findings of this report are limited to the results of the general, system level analyses.

Besides considering the man-made and natural resource base features of the study area, any landfill or incinerator siting analysis must consider the existing regulations governing the siting of sanitary landfills and incinerators as set forth in Chapters NR 140, NR 180, and NR 185 of the Wisconsin Administrative Code. Because of the very limited potential which exists in Milwaukee County for the construction and use of a natural attenuation landfill, as defined in Chapter V, the analysis assumes that any landfill will be provided with engineered facilities for leachate control. It is important to note that zone of saturation landfills have been found to be environmentally acceptable. However, the ideal natural resource characteristics associated with a natural attenuation site will be sought in the general siting analysis for landfill facilities. The criteria used to identify potential sites for both landfill and incinerator facilities are set forth below.

CRITERIA

A general siting analysis requires the development and application of a set of criteria relating to the environmental, engineering, and regulatory considerations involved in landfill and incinerator facility siting. The criteria utilized in the analysis were based on the requirements of Chapter 144 of the Wisconsin Statutes and Chapters NR 140 and NR 180 of the Wisconsin Administrative Code, and on other pertinent engineering and transportation requirements for the initial screening of potential landfill or incinerator sites.

The criteria applied in the landfill siting analysis can be categorized as relating to geology, topography, soils, groundwater, surface water, environmentally significant areas, urban land uses, transportation routes, and historical and archaeological sites. Detailed inventory data on these natural and man-made features of the study area are presented in Chapter II. In some cases, application of the criteria may preclude use of a proposed landfill site, while in other cases, such application may only limit the site potential. For the purposes of the general siting analysis, the criteria were applied in a conservative manner in order not to categorically eliminate sites that may have potential for landfill development when further evaluated on a site-specific basis.

The criteria applied in the incinerator siting analysis can be categorized as relating to existing urban land uses, location of transfer stations, transportation routes, potential energy users, historic sites, and air quality. As in the landfill siting analysis, application of criteria may preclude use of a proposed incinerator site, while in other cases, such application may only limit the site potential. With regard to the incinerator locations, it should be noted that the highest potential sites will be within either existing or planned industrialized areas or within or adjacent to existing solid waste management facilities such as transfer stations. In addition, the site size required will generally be relatively small compared to the size of landfill sites. Thus, criteria relating to such natural resource features as geology, topography, soils, groundwater, surface water, and environmentally significant areas were not specifically considered; however, further site feasibility studies would need to investigate these features.

Geology

Depth to bedrock and the type of glacial deposits are the main geological considerations involved in landfill siting.

Depth to Bedrock: Considerable excavation is usually required for the development of most types of landfills. In addition, it is necessary to maintain adequate separation between the top of the bedrock and the confining layer, or liner, at the bottom of the landfill. The type and characteristics of this separation depend on the characteristics of the confining material, or type of liner, and of the bedrock. A depth to bedrock of greater than 20 feet is generally considered practical and desirable in order to meet the separation requirements and reduce the potential for groundwater contamination. Areas meeting this criterion are shown on Map 24. Areas with depths of less than 20 feet to bedrock are considered to have low potential for the location of a solid waste landfill.

Glacial Deposits: The majority of materials that cover the bedrock surface in Milwaukee County are glacial deposits of the Quaternary Age and include end moraine, ground moraine, outwash, and lake basin deposits. The surficial geology of Milwaukee County is shown on Map 25.

End moraines and ground moraines consist of unsorted, unstratified debris ranging in size from clay to boulders. The potential for locating large quantities of clay materials necessary for the development of a solid waste landfill is relatively high in these formations of glacial origin. Accordingly, areas occupied by such formations were classified as having a high potential for landfill siting.

Outwash plains consist primarily of sands and gravels with small amounts of clay. Outwash plains are typically stratified in relatively thin layers, reducing the potential for locating extensive clay deposits in deep layers. Accordingly, areas occupied by such formations were classified as having moderate potential for landfill siting.

Lacustrine or lake deposits, which consist of fine-grained strata, primarily silt and clay, have settled out from suspension in turbid lake waters. Lacustrine deposits form a stratified profile of silt and clay that may provide the low permeability necessary for the proper development of a landfill site. Accordingly, areas occupied by such formations were classified as having a high potential for landfill siting.

Topography

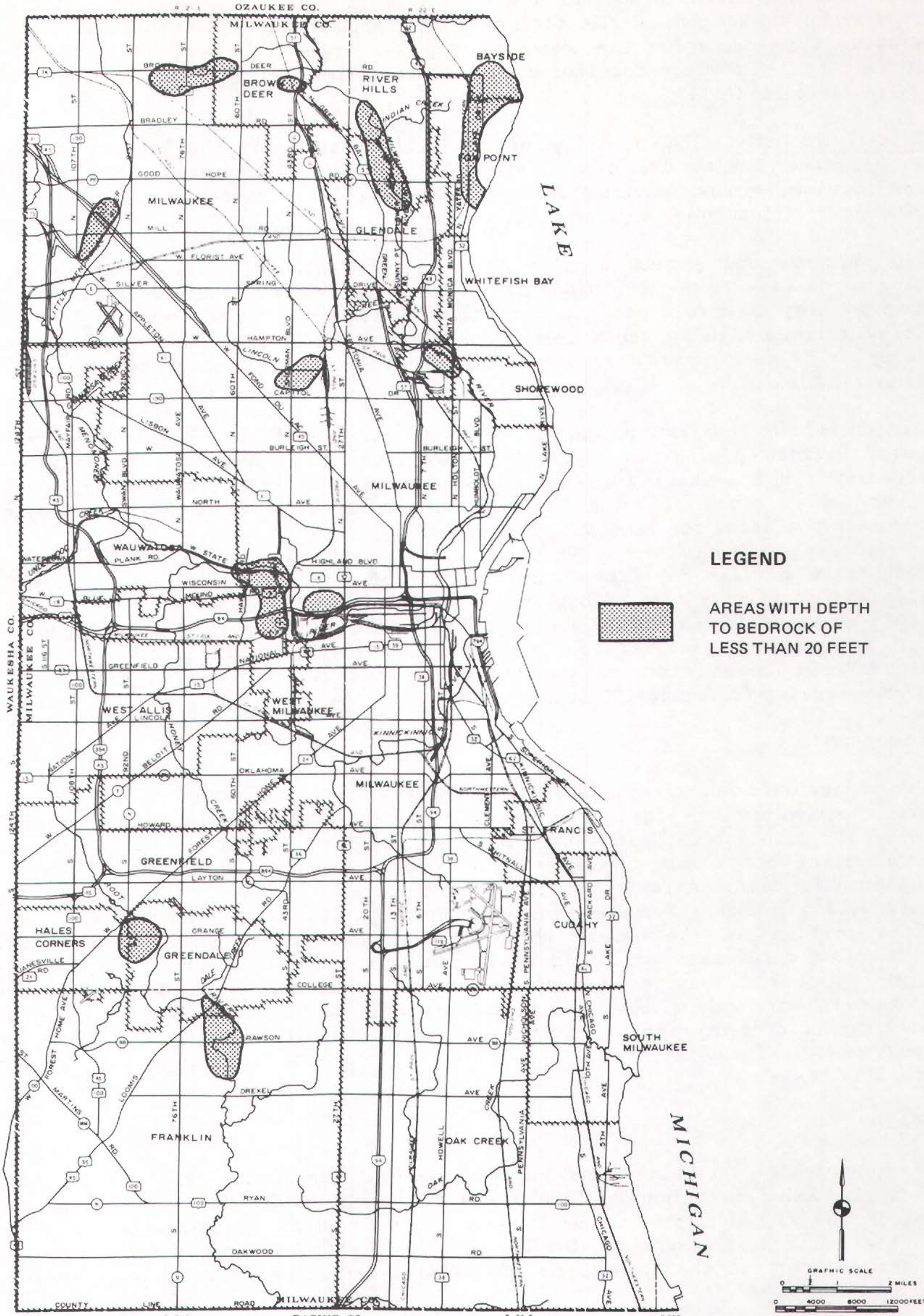
The topographic characteristics of Milwaukee County, as noted in Chapter II, were determined by glacial action and the resulting formation of ground, terminal, interlobate, and kettle moraines, and of glacial outwash terraces. Portions of the County are covered by glacial deposits with steep slopes, a topographic characteristic particularly important in the evaluation of the suitability of sites for the development of solid waste management facilities. Other portions of the County which were considered to have potential for siting and development of solid waste management facilities may contain certain topographic features in addition to steep slopes that would make such sites either more or less suitable for these facilities. Accordingly, the topographic characteristics of any site considered to have potential for the location of a landfill or an incinerator will have to be evaluated on a site-specific basis.

Soils

The geographic distribution and engineering characteristics of the soil types that are found in Milwaukee County are set forth in Chapter II. In order to assess the significance of the diverse soils found in southeastern Wisconsin to the sound development of the Region, the U. S. Soil Conservation Service, under contract to the Commission, prepared detailed operational soil surveys

Map 24

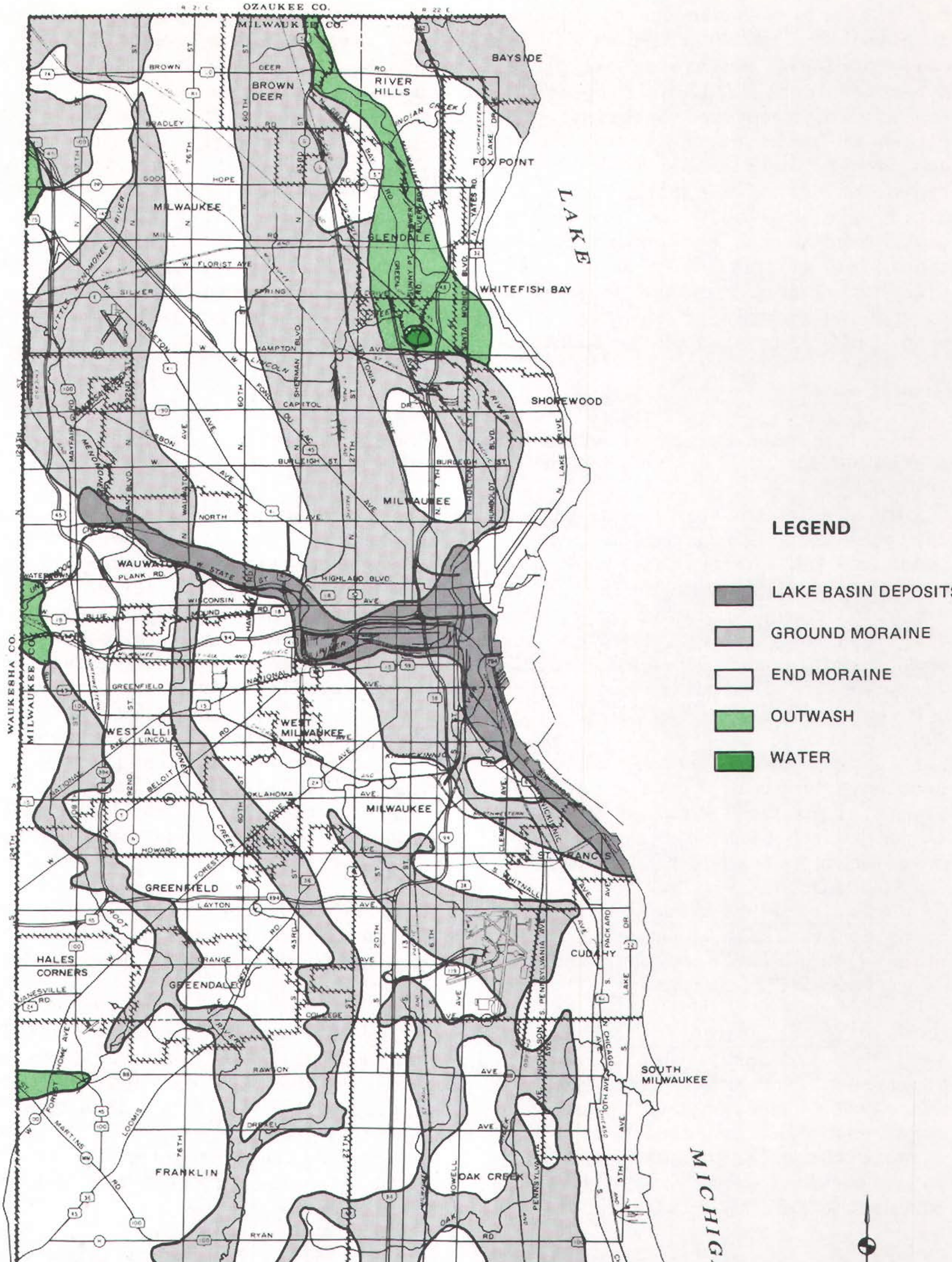
AREAS WITH DEPTH TO BEDROCK OF LESS THAN 20 FEET IN MILWAUKEE COUNTY



Source: U. S. Geological Survey and SEWRPC.

Map 25

GLACIAL GEOLOGY OF MILWAUKEE COUNTY



Source: U. S. Geological Survey and SEWRPC.

for the entire seven-county Planning Region in 1963. These surveys produced detailed maps of the soils within the Region, together with data on the physical, chemical, and biological properties of the soils, and, more importantly, interpretations of those properties for planning, engineering, agricultural, and natural resource conservation purposes. Interpretations of the soil properties in terms of their suitability for sanitary landfill construction are accordingly available. As described in Chapter II, both generalized soils and detailed soils maps relating soil properties to suitability for landfill siting are available for use in the evaluation of potential landfill sites. A given land parcel may encompass several different soils with varying limitations for landfill development. The soils should be evaluated on a site-by-site basis, utilizing the detailed soils maps and interpretations for landfill siting. An example of the type of landfill soil suitability map which can be produced for any area of the County is illustrated on Map 26.

Groundwater

Groundwater considerations which are important in landfill siting are presented below.

Depth to Groundwater: Areas with a depth of less than 10 feet to groundwater are considered to have low potential for landfill siting and development. Areas of the County that have a depth to groundwater of less than 10 feet are shown on Map 27. There is some potential for landfill development in areas with high groundwater if the zone of saturation technique is used, as described in Chapter V. However, because of the increased cost of constructing and operating this type of landfill, areas of shallow depth to groundwater were classified as having moderate potential for landfill siting.

Well Locations: Chapter NR 180 of the Wisconsin Administrative Code requires that landfills be located at a horizontal distance of more than 1,200 feet from any public or private water supply well unless special conditions indicate that contamination of the well will not occur. This factor is discussed in a later section in conjunction with the consideration of existing and proposed urban development in landfill siting.

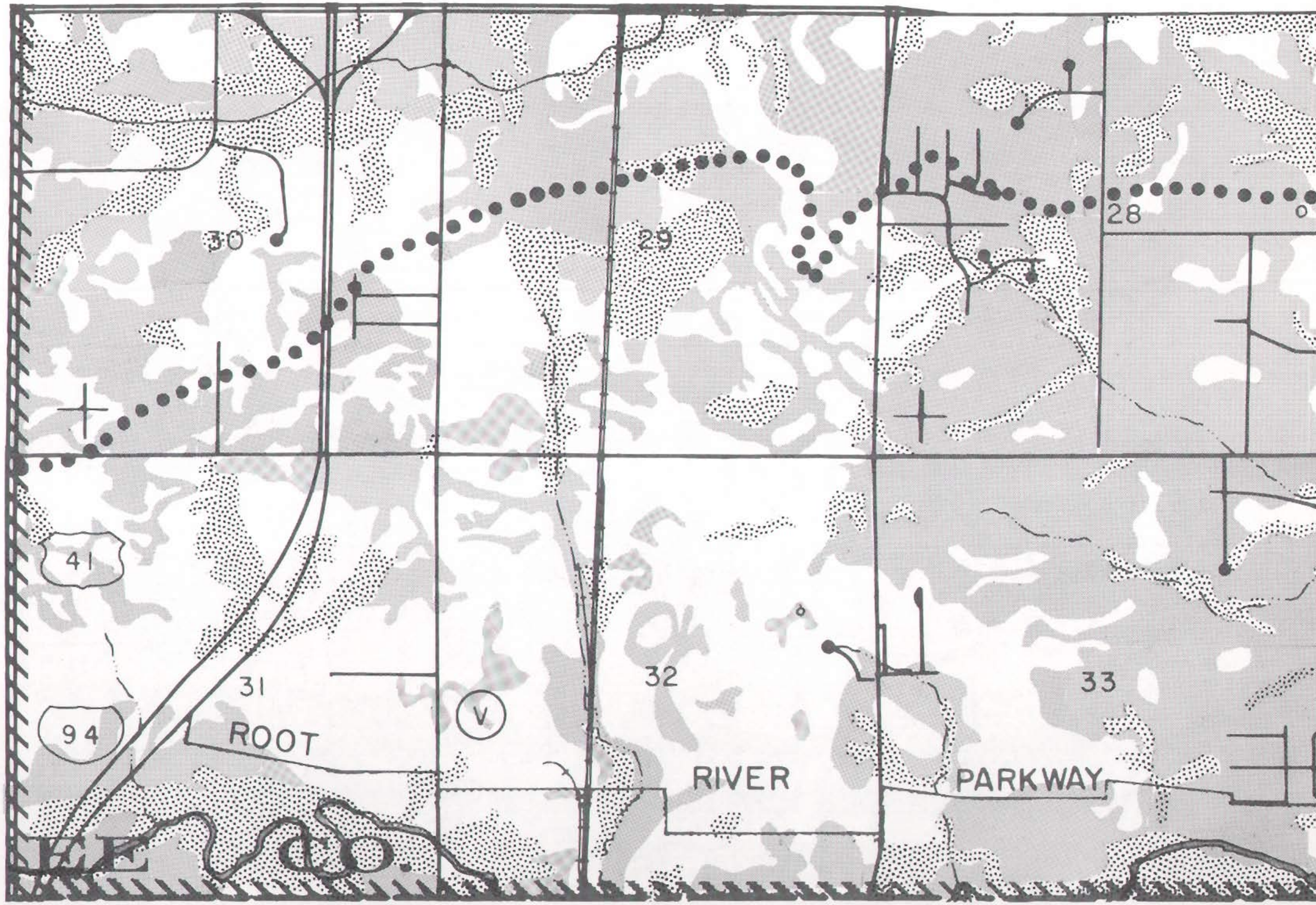
Groundwater Flow Direction: Generalized mapping of the groundwater flow patterns is available. However, local variation in the regional flow patterns is often significant, and thus this aspect of landfill siting must be considered on a site-specific basis.

General Groundwater Protection: Chapter NR 180 of the Wisconsin Administrative Code requires that a solid waste landfill not be located where the Department finds there is reasonable probability that the disposal of solid waste will have a detrimental effect on groundwater quality. This general requirement was evaluated, to the extent possible, during review of the geological characteristics of the study area. In addition, the potential impacts on groundwater were examined during the consideration of criteria relating landfill siting to existing urban land uses.

Chapter NR 140 of the Wisconsin Administrative Code establishes groundwater quality standards for substances detected in or having a reasonable probability of entering groundwater, specifies procedures for determining if a numerical standard has been attained or exceeded, specifies procedures for

Map 26

SAMPLE OF MAPPING ILLUSTRATING SOIL SUITABILITY FOR LANDFILL DEVELOPMENT



LEGEND

SLIGHT LIMITATIONS

MODERATE LIMITATIONS

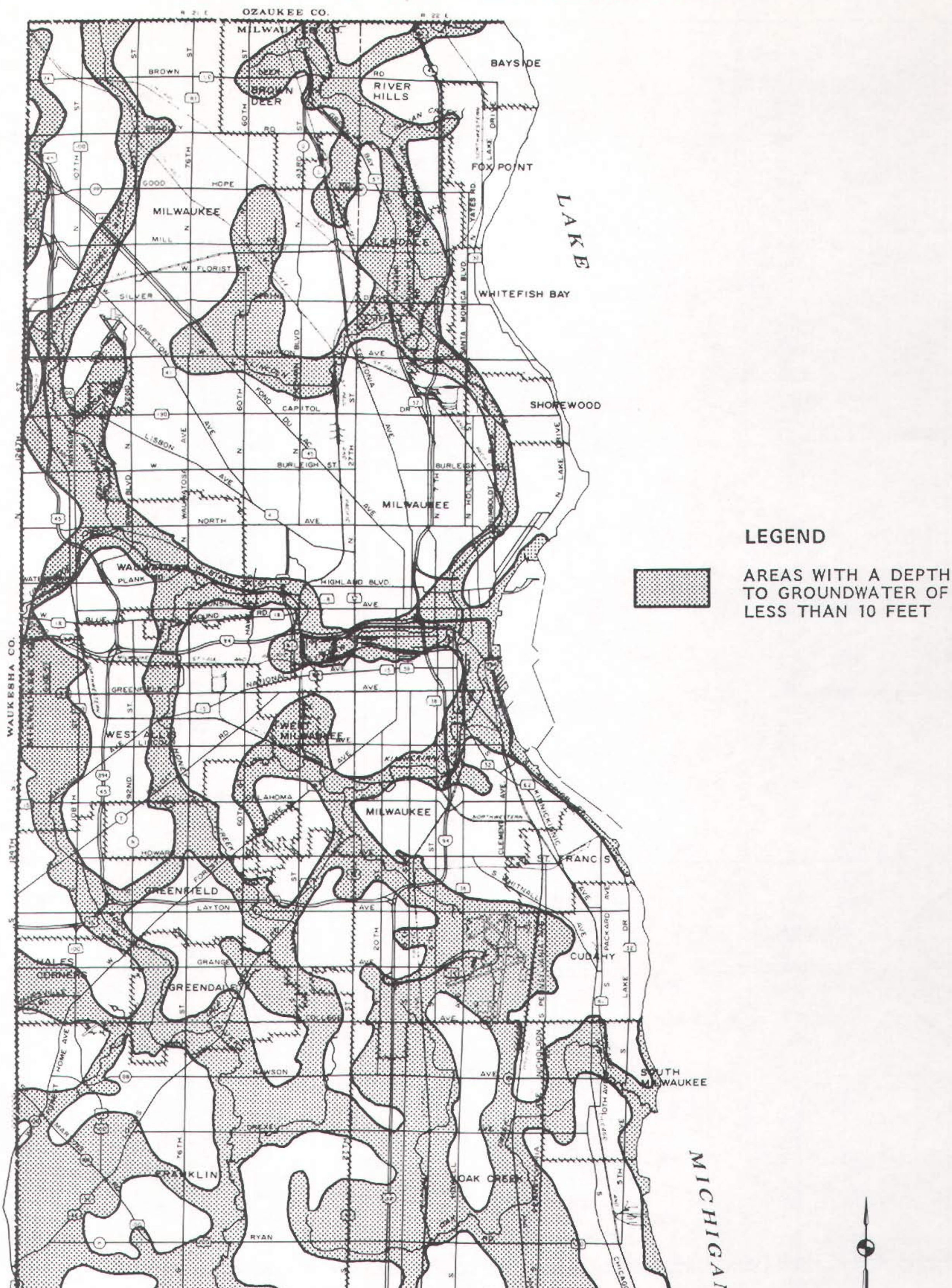
SEVERE LIMITATIONS

WATER

Source: U. S. Department of Agriculture, Soil Conservation Service; and SEWRPC.

Map 27

AREAS WITH A DEPTH TO GROUNDWATER OF LESS THAN 10 FEET IN MILWAUKEE COUNTY



Source: U. S. Geological Survey and SEWRPC.

establishing standards application and monitoring, establishes responses by the Wisconsin Department of Natural Resources if a standard is attained or exceeded, and provides for exemptions for facilities and activities otherwise regulated. These regulations establish an enforcement standard and a preventive action limit for groundwater substances. The preventive action limit represents a lesser concentration of a substance than the enforcement standard, must be used in design codes and management specifications for facilities such as landfills so that contamination is prevented, and serves as a signal that remedial action may be necessary. Enforcement standards define when a violation has occurred, and generally require that a regulatory agency prohibit the continuation of the activity from which the substance came. These regulations are important considerations in the analysis of landfill siting, design, and operation.

Surface Water

The locational criteria for the siting of a solid waste land disposal site with regard to the surface waters of the Region are set forth in Chapter NR 180 of the Wisconsin Administrative Code, which does not permit development of a landfill within the following areas:

- Within 1,000 feet of any navigable lake, pond, or flowage;
- Within 300 feet of a navigable river or stream;
- Within a floodplain;
- Within wetlands; and
- Within an area where the Department of Natural Resources finds there is a reasonable probability that disposal of solid waste will have a detrimental effect on any surface water.

Ponds, flowages, rivers, and streams with appropriate buffer zones, as well as wetlands and floodplains, were accordingly classified as having low potential for a landfill site. Map 28 shows the location and extent of the 100-year recurrence interval floodplain areas in the County.

Environmentally Significant Areas

The siting of a solid waste management facility requires consideration of environmentally significant areas. Accordingly, primary environmental corridors were considered as having low potential for the location and development of solid waste landfills. Environmentally significant areas include lakes, ponds, flowages, and rivers and streams, and their associated shorelands and floodlands; wetlands; woodlands; wildlife habitat areas; areas of steep slopes; prairies; existing and proposed park sites; and areas having scenic, scientific, or cultural value. The primary environmental corridors within Milwaukee County, as delineated by the Regional Planning Commission, are shown on Map 29. While the location of a sanitary landfill site is not recommended anywhere within these environmentally significant areas, the upland, wooded portions of such corridors may be used as buffer zones for landfills.

Map 28

DELINEATED FLOODPLAINS IN MILWAUKEE COUNTY: 1984

Source: SEWRPC.

Map 29

PRIMARY ENVIRONMENTAL CORRIDORS IN MILWAUKEE COUNTY: 1984

Source: SEWRPC.

Prime Agricultural Lands

As discussed in Chapter II, the rapid conversion of farmland to urban use has become a matter of public concern. The adopted regional land use plan recommends that the remaining prime farmlands be preserved in agricultural use. Since the State Legislature adopted the Farmland Preservation Act, all counties of the Region except Milwaukee County have prepared farmland preservation plans. Large areas of the other counties have been zoned for exclusive agricultural use, whereas only a small area in the City of Franklin totaling 1,355 acres, or about 1 percent of the total area of the County, has been so zoned in Milwaukee County. The prime agricultural areas were considered to have no limitations for landfill and incinerator siting, and would be classified as having a high potential for the siting of a landfill or incinerator.

Existing Urban Areas

As already noted, Chapter NR 180 of the Wisconsin Administrative Code requires a horizontal distance of at least 1,200 feet between a landfill and any public or private water supply source. This limit may be increased or decreased if justified by site-specific groundwater studies. For purposes of landfill site selection, a distance of about one-quarter mile from areas of existing residential, commercial, and industrial urban development--where groundwater wells would be expected to be found in the absence of a public water supply system--was considered appropriate for the general siting analysis. Areas of residential, commercial, and industrial urban development served by groundwater wells that were located within this distance were eliminated from further consideration. Areas within 1,320 feet of urban areas served by municipal water systems were considered to have moderate limitations for landfill siting. The existing urbanized areas in the study area are shown on Map 3 in Chapter II.

The Wisconsin Administrative Code prohibits the location of solid waste land disposal sites within 1,000 feet of the nearest edge of the right-of-way of any state trunk highway or federal and interstate or federal aid primary highway, or within 1,000 feet of the boundary of any public park, unless the site is screened by natural objects, plantings, fences, or other appropriate means so as not to be visible from the highway or park. Tree plantings, berms, and other site modifications are relatively simple engineering modifications that can provide adequate screening from roads and parks. Therefore, this criterion was not used to eliminate areas from consideration as potential landfill sites.

The potential incinerator facility sites were necessarily located within or adjacent to existing urban lands for several reasons. Such sites need to be near potential industrial energy users, and to be on or near major transportation routes.

Airports

The Federal Aviation Administration and the Wisconsin Department of Natural Resources have adopted restrictions on the development of solid waste landfills within the vicinity of airports. The primary conflict between these two land uses is the attraction of birds to the landfill sites, causing potential collision hazards for aircraft. The Federal Aviation Administration has published Order 5200.5, FAA Guidance Concerning Sanitary Landfills On or Near Airports, that sets forth federal policy concerning landfill siting near airports. These federal guidelines must be observed in order for federal grants-in-aid to be made available for airport development. These guidelines are also considered by the Wisconsin Department of Natural Resources in the review of any solid waste site development proposal.

The following criteria are to be utilized in the siting analysis for a solid waste landfill:

- Landfills should not be developed in areas located within 10,000 feet of any runway used or planned to be used by turbojet-powered aircraft.
- Landfills should not be developed in areas located within 5,000 feet of any runway used only by reciprocating engine-powered aircraft.
- Landfills should not be developed in any area located between the runway approach and departure patterns of an airport and bird feeding, watering, or roosting areas.

As noted in Chapter II, there are currently nine airports in the study area. General Mitchell and Lawrence J. Timmerman Fields are served by turbojet-powered aircraft. Landfills should not be located within 10,000 feet of any runway at these airports. Rainbow Airport is used by reciprocating engine-powered aircraft, and, for the purposes of this evaluation, a 5,000-foot-long buffer zone has been used, within which there are severe limitations for landfill siting. These regulations were established to ensure that bird species that are typically attracted to landfill sites are kept away from airport traffic patterns and approaching and departing aircraft. There are no specific FAA guidelines concerning siting a landfill near a heliport. A site-specific evaluation would need to be conducted of the potential impacts of siting such a facility near a heliport in Milwaukee County. The airports in Milwaukee County, and appropriate buffer zones, where applicable, are shown on Map 30.

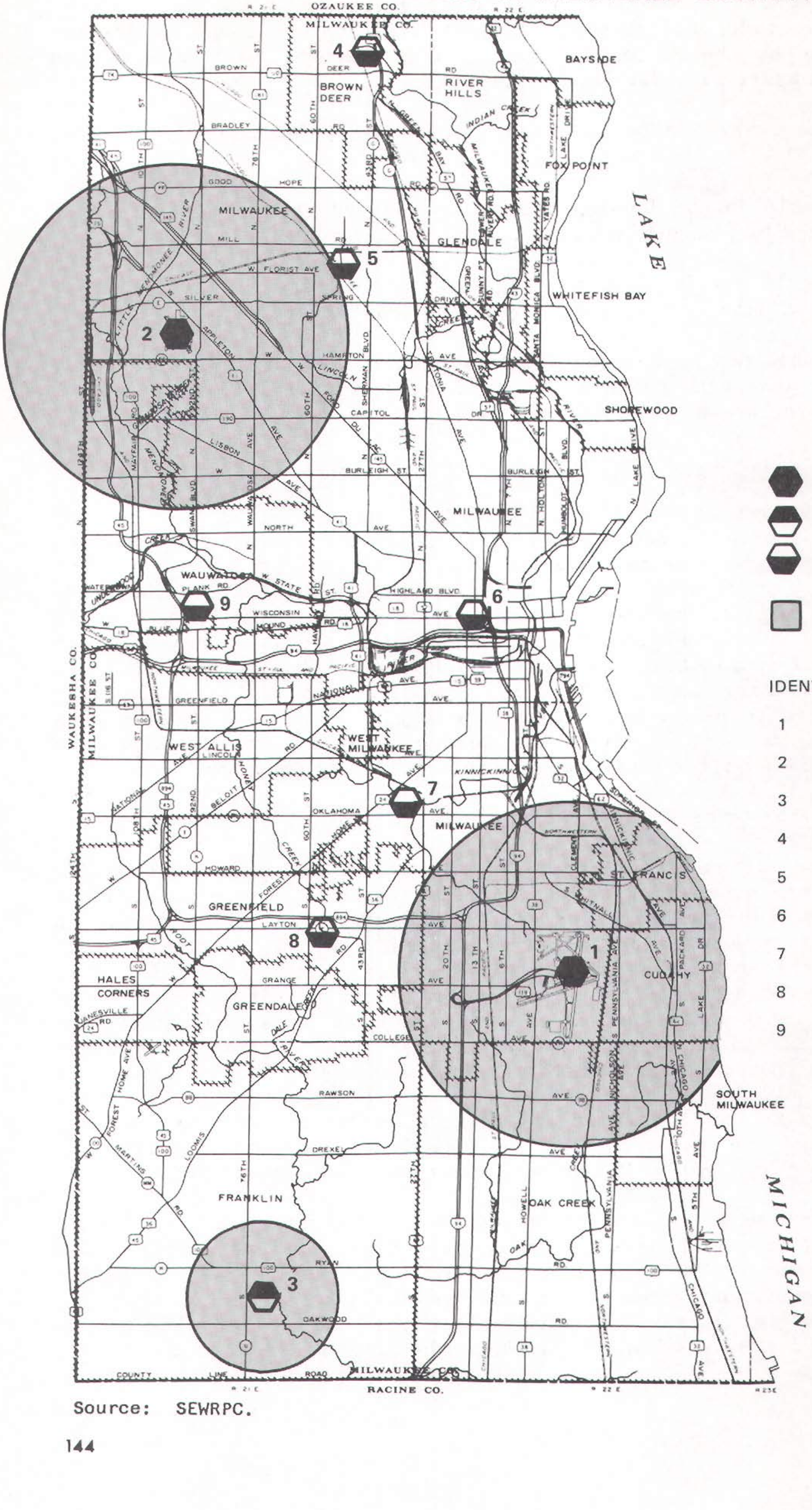
Location of Transfer Stations

In the evaluation of potential incinerator sites, it is important to consider the proximity of such sites to existing transfer stations. Criteria relating to transfer stations were not used for siting a landfill facility because of the overriding environmental considerations concerning the siting of such facilities. There are presently one inactive and eight active transfer stations in Milwaukee County. Only those transfer stations on sites large enough to accommodate an incinerator and associated equipment were evaluated. The advantages of locating an incinerator at the same site as the transfer station are a reduction in transportation costs, a more efficient use of labor and equipment, the potential for reduced land costs, public acceptability since the site is already in use for solid waste management, and the benefits of onsite processing and resource recovery. The locations of the one inactive and eight active transfer stations in Milwaukee County are shown on Map 31.

Transportation costs can be reduced by locating an incinerator at the site of a transfer station, because there is no need to haul portions of the solid wastes beyond that point. There is also the potential for a more efficient use of labor and equipment since fewer workers would be needed if they can be involved in a single, larger operation rather than in two separate operations. Less equipment may need to be purchased because of the overlap in use.

Map 30

EXISTING AIRPORTS AND ASSOCIATED LANDFILL BUFFER ZONES IN MILWAUKEE COUNTY: 1984



LEGEND

- PUBLIC USE–PUBLIC OWNERSHIP
- PUBLIC USE–PRIVATE OWNERSHIP
- PRIVATE USE HELIPAD–PRIVATE OWNERSHIP
- BUFFER ZONES WITH NO POTENTIAL FOR LANDFILL DEVELOPMENT

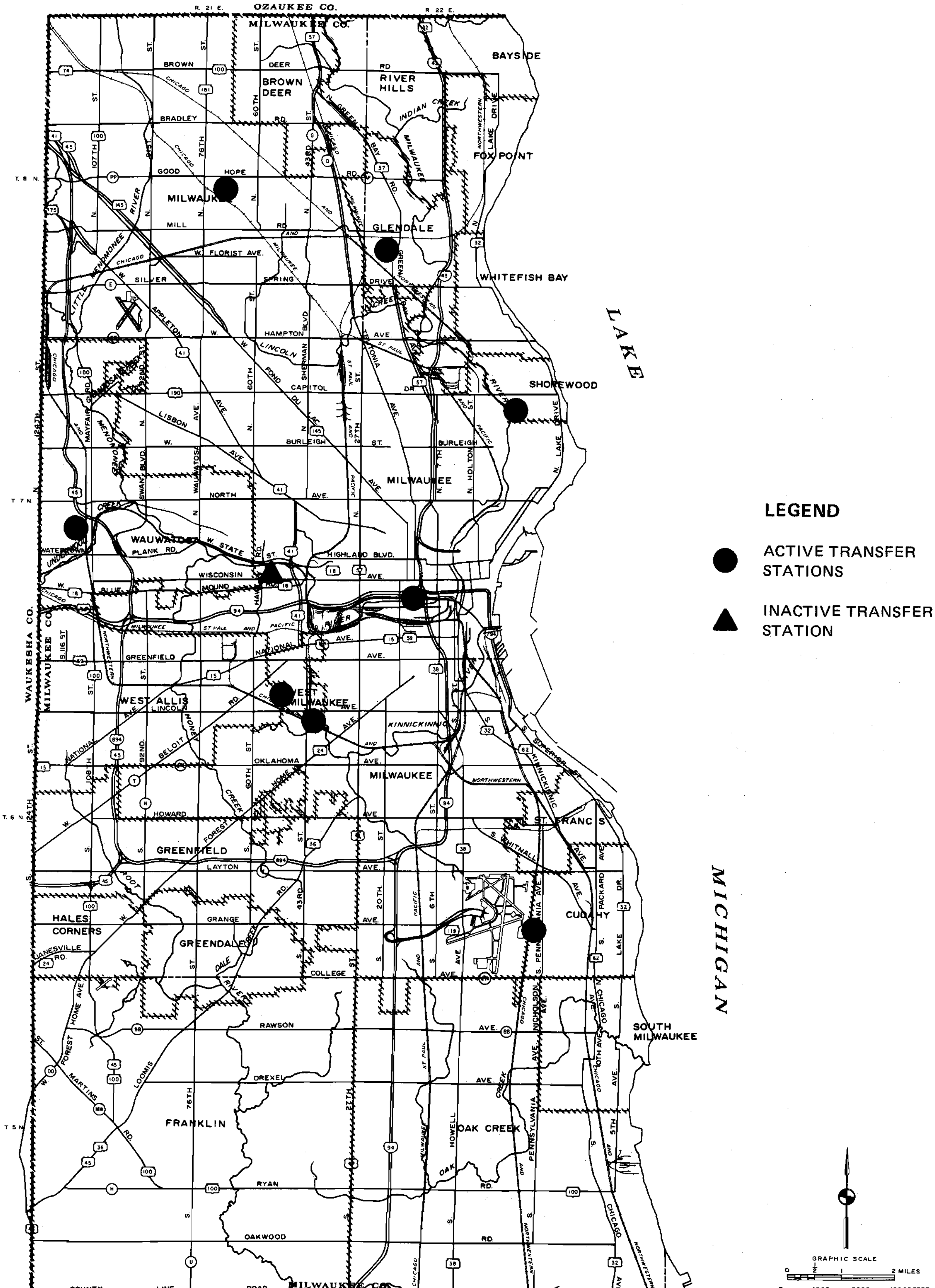
IDENTIFICATION NUMBER AND NAME

1	GENERAL MITCHELL FIELD
2	LAWRENCE J. TIMMERMAN FIELD
3	RAINBOW AIRPORT
4	WITI-TV STUDIO BUILDING
5	U. S. ARMY, 84TH DIVISION
6	WISN-TV, CHANNEL 12
7	ST. LUKES' S HOSPITAL
8	ALL-STATE EQUIPMENT COMPANY
9	MILWAUKEE COUNTY MEDICAL COMPLEX

Source: SEWRPC.

Map 31

TRANSFER STATIONS IN MILWAUKEE COUNTY: 1984



Source: SEWRPC.

Costs are reduced by placing an incinerator at the site of a transfer station, because no new land will need to be purchased. It should be noted, however, that in order for these savings to be realized, the transfer station site must have enough space for an incinerator facility.

Another advantage of the dual facility site is that recyclables can be processed and separated at the incinerator site, and all nonrecyclable materials can be disposed of immediately and efficiently. There also is a reduction in the number of times the wastes must be processed and separated when both facilities are at the same location.

Potential Energy Users

An incinerator should be located near potential energy users in order to be most cost-effective. Commission data were used to generate a table of the approximately 100 largest energy users, based on fuel consumption, in Milwaukee County. The British thermal unit (BTU) value of the fuel type was computed for these energy users, and the industries were ranked according to their respective BTU consumption.

The locations of the largest energy users were mapped, together with potential incinerator sites selected through an initial analysis based upon other considerations noted above. For the purposes of this study, it was assumed that an industry would need to be within one-half mile of an incinerator facility to be considered a potential energy user. This distance was selected on the basis that steam generated by an incinerator facility could generally be most efficiently used by a potential energy user within one-half mile of the point of generation. Table 30 lists the potential waste to energy sites in the study area, along with the annual energy use, in BTU's, of all potential energy users proximate to the site.

It should be noted that this systems level analysis did not include direct contact with potential energy users to assess their present interest in and compatibility with a potential incinerator system, since plan implementation will take place over a 20-year period, during which such decisions may change. These contacts would be made as part of the implementation phase, should it be recommended that incineration with energy recovery be incorporated into the plan.

Air Quality

Air quality is an important consideration in the evaluation of potential incinerator sites. As discussed in Chapter II, federal and state air quality standards have been established which are intended to protect human health and the public welfare. For southeastern Wisconsin, ambient air quality standards have been set for ozone, carbon monoxide, sulfur dioxide, nitrogen oxides, lead, and particulate matter. All of Milwaukee County is presently designated as an ozone nonattainment area, and portions of the County have been designated as nonattainment areas for sulfur dioxide and particulate matter. The areas of nonattainment for these pollutants are shown on Map 32.

An incinerator facility in Milwaukee County would constitute a point source of air pollution. According to federal and state air quality regulations, any new point source in a nonattainment area would need to be offset by a reduction of

Table 30

POTENTIAL WASTE TO ENERGY SITES IN THE MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN STUDY AREA

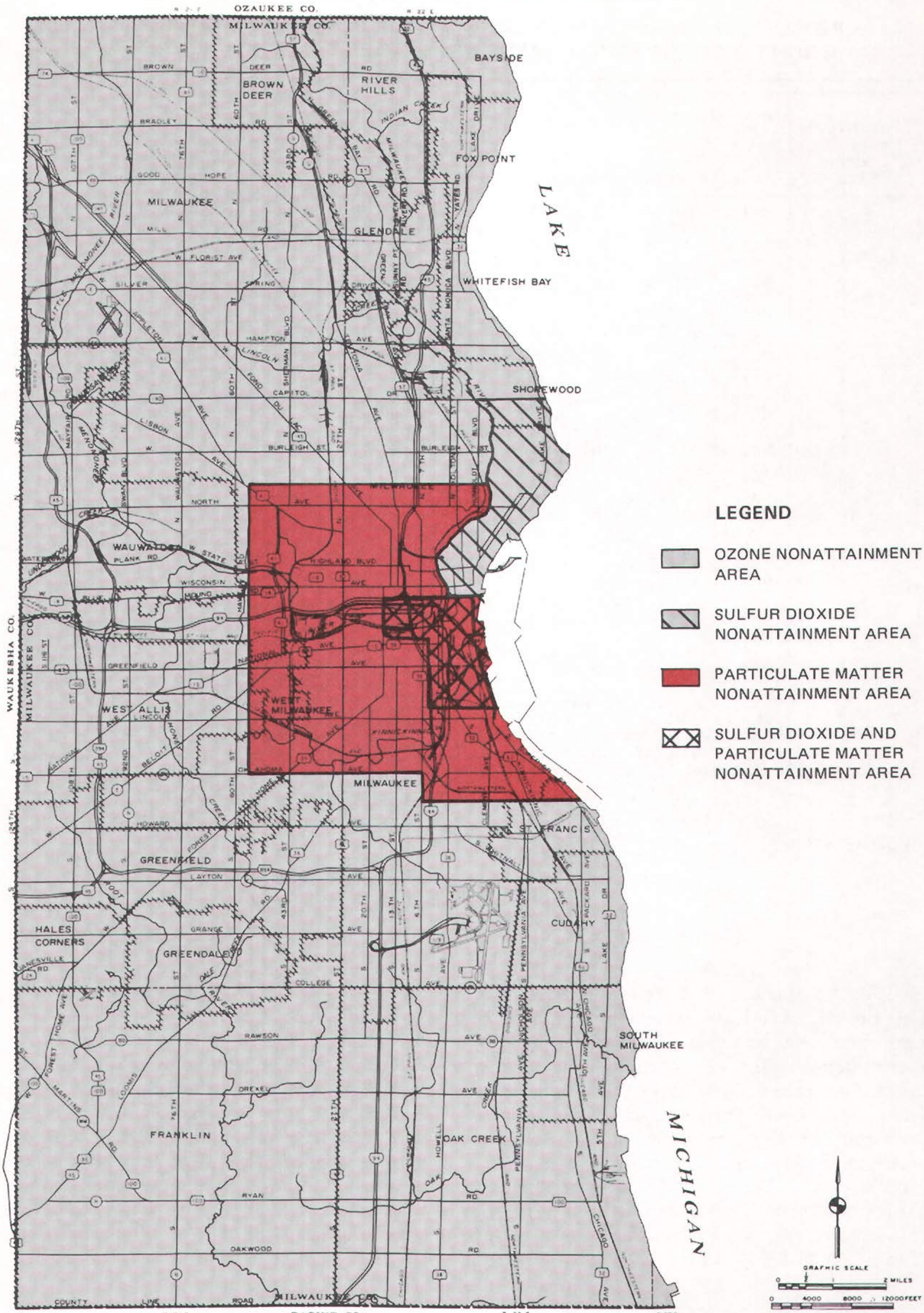
Potential Waste to Energy Site	Location of Site	Number of Potential Energy Users Proximate to Site	Total Annual Energy Use of All Proximate Energy Users (billion BTU's)
1	SW¼ of SW¼ of T8N, R21E, Section 9, City of Milwaukee	1	131
2	NW¼ of NW¼ of T8N, R21E, Section 22, City of Milwaukee	0	0
3	SE¼ of SW¼ of T7N, R21E, Section 1, City of Milwaukee	3	2,040
4	SE¼ of NW¼ of T7N, R21E, Section 7, City of Wauwatosa	3	1,010
5	SE¼ of SE¼ of T7N, R22E, Section 16, City of Milwaukee	2	1,040
6	NE¼ of SE¼ of T7N, R21E, Section 20, City of Wauwatosa	1	60.6
7	NE¼ of SE¼ of T7N, R22E, Section 20, City of Milwaukee	3	1,340
8	SE¼ of SE¼ of T7N, R22E, Section 30, City of Milwaukee	4	650
9	SE¼ of NW¼ of T7N, R21E, Section 34, City of Milwaukee	4	1,030
10	NE¼ of SE¼ of T7N, R22E, Section 32, City of Milwaukee	4	2,210
11	SW¼ of SE¼ of T7N, R22E, Section 33, City of Milwaukee	4	2,170
12	NE¼ of SW¼ of T6N, R21E, Section 2, City of West Allis	8	1,650
13	NW¼ of SW¼ of T6N, R21E, Section 2, Village of West Milwaukee	5	1,160
14	NE¼ of NW¼ of T6N, R21E, Section 12, Village of West Milwaukee	7	1,470
15	SE¼ of SW¼ of T6N, R21E, Section 7, City of Milwaukee	4	426
16	SW¼ of SW¼ of T5N, R22E, Section 13, City of Oak Creek	4	1,040
17	SE¼ of NE¼ of T5N, R21E, Section 22, City of Franklin	1	0.025

Source: SEWRPC.

emissions at a ratio of greater than one to one. The amount of emission offset would be dictated by the size of the new facility, the quality of the emissions, and the areas which would be impacted. It is important to note that present Department of Natural Resources guidelines require that such emission offsets be attained either through internal reductions or by using emissions credits obtained from an existing source, providing that the other source was determined to be impacting the nonattainment area to the same or greater degree than the new source. Alternatively, the size of the facility and the use of sophisticated pollution controls could be such that the emissions would be below 10 tons per year for each of the above-referenced pollutants. Accordingly, this criterion was not used to preclude the siting of an incinerator facility in the County.

Map 32

AMBIENT AIR QUALITY NONATTAINMENT AREAS IN MILWAUKEE COUNTY: 1984



Source: Wisconsin Department of Natural Resources and SEWRPC.

Historical and Archaeological Sites

As indicated in Chapter II, there are more than 10,000 known historical and archaeological sites in Milwaukee County, including 102 sites which have been placed on the National Register of Historic Places. Regulations require that detailed analyses be conducted by the State Historic Preservation Officer should a project, such as the siting of a landfill or incinerator, have the potential to adversely affect a historically or archaeologically important site or area.

Additional Siting Considerations

The criteria set forth herein for use in evaluating the suitability of sites for locating a landfill or an incinerator facility deal primarily with physical considerations. There are certain nonphysical factors, however, which must also be considered in evaluating the suitability of a potential landfill or incinerator site. One of these factors is anticipated changes in land use as indicated by adopted local land use plans, zoning ordinances, and pending development projects. Another factor is potential public opposition. While these nonphysical criteria are important and must be considered, such consideration is more appropriate at the facility level of planning. Accordingly, such considerations were not included in this planning effort, with the exception of proposed land development committed in the form of an approved project plan which would be inconsistent with the siting of a solid waste landfill or incinerator facility. In such cases, the site was considered to have low potential for a landfill site.

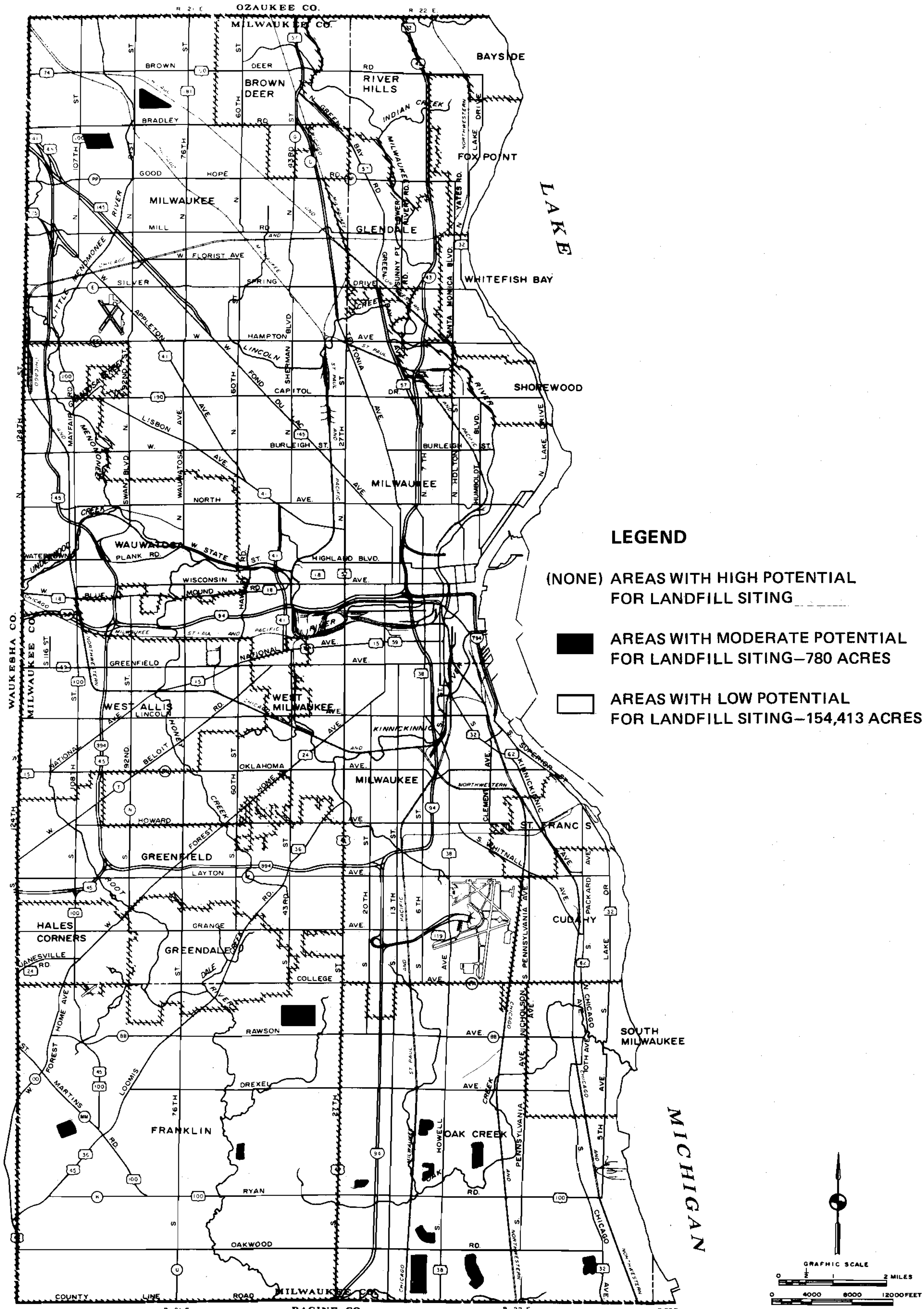
SITE LOCATION RANKING

After applying each category of criteria for siting a landfill or an incinerator, composite maps were prepared. Three suitability classifications were used for landfill siting. As shown on Map 33, approximately 155,193 acres, or all of the total area of the County, were initially considered for landfill development in the study area. Of this total, approximately 154,413 acres, or 99 percent, were categorized as having a low potential for landfill siting. The large extent of this area is due primarily to the extent of urbanization within the County. In addition, approximately 780 acres, or less than 1 percent of the total area of the County, were classified as having only moderate potential for landfill siting. This potential, however, is somewhat limited; and any sites located in these areas may be expected to require more intensive engineering and to entail higher site development costs. It can be noted that no areas of the County are considered to have a high potential for a landfill site. However, the general siting analyses have focused on physical criteria which have been used chiefly for siting evaluations for general, mixed-refuse solid waste landfills. There are somewhat different design requirements for landfills designated only for particular solid wastes, such as incinerator ash. These special-use landfills might be more readily engineered for sites with moderate or low potential for a landfill. These areas should be given first consideration in future landfill siting studies should it be concluded that a new landfill is to be part of the recommended plan.

With regard to incinerator siting, 17 potential sites were determined to have high enough potential to warrant further consideration, as shown on Map 34. More detailed analysis of these sites is necessary to determine their cost-effectiveness and overall feasibility.

Map 33

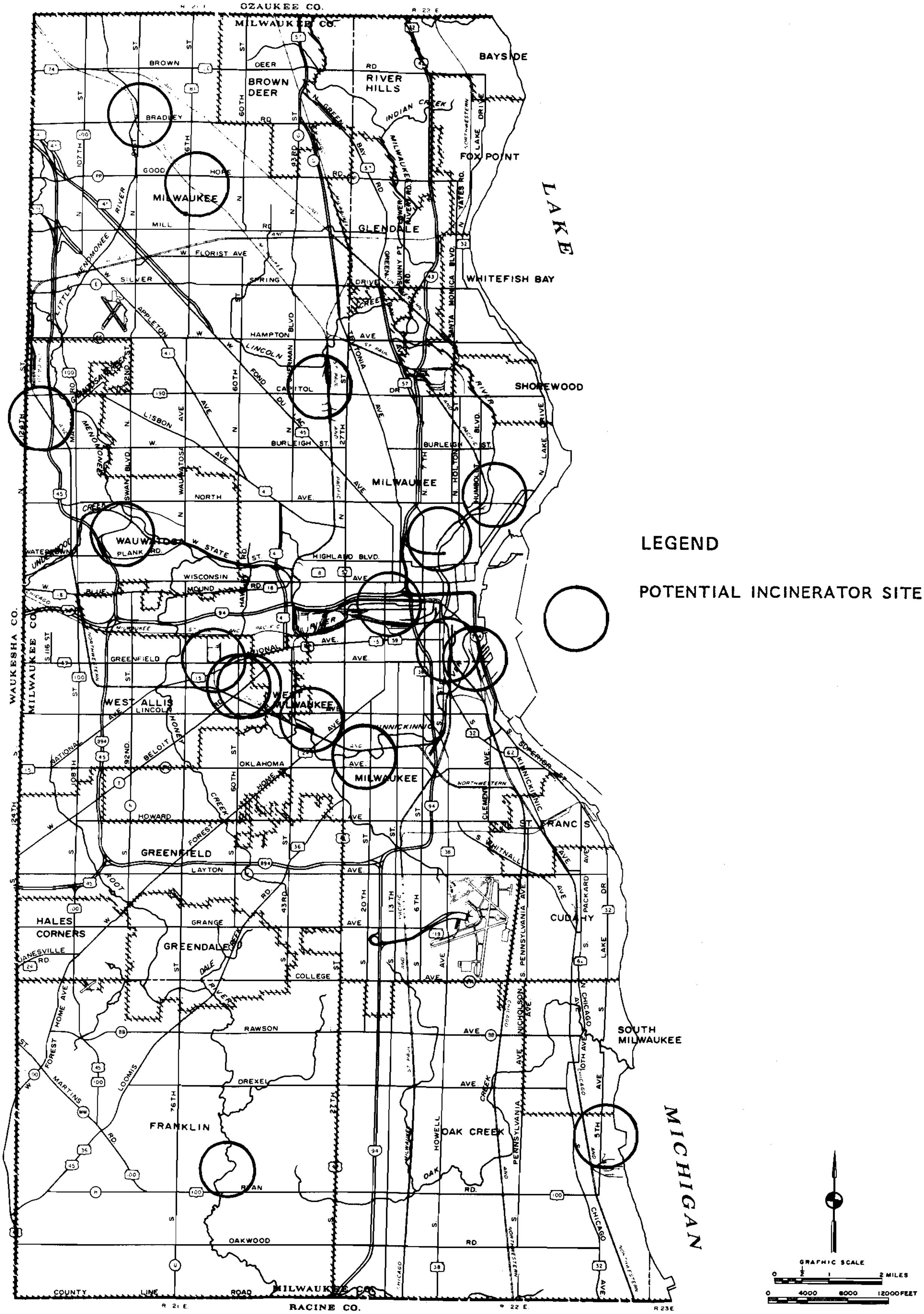
LANDFILL SITING POTENTIAL IN MILWAUKEE COUNTY



Source: SEWRPC.

Map 34

POTENTIAL INCINERATOR SITES IN MILWAUKEE COUNTY



Source: SEWRPC.

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Chapter V

INVENTORY AND EVALUATION OF SOLID WASTE MANAGEMENT TECHNIQUES

INTRODUCTION

The principal objective of the Milwaukee County solid waste management planning effort is the development of a cost-effective plan for the management of the solid wastes generated within the County. This chapter describes various solid waste management techniques that may be applicable in Milwaukee County. The techniques are related to 10 solid waste management functions: source reduction, source separation, storage, collection, transfer, transportation, processing, treatment, resource recovery, and disposal. This chapter also describes 12 alternative plans which were developed under the study by combining these techniques in various ways to meet the needs of the study area. These 12 plans will be considered in greater detail in Chapter VI.

This chapter is divided into three sections. The first section describes each of the solid waste management functions, including the four necessary functions of pre-collection storage, collection, transportation, and disposal; and the six optional functions of source reduction, source separation, transfer, processing, treatment, and resource recovery. This section also describes the various techniques which can be used to perform each of the 10 solid waste management functions. It should be noted that decisions concerning the need for, and techniques to be used in, performing certain solid waste management functions--including pre-collection storage and collection--are best made by the individuals and local units of government concerned, and are not, therefore, considered in detail in this study. Also set forth in this section are those factors considered in determining the applicability of the various techniques within the study area.

The second section of the chapter identifies those techniques which were found to have the greatest potential for application within the study area, and which, as such, warrant more detailed consideration. The third section of the chapter sets forth 12 alternative plans developed by combining the applicable solid waste management techniques into logical sets. A comparative evaluation of the alternative plans, including comparative cost analyses, is presented in Chapter VI of this report.

SOLID WASTE MANAGEMENT FUNCTIONS

Solid waste management in the State of Wisconsin, and throughout the country, is undergoing change. This change is due, in part, to the development of improved methods of storage, collection, transfer, transportation, and disposal, and to increased public interest in source reduction, source separation, processing, treatment, and resource recovery. This change is also due to the need to minimize both the monetary and environmental costs of managing the increasing quantities of solid wastes generated by our society. Consequently, any solid waste management study must consider the latest techniques for solid waste management. Yet, to assure a workable solid waste management plan, it is also important that the techniques to be considered have been proven to be practicable and reliable. This section discusses the various solid waste management functions and the techniques available to perform each function. Table 31 lists these solid waste management functions and associated techniques, and presents pertinent data on those techniques. This section also identifies those techniques which are considered applicable within Milwaukee County. More detailed data on each process can be found in the references listed in Appendix D.

Source Reduction

Source reduction can be defined as the implementation of policies and practices to reduce the rate of solid waste generation. The purpose of source reduction is to reduce the quantity of solid waste to be handled in the subsequent solid waste management functions which deal with solid waste once it is generated.

There are four means of source reduction: product reuse, conservation of nonconsumable materials in products, reduced product use, and increased product life. The option of product reuse requires a shift from the use of disposable products designed to be used only once to the use of products which can be reused, such as returnable beverage containers in lieu of nonreturnable containers. One example of an attempt to apply source reduction has been the introduction of legislation to promote the reuse of beverage containers through special charges on nonreusable containers. Such legislation has been proposed but not enacted in Wisconsin; however, the neighboring states of Michigan and Iowa do have such legislation in effect. The option of decreasing material usage in products involves practices such as eliminating excess packaging. The option of decreasing consumption promotes a reduction in the use of disposable products by consumers. The option of increased product life involves the redesign of products for longer use and for ease of repair and maintenance. This type of source reduction applies particularly to durable goods such as tires, appliances, and furniture.

The advantages of source reduction as a solid waste management function are that it involves no direct local costs, it provides potential savings in the energy required in production, and it reduces the costs of solid waste management. It is estimated that through source reduction measures, the quantity of waste generated could be reduced by up to 10 percent by weight.[1] The disadvantages of source reduction are that it requires changes in producer and consumer behavior, and since production and distribution systems are often national in scope, local units of government have limited ability to implement a waste reduction program which extends beyond the procurement policies of the local government itself. The inventory data presented in Chapter II indicated that local government activities account for a relatively small proportion of the total county solid waste stream. Consequently, it may be concluded that little can be done at the county and local level to significantly reduce the amounts of waste generated. The reduction of wastes generated is, nevertheless, a desirable goal. Public education efforts at the state level could

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[1]Wisconsin Department of Natural Resources, Wisconsin Solid Waste Management Plan, February 1981.

Table 31

SELECTED INFORMATION ON SOLID WASTE MANAGEMENT TECHNIQUES

Solid Waste Management Function and Associated Techniques	Advantages to Application in Milwaukee County	Disadvantages to Application in Milwaukee County	General Cost Data	Conclusions Regarding Incorporation into Alternative Systems	Comments
<u>Source Reduction</u> Product Reuse Reduced Material Use in Products Increased Product Life Decreased Product Consumption	No direct local costs Provides for an energy savings in manufacturing	Requires changes in consumer habits No direct control beyond changes in local procurement policies	No direct local costs Potential savings in other solid waste management functions	Not specifically included in county plan alternative development because of limited local control	Legislation to promote the reuse of containers, which has been considered but not adopted by the State, is a form of source reduction
<u>Source Separation</u> Precollection Material Separation and Recycling Center Dropoff	Low technology Reduces disposal cost and landfill needs Reduces energy and resource needs Greater variety of materials can be collected Low equipment needs	Relies on volunteer workers and citizen willingness to participate Fluctuating markets Possible noise, potential traffic and vandalism problems	Initial startup cost of typical system--$10,000-$30,000 Product Market Prices Newspaper $20-$40 per ton Glass $45 per ton Ferrous metal $6-$45 per ton Aluminum $500-$700 per ton	Included in county plan alternative development	--
Precollection Separation and Collection of Separated Materials	Low technology Reduces disposal cost and landfill needs Reduces energy and resource needs Higher participation than drop-off center	Relies on citizen willingness to participate Can be costly to incorporate into collection system Fluctuating markets May require added equipment	Same product market prices as noted above	Included in county plan alternative development	--
<u>Storage</u> Standard Metal or Plastic Containers 20 to 32 gallon size	Animal-proof if in good condition Strength	Potential for rusting or cracking Higher initial cost than bags	$13-$25 per container	Not specifically addressed in county plan alternative development. General data are included	Analysis of alternative precollection storage systems should be made individually or locally
Plastic Bags	Reduce collection energy manpower and cost Add to heat content of waste	Increased susceptibility to animal entry Limited use for storing heavy or sharp items	Bag costs of about $0.10 each Can reduce collection costs by about 25 to 35 percent	Not specifically addressed in county plan alternative development. General data are included	Analysis of alternative precollection storage systems should be made individually or locally
Mobile Cart	Reduces hand labor Reduces number of containers	Require special equipment	$54 per cart	Not specifically addressed in county plan alternative development. General data are included	Analysis of alternative precollection storage systems should be made individually or locally
Mechanized Bulk Containers	Reduce hand labor Reduce number of containers Represent potential cost savings	Require special equipment Require storage and access space Require maintenance	Potential cost savings must be evaluated for each situation	Not specifically addressed in county plan alternative development. General data are included	Analysis of alternative precollection storage systems should be made individually or locally

Table 31 (continued)

Solid Waste Management Function and Associated Techniques	Advantages to Application in Milwaukee County	Disadvantages to Application in Milwaukee County	General Cost Data	Conclusions Regarding Incorporation into Alternative Systems	Comments
Collection					
Direct Haul by Residents to Disposal Site	Potential low costs	Not applicable to urbanized areas Potential traffic problems Individual vehicle fuel usage	--	Not specifically addressed in county plan alternative development. Not applicable in Milwaukee County	--
Centrally Located Bulk Containers	Potential cost savings Reduce hand labor Reduce number of containers to be handled	Requires special equipment Requires storage and access space Requires attendance and maintenance	--	Not specifically addressed in county plan alternative development. General data are included	--
House-to-House Backyard	Cans are not sitting at curb High level of service No individual participation or labor needed Higher flexibility in routing of collection vehicles	Costly Collectors enter private property	\$6-\$12 per month per household	Not specifically addressed in county plan alternative development. General data are included	Analysis of this alternative collection method should be made individually or locally
House-to-House Curbside	Lower cost than backyard Reduces fuel usage	Requires individual participation and labor Routing flexibility is reduced Aesthetics of containers at curb Special consideration may be needed for elderly and handicapped	15 to 40 percent less costly than backyard pickup \$5-\$9 per month per household	Not specifically addressed in county plan alternative development. General data are included	Analysis of this alternative collection method should be made individually or locally
Transfer					
Transfer Station	Potential savings in transport costs Reduces collection crew and equipment needs	Added materials-handling requirements Requires additional capital, operator, and maintenance costs	\$3-\$7 per ton	Included in county plan alternative development	--

Table 31 (continued)

Solid Waste Management Function and Associated Techniques	Advantages to Application in Milwaukee County	Disadvantages to Application in Milwaukee County	General Cost Data	Conclusions Regarding Incorporation into Alternative Systems	Comments
Transportation					
Individual Vehicle	Potential low cost	Traffic problems Not applicable in urban areas Individual vehicle fuel usage	--	Not included in county plan alternative development	--
Direct Haul by Collection Vehicles	Less costly if haul distance is short	--	\$0.18-\$0.24 per ton per mile	Included in county plan alternative development for selected areas	--
Larger Capacity Truck Transport Following Transfer	Potential cost savings for longer haul distances Reduces collection crew manpower and equipment	Requires additional equipment and transfer station investment and maintenance Added materials handling	\$0.10-\$0.15 per ton per mile	Included in county plan alternative development for selected areas	--
Processing					
Baling	Reduces volume Improves handling and transport Reduces landfill needs	Increased capital and operational cost Mechanical equipment maintenance requirements	\$9-\$14 per ton	Not included in county plan alternative development	Most applicable in areas which generate adequate quantities but have limited landfill capacity or long transport distances
Shredding	Reduces volume Improves handling and transport Reduces landfill needs Step toward resource recovery	Increased capital and operation cost Mechanical equipment maintenance requirements	\$10-\$17 per ton	Included in county plan alternative development only in conjunction with refuse-derived fuel resource recovery alternatives	--
Densifying	Reduces volume of waste Reduces landfill needs Potential for energy recovery	High capital costs Lack of established market for product	\$15-\$25 per ton if adequate markets for the product are available	Not included in county plan alternative development	--
Incineration	Reduces volume of waste Reduces landfill needs Potential for energy recovery	High capital and operation cost Requires air quality consideration High technology	\$25-\$50 per ton depending upon energy customers and type of facility Capital cost \$50,000 to \$150,000 per ton of capacity	Included in county plan alternative development	--

Table 31 (continued)

Solid Waste Management Function and Associated Techniques	Advantages to Application in Milwaukee County	Disadvantages to Application in Milwaukee County	General Cost Data	Conclusions Regarding Incorporation into Alternative Systems	Comments
Treatment					
Pyrolysis	Reduces volume of waste Potential energy recovery Reduces landfill needs	High capital and operation cost Feasibility not proven	--	Not included in county plan alternative development	--
Composting	Proven technology Reduces landfill needs	Little historical success in U. S. Lack of viable markets	$10-$15 per ton	Included in county plan alternative development	--
Bioconversion	Potential energy recovery Reduces landfill needs	Still in development stages Residue disposal problem	--	Considered in county plan alternative development as a special recycling item	--
Resource Recovery					
Landfill Methane Recovery	Energy recovery	Requires large existing landfill Irregular gas production Process is in early development stages	--	Included in county plan alternative development	--
Steam or Electricity Production with Incineration	Technology is improving High level of energy recovery Reduces landfill needs	High capital cost and operational requirements Need market for product High technology	$15-$50 per ton	Included in county plan alternative development	--
Refuse-Derived Fuel	High level of energy recovery Reduces landfill needs	High capital cost and operational requirements Limited markets	$15-$25 per ton including metal and glass	Included in county plan alternative development	--
Post Collection Material Recovery and Recycle	High level of resource recovery	High cost and operational requirements Developing process Market variability	$15-$25 per ton including metal and glass	Included in county plan alternative development only in conjunction with refuse-derived fuel alternative	--
Disposal					
Sanitary Landfill	Proven low level technology Generally low cost	Land required Limited resource recovery	$10-$25 per ton	Included in county plan alternative development	--

Source: SEWRPC.

provide information on the potential for reducing wastes through individual actions, and on the potential for state legislation to promote the use of reusable containers. Accordingly, it was determined that this function would not be addressed further as a component of alternative solid waste management plans for Milwaukee County.

Source Separation

Source separation can be defined as the division of solid wastes into recoverable and nonrecoverable fractions by segregating one or more materials--such as paper, glass, or cans--from the refuse prior to collection. For the purposes of this study, the term source separation was defined to include the subsequent steps needed to collect, store, and market the separated recyclable materials. The two main purposes of source separation are: 1) the recovery and reuse of recyclable materials, and 2) a reduction in the amount of solid waste which must otherwise be disposed of.

Source separation programs for residential wastes involve either providing centers to which the segregated materials can be brought, or collecting the segregated materials at the point of generation. As already noted, an amendment to Chapter NR 144 of the Wisconsin Statutes requires that, based on population criteria, 23 recycling centers be established in Milwaukee County by July 1, 1986. The segregated materials that are collected are transported to a site for processing and subsequent delivery to a manufacturer for use as raw materials. Industrial and commercial wastes are recycled through internal manufacturing processes, by transport of the wastes to private recycling operations, or by collection and transport to processing facilities by private contractors.

Newspaper and mixed wastepaper are the materials most often collected in source separation programs. These are normally the most abundant recyclable materials in the total solid waste stream, and are readily separated from other refuse. In Milwaukee County, paper is estimated to make up approximately 75 percent by weight of the recyclable materials in the solid waste stream, and 40 percent by weight of the total solid waste stream. Cans and glass are also often separated and collected. For these materials to have a market value, ferrous and aluminum cans must be separated from each other as well as from the rest of the solid wastes, and glass must usually be separated by color. The volume of the separated material is normally decreased by flattening, shredding, or crushing. Waste oil is another material which can be effectively recycled after collection at central locations. The materials most readily recycled--paper, glass, metals, and oil--constitute by weight about 50 percent of the total solid waste stream generated in Milwaukee County.

As discussed in Chapter II, source separation and recycling are significant elements of the solid waste management function in Milwaukee County. Industries and commercial establishments in the County perform a major role in the recycling effort. About 70 percent of the industries that responded to the industrial survey conducted as part of the study practiced some type of recycling. The major industrial and commercial wastes recycled by industries in the County include paper and cardboard, scrap aluminum, scrap steel, oil and grease, chemicals, plastics, and food processing wastes. As previously mentioned, these wastes are recycled by internal manufacturing processes, by transport to private recycling operations, or through collection and transport by private contractors.

Another important contribution to the recycling effort is made by citizens and local community groups. Most of these recycling efforts are carried out by nonprofit community organizations such as the Boy and Girl Scouts, churches, and high school classes. Programs to collect paper, aluminium, and glass are being carried out by nonprofit groups organized specifically to promote recycling in the Villages of Brown Deer and Hales Corners. Additional limited recycling programs are being conducted by local units of government in the Cities of Cudahy, Glendale, Greenfield, Milwaukee, Oak Creek, South Milwaukee, Wauwatosa, and West Allis, and the Villages of Bayside, Fox Point, Greendale, Shorewood, West Milwaukee, and Whitefish Bay.

Further consideration herein of recycling relates primarily to residential solid wastes. For the purpose of this planning effort, it was assumed that industrial and commercial wastes would continue to be recycled through primarily private efforts. Consequently, further evaluations will not be concerned with the recycling of industrial and commercial wastes.

There are several steps involved in initiating a source separation program for residential wastes. These steps include a survey of citizen support, a survey of markets for recoverable products, a public information program on the benefits of recycling and on the actions required, an assessment of equipment and labor needs and of cost-feasibility, consideration of source separation ordinances, selection of operating procedures and hours, and implementation and monitoring.

Figure 7 shows the volume of materials that would be collected in a source separation program in Milwaukee County under varying levels of participation. Based on national studies,[2] the most successful source separation programs have recovered from 50 to 65 percent of the newspaper, 40 to 50 percent of the glass, and 20 to 30 percent of the metal cans in the total solid waste stream. Even voluntary programs that are well publicized and have some recycling experience, such as waste paper drives by community organizations, may expect to achieve only moderate participation at best. Mandatory programs may approach the maximum participation level, while programs with little publicity and minimum citizen interest may be expected to achieve only a minimum participation level. In Milwaukee County it is estimated that an average of 80,000 tons per year over the plan period, or about 16 percent of the residential solid wastes generated, could be recycled through highly successful, maximum participation, source separation programs; while an average of 25,000 tons per year, or about 5 percent of the residential solid wastes generated, could be recycled through moderately successful programs.

The value of recycled materials varies considerably, as shown in Table 32. It is possible to increase the market value of the source-separated materials by processing to improve uniformity and size. By processing the materials, however, the programs may incur additional capital and labor costs. Thus, the decision to process should be preceded by careful analyses of the potential increase in revenues which may be expected to offset the additional costs incurred.

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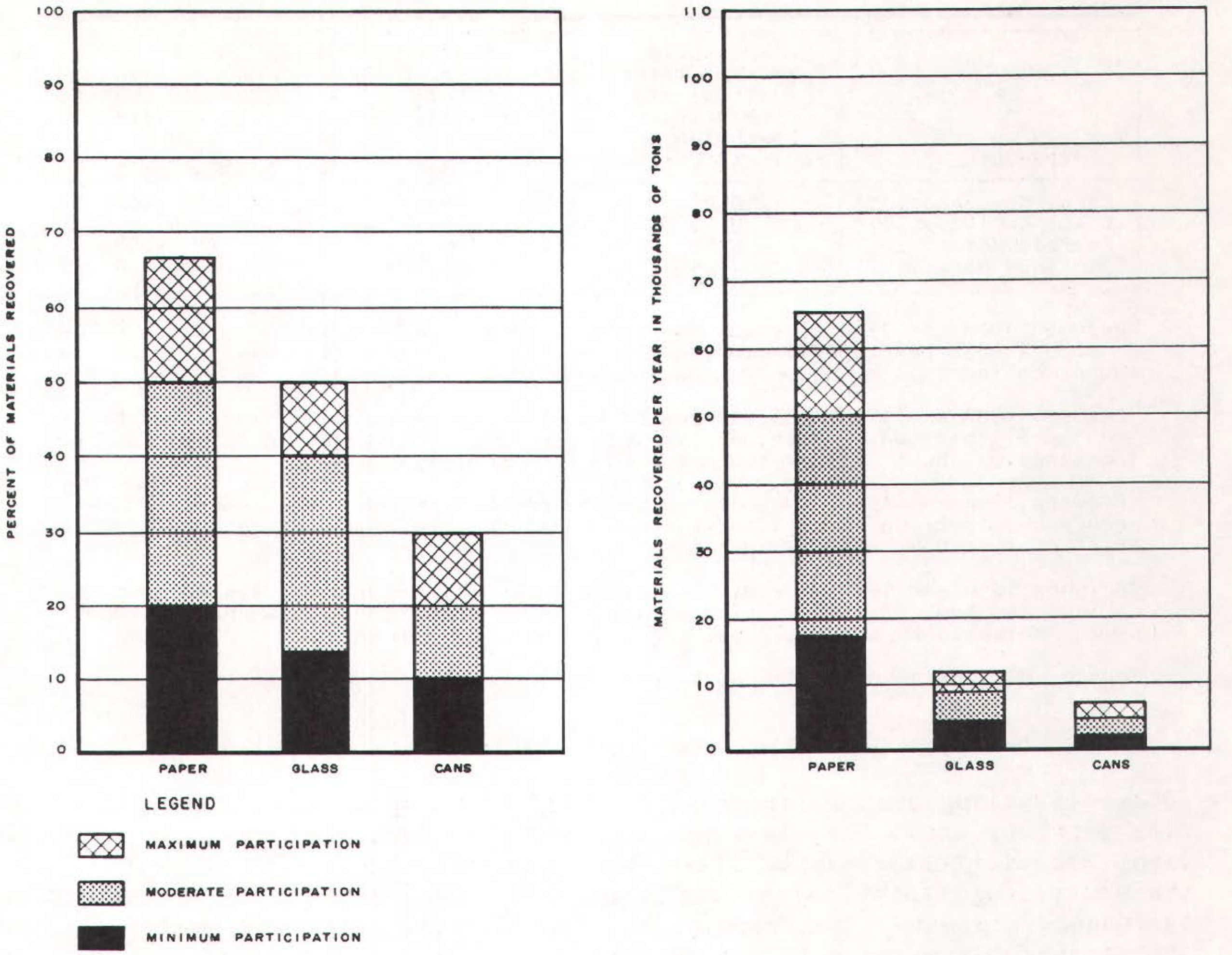
[2]U. S. Environmental Protection Agency, Source Separation Collection and Processing Equipment, A User's Guide, 1980.

Figure 7

ESTIMATED AVERAGE ANNUAL RECOVERY OF SOURCE-SEPARATED MATERIALS FROM RESIDENTIAL WASTES UNDER DIFFERING LEVELS OF PARTICIPATION IN MILWAUKEE COUNTY: 2010



Source: SEWRPC.

Paper can be upgraded at a lower cost than can glass or metals because paper is readily shredded and baled, and because markets do not require that paper be as pure as other recyclable materials. Paper can also be recovered in relatively greater volumes in comparison to cans or glass, and, therefore, its recycling is potentially more effective in reducing the demand for landfill space. The market price of paper varies, but baled paper is usually worth more than unbaled paper. Systems to separate ferrous from nonferrous cans are slightly more complex than systems to process paper. The cans are separated magnetically and then flattened or shredded for shipment. Metal cans make up a smaller portion of the total recyclable material in the waste stream than do paper or glass, and the market price is generally lower than that of glass (see Table 32). Processing, however, can significantly improve the value of metal cans. Mixed cans have no industrial market, but separated steel cans were worth from $6.00 to $45 per ton in 1984. Aluminum cans bring the highest market price of any recyclable, $500 to $700 per ton in 1984, and, while occurring in lower quantities than other recyclables in the total waste stream, provide the highest profit margin per ton.

Table 32

RANGE IN MARKET PRICE OF UNPROCESSED RECYCLABLE MATERIALS: 1984

Product	Industrial Market Price (FOB) of Unprocessed Recyclables (dollars per ton)	Industrial Market Price (FOB) of Processed Recyclables (dollars per ton)	Local Prices for Unprocessed Recyclables: 1984 Range (dollars per ton)
Baled Newspaper....	0-25	20-60	20-40[a]
Glass Cullet.......	0-25	35-60	45[b]
Ferrous Metal......	0-45	10-80	6-45[c]
Aluminum Metal.....	450	500-700	500-700[d]

[a] Between 1980 and 1984, the maximum price paid for baled newspaper increased by as much as $25 per ton for limited time periods. However, the average annual maximum price remained relatively constant over that time period.

[b] Between 1980 and 1984, the maximum price paid for glass cullet increased by as much as $15 per ton for limited time periods, and the average annual maximum price increased by about $10 per ton over that time period.

[c] Between 1980 and 1984, the maximum price paid for ferrous metal increased by as much as $30 per ton for limited time periods. However, the average annual maximum price increased by about $5 per ton over that time period.

[d] Between 1980 and 1984, the maximum price paid for aluminum increased by as much as $100 per ton for limited time periods. However, the average annual maximum price increased by about $20 per ton over that time period.

Source: Wisconsin Department of Natural Resources and SEWRPC.

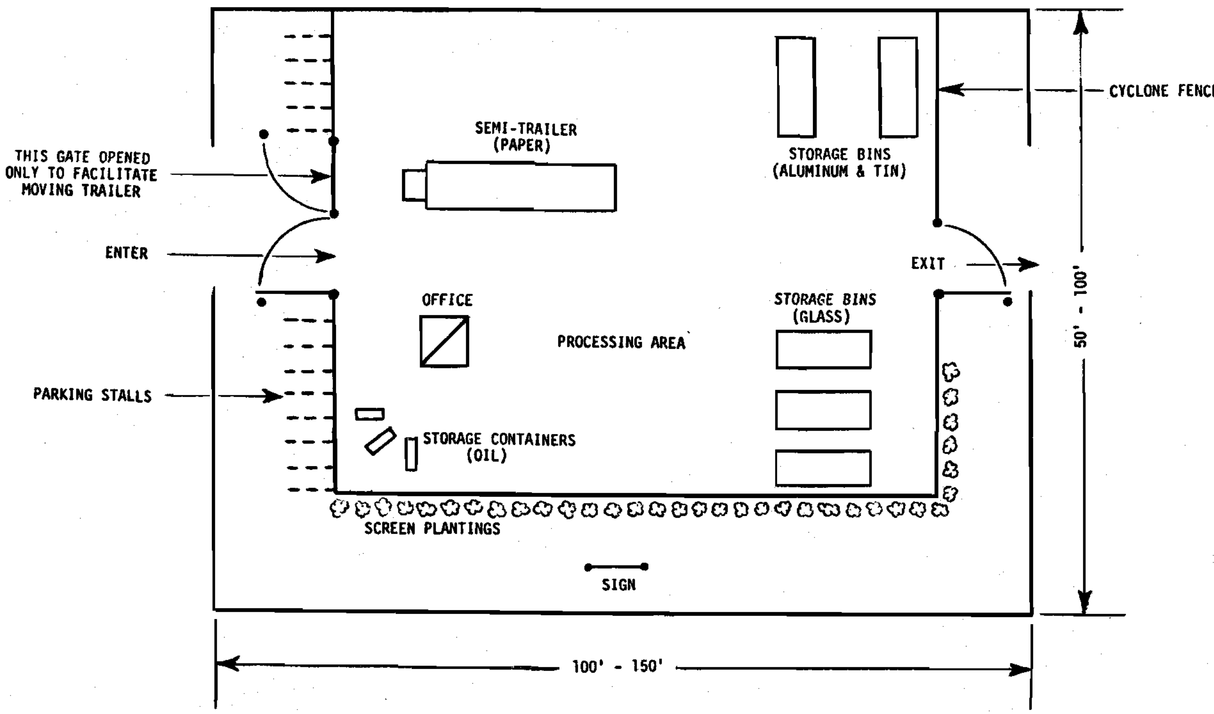
Glass recycling systems are considerably more complex than recycling systems for paper or cans. The glass not only must be separated by color, but also from ceramic contaminants. Glass can be separated prior to collection or at the recycling center. After the glass has been cleaned, it is crushed and screened to remove metal caps, rings, and labels. Labor and equipment needed to process glass are more costly than needed to process paper or cans; however, glass recycling often generates greater revenues. Glass can be recovered in large quantities and in 1984 had a market price of $45 per ton. In general, processing beyond that which can be done readily by unskilled hand labor is difficult to implement at the local level. However, certain commercial recyclers do have mechanized equipment to process the glass prior to sale for reuse.

The principal advantage of a source separation program is its potential to reduce the costs of subsequent solid waste management functions. Also, this option involves low technology which has been proven to be workable. Another advantage is that revenue can be obtained from the sale of the recyclable material.

One of the disadvantages of source separation is a potential reduction in the heat content of the total solid waste stream, along with a reduced potential for heat recovery. Also, any successful source separation and recycling program may be expected to entail significant operation and administrative costs. Volunteer labor may not be consistent or reliable. Finally, the sale of recyclable materials, as well as the net cost of the program, may be affected by fluctuating market prices.

Figure 8

RECYCLING CENTER SCHEMATIC



Source: SEWRPC.

It is concluded that source separation is a viable component of an overall solid waste management program in Milwaukee County. As discussed in Chapter II, new state regulations will require that 23 recycling centers be operated in Milwaukee County by July 1, 1986. A recycling center is a site for temporary storage of materials before transport, processing, and reuse. The centers are to be operated by the local municipalities. Figure 8 illustrates the usual components of a recycling center.

Recycling Centers: The initial cost of establishing a recycling center varies with the size of the area required, the size and number of storage facilities needed, and the equipment required. The cost of a center designed to collect and store paper, glass, plastic, aluminum, metal, and waste oils may be expected to range from $10,000 to $30,000, excluding land costs, for a community or a portion of a community with between 10,000 and 25,000 households, which is the size range expected to be served by a typical recycling center. Costs can often be reduced substantially by making use of existing facilities and equipment which are not fully used for other purposes. There are private recycling firms which will assist in the establishment of a recycling center by providing storage containers as part of an agreement for the purchase of the recyclable materials.

The principal advantage of the use of recycling centers is that less labor and equipment are needed than for point-of-generation separate collection systems. As a result, lower costs are entailed. Because they can provide many different kinds of storage containers, recycling centers also can collect a greater variety of recyclable materials than can separate collection systems. The recycling center needs a staff to oversee operations and to transport the materials to a market or processor. Since recycling centers can operate independently of refuse collection programs, they can be staffed by volunteer labor provided by civic groups, which would be compensated from the revenue resulting from the sale of the materials.

The disadvantage of a recycling center program is that the volume of materials brought to such centers is generally significantly less than that collected under separate collection programs.

Because of the DNR requirements regarding recycling centers, and the relatively low cost of equipment and operation, the recycling center system was considered a viable option for Milwaukee County, and was utilized as a component in the development of alternative solid waste management plans.

Separate Collection System: If the source separation program is to be implemented through a separate collection system, the recyclable materials are normally collected by public works vehicles, such as pickup or stake body trucks. Use of these "adapted" vehicles, which can be used for a variety of other municipal operations, minimizes capital costs. Moreover, the vehicles are generally reliable and easily maintained. A growing number of municipalities, however, are using "special" collection equipment such as racks, trailers, and compartmentalized vehicles. Some collect two or more recyclable materials simultaneously, while others combine their recycling and refuse collection programs.

The purpose of a separate collection system is to provide a more convenient outlet for recyclable materials than a recycling center, and thereby encourage separation and recycling of materials. This type of collection can be more costly than recycling centers, particularly if provided on a regular basis, but two such operations currently being carried out in the Cities of Madison and Racine have proven that the revenues from the sale of recyclable newspaper and the cost savings at the landfill exceed the cost of operating such a collection system.

The City of Racine has been involved in newspaper recycling since 1974. Bundled newspapers are collected during the regular collection period and placed in racks on the collection vehicles. When these racks are filled, the newspapers are deposited at drop-off points along the refuse collection route. A separate vehicle then gathers them and transports them to the processing station where they are loaded on a semi-trailer, and then sold to a private contractor. The cost of this operation in 1984 was about $16,700. The revenue from the sale of the newspaper and the savings in landfill costs together approximated $42,550 per year in 1984. This program has demonstrated that revenues from such operations can exceed costs, and this margin may be expected to improve in the future as disposal costs at landfills increase.

In the City of Madison, a citywide program to collect bundled newspaper was initiated in 1971. The newspapers are collected during the regular collection period and transported to the processing station by the collection vehicles, which are equipped with racks. The newspapers are then loaded onto semi-trailers for delivery to a private contractor in Chicago, Illinois. The cost of this operation in 1984 was about $34,400. The revenue from the sale of the newspaper and the savings in landfill costs together approximated $42,500 in 1984.

The principal advantages of a separate collection system for recyclable materials are the increased level of participation in the program, smaller landfill costs, and the potential for higher revenues from the sale of the materials. The chief disadvantages are the initial equipment cost and the increased operation costs.

In Milwaukee County, the collection of residential solid waste is carried out predominantly by municipal collection systems, adding to the feasibility of a separate collection system.

Because of the potential profitability, the demonstrated feasibility, and the ease of implementation, a separate collection system was considered as a viable component in the development of alternative solid waste management plans for Milwaukee County.

Storage

Storage of solid waste can be defined as the temporary holding of the material in containers either prior to collection or following collection at a transfer or processing station. The primary purpose of the storage function is to accumulate a sufficient quantity of solid waste for economical collection and transport.

To choose the best storage containers for a collection system, the effects on the users, public health, and collection efficiency must be considered. Proper containers can save collection costs and energy use, increase the speed of collection, and potentially reduce a labor requirement. There are several types of storage methods. The most common type of storage container for residential waste is the 20- to 32-gallon, metal or plastic garbage can. These containers in 1984 cost from $13 to $25, are light weight, are not readily cracked or rusted through, and have tight-fitting lids. Containers larger than 32-gallons are usually not acceptable. The advantage of cans over bags is that they are animal-proof if kept in good condition. Compared to bulk containers, the cans have the advantage of not needing special mechanized equipment for collection. The use of many smaller cans at each stop increases the handling time required to load the refuse into the truck, while the use of larger or heavier cans increases the weight the residents and the collection crew must lift.

Plastic and paper bags are used both as can liners and as substitutes for rigid containers. Bag systems provide ease of collection through easier handling and do not require lid removal or set-back motion. Studies show that up to 35 percent of the collection cost can be saved through the use of bags. This savings is partially offset by the cost of the bags--in 1984, about $0.10 each. Bags, if properly used, also provide aesthetic benefits and are generally more convenient to the generator. The use of plastic or paper bags will slightly increase the amounts of those materials in the solid waste stream; however, the bags also increase the heat content of the solid waste. The disadvantages of bags include susceptibility to animal-caused damage, and the potential for breakage when used for certain heavy and sharp objects.

A third type of storage container used for residential solid wastes is the mobile cart, which is becoming more popular in many urban areas because of the potential efficiency and cost savings. In Milwaukee County, these carts are used in the Villages of Brown Deer and Shorewood, and in a portion of the City of Milwaukee. The carts, which have a capacity of about 10 cubic feet, have the advantage of being a larger capacity, uniform storage container which can result in more efficient collection. In addition, the cart system reduces the heavy physical labor involved in lifting containers under a manual system. These carts are generally wheeled to the curb by residents and picked up mechanically by specially equipped trucks. The disadvantage of these containers is that special equipment is required to lift them. Also, start-up costs are high. The carts cost about $55 per unit in 1984. However, communities that have implemented the system report substantial cost savings after the start-up costs are recovered. Consideration must be given to the width of alleys if a mobile system is to be considered.

In areas of concentrated multifamily residences and for certain commercial and industrial establishments, two- to four-cubic-yard metal containers--often called "green boxes"--may be used for storage of solid wastes. Larger units of up to 40 cubic yards in size can be used at larger commercial or industrial establishments and at construction or demolition sites. These containers also can be used in low-density residential areas as an intermediate or transfer station in the collection system, and, if placed at key locations, as drop-off centers for segregated or combined household wastes. A typical two-cubic-yard container cost about $300 in 1984. A 20-cubic-yard container costs about $3,000. These containers can be loaded and unloaded mechanically with special trucks equipped with a hoisting mechanism. In multifamily areas, several apartment buildings may use the same container. In some cases, these containers are unloaded onsite into a packer truck. In other cases, where the containers are larger, they are hoisted or pulled onto special trucks and hauled to the disposal or processing site for unloading. This type of container is also used at transfer stations.

Bulk containers and mechanized collection have long been regarded as an efficient and acceptable way of servicing apartment buildings and commercial establishments. Several of the more efficient residential solid waste systems in the United States use clustered storage and mechanized pickup, whereby more than one residence can be serviced per stop. Where there are proper storage areas and sufficient access space, and where economic analysis shows a potential cost savings, mechanized collection should be considered as a viable option.

In multifamily building areas, it is generally the most practical to use bulk containers designed for mechanized collection. Individual housing units should use properly maintained, lightweight metal or plastic cans of no more than 32 gallons in volume, weighing no more than 80 pounds when filled; plastic bags; or mobile carts when mechanized collection systems are determined practical on a local community basis.

Pre-collection storage primarily affects the design and operation of the local collection system and attendant costs. Decisions on the type of pre-collection storage can best be made at the local level. Thus, specific pre-collection storage techniques were not further considered in this study. Rather, the alternatives considered were all assumed to incorporate existing types of pre-collection storage.

Post-collection storage options at transfer stations or at processing facilities will be considered in the development of alternative solid waste management plans as part of the transfer and processing systems.

Collection

The collection operation can be defined to consist of the removal of solid wastes from the storage point at the place of generation. This operation begins when the collection vehicle leaves the garage, and includes all time spent on the route. The transport operation begins when the collection vehicle departs for the disposal or processing site from the last loading point. This operation includes the time spent at the disposal site and the time spent after leaving the disposal or processing site to return to the first container on the next collection route. The purpose of the collection function is to gather solid waste from the individual generators prior to transport to transfer, processing, or disposal sites.

Two types of solid waste collection and transport services are provided in Milwaukee County: municipally operated collection and transportation services, which provide the majority of the residential waste collection service, and private collection services, which provide the majority of the commercial and industrial solid waste collection services. The municipalities themselves provide the majority of the residential solid waste collection and transportation services in Milwaukee County in the Cities of Cudahy, Glendale, Milwaukee, Oak Creek, South Milwaukee, Wauwatosa, and West Allis, and the Villages of Bayside, Fox Point, Glendale, River Hills, Shorewood, West Milwaukee, and Whitefish Bay. Private contractors are used for the collection and transportation of residential wastes in the Cities of Franklin, Greenfield, and St. Francis, and the Villages of Brown Deer and St. Francis.

In Milwaukee County it is estimated that 60 to 75 percent of the total cost of solid waste management is incurred in the collection and transportation phase. Based upon existing trends, this percentage may be expected to decrease because of the improved efficiency in collection systems and expected increases in landfill disposal costs. The existing solid waste disposal facilities and transportation patterns for the residential and commercial solid wastes generated in and around the County are shown on Map 22 in Chapter II.

Private industry provides the vast majority of the collection and transportation services for commercial and industrial wastes in Milwaukee County. As shown in Table 20 in Chapter II, there are 115 licensed private collection services operating in the County. Private collection services can be arranged either on an individual contract basis with each commercial establishment or industry, or through contracts with an entire municipality.

There are four aspects of the collection function which warrant careful consideration in the design of a collection system: the point of collection, the frequency of collection, crew size, and the type of collection equipment. Decisions concerning the collection system for residential areas are best made locally, based on a community-by-community analysis, and individually in the case of commercial and industrial establishments. The following discussion on collection systems is provided to facilitate an understanding of the relationship between the collection function and other solid waste management functions.

Point of Collection: The solid waste collection point is generally either curbside/alley or backyard. Curbside/alley collection requires the resident to place the solid waste at the curb or alley for collection and to retrieve the empty storage containers. Backyard collection does not require special placement of residential storage containers by individual occupants.

Curbside/alley has the advantage of being the most productive and efficient type of service. The collection crews are not required to carry waste containers any significant distances, and fuel usage by collection vehicles is reduced. The disadvantages of this type of service are the need for special considerations in the case of the elderly and handicapped, and the fact that full containers must remain at the curb until pickup, thus limiting routing flexibility.

Backyard collection can take several forms. Collectors may remove refuse from the backyards of premises and return any reusable containers; or collectors may transfer the contents of a household container, in the backyard, to a larger receptacle which is carried out and emptied into the vehicle. The latter eliminates the need to return the resident's container after emptying it. The chief advantage of the backyard collection system is that it is the most complete service from the resident's viewpoint. In addition, the cluttering of curbs with containers and attendant litter is eliminated. The disadvantages of this service are significantly higher costs and the need for collectors to enter private property. Backyard pickup service offers a maximum degree of routing flexibility, but the low productivity and high costs of such pickup service frequently result in a decision to employ a more efficient collection system.

Modified versions of the backyard collection system include a set-out service and a set-back service. In set-out service, containers are carried out to the curb by collectors. Residents are responsible for returning their own empty containers. Full cans are therefore on the street only a short time, thus reducing litter. Because the containers may, for various reasons, remain at the curb for considerable periods, they should be set out with lids in place, and the lids should be replaced on the empty containers by the crew. In set-back service, customers bring their containers to the curb, and the collection crews return the empty containers to the yard. This method has less routing flexibility than the other two methods of backyard service and is not often used.

In all container pickup methods, it is desirable that only one round trip between household backyard and vehicle be required. The use of bags can help achieve this objective, since bags eliminate the need for a return trip to the backyard.

In Milwaukee County, curbside/alley pickup is the most prevalent collection method. The Cities of Cudahy, Franklin, Glendale, Greenfield, Oak Creek, and St. Francis, and the Villages of Brown Deer, Greendale, Hales Corners, and Shorewood, have curbside/alley pickup. Due chiefly to efficiency and associated costs, recent trends are away from backyard and toward curbside pick-up. One option is for municipal collection services or private collection services to offer a choice of curbside or backyard service, but charge a different rate for each. The Villages of Bayside, Fox Point, River Hills, and Whitefish Bay provide backyard pickup. The City of Milwaukee has both types of collection, and the Cities of Wauwatosa and West Allis have an option for either method, with different rates charged for each.

Frequency of Collection: For health and aesthetic reasons, the maximum acceptable time period between collections of residential wastes containing food wastes and other putrescible material is generally considered to be a week. Such collection is generally required to avoid the need for containers with large storage capacity or the use of individual compactors. In certain situations--such as during peak seasonal load periods--even more frequent collection may be required because of increased population and limited storage space. In other situations, where residents are amenable, less frequent collection may be possible if storage space and containers are available or compactors are used, and special care is taken to store the solid waste properly. For large bulky materials, collection can be much less frequent--up to once every six months.

In Milwaukee County, all communities have weekly collection of residential solid waste except the Villages of Bayside, Fox Point, and River Hills, which have collection at two-week intervals. An increase in frequency of collection will increase the costs of solid waste collection because of the more intensive use of labor and equipment.

Crew Size: The number of persons in a collection crew depends on the system, equipment, and type of service offered. In general, significant cost savings can be realized by using a minimum-size crew; there seldom is justification for using more than a two-man crew for curb/alley collection--and a one-man crew may suffice--or a three-man crew for backyard collection. Except for the driver, the crew-member time is nonproductive during disposal trips. Some communities in Milwaukee County use a shuttle system for disposal, whereby an empty collection vehicle is driven to the collection route so that collection can continue, while a driver transports the full truck to the disposal site. Systems utilizing a single crew member as a driver/loader with a side-loading or front-loading vehicle have been shown to be particularly efficient for curb and alley collection routes.

Collection Equipment: Although some noncompaction closed body trucks are still used for solid waste collection, the vast majority of collection trucks are front-, side-, or rear-loading compactors. Each design has its advantages and disadvantages. Side loaders are universally used in one-man manual collection systems because the driver-collector must be able to reach the storage container conveniently from his cab and must be able to load the truck at a point as close to the cab as possible to reduce walking time.

In Milwaukee County the most commonly used collection vehicles are 15- to 25-cubic-yard rear-loading compactors and 12- to 25-cubic-yard side-loading compactors. Small satellite vehicles are also used in some areas, with loads then being transferred to a larger collection vehicle. These satellite vehicles are often towed with the larger vehicle and used to do the majority of the collection, with periodic trips made to deposit the loads from the small vehicle to the larger vehicle. This requires the use of bags for the solid waste in order to make handling easier, since there is a duplication in handling the material.

When designing or modifying a collection system, decisions should not be made on the type of equipment and size of the crews until the policies regarding the level of service to be provided have been established. Only on the basis of these policies can the equipment and size of crews be selected. Other factors, such as round-trip time to the disposal site, street widths, local weight and height limits on vehicles, housing density, labor wage rates, and the amount of waste at each stop, will also have an impact on such decisions. Table 33 shows the productivity performance of 11 solid waste collection systems, and illustrates the productivity relationships between the various types of collection systems. Similar information for Milwaukee County is provided in Table 34.

Table 33

PRODUCTIVITY PERFORMANCE IN 11 RESIDENTIAL SOLID WASTE COLLECTION SYSTEMS

Level of Service by Point and Frequency of Collection	Type of Operation			Tons Collected per Crew Collection Hour	Households Served per Crew Collection Hour	People Served per Truck per Week	Costs[a]	
	Crew Size	Method	Incentive				Dollars per Ton Collected	Dollars per Stop
Curb or Alley Once-a-Week	1	1 side	Task	2.2	100.9	7,763	19.87	0.44
	1	1 side	8 hour	1.9	54.7	4,344	20.52	0.68
	2	1 side	Task	2.1	109.6	7,517	27.36	0.51
	2	1 side	8 hour	3.0	118.2	9,615	19.49	0.49
	3	2 sides	Task	3.8	99.2	7,060	24.28	0.89
	3	2 sides	8 hour	1.7	63.7	4,150	44.45	1.20
Curb or Alley Twice-a-Week	2	1 side	Task	1.3	88.5	3,636	29.87	0.89
	2	1 side	Task	--	--	4,607	43.43	0.68
	3	2 sides	Task	3.0	199.5	6,316	32.03	1.06
Backyard Once-a-Week	2	Tote barrel	Task	1.2	71.7	5,130	42.29	0.73
	2	Tote barrel	8 hour	1.1	43.8	3,690	46.40	1.11

[a]Costs updated to 1984 dollars by SEWRPC.

Source: David G. Wilson, Handbook of Solid Waste Management, 1976.

Transfer

Transfer of solid waste refers to the transfer of wastes from small collection vehicles to larger vehicles prior to transport over extended distances to either processing centers or disposal sites. A transfer station is the location at which wastes are temporarily stored and then transferred. The purpose of transferring wastes from smaller to larger vehicles is to reduce the cost of the transportation function; this is generally done by not utilizing the collection crew and equipment for transport.

In the transfer operation, the small vehicles can be private automobiles, pickup trucks, or, more commonly, collection and packer trucks. The larger vehicles normally are large capacity trucks, although barges and railroad cars are sometimes used in special situations. The popularity of truck transfer systems has led to the development of equipment specifically suited to this purpose. Two basic types of transfer systems have developed. The first is the direct-dump system whereby a collection truck or individuals dump by gravity into a large open-top trailer or container. In the second basic transfer system, wastes are transferred to a container equipped to provide pressurized horizontal compaction.

Although a transfer operation offers potential savings, the operation requires an extra materials-handling step and the construction of a transfer facility. The costs that are incurred include capital costs for land and facility construction, operation and maintenance costs for the transfer facility, and the costs for transport of the waste from the transfer station to the disposal site. Some years ago, before the development of improved equipment such as large one-man compactor trucks, it was possible to generalize on the haul distance for which the use of a transfer station would be cost-effective.

However, this is no longer possible, and each system must be analyzed for each major waste generation center to determine the point at which a transfer station is more economical than direct haul. Normally, a one-way distance of between 10 and 25 miles is the break-even point. To determine the feasi-

Table 34

PRODUCTIVITY PERFORMANCE OF SELECTED RESIDENTIAL SOLID WASTE COLLECTION SYSTEMS IN MILWAUKEE COUNTY: 1984

Level of Service by Point and Frequency of Collection	Type of Operation		Tons Collected per Crew Collection Hour	Households Served per Crew Collection Hour
	Crew Size	Incentive		
Curbside or Alley Once-a-Week	3	8.5 hours	1.7	29
	2	8 hours	2.0	54
	3	8 hours	2.5	84
	3	8 hours	1.0	34
Backyard and Curbside and Alley Once-a-Week	3	8 hours[a]	1.2	37
	2	8 hours	0.9	20
Backyard Once-a-Week	3	8 hours	1.0	34
Backyard Twice-per-Month	3	8 hours	1.3	19

[a]Employees are required to finish an assigned route. Actual time required is generally less than 8 hours.

Source: SEWRPC.

bility of using a transfer station, cost-effectiveness studies of alternative collection/transport systems must be made and trade-offs determined. A generalized approach to determining the feasibility of a transfer station is shown in Figure 9. Detailed costs for specific situations are provided in Chapter VI.

The principal advantage of transferring wastes is the potential reduction in cost and fuel which can be achieved by not utilizing the collection crew and equipment for transportation. Another advantage is that the transfer station can serve as a site for volume reduction processing.

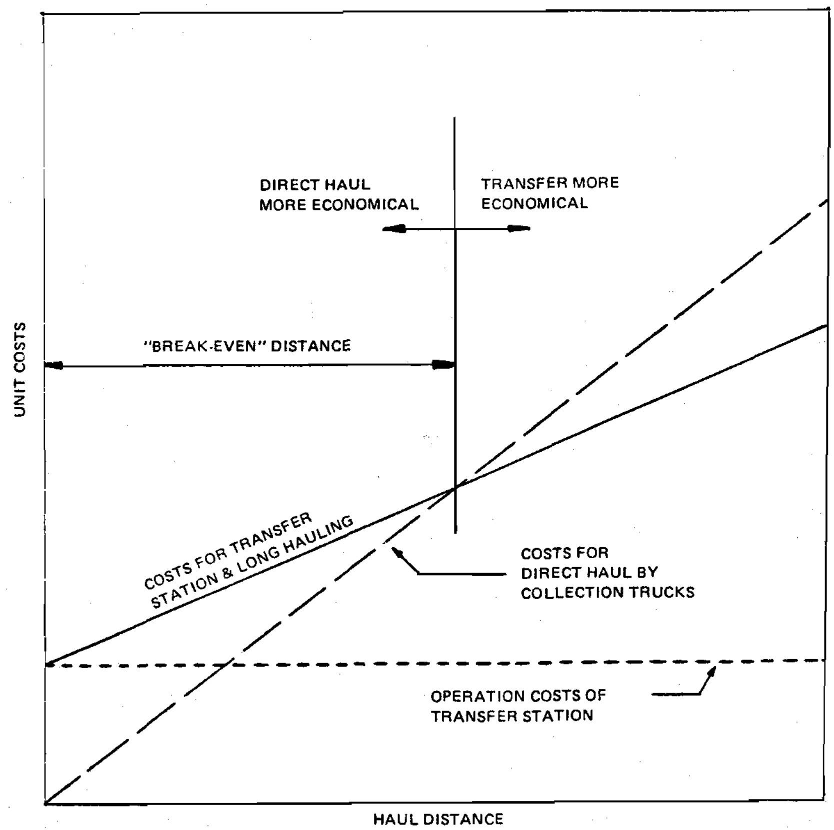
The principal disadvantages are the capital, operation, and maintenance costs associated with the transfer station, although these costs should presumably be offset by the savings in collection and transport costs.

As previously noted, transfer stations are currently an important feature of solid waste management operations in Milwaukee County. It is estimated that 390,000 tons, or 87 percent, of the residential solid wastes generated in the County are transported to one of the eight transfer stations listed in Table 21 in Chapter II. These eight stations serve as temporary disposal and consolidation points for all or most of the residential, and some commercial, refuse collected in the Cities of Cudahy, Glendale, Milwaukee, Wauwatosa, and West Allis, and the Villages of Shorewood, West Milwaukee, and Whitefish Bay. Additional solid wastes generated within Milwaukee County are consolidated at transfer stations operated outside the County by private contractors which operate in the County.

Because of the potential cost savings and the current widespread use of transfer stations, this technique was considered to be a viable option as a con-

Figure 9

GENERALIZED TRANSFER STATION
COST ANALYSIS SCHEMATIC



Source: David G. Wilson, Handbook of Solid Waste Management, 1976; and SEWRPC.

tinuing component in the development of alternative solid waste management plans for Milwaukee County.

Transportation

Although transportation of solid waste occurs, in fact, during collection, the term is herein defined as the relatively long-distance transport of solid waste following the time the collection vehicle leaves for the processing or disposal site from the last point of loading. The transport operation also includes the transport time after leaving the disposal or processing site to return to the collection route. The purpose of the transportation step is to deliver the solid waste to the processing or disposal site.

Transportation can be accomplished by rail, barge, or truck. Generally, rail haul is not competitive unless large volumes of processed waste are to be transported distances of greater than 100 miles. Barging is a special case limited to a few suitable geographic locations.

The type of transport vehicle used is dependent upon the amount and type of waste to be handled. Collection vehicles can be used for transportation. The two basic types of trucks that may be used following transfer are the open top trailer and the compacted load trailer. Other options include transport of open or enclosed containers with compactors used to receive wastes at the transfer stations. Trucks designed with hoisting or pulling mechanisms are used to transport these containers.

As discussed in Chapter II, in Milwaukee County solid wastes are transported to the transfer stations mainly by municipal vehicles. These vehicles range from 12- to 25-cubic-yard, or from about five- to 12-ton, packer trucks, and are either rear or side loading. Solid wastes are transported from the transfer stations to the landfill mainly by private collection services, which most commonly use tractor trailers with a capacity of up to 40 tons--or about 100 cubic yards.

The economic and other considerations of the transportation system are closely related to the type of transfer and processing operation to be used. Accordingly, this study included a detailed analysis of the transportation function. The results of this analysis are considered to be an integral component of any transfer and processing functions which are found viable in the development of alternative plans.

Processing

Processing can be defined as a physical or chemical process used to change the characteristics of solid waste to facilitate reuse or disposal. The purposes of processing are to reduce the amount of material, to improve its handling characteristics, or to improve its usefulness. The three processing techniques which are most commonly used are baling, shredding, and densifying. Incineration is sometimes classified as a processing operation and will be discussed in this section. Processing can be conducted at the point of reuse, at the point of landfill, or at an intermediate transfer location.

Baling: Baling is a mechanical method of reducing the volume of solid waste by high pressure compaction. Three basic types of solid waste balers are used. One type, developed on the principles used for baling scrap metal, achieves densities which are high enough to eliminate the need for baling wire. This type of baler requires preshredding. The second type, developed on the principles used in a "hay baler," is a horizontal, continuous push-through type of solid waste baler. Use of this system also requires pre-shredding in order to obtain a homogeneous material for the continuous feed hopper, thereby minimizing bridging or blockage in the hopper. The bales are secured by tie wires to facilitate handling. A third type of solid waste baler is based on the principles used in balers employed to bundle corrugated cartons at supermarkets and other commercial establishments. This type of baler requires no pre-processing, though tie wires are required because of the lower density obtained.

Densities of baled wastes vary from 1,000 to 1,800 pounds per cubic yard, depending on the type of baler used. The cost of baling may be expected to range from $10 to $14 per ton.

The principal advantages of baling are that the volume of the waste is reduced by up to 50 percent, and the waste is easier and less costly to handle and transport. Baling has recently become a more reliable process with the introduction of better equipment. The principal disadvantages are the initial capital investment required and the operational costs of the baling facility. Baling of wastes is generally most applicable in situations where large volumes of waste are generated but where nearby disposal sites are unavailable.

Since the emphasis of the alternatives developed for this plan will be on the reduction of the amount of waste to be landfilled, rather than on a reduction in the gross volume of waste to be disposed of, baling is not considered a viable option in the Milwaukee County study area. Accordingly, it was not considered as a component in the development of alternative solid waste management plans.

Shredding: Shredding is a generic term used for several similar size-reduction processing operations, including pulverization, milling, hammermilling, grinding, and comminution. The purpose of shredding is to reduce the volume of solid waste and turn it into a relatively homogeneous material which can be more easily handled. The most attractive feature is the bulk reduction achieved. When compacted in a landfill, shredded waste has fewer voids than unprocessed waste and the density can be increased by 25 to 50 percent. Shredding can also facilitate incineration and may be a necessary part of many resource recovery systems. The cost of shredding may be expected to range between $12 and $17 per ton.

The principal advantages of shredding are that the volume of waste when landfilled is reduced from 25 to 50 percent and the waste is easier to handle and transport. However, handling and transport is not improved to the same extent as with baled waste. Shredding also enhances the marketability of certain fractions of the solid waste stream. The principal disadvantage of shredding is the initial capital investment required for equipment and the operating costs of the shredding operation. Shredding of waste appears most applicable in areas where there may be a landfill capacity shortage and in situations where the solid waste could be recycled as a fuel.

As discussed in Chapter I, shredding of solid waste was an integral part of the Americology system operated in the City of Milwaukee from 1978 to 1981. That system is not in operation owing principally to problems which were encountered in burning the refuse-derived fuel in the boilers at the Wisconsin Electric Power Company Oak Creek power plant. However, this facility could be considered for reactivation in some form--perhaps with modification--as part of an alternative plan requiring refuse-derived fuel.

Shredding also appears to be a viable component for the automobile tire component of the waste stream. It was estimated that 830,000 tires are discarded each year in Milwaukee County. At the Owens Illinois Company in Tomahawk, Wisconsin, tires are burned as a fuel to produce process steam for use in industrial paper making. Shredded tires could be considered as a source of fuel for incineration systems, either using a dedicated incineration system for the tires, or using shredded tires as supplemental fuel for a general solid waste incinerator system during low loading periods.

Shredding was considered as a step in the operation of a system producing refuse-derived fuel in the development of alternative solid waste management plans for Milwaukee County. In addition, shredding is considered a viable process for waste tires.

Densifying

A process called densifying, which is similar to shredding, can be used on a relatively small scale; up to about 10 tons per hour of waste can be processed using this system. The process converts the bulky solid wastes into a more manageable size which allows for more convenient hauling. The advantages of densifying are a reduction in the volume of the wastes, which provides for less costly hauling and landfilling, and the potential for turning the waste into energy. The product material can vary from small pellets which are used as a fuel supplement to wood log-size bars which are marketed as wood substitute fireplace fuel. There is a market for this type of waste, although cost-effectiveness has not been demonstrated on a large scale. The principal disadvantages of densifying are the initial capital investment, and the lack of established markets for the products. In addition, there are limited large-scale operating systems as of this time. The quality of the product and its potential for use as a fuel can vary with the incoming waste stream. For example, if the amount of plastic in the solid waste becomes too high, the burning temperatures may exceed the desirable level. Should the product market become established, this system could become cost-effective. Review of available manufacturers' data indicates that cost-effectiveness may be achieved if the product can be marketed effectively for $30 to $50 per ton.

Because of the lack of demonstrated large-scale feasibility and market establishment, this process was not considered in the development of alternative solid waste management plans for Milwaukee County.

Incineration: Incineration is defined as the controlled burning of solid, liquid, or gaseous wastes. The main purpose of incinerating solid waste is to reduce the volume of, and the contaminants in, the solid waste material, with a secondary purpose being the production of energy. Certain end products of solid waste incineration require further processing or disposal. These include the particulate matter carried by the gas stream, incinerator residue, grate siftings, and process water. Bulky burnable wastes usually are not processed in an incinerator, since they either are too large to load in the combustion chamber, burn too slowly, or contain frame steel of a dimension and shape that could foul grate operation or the residue removal systems. Other large items, such as washing machines, refrigerators, water heater tanks, stoves, and large auto parts, cannot be handled by incineration. In addition, inert materials such as foundry sand would not be incinerated. Such materials make up approximately 20 percent by volume of the Milwaukee County solid waste stream at the point of collection.

Incineration can reduce the original volume of combustible wastes by up to 90 percent. In Milwaukee County it is estimated that 65 percent by weight of the total solid waste stream is combustible. Incineration still requires a landfill both to receive the ashes of the incineration process, and to receive those wastes that cannot be incinerated or recycled. Thus, incineration can provide only a partial solution to the waste disposal problem.

An October 1984 report to the U. S. Conference of Mayors indicated that there were 33 resource recovery incinerator plants with capacities exceeding 300 tons per day under construction or completed in the United States. The costs of incineration of solid waste vary substantially, depending upon the market available for the steam product generated and the size of the installation, but may be expected to range from $25 to $50 per ton. There are several types of incineration systems. Those that appear most applicable are the custom-designed refractory-lined furnace and boiler, smaller modular systems, and fluidized bed systems. Consideration was also given to an incineration system designed to generate energy for the specific purpose of drying wastewater treatment plant sludges.

Custom-Designed Refractory-Lined Incinerators--Custom-designed incinerators are designed primarily to reduce volume and contaminants in waste. These furnaces are refractory lined, contain grates which move the waste from a feeder mechanism to a discharge device, and are sized to permit the combustion of the burning gases to be completed within the furnace in a refractory-lined combustion chamber enclosure. Systems can be designed for heat recovery, with the recovered heat used to produce steam for space heating, industrial processing, and power generation purposes. The most common type of new system is one in which the solid waste can be fed as a fuel directly into the furnace without prior treatment. When the wastes are handled in this fashion, the process is referred to as a mass burning process. A diagram of a typical mass burn incineration system with heat recovery is shown in Figure 10. Alternatively, the refuse can be processed in some manner, such as shredding, prior to introduction into the furnace. Heat recovery generally is effected either by the use of a refractory-lined furnace followed by a boiler which converts the waste heat from the furnace to steam or hot water, or by use of a water-walled furnace which incorporates or is followed by a boiler for the conversion of heat to steam. Larger custom-designed facilities generally can be expected to have an initial capital cost of from $50,000 to $150,000 per ton per day of capacity, with the higher costs being attributed to designs for special air quality emission limitations or incorporating special construction requirements. Thus, a 300-ton-per-day unit could cost between $15 and $45 million.

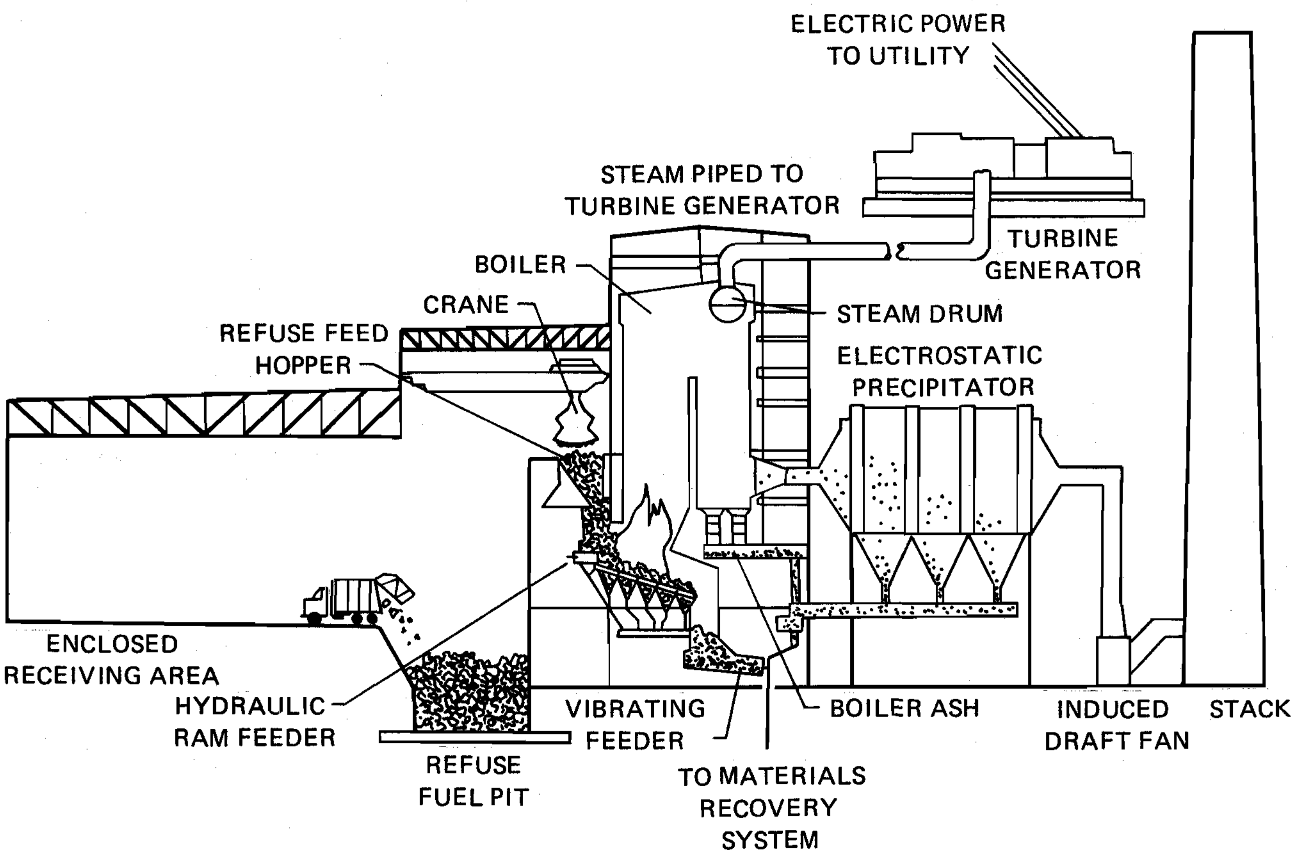
Modular Incinerators--Responding to the needs of industry to provide a means of disposing of space-occupying waste which contains a large combustible fraction, several manufacturers of incinerators have developed small, prefabricated incinerators with capacities of from one to five tons of waste per hour. In recent years, modular furnaces have also been used successfully for the incineration of municipal solid waste. Although smaller in size, modular units can be combined to form a relatively large system with capacities of up to 300 tons per day. Currently, there are a number of these systems under construction or in operation in the United States. They typically range in size from 50 to 300 tons of input per day, and cost from $4 to $20 million to construct.

While the "modular" type systems are smaller, they may serve a specific market and can be more cost-effective than the larger systems. Incineration using modular units may be attractive when smaller industrial or institutional customers are available for the energy recovered.

Fluidized Bed Incineration--Atmospheric fluidized bed incineration is of considerable interest to electric utilities. A schematic diagram of such a system is shown in Figure 11. The interest in these systems is due to the fact that they typically operate at higher combustion efficiencies and at lower excess air levels than do conventional systems. In addition, these systems have a more forgiving fuel feed system and can minimize air pollutant emissions. Preliminary estimates indicate that the costs of such systems may be substantially less than the costs of other types of systems, especially when

Figure 10

SCHEMATIC DIAGRAM OF MASS BURN INCINERATION SYSTEM WITH HEAT RECOVERY



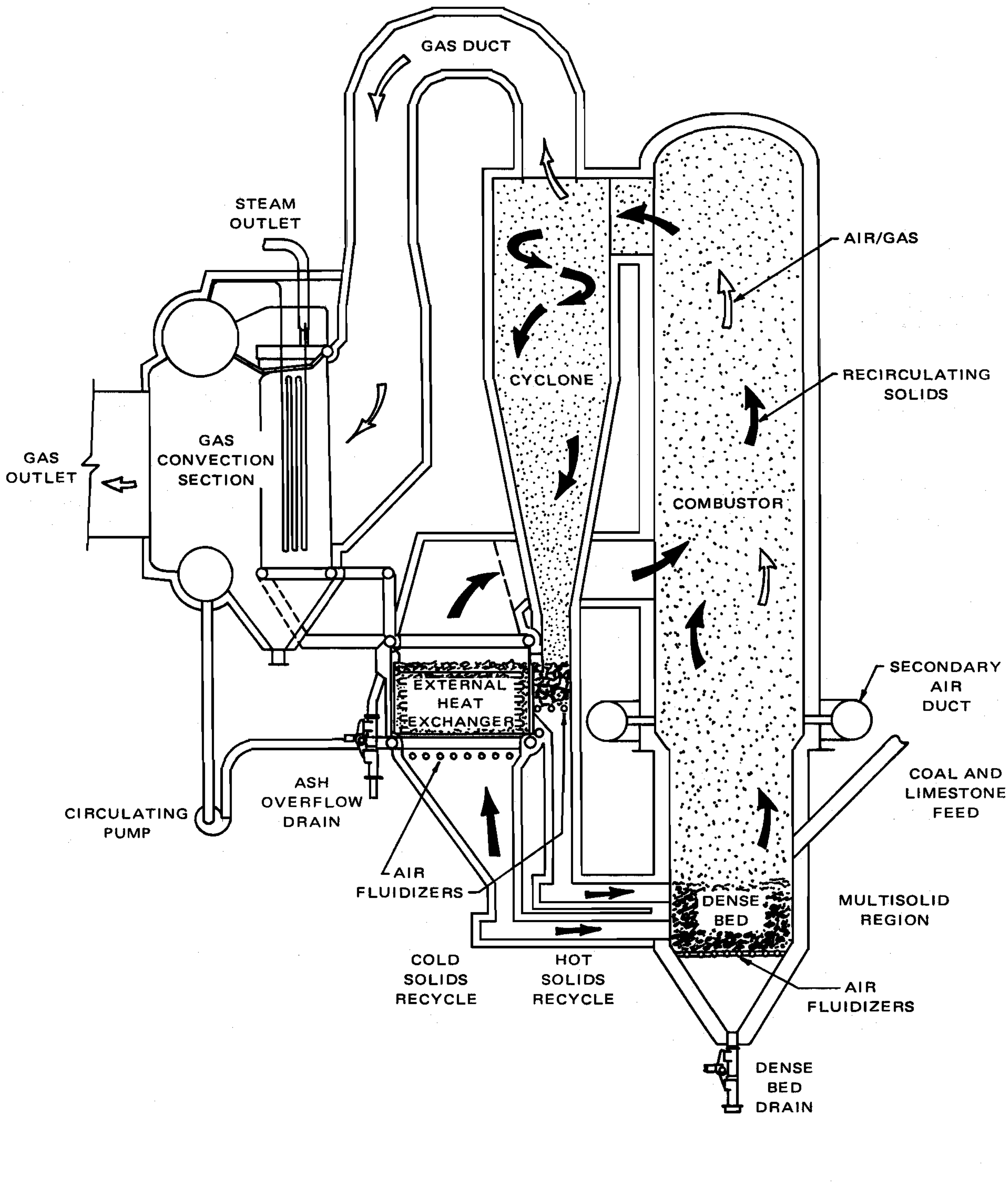
Source: Adapted from several incineration equipment manufacturer data sources by SEWRPC.

located in areas where air emission controls are stringent. At the present time, there are only limited operating data on these systems. However, because of their potential advantages, fluidized bed systems could be considered for use in the Milwaukee County plan pending the availability of additional data on large operating systems. The system would require the processing of the solid waste into a fuel product. However, it may be able to use a larger particle fuel size than other systems.

Cogeneration System for Sludge Drying--In 1984, the City of Milwaukee retained the firm of Black & Veatch to conduct a study of the feasibility of waste-to-energy resource recovery alternatives. These alternatives included using refuse-derived fuel or other forms of residential solid waste to produce steam that would be used by the Milwaukee Metropolitan Sewerage District to dry sludge in Milorganite production. A pilot study was conducted to evaluate the feasibility of using steam in the Milorganite production process. The study indicated that the indirect steam-drying process does not produce the desired quality of material for marketing as a commercial fertilizer. Additionally, drying the sludge directly with the incinerator off-gases was ruled out as a possibility since the product could be contaminated by that direct

Figure 11

SCHEMATIC DIAGRAM OF A
FLUIDIZED BED INCINERATION SYSTEM



Source: Power Magazine, February 1985.

contact. Therefore, the study concluded that the steam-drying process should not be pursued as an alternative to existing means for drying sludge for the production of Milorganite.

Incineration Conclusions: Incineration has the advantage of substantially reducing the volume of waste to be landfilled. As already noted, the system can be designed to recover energy and thus offset the costs of construction and operation. The main disadvantage is the high initial capital cost and the continuing high operation and maintenance costs. Incineration is considered a high technology system which requires specialized operators and equipment maintenance personnel. Furthermore, ash produced by incineration of solid wastes may contain materials which can result in it being categorized as toxic and hazardous. Should this occur, incineration may need to be restricted to residential wastes and limited commercial and industrial wastes; the ash may need to undergo pre-treatment prior to disposal; or the ash may have to be disposed of in a licensed hazardous waste landfill. In addition, incineration systems have the potential to contribute to air quality problems. The design of the systems must therefore take into account all state and federal air quality criteria and should provide enough flexibility to allow the systems to adapt to changes in the criteria. Depending upon the site in question, special air emission control measures may need to be designed into the system which provide for more stringent controls than required by State and federal law.

Because of the potential to reduce landfill needs, to recover energy from solid waste, and to reduce costs over the long term, incineration was considered as a viable option for use in the development of alternative solid waste management plans for Milwaukee County.

Treatment

Treatment can be defined as a biological or chemical process designed to change the character of solid waste. Treatment is used to convert solid waste to intermediate products and energy. Treatment processes include pyrolysis, composting, and bioconversion.

Pyrolysis: Pyrolysis is a process which utilizes the organic portion of the waste to produce oil, gas, and char, all three of which are marketable. This process has been tested at several pilot plant installations, including those in St. Louis, Missouri; Orchard Park, New York; Charleston, West Virginia; and El Cajon, California. Based on the performance of these pilot plants, the technological and economical feasibility of operating a full-scale pyrolysis plant is as yet uncertain. Because of this uncertainty, this treatment system was not considered feasible for use in Milwaukee County at this time.

Composting: Composting is a biological degradation process by which the organic materials in solid wastes are converted into a nuisance-free, humus-like material that can be used as a soil conditioner. Composting of municipal solid waste has been practiced in Europe and the United States for many years. The technology of composting is well advanced, and there are no technological barriers to use of the process. In the United States, composting plants have been established in various communities over the last 20 years. Many of these plants have not, however, been considered successful, and most have closed. The major problem has been the lack of a viable market for the compost produced. In Milwaukee County, efforts are underway to evaluate the potential for separating vegetative wastes from the solid waste stream for use in either composting or other recycling types of operations. In addition, the composting of vegetative material is desirable in a solid waste management system which includes incineration because the moisture content of the vegetative materials can adversely affect the efficient incineration of other combustible wastes. Because of these ongoing efforts, the composting option was considered further in the development of alternative plans for Milwaukee County.

Bioconversion: Bioconversion is a process whereby both solid waste and sewage sludge are used to create methane gas, which can be burned onsite or transported and used as a fuel. Rexnord Corporation, Inc., has gathered data on the process from an experimental plant operating in Pompano Beach, Florida. The plant has made use of technology based on bacteria that decompose organic material into simpler compounds in an anaerobic digestion system. The principal products of this process are methane and carbon dioxide. The solid waste material must be processed by shredding and metal separation prior to being introduced into the anaerobic digestion system. A flow diagram for a 200-ton-per-day facility is shown in Figure 12. The cost of this facility was estimated at $17 million, with annual operating and maintenance costs of $1.4 million. This capital cost includes an estimate of $8 million for an incinerator to burn the partially dried digested solid waste. Studies indicate that approximately 7,500 cubic feet of mixed methane and carbon dioxide gas are produced per input ton of raw refuse; thus, about 4,000 cubic feet of methane--equivalent to pipeline quality gas--per input ton could be produced by this process. Based on an average home gas consumption of 100,000 cubic feet per year, a 200-ton-per-day plant could serve the gas needs of more than 2,500 homes.

Because of the lack of large-scale operating experience with such a system, bioconversion has not been considered specifically in the development of alternative plans for Milwaukee County. It is, however, recommended that further developments in this process be monitored. Because of the local interest in bioconversion systems, this alternative is deemed worthy of consideration as a component of the plan at such time as more data are available.

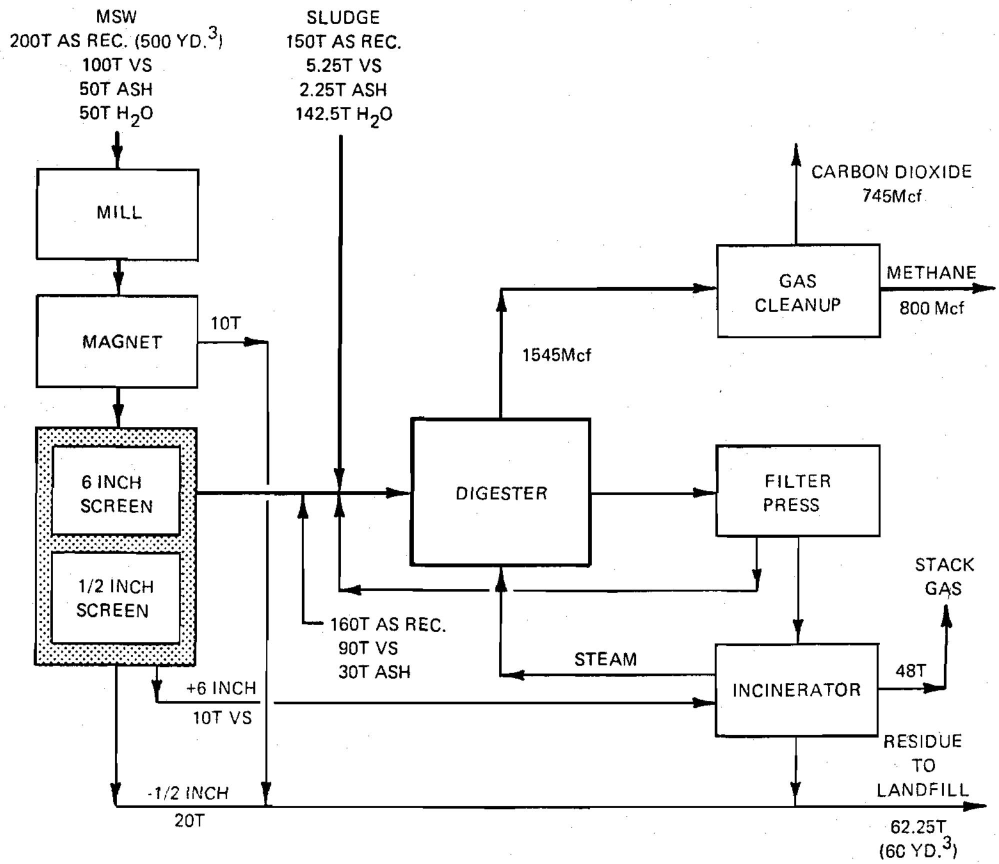
Resource Recovery

Resource recovery may be defined as the extraction of economically usable materials or energy from waste materials. In implementing a resource recovery system, both the markets and the technologies available must be carefully considered. Resource recovery systems include landfill methane recovery, steam production by incineration, and refuse-derived fuel (RDF) production.

Landfill Methane Recovery: Landfill methane recovery is a process in which methane gas is recovered at the landfill. The gas may be burned onsite or transported to power plants. However, the gas requires scrubbing to remove moisture and other impurities before burning. The gas is not produced at a constant rate, and, consequently, the available volumes are difficult to predict with reliability. This process is still in the early stages of development, but is seen as potentially feasible because of the relatively large size of landfills in and around Milwaukee County. In 1985, the operator of two large landfills--the Metro landfill in the City of Franklin within Milwaukee County, and the Omega Hills landfill in the Village of Germantown adjacent to Milwaukee County--announced plans to develop methane recovery systems. These systems would provide for recovery and burning of methane gas from the landfills, with the heat energy developed being used to generate electricity. The

Figure 12

FLOW DIAGRAM FOR A 200-TON-PER-DAY BIOCONVERSION SYSTEM



Source: Waste Management, Inc., and Gas Research Institute.

facilities are planned to have a combined capacity to produce 9,900 kilowatt-hours of electricity per day by recovering and burning about 6.5 million cubic feet of methane per day. This resource recovery system was considered viable for application in Milwaukee County, and therefore was considered in the development of alternative solid waste management plans for the County.

Steam Production by Incineration: It has been estimated that the solid waste generated in Milwaukee County has a heat value of 4,500 British thermal units (BTU's) per pound when preceded by separation of fractions which are not amenable to combustion, such as bulky material, construction debris, and wet vegetation materials. Steam production by incineration is another resource recovery process. Assuming combustion of 40 percent of the residential and commercial solid waste generated in the County, about 142,000 pounds of steam could be generated per hour--equivalent in heat value to about 23,000 gallons of No. 2 fuel oil, or about 3,300,000 cubic feet of natural gas per day. Assuming a value of $5.50 per 1,000 pounds of steam, this would result in a potential income of about $6,900,000 per year which could be used to offset the production cost. In addition, there would be a reduction in landfilling and transportation costs of about $5,200,000 per year which could also be used to offset the incineration facility cost. The potential energy production could be higher should a higher percentage of the County's solid waste be incinerated, presuming customers are available for the energy produced.

The production of steam and electricity from solid waste incinerators is a proven technology which, with efficient equipment and increasing energy costs, is currently receiving increased attention. This process is considered a viable option and was considered further in the development of alternative solid waste management plans for Milwaukee County.

The combustion facilities can be designed to burn waste which has been processed by shredding and removal of metals and other recoverable materials. Another option is the use of an incinerator system designed to burn solid waste which has received only limited processing to remove bulky unburnable or dangerous materials. This type of modified "mass burning" facility has less equipment requirements than the true mass burning type.

Refuse-Derived Fuel: The production of refuse-derived fuel (RDF) is another resource recovery option. This option entails several shredding and materials separation steps to produce the fuel. There are possible markets for such fuel in Milwaukee County, but they are limited. The Wisconsin Electric Power Company (WEPCo) is a potential market for RDF. Based on past unsuccessful experiences in the Milwaukee area as previously described, however, specially designed boilers would be required rather than modifications to existing systems, and this would entail major capital expenditures.

The City of Madison operates a resource recovery program which includes a high technology energy recovery system utilizing mixed municipal wastes. The plant, which began operation in 1979, presently processes up to 60 percent of the City's residential waste into RDF. Madison Gas & Electric, a private utility, has co-fired mixtures of up to 20 percent, by BTU, of RDF with coal for electric power generation with acceptable results. The Oscar Mayer, Inc., plant in Madison has also successfully used a co-fired mixture of up to 30 percent by BTU value of RDF with coal. The total cost of the Madison facility, including the processing plants, RDF receiving station, and boiler modifications, was $5.1 million. The system has a design capacity of between 400 and 500 tons per day and is currently operating at 250 to 350 tons per day. Operation and maintenance costs were about $1,488,000 in 1984.

In 1984, approximately 70,000 tons of solid waste was collected in the City of Madison. Of this total, approximately 59,700 tons were transported to the RDF processing facility, with about 56,900 tons determined to be processible into RDF. A total of 18,200 tons of RDF were produced and sold to the Madison Gas & Electric utility and the Oscar Mayer plant, which generated a revenue of $350,800, or about $19.30 per ton of RDF. The remainder of the solid waste was either landfilled--47,000 tons--or recycled-4,800 tons. The total net cost for solid waste disposal in the City of Madison in 1984 was about $2.3 million, or about $32.50 per ton. This includes a credit from the sale of RDF. The net cost of disposal substantially exceeds the cost of landfilling, which is presently about $10 per ton. However, operating the facility at full capacity and an improved market for the RDF could make the present system more competitive with landfilling.

High-level resource recovery systems with materials separation and refuse-derived fuel products require suitable markets. Based on consideration of the factors involved, the production of refuse-derived fuel was considered a feasible option warranting further investigation in the Milwaukee County study.

Post-Collection Material Recovery and Recycling: An additional form of resource recovery is post-collection material recovery. Typically, this process is done in combination with another resource recovery system such as the production of RDF. Noncombustible materials, including glass and metal, not included in the RDF are separated out and marketed. The abandoned Americology plant in the City of Milwaukee was a post-collection material recovery and recycling plant. As described earlier, that facility is presently not being operated principally because of a lack of markets for the refuse-derived fuel product. The advantage of this system is that large amounts of recyclable materials can be recovered from the waste stream without establishing recycling centers or instituting a separate collection system for recyclables. The disadvantages are the high initial capital costs for equipment and subsequent operating costs. Since the Americology facility is in existence, it was determined that this option should be considered further in the development of alternative solid waste management plans for Milwaukee County in conjunction with the RDF alternative.

Waste Exchange Systems: Another form of resource recovery is the use of a waste exchange system, in which the wastes of one firm's operation are offered to another firm that can use the waste as a raw material. In theory, both seller and buyer can benefit and the exchanged wastes do not have to be disposed of in landfills. Two types of waste exchange programs are in use: information exchange and material exchange.

An information exchange program consists of a library listing--called a waste exchange information center--where offers of waste materials are forwarded to a central clearinghouse and the resulting information is periodically redistributed to a subscription list of potential customers. Businesses inquiring about wastes are linked to the offering firm, at which time the waste exchange information center withdraws from the negotiations. Information-type waste exchanges typically have small staffs and low costs, and are run by nonprofit trade, business, or governmental groups.

Material waste exchanges are more elaborate and costly operations. The exchange acts as a waste broker, buying, analyzing, modifying, and marketing wastes. Seven of the 22 waste exchanges in operation in the United States in 1985 were material-type exchanges. The 18 exchanges in operation in Europe and Australia were all information exchanges. There were no waste exchanges of any type in operation in the State of Wisconsin in 1985. The Midwest Industrial Waste Exchange (MIWE), located in St. Louis, was in the process of broadening its information base. MIWE currently concentrates on midwestern waste listings, and is reported to be interested in involving more Wisconsin industries. The Illinois Material Exchange Service publishes a list of wanted industrial waste materials and industries which have such materials available. The mailing list for Wisconsin has been growing steadily, and presently more than 600 of these publications are mailed to Wisconsin industries six times annually.

Disposal

Sanitary landfilling is an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards and nuisances. A sanitary landfill is a needed component of any solid waste management system for environmentally safe disposal of its solid wastes. The type of landfill and the design requirements are chiefly related to the physical environmental setting of the site and the amount of waste to be disposed of. The principal concern in the design is groundwater protection. Groundwater or infiltrating surface water moving through solid waste can produce leachate, a solution containing dissolved and finely suspended solid matter and microbial waste products. Leachate may leave the fill at the ground surface as a spring or percolate through the soil and rock that underlie and surround the waste. The composition of leachate is important in determining its potential effects on the quality of nearby surface water and groundwater. Contaminants carried in leachate are dependent on solid waste composition and on the simultaneously occurring physical, chemical, and biological activities within the fill.

There are four basic landfill types presently feasible for application in the State of Wisconsin that relate to the manner in which the generated leachate is managed. They are natural attenuation, lined, zone of saturation, and shallow lift landfills. A schematic diagram of each type is shown in Figure 13.

Natural Attenuation Landfill: Natural attenuation is a process whereby the leachate emanating from the landfill site is naturally treated as it migrates through underlying soils. A natural attenuation site depends upon natural in-place soils to provide for environmentally secure disposal. Natural attenuation sites are located in areas with relatively impermeable soils such as clays, silts, clay tills, and sandy silts. A minimum groundwater separation distance of 10 to 20 feet from the bottom of the landfill is needed for such landfills. Leachate collection is not generally practiced at natural attenuation sites, since the underlying soils are relied upon for treatment. However, backup leachate collection systems may be installed where clay soils are particularly tight and it is expected that leachate production may surpass the percolation possible through the base grade.

A natural attenuation site will normally be the least costly option and will require the least amount of long-term care and maintenance after filling. The specific criteria that need to be considered in the development of a natural attenuation site include: the soil type, the quantity of refuse to be disposed of, the time frame in which the quantity of refuse is to be disposed of, the type of solid waste, the depth of solid waste deposits, the depth to groundwater, and the groundwater flow system. Recently, regulatory policies on the siting of landfills have resulted in the use of such landfills only in unusual situations with only the most favorable site conditions. This type of landfill is not considered by the Wisconsin Department of Natural Resources to be suitable for the disposal of large volumes of municipal waste materials.

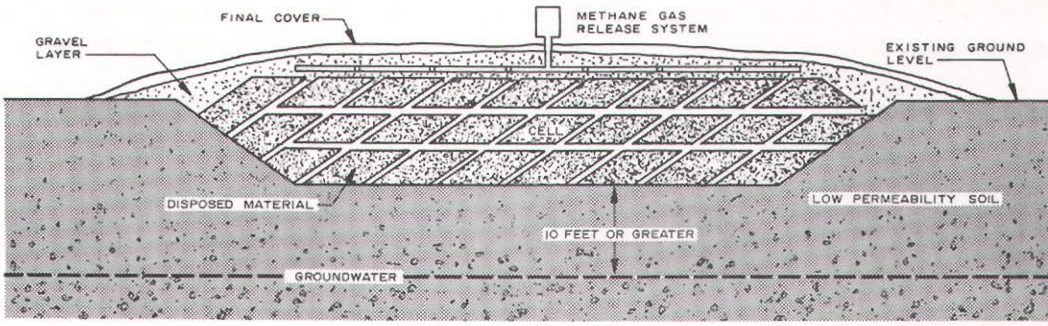
Lined Landfill: If soil conditions are such that natural attenuation of the leachate will not take place, a clay or other artificial liner may be constructed to minimize the downward vertical migration of the leachate. This liner is designed to allow the leachate to be collected in an underdrain system and transported to a sewage treatment plant for disposal. By stopping the downward migration of leachate, adverse impacts on the underlying groundwater systems can be avoided; and by collecting the leachate and conveying it to a sewage treatment plant for treatment prior to disposal, adverse impacts on surface water can be avoided.

Clay-lined sites are generally located in areas with at least some heavy soils such as clay silts, clay tills, and sandy silts. However, sites with sandier

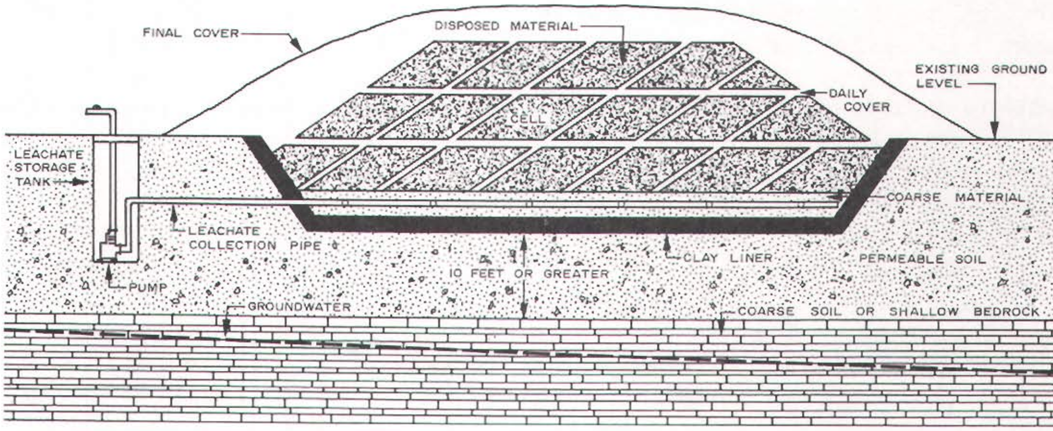
Figure 13

TYPES OF LANDFILLS UTILIZED IN THE STATE OF WISCONSIN

NATURAL ATTENUATION LANDFILL

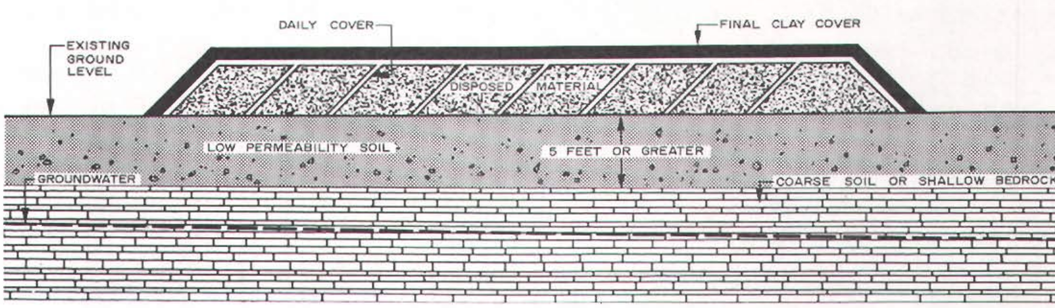


CLAY-LINED LANDFILL

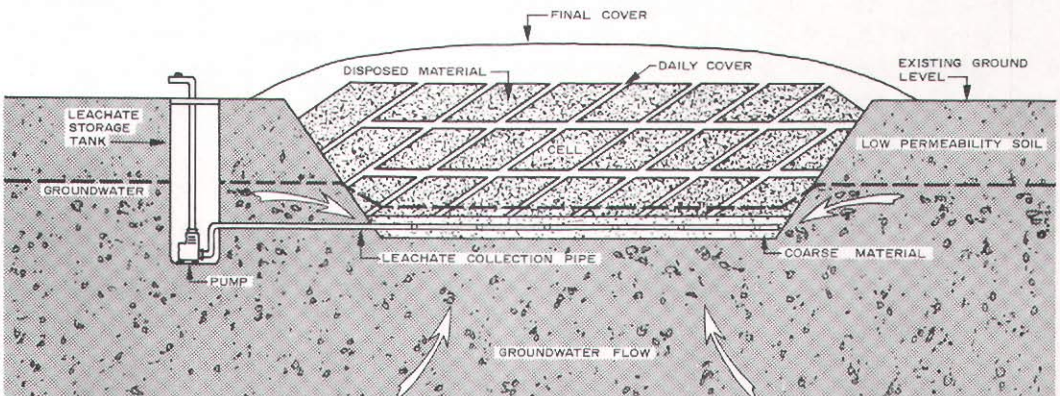


NOTE: This type of landfill may require a double liner and leachate collection system in some instances. Synthetic lining material may also be used. A methane gas release system may also be used as noted above for the natural attenuation landfill.

SHALLOW LIFT LANDFILL



ZONE OF SATURATION LANDFILL



NOTE: This type of facility may also be equipped with a liner or double liner of clay and/or synthetic materials. A methane gas release system may also be used as noted above for the natural attenuation landfill.

Source: SEWRPC.

granular soils may also be used if off-site materials are hauled in for liner and final cover material. A minimum separation distance of 10 feet to the high groundwater is generally needed. Significant earthwork and construction control are required in the development of clay liners, and long-term care and maintenance of the landfill site after filling is generally required.

A variation of the lined site is the "retarder" lined site. A retarder is a blended soil layer which retards but does not totally block the downward migration of leachate. The principle behind the retarder is to attenuate the more hazardous constituents of the leachate by selecting proper soils for the construction of the retarder and by maintaining a permeability which allows the less harmful constituents to migrate through the retarder. A retarder site must be located and designed so that the underlying groundwater system and soil can be relied upon for the natural dilution and further attenuation of the less hazardous constituents in the leachate migrating through the retarder. The advantages of the retarder over the liner are that it decreases the amount of leachate that must be ultimately collected and removed from the landfill site and that it relies on natural phenomenon for the attenuation of the leachate. Large retarder-type landfills are not generally feasible because a significant thickness of retarder and favorable groundwater conditions are required to attenuate the quantities of leachate associated with larger landfills. Retarder landfills appear to be more appropriate in areas where leachate treatment facilities such as sewage treatment plants are located at long-haul distances, or are at--or exceeding--plant capacity. The retarder in many aspects is similar in construction to the clay liner except that the retarder is composed of soils that have a smaller fraction of clay. Evaluations of clay mineralogy, compaction, permeability, and other factors are essential if the retarder concept is to work.

In some instances, two linings and two leachate collection systems may be needed. The clay lining may be supplemented with synthetic materials. In Wisconsin, large municipal landfills are required by the Wisconsin Department of Natural Resources to be either clay lined or of a zone of saturation design.

Zone of Saturation Landfill: A zone of saturation landfill site is developed through the excavation of clay soils below the water table. The clay soils chosen for such a site are of such a low permeability that during excavation the rate of infiltration does not exceed the rate of evaporation, and there is no net gain of accumulated water within the excavation. After the site has been excavated, a leachate collection system is constructed at the base of the landfill. During and after active filling operations, some groundwater will migrate into the site to make contact with the refuse, and will subsequently form leachate. Percolation from precipitation will also enter to form leachate. Because of the inward migration of groundwater, the leachate quality becomes somewhat diluted. Leachate strength and volume, however, are similar to the strength and volume of leachate from clay-lined landfills. This is withdrawn by the leachate collection system.

A zone of saturation landfill site may be expected to generate higher quantities of leachate because of the groundwater component of infiltration. The inward infiltration of groundwater prevents the outward migration of leachate, and a properly developed zone of saturation site will result in no discharge of leachate to the groundwater system. This inward migration of groundwater will somewhat dilute the leachate. Locating a zone of saturation site adjacent to or in a groundwater discharge area may yield one of the most environmentally desirable landfill facilities. While the operational and development costs of such a landfill site may be comparable to those of natural attenuation sites, the long-term care and maintenance costs of such a facility following filling are relatively high. The nature of the groundwater system may require continuing removal of leachate from such a facility long after filling has ceased.

These landfills may have one or two clay liners and leachate collection systems, depending upon the subsurface conditions and the type of material to be landfilled. In some cases, a synthetic lining material is used in conjunction with the clay; however, synthetic liners have not yet been used in conjunction with zone of saturation landfills in Wisconsin.

Shallow Lift Landfill: A variation of the natural attenuation landfill applicable for small communities is the shallow lift landfill. This type involves the construction of one lift of refuse, six to eight feet in thickness, over a clayey type soil that may be five or more feet thick. This type of landfill construction has been limited to the unglaciated areas of southwest and western Wisconsin. Underlying the clay soil may be bedrock, shallow groundwater, or other unsuitable soil or groundwater conditions. The impact on the groundwater is considered to be minimized because of the low refuse depth. Operating a shallow lift landfill site requires the placement of final cover on each cell as each cell is completed. Therefore, the waste is "sandwiched" in clay materials which virtually eliminates infiltration during operation and significantly decreases infiltration after abandonment. Shallow lift landfill sites are usually suitable only for small communities since they require significant acreage per unit volume of waste deposited because of the shallow depth of refuse. Considerable earthwork may be required in the development of a shallow lift landfill because of the need to place final cover upon each cell, along with additional base grade preparation such as removal of topsoil, addition of clay materials, and grading. The primary advantage of the shallow lift landfill is that it allows the development of a waste disposal facility within otherwise marginally suitable areas.

Other Disposal Considerations: Leachate removal from any of the above-noted engineered sites is a major consideration in landfill planning and development. The leachate can be disposed of by processing in a sewage treatment plant either without or following pre-treatment. This method of disposal requires detailed studies comparing the estimated quantity of the leachate to the amount of wastewater treated and the capacity of the sewage treatment plant. Unless the plant wastewater flow is very large in comparison to the leachate quantity, holding or storage tanks may be considered at the plant to allow the leachate to be fed into the plant at an acceptable rate.

An additional consideration in landfill planning and development is the need to control gases which accumulate within the landfill. Decomposition of landfilled refuse results in the production of a mixture of gases, including primarily carbon dioxide, methane, nitrogen, and, on occasion, hydrogen sulfide. Generation of carbon dioxide is of concern because it is water soluble and can be absorbed by landfill leachate, thereby decreasing the pH and increasing its corrosiveness. Methane, which is virtually insoluble, can move by diffusion up from the decomposing refuse into the atmosphere, or laterally into adjacent areas. Concentrations of methane in the atmosphere of between 5 and 15 percent are explosive. Gas migration can be controlled through the use of impermeable liners, construction of trenches to intercept and vent the migrating gases, and installation of collector pipes, fans, and venting systems. In some locations, these gases can be collected and burned to generate energy, or collected, cleaned, and used as a substitute for, or as a supplement to, natural or propone gas.

Operational Methods: The principal operational methods used for landfilling may be classified as: 1) area, 2) trench, as shown in Figure 14, and 3) depression.

The area method consists of unloading and spreading the wastes in narrow strips on the surface of the land in a series of layers. Each layer is compacted as the filling progresses. At the end of each working day, daily cover is placed over the completed fill. The cover material must be hauled in by truck or earth-moving equipment from adjacent land or from borrow-pit areas. Because of the potential costs and problems associated with obtaining suitable cover material, the application of this method should be preceded by a detailed engineering feasibility study. This method is favorable for sites proposed to accommodate high volumes of wastes.

The ramp method of operation is a variation of the area method in which earth cover is excavated immediately in front of the active working face of the landfill. In this way, a small excavation is made for a portion of the next day's waste. This technique allows for more efficient use of the disposal site when a single lift is constructed than the area method does because cover does not have to be imported from other areas.

The trench method of landfilling is ideally suited to areas where an adequate depth of cover material is available at the site and the groundwater table is low. To start the process, a portion of the trench is dug and the excavated material is stockpiled to form an embankment behind the first trench. Wastes are then placed in the trench, spread into thin layers, and compacted. The active fill area should be large enough to avoid costly delays for collection vehicles waiting to unload. Cover material is obtained by excavating an adjacent trench or continuing the trench that is being filled. This method is quite adaptable to varying but relatively low quantities of wastes.

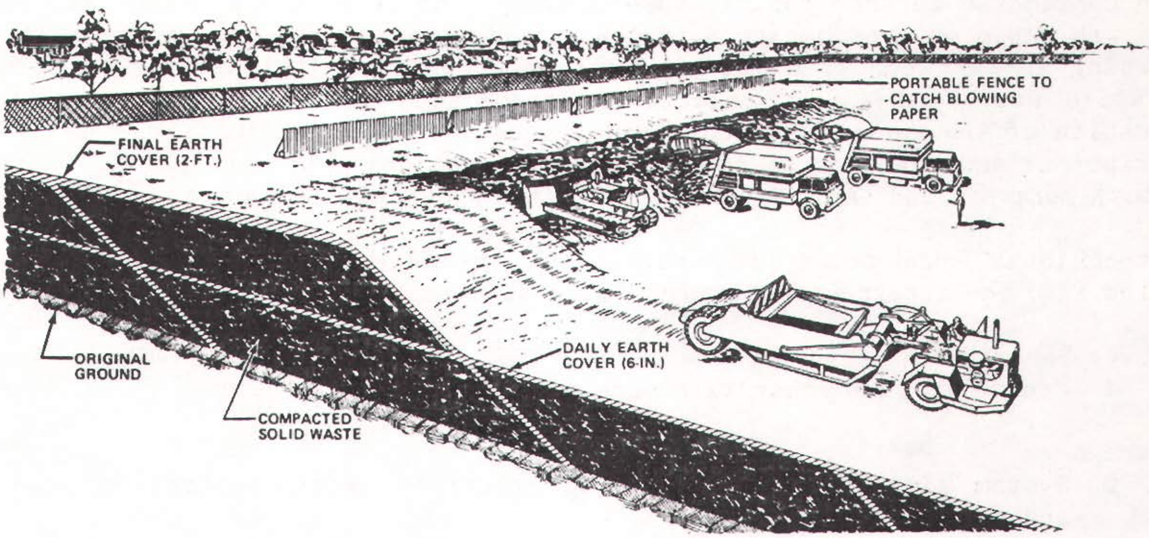
The depression method is often used effectively for landfilling operations where natural or artificial depressions exist. Dry borrow pits and other depressions are commonly used for this purpose. The techniques used to place and compact solid wastes in depression landfills vary with the geometry of the site, the characteristics of the cover material, the hydrology and geology of the site, and the access to the site.

The cost of landfilling varies widely with the type and size of landfill. In Milwaukee and the surrounding counties, the costs vary from \$10 to \$25 per ton.

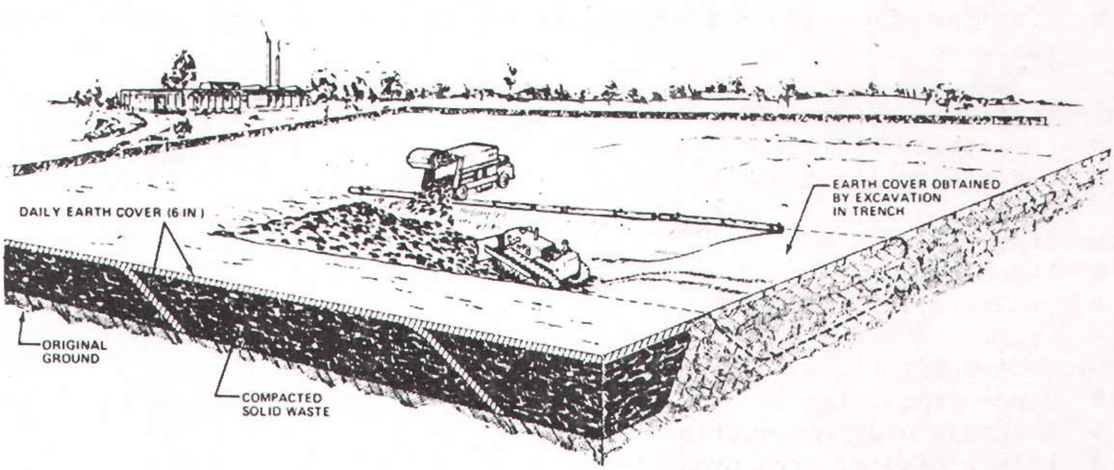
The advantages of landfilling are that it is a low-level, proven technology for the ultimate safe disposal of solid wastes. Landfilling is a method of disposal which is flexible in that nearly all solid wastes can be landfilled with little or no processing. Generally, landfilling is lower in cost compared to other, higher technology methods of solid waste management. The disadvantages of landfilling are the use of land for disposal, the lack of adequate sites for new landfill development, the potential for groundwater contamination, and the fact that the resource recovery potential in solid waste is not utilized or realized.

Figure 14

METHODS OF LANDFILL OPERATION



IN THE AREA METHOD OF SANITARY LANDFILLING, A BULLDOZER SPREADS AND COMPACTS THE WASTE ON THE NATURAL SURFACE OF THE GROUND, AND A SCRAPER IS USED TO HAUL THE COVER MATERIAL AT THE END OF THE DAY'S OPERATION



IN THE TRENCH METHOD OF SANITARY LANDFILLING, THE COLLECTION TRUCK DEPOSITS ITS LOAD INTO A TRENCH WHERE A BULLDOZER SPREADS AND COMPACTS IT. AT THE END OF THE DAY, THE TRENCH IS EXTENDED, AND THE EXCAVATED SOILS ARE USED AS DAILY COVER MATERIAL

Source: U. S. Environmental Protection Agency and SEWRPC.

Regardless of the other options incorporated into the solid waste management system, landfilling was considered as one component of every alternative plan developed for Milwaukee County under the study.

ALTERNATIVE SOLID WASTE MANAGEMENT SYSTEMS

This section of the report describes alternative solid waste management plans to be considered further for Milwaukee County. The selection of these alternatives was based on consideration of the existing solid waste management systems operating in the County, state regulations governing solid waste management, the solid waste management objectives established under the study, and the evaluation of the techniques contained in the previous section. More detailed descriptions and analyses of each of the alternatives set forth below, including both monetary and environmental costs, are provided in Chapter VI.

The techniques found potentially viable for use in Milwaukee County and incorporated into the alternative plans to be considered further were:

Source Separation
- Pre-collection separation with recycling center.

Storage
- System similar to the existing practices incorporating cans, bags, and bulk containers.

Collection
- System similar to existing practices relying principally on municipal and private collection operations.

Transfer
- Transfer from collection trucks to larger capacity trucks or bulk containers.

Transportation
- Collection vehicles.
- Large-capacity trucks.

Processing
- Shredding.
- Incineration.

Resource Recovery
- Steam production.
- Electric power production.
- Refuse-derived fuel production.

Disposal
- Sanitary landfill.

The alternative solid waste management system plans considered worthy of further analyses under the study were:

1. Continued use of the existing solid waste management system, including all existing functions. This alternative includes provisions for the

improvement of existing facilities not now in compliance with current state solid waste management regulations, and initiation of a countywide recycling program as required by present State law.

2. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems; and

   - Disposal at one existing major general-use sanitary landfill and at other, special-use landfills.

3. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems; and

   - Disposal at two existing major general-use sanitary landfills and other, special-use landfills.

4. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems;

   - One incinerator designed for steam generation; and

   - Disposal at two existing major general-use sanitary landfills and other, special-use landfills.

5. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems;

   - One incinerator designed for steam and electric power generation; and

   - Disposal at two major general-use sanitary landfills and other, special-use landfills.

6. A system similar to Alternative 4 but including two incinerators designed for steam generation.

7. A system similar to Alternative 4 but including three incinerators designed for steam generation.

8. A system similar to Alternative 4 but including 6 to 10 smaller incinerators designed for steam generation.

9. A system similar to Alternative 5 but including two incinerators designed for steam and electric power generation.

10. A system similar to Alternative 5 but including three incinerators designed for steam and electric power generation.

11. A system similar to Alternative 5 but including 6 to 10 smaller incinerators designed for steam and electric power generation.

12. A system consisting of the following functions:

- Storage, collection, and transfer using techniques similar to those used by existing systems; and

- Shredding and processing of a portion of the solid waste into refuse-derived fuel for marketing and/or incineration at a dedicated system designed for RDF.

In addition to these alternatives, consideration will be given to what are termed "accessory alternatives," which could be used in combination with one of the above-described "major" alternatives. The accessory alternatives include separate collection of newsprint, composting, increased use of community recycling systems, a bioconversion methane recovery system, and landfill methane recovery.

Each of the above-noted alternative system plans is evaluated in Chapter VII with regard to its economic and environmental feasibility. Chapters VIII and IX discuss the implementation of a solid waste management system for Milwaukee County, including financial, legal, staffing, operational, and management considerations.

Chapter VI

INVENTORY AND GENERAL EVALUATION OF IMPLEMENTATION METHODS

INTRODUCTION

A wide range of implementation measures is available to public agencies in Wisconsin for carrying out a solid waste management system plan. This chapter discusses the institutional and legal mechanisms, and organizational and cooperative arrangements, relevant to plan implementation, and presents options for financing, and operational management and staffing. The discussion emphasizes implementation strategies for a countywide program, identifies the advantages and disadvantages of the various measures, and identifies those implementation measures which have good potential for application in Milwaukee County.

BASIC CONCEPTS AND PRINCIPLES RELATING TO PLAN IMPLEMENTATION

Before identifying specific plan implementation measures, it is useful to consider certain basic concepts and principles that bear on the sound implementation of a solid waste management plan. These include the use of the existing institutional structure to the maximum extent possible; the importance of plan adoption and support by member units of government to successful plan implementation; and the need for coordination and cooperation among the many units and agencies of government involved.

The solid waste management plan for Milwaukee County is intended to emphasize, to the maximum extent practicable, implementation measures based upon, and related to, the existing governmental structure, existing governmental programs, and existing legislation.

Ideally, the initial step in the plan implementation process is the formal adoption of the recommended solid waste management plan by the designated management agencies and other affected units and agencies of government. Such adoption signifies intergovernmental understanding of, and agreement on, the recommendations contained in the plan. Furthermore, such formal action should serve as notice to other governmental units and agency staffs to begin the process of integrating the plan recommendations with other ongoing programs. In the absence of such formal action, neither the staffs of the agencies and units of government nor the general public at large can know what the formal position of the unit and agencies of government concerned may be with respect to this important matter.

One of the basic concepts supported by the Technical Coordinating and Advisory Committee for the Milwaukee County Solid Waste Management Plan was the promotion of a cooperative approach to the solid waste management problems of the County by all of the various units and agencies of government concerned with solid waste management within the County. In the absence of the creation of a new countywide unit of government responsible for all aspects of solid waste management, a great deal of intergovernmental coordination and cooperation will be necessary to implement the recommended plan effectively and efficiently.

The following review and analysis of available plan implementation measures pertains to source separation, transfer, processing, and disposal. It is assumed that the storage, collection, and transportation functions will continue to be carried out by the local communities, individual generators, and private contractors. Thus, implementation measures for storage, collection, and transportation are not explicitly considered herein.

INSTITUTIONAL AND LEGAL MECHANISMS

The most common institutional arrangement for solid waste management in Milwaukee County is a contractual agreement between a private industry-landfill operator or solid waste collection firm and the party responsible for solid waste disposal--be it a local unit of government, an industrial or commercial establishment, or an individual. Under these agreements, the private sector assumes responsibility for the proper siting, design, and operation of the landfill facilities required for waste disposal, or, in the case of collection firms, responsibility for maintaining the collection and transportation equipment and staff. The contractual agreements are made, in some cases, between local units of government and private contractors and, in other cases, directly between individual industrial and commercial establishments and institutions and the contractors.

Under Wisconsin law, counties, cities, villages, towns, and special institutional districts have the authority to manage solid waste alone or in cooperation with one another. The private sector, including both individuals and organizations, also has authority to carry out solid waste management activities. Because of the many and varied agencies which can potentially be involved in solid waste management within the County, it is important to identify those agencies having the legal authority and financial capability to most effectively implement the solid waste management plan. Accordingly, those agencies whose actions will have a significant effect either directly or indirectly upon the successful implementation of the solid waste management plan, and whose full cooperation in plan implementation will be important, if not absolutely essential, are listed and discussed below.

County

County government has been granted the largest measure of organizational authority subject to the constitution and general laws of the State. With the passage of Chapter 30, Laws of 1971, counties have been granted the optional authority to plan, organize, finance, and implement programs to effect the storage, collection, transportation, processing, recycling, or final disposition of solid waste. Section 59.07 of the Wisconsin Statutes provides authority for counties to create a solid waste management board and to retain a solid waste manager to operate a county system. The solid waste management board is authorized to:

1. Develop plans for a solid waste management system;

2. Collect, transport, dispose of, destroy, or transform wastes within the county or joint county area, including, without restriction because of enumeration: garbage, ash, or incinerator residue; municipal, domestic, agricultural, industrial, and commercial rubbish; and waste or refuse material, including explosives, pathological waste, chemical waste, and herbicide and pesticide wastes;

3. Acquire lands by purchase, lease, donation or eminent domain within the county for use in the solid waste management system;

4. Authorize employees or agents to enter upon lands to conduct reasonable and necessary investigations and tests to determine the suitability of sites for solid waste management activities whenever permission is obtained from the property owner;

5. Acquire by purchase, lease, donation, or eminent domain such easements, or other limited interests in lands, as are desired or needed to assure compatible land use in the environs of any site that is part of the solid waste disposal system;

6. Establish operations and methods of waste management as are deemed appropriate. Waste burial operations shall be in accordance with sanitary landfill methods and the sites shall, insofar as practicable, be restored and made suitable for attractive recreational or productive use upon completion of waste disposal operations;

7. Acquire necessary equipment, or use equipment and facilities of the county highway agency, to construct, equip, and operate incinerators or other structures to be used in the solid waste management system;

8. Adopt and enforce ordinances necessary for the conduct of the solid waste management system and provide forfeitures for violations;

9. Contract with private collectors, transporters, or municipalities to receive and dispose of waste;

10. Engage in, sponsor, or co-sponsor research and demonstration projects intended to improve the techniques of solid waste management, or to increase the extent of reuse or recycling of materials and resources included within the waste;

11. Accept funds derived from state or federal grant or assistance programs and enter into necessary contracts or agreements;

12. Appropriate funds and levy taxes to provide funds for acquisition or lease of sites, easements, and necessary facilities and equipment, and for all other costs required for the solid waste management system. However, no town, city, or village which operates its own waste collection and/or disposal facility, or property therein, shall be subject to any tax levied hereunder to cover the cost of operation of these functions. Such appropriations may be treated as a revolving capital fund to be reimbursed from proceeds of the system;

13. Make payments to any municipality in which county disposal sites or facilities are located to cover the reasonable costs of services rendered to such sites or facilities;

14. Charge or assess reasonable fees approximately commensurate with the costs of services rendered to persons using the services of the county solid waste management system. Fees may include a reasonable charge for depreciation which shall create a reserve for future capital outlays for waste disposal facilities or equipment. All assessments for liquid waste shall be by volume;

15. Create districts with different types of solid waste collection or disposal services provided within them, and different regulations and cost allocations within each service district. Costs allocated to such service districts may be provided by a general tax upon the property of the respective districts, or by allocation of charges to the cities, villages, or towns whose territory is included within such districts; and

16. Utilize or dispose of, by sale or otherwise, any and all products or by-products of the solid waste management system.

The alternative to creating such a county solid waste management board, if the County becomes involved in solid waste management, is to carry out the management actions through one of the standing committees of the County Board, or through one of the established county commissions.

Actions or authorities exercised by the county or its solid waste management board generally do not require the approval of municipalities using such services. While county government has thus been given broad authority in Wisconsin to manage solid wastes, any city, village, or town may opt out of a county solid waste program by simply operating its own collection and disposal facility unless the optional waste streamflow control powers granted to the county by the Statutes are exercised.

Solid waste streamflow control powers are available to the County as well as to cities, villages, and towns which have a resident population of greater than 10,000 persons, based upon amendments to Chapter 144 of the Wisconsin Statutes. The county or a qualifying municipality can use flow control to direct by ordinance solid waste produced within its geographic limits either to a designated recycling center or to a resource recovery center, such as an incinerator producing steam or electricity from solid waste. The county must indicate which wastes are to be covered by the flow control, both by the type of waste and by the geographic area to which the ordinance applies. It is important to note that under Chapter 144.794(4)(b) of the Wisconsin Statutes, Milwaukee County may not adopt an initial intent resolution to establish a waste flow control ordinance which covers solid waste in a municipality if that municipality has already adopted such an initial intent resolution. Furthermore, if Milwaukee County were to adopt an initial intent resolution to establish a waste flow control ordinance, it would not be valid in a municipality that adopted a resolution of refusal to participate in a county waste flow control program within six weeks after adoption of the county's initial intent resolution, and then adopted an initial intent resolution to establish waste flow control in that community within three months following adoption of the county initial intent resolution. Certain wastes are exempt from flow control, including:

1. Commercial or industrial waste which is privately processed and reused;

2. Waste separated by the generator for sale, reuse, or recycling;

3. Single-family waste disposed of onsite;

4. Commercial or industrial waste disposed of in a facility owned by the generator;

5. Sewage or industrial sludge;

6. Waste processed by a recycling or resource recovery facility which existed on or before January 1, 1984, or for which a feasibility report or permit application was received by the Wisconsin Department of Natural Resources by January 1, 1984;

7. Solid waste from a town which has entered into an agreement with a city or village for the resource recovery or recycling of its wastes, if the city or village has a flow control ordinance; and

8. Solid waste which any municipality determines is not suitable for recycling or recovery.

The county or a municipality proposing flow control must determine that the use of such control is in the public interest, based upon a set of criteria specified in the law. These criteria include:

1. That the required use will result in the reuse or recovery of material from solid waste;

2. That the required use will lessen the demand for solid waste disposal facilities;

3. That the required use will conserve natural resources or energy;

4. That the required use is necessary to obtain the type and quantity of solid waste needed to make the facility economically feasible;

5. That alternatives to the required use which may be used to obtain the necessary types and quantity of solid waste have been compiled, analyzed, and considered;

6. That the required use is consistent with planning efforts of the county or municipality;

7. That the required use is consistent with any current solid waste management plan;

8. That the operation of the facility is technically feasible and will not result in significant adverse environmental impacts;

9. That the required use will be responsive to concerns expressed at the public hearing;

10. That the construction and operation of the proposed facility will comply with Chapter 144 of the State Statutes and that all necessary permits, licenses, and approvals required by the Department of Natural Resources will be obtained; and

11. That the proposed effective period of the flow control ordinance is reasonable.

A public hearing must be held by the municipality prior to making any determination that the required use is in the public interest.

It should be noted that to date, this solid waste streamflow control power has not been utilized by any county or municipality in the State. However, several municipalities in the State have adopted initial intent resolutions, the first step in establishing flow control over the waste stream. The feature of the law which provides for compensation to affected facilities has been a significant deterrent to its use. The provision requires counties or municipalities that utilize flow control to compensate owners of solid waste facilities for any adverse impacts of the imposition of a required use order. Landfill owners are eligible for compensation only if the landfill is an approved facility as defined by Section 144.441(2)(a) of the State Statutes. All affected solid waste facilities are eligible for compensation, and Section 144.794(14) of the Statutes provides a specific formula for compensating owners of solid waste disposal facilities and collection services. The components of the formula vary for landfill owners and collection firms, and thus compensation needs to be evaluated on a case-by-case basis using the rules established in the Statutes.

Cities and Villages

Cities and villages possess adequate authority to implement solid waste management plans. Cities and villages are authorized under Sections 66.049, 62.225, and 61.345 of the Wisconsin Statutes to deal with the collection and disposal of solid waste and the institution of recycling or resource recovery facilities.

It is often difficult for a city or village to locate landfill sites within their own geographic area of jurisdiction. This is particularly true for many of the cities and villages in Milwaukee County because of the lack of environmentally suitable and politically acceptable tracts of land. Furthermore, site selection and construction and operation of a landfill require a substantial capital expenditure, and call for a long-term financial and legal commitment by the municipality. Consequently, the opening and subsequent operation of a landfill on an individual city or village basis may, as a practical matter, no longer be a feasible alternative for most of the communities in Milwaukee County.

Cities and villages can, however, effectively site other types of solid waste management facilities, particularly collection and transportation facilities. Recycling operations and resource recovery systems such as incineration with energy recovery can also be effectively carried out by cities and villages. However, it may not be practical for smaller communities to implement incineration systems because of the capital costs entailed and the need to optimize the size of facilities so that some degree of economy of scale is achieved.

Metropolitan Sewerage District

A county board may authorize a metropolitan sewerage district to exercise all of the solid waste management powers granted to the county board under Section 59.07 of the Wisconsin Statutes except the power to acquire land by eminent domain. County board approval is not required for the management of solid wastes contained in or produced as a by-product of district sewage treatment activities. Milwaukee County has not authorized the Milwaukee Metropolitan Sewerage District to assume solid waste management powers.

Intergovernmental Agreements

Local governments may also provide for solid waste management through intergovernmental agreements under Section 66.30 of the Wisconsin Statutes. These joint agreements are clearly limited to those powers which the local governmental units can legally perform individually.

Joint Sewerage Commission

Solid waste disposal services may also be provided by a joint sewerage commission formed by two or more cities, villages, town sanitary districts, or town utility districts under Section 144.07 of the Wisconsin Statutes. However, no such commissions exist in Milwaukee County.

Private Sector

The private sector, including both individuals and companies, has the implied authority to carry out solid waste management activities. There are many private concerns involved in collecting, processing, storing, and disposing of solid waste, and there are many industries that handle and dispose of the wastes generated by their industrial processes. While there is no specific legislative delegation of authority to private entities, they are certainly not prohibited from handling solid waste, and, as previously noted, such entities have played a large part in managing solid wastes generated in Milwaukee County.

Summary

As discussed above, all local governmental units in Milwaukee County have been granted authority by the State to manage solid wastes. All of the above-noted institutional and legal arrangements are presently used for solid waste management within Milwaukee County with two exceptions: 1) the County has no joint sewerage commission arrangements, and 2) the County has not granted solid waste management authority to the Milwaukee Metropolitan Sewerage District. Thus, nearly all of the institutional approaches may be considered to be viable means of implementing a solid waste management plan for Milwaukee County.

ORGANIZATIONAL AND COOPERATIVE ARRANGEMENTS

Solid waste management services are most frequently provided under one of four basic arrangements:

1. As public services, usually by a governmental department. Under this arrangement, services are provided by counties or municipalities with public employees and publicly owned equipment.

2. By private firms under contract to a governmental unit. Under this arrangement, the contractor retains the labor and owns the equipment involved, and must meet performance criteria set forth in the contract governing the provision of the services.

3. By private firms in open competition, with little, if any, governmental regulation. Under this approach, the private contractor makes arrangements for the provision of services directly with the households, businesses, and industries generating the solid wastes.

4. By private firms operating under exclusive franchises by which each is licensed to operate alone in a given area. This option is generally applicable only to the collection function and is considered viable for use in Milwaukee County only as a collection arrangement.

Numerous variations of these four basic types of public and private solid waste management operations are possible. Table 35 lists eight organizational alternatives with the advantages and disadvantages, as well as other selected information on each alternative. Those alternatives considered practicable for use in Milwaukee County are noted. The alternatives are discussed below.

Privately Owned and Operated Solid Waste Management System

Under this alternative, a particular solid waste management system component would be owned and operated on a private commercial basis. Generally, the operator would contract for services with the local units of government. The principal advantage of this system is that the local units of government do not incur a large capital expenditure for development and operation of the solid waste management facilities. The principal disadvantage is that the local communities have less control over the costs and operational methods used. In addition, planning for systems operated by private industry is unlikely to be an open process in which local officials and citizens can participate in order to ensure that both the existing and future waste management needs of the community are met most effectively and efficiently. Such a system is considered a viable alternative for Milwaukee County for all the solid waste management system components.

Individual Municipally Owned System Operated by a Private Contractor

Under this alternative, each local unit of government would own solid waste management facilities designed and operated solely to meet local needs. The facilities would be operated by a private contractor who would contract for services with the local unit of government as a cooperating agency. The principal advantage of such a system is that the local units of government have control over the development and operation of the solid waste management system component serving their communities. Such systems may, however, require large capital outlays by local units of government, and high unit and total operating costs owing to the lack of economies of scale. In addition, such a highly localized system of solid waste management is not likely to provide

Table 35

SELECTED INFORMATION ON ALTERNATIVE SOLID WASTE MANAGEMENT ORGANIZATIONAL ARRANGEMENTS

Solid Waste Management Organizational Arrangements	Advantages of Application in Milwaukee County	*Disadvantages of Application in Milwaukee County*	Decision Policy and Decision-Makers	Methods for Distribution of Costs	*Daily Management*	Conclusions Regarding Application in Milwaukee County
Privately Owned and Operated Systems	-No large capital expenditure by local government for development and operation -Users do not pay for service through increased taxes -Local government does not face uncertainties of new technologies and flucuating markets for recyclable goods -Potential for improved cost effectiveness -Private contractor contributes to tax base	-Decisions by contractor based primarily on financial considerations -Limited control by local units of government over solid waste management fees and services in the community -Does not provide for countywide long-range planning	Private contractor and negotiations with generators	Individual user fees and contracts with municipalities	Private contractor totally responsible for management	Viable alternative
Individual Municipally Owned and Privately Operated Systems	-Provides for a high level of autonomy and control by the local community in the development and operation of the solid waste management system	-Requires large capital expenditure by local unit of government for development and operation of the solid waste management system -Does not provide for countywide long-range planning -Local governments face the uncertainty of new technology and fluctuating markets for recyclable goods -Potential for high cost due to small scale	Board, commission, or agency with policy-making and review authority representing the municipality	-Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these -Payments made to policy-making unit by participating municipality and individual users and then passed on to private contractor; or municipality and individual users make payments directly to private contractor	Private contractor responsible for day-to-day management subject to approval and periodic review by policy-making unit	Not a viable alternative for major system components such as a landfill. Could be viable for a transfer station
Indivudal Municipally Owned and Operated Systems	-Provides for total control of all aspects of solid waste management in the community	-Requires large capital expenditure by local unit of government for development and operation of the solid waste system -Does not provide for countywide long-range planning -Local governments would face the uncertainties of new technology and fluctuating markets for recyclable goods -Potential for inefficiency and high cost due to small scale	Board, commission, or agency with policy-making and review authority representing the municipality	-Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation or any combination of these -Payments made to policy-making unit by participating municipality and indivudal users to cover capital and/or operating costs	Personnel hired by policy-making unit with delegated authority to manage system subject to approval and periodic review of policy-making unit	Not a viable alternative for major system components such as a landfill. Could be viable for a transfer station
Multimunicipally Owned Systems Operated by Private Concerns	-Large capital expenditure for development and operation of the solid waste system would be shared by cooperating communities -Provides for a significant amount of local autonomy and control of the system by the local units of government -Potential for improved cost-effectiveness over the individual municipal systems	-Requires a high level of cooperation between the participating communities -Requires large capital investment for local units of government -May not provide for countywide long-range planning -Local governments would face the uncertainty of new technology and fluctuating markets for recyclable goods	Board, commission, or agency with policy-making and review authority representing all participating municipalities	-Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these -Payments made to policy-making unit by participating municipalities and individual users and then passed on to private contractpr; or participating municipalities and individual users make payments directly to private contractor	Private contractor responsible for day-to-day management subject to approval and periodic review of policy-making unit	Viable alternative which would be most applicable for transfer stations and recycling centers. The alternative has limitations for major components such as a landfill

Table 35 (continued)

Solid Waste Management Organizational Arrangements	Advantages of Application in Milwaukee County	Disadvantages of Application in Milwaukee County	Decision Policy and Decision-Makers	Methods for Distribution of Costs	Daily Management	Conclusions Regarding Application in Milwaukee County
Multimunicipality Owned and Operated Systems	-Provides for total control of all aspects of solid waste management in the cooperating communities -Improved cost-effectiveness over individually owned and operated municipal solid waste management systems	-Requires large capital expenditure by the local units of government for development and operation of the solid waste management system -May not provide for countywide long-range planning -Local cooperating communities face the uncertainty of new technology and fluctuating markets for recyclable goods -Requires a high level of cooperation between the participating communities	Board, commission, or agency with policy-making and review authority representing all participating municipalities	-Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these -Payments made to policy-making unit by participating municipalities and individual users to cover capital and/or operating costs	Personnel hired by policy-making unit with delegated authority to manage system subject to approval and periodic review of policy-making unit	Viable alternative which would be most applicable for transfer stations and recycling centers. The alternative has limitations for major components such as a landfill
County Owned Systems Operated by Private Contractors	-Large capital expenditure for development and operation of solid waste management facility would be shared by county residents -Provides for implementation of long-range countywide planning -Provides for a significant amount of control by the County over the solid waste management system and its operation -Potential for increased cost-effectiveness and efficiency because of increased size and scope of the system	-Requires high level of intercommunity cooperation and coordination -Requires large capital expenditure by county government -County would face the uncertainty of new technology and fluctuating markets for recyclable goods	County board committee or county department or board with policy-making and review authority	-Changes based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these -Payments made to County by participating municipalities and individual users and then passed on to private contractor; or participating municipalities and individual users make payments directly to private contractor	Private contractor responsible for day-to-day management subject to approval and periodic review of policy-making unit	Viable alternative
County Owned and Operated System	-Large capital expenditure for development and operation of the solid waste management system would be shared by county residents -Provides for implementation of long-range countywide planning -Provides for total control of the solid waste management system by the County -Potential for increased cost-effectiveness and efficiency because of increased size and scope of the system	-Requires high level of intercommunity cooperation and coordination -Requires that the County face the uncertainty of new technology and fluctuating markets for recyclable goods -Requires that the County be involved with day-to-day operation of the facility -Requires large expenditure by county government for capital and operation	County board committee or county department or board with policy-making and review authority	-Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these -Payments made to the County by participating municipalities and individual users	Hired administrator or manager or member of county department or board responsible for day-to-day management subject to approval and periodic review of policy-making unit	Viable alternative
Multicounty Solid Waste Management System	-Large capital expenditures for development and operation of the solid waste management system would be shared by residents of more than one county -Provide for regionalized long-range solid waste management planning -Increased cost-effectiveness and operating efficiency	-Requires very high level of intercommunity cooperation and coordination -Requires large capital expenditure by county government -Reduces the amount of control local communities have on the system	Intercounty board committee or intercounty department or board with policy-making and review authority	-Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these -Payments made to participating counties by participating municipalities and individual users	Hired administrator or manager or member of intercounty department or board responsible for day-to-day management subject to approval and periodic review of policy-making unit	Viable alternative

Source: SEWRPC.

a coordinated, long-range solution to solid waste management in Milwaukee County. Moreover, the development of solid waste facilities is sufficiently complex that it is unlikely that each community would be successful in providing for its own needs at an acceptable cost in the long term.

Such a system is a viable alternative for further consideration only by the larger municipalities in Milwaukee County for major system components such as landfills or incinerators. This arrangement could be viable for any community for components such as recycling centers or transfer stations.

Individual Municipally Owned and Operated Solid Waste Management System

Under this alternative, the individual municipalities would own and operate the required solid waste management facilities. The principal advantage of such a system is that the local unit of government has full control of the local solid waste management system. However, this alternative would necessitate a large capital outlay by each local unit of government owing to the lack of economies of scale. In addition, such a system may not function as an integrated system throughout the County.

Such a system is a viable alternative for further consideration only by the larger municipalities in Milwaukee County for major system components such as landfills or incinerators. This alternative could be considered viable for any community for components such as recycling centers and transfer stations.

Multimunicipally Owned System Operated by a Private Contractor

Under this alternative, two or more local units of government would jointly own the required solid waste management facilities. The facilities would be operated by a private contractor who would generally contract to provide services to the cooperating governments. The principal advantage of this system is that it provides for a high degree of local municipal control over the development of facilities and services while the daily operation and overall management of the system is performed by a private contractor. Furthermore, implementation of such a system ensures that a single municipality is not burdened with a large capital outlay for development and operation of the system. Even the shared costs, however, are likely to be high. The principal disadvantage of this system is that it may not provide for a fully coordinated approach to solid waste management in Milwaukee County. Furthermore, implementation of such a system could result in a loss of economies of scale since a number of such systems may be formed within the County, with the potential for large capital outlays and unnecessary duplication of effort. These disadvantages could, however, be overcome by the coordination afforded in a countywide planning effort. Such a system is a viable alternative for further consideration by all communities in Milwaukee County for all components.

Multimunicipally Owned and Operated Solid Waste Management System

Under this alternative, two or more local units of government would cooperate in the joint ownership and operation of the required solid waste management facilities. The principal advantage of this system is that the solid waste management needs of the communities involved would be adequately addressed and the operation of the system would be under the control of the cooperating local units of government. The principal disadvantage of such a system is that the communities may be required to make large capital outlays for development of the solid waste management system. Implementation of such a system may not provide a comprehensive, long-range solution for solid waste management within Milwaukee County. Such a system is a viable alternative for further consideration by all municipalities in Milwaukee County for all components.

County-Owned System Operated by a Private Contractor

Under this alternative, the County would own the required solid waste management facilities, with the facilities being operated by a private contractor who would contract to provide services with the local units of government, as cooperating agencies. The principal advantage of this system is that it provides for economies of scale through development of those facilities needed on a countywide basis. Development of these facilities would be based on a long-range plan, and the needs of the entire County could be met with a minimum of duplicated effort and expense. This alternative would provide for some degree of county control while utilizing the expertise and incentive of private operation. The principal disadvantage is that a large capital outlay would have to be borne by the County. The system would have to be flexible enough to provide reliable service for all the varied amounts and types of solid waste generated in the County. Such a system is a viable alternative for further consideration in Milwaukee County.

County-Owned and -Operated Solid Waste Management System

Under this alternative, the County would own and operate the required solid waste management facilities and system. The principal advantage of this system is that the County is in full control of all aspects of solid waste management and is able to implement a long-range, comprehensive plan. Furthermore, the greatest economies of scale could be achieved through implementation of this system. The principal disadvantage of this alternative is the capital and operation and maintenance costs that would accrue to the County. Such a system would have to be flexible enough to provide reliable service for all the varied amounts and types of solid waste generated in the County. Such a system is a viable alternative for further consideration in Milwaukee County.

Multicounty Solid Waste Management System

Under this alternative, two or more counties would jointly own the required solid waste management facilities. Under such an organizational arrangement, either the cooperating counties would operate the facilities, or the counties would retain a private contractor for operation. The principal advantage of this system is that an areawide approach would provide the greatest economies of scale. Furthermore, the capital outlays would be shared by a broad base. The principal disadvantage is that a high level of stable, long-term coordination and cooperation among the participating counties would be required. Without such cooperation, the diversified needs for solid waste disposal by the communities concerned may not be met.

At the present time, the counties bordering Milwaukee County are proceeding with the preparation and implementation of county-oriented solid waste management plans. The current emphasis by the Wisconsin Department of Natural Resources is on supporting and encouraging solid waste management planning at the county level. Thus, a system that provides for the needs of Milwaukee

County alone may offer a less than cost-effective, long-term solution, particularly with respect to special solid waste management needs such as leachate disposal and disposal of toxic and hazardous wastes. Thus, as the management plan is developed, a system which serves an area larger than the County in some or all aspects may need to be considered.

ALTERNATIVE FINANCING MECHANISMS

A practical plan for financing a solid waste management system is dependent on the type of management organization utilized, since each type of organization has certain legal financing options associated with its structure. The financing needs for solid waste management can be broken down into two categories: capital financing and operation and maintenance financing. Methods of financing presently utilized in Milwaukee County are discussed in Chapter II. The methods of financing used by 16 countywide solid waste management systems operating in the State of Wisconsin are shown in Table 36. It should be noted that none of the counties listed presently operate an incinerator disposal system. Alternative mechanisms which can be considered in financing solid waste management systems are discussed below.

Capital Cost Financing

The development of solid waste management systems often requires large capital outlays. Local units of government and private industry may not have sufficient capital on hand to develop the system without borrowing. The cost of interest over the lifetime of a loan can be a very substantial expense. Thus, it is necessary to look for financing techniques that minimize this cost.

Local units of government have the following alternatives available to them for financing capital expenditures for solid waste management systems:

- Pay-as-you-go
- Reserve fund financing
- Loans from the state trust funds
- General obligation bonds
- Special assessment bonds
- General obligation-local improvement bonds
- Public improvement bonds
- Revenue bonds
- Promissory notes
- Bond anticipation notes
- Contractors' certificates
- Grants
- Leasing

In actual practice, pay-as-you-go, reserve funds, general obligation bonds, and promissory notes are most often used.

The pay-as-you-go system can be the least costly system for financing any capital expenditure. It requires having sufficient revenues to pay all bills for capital expenditures as they come due. This alternative may not be practical for very large systems. However, it can be used to fund parts of a total system.

Table 36

CAPITAL AND OPERATIONS COST MECHANISMS UTILIZED TO FINANCE COUNTYWIDE SOLID WASTE MANAGEMENT LANDFILL SYSTEMS: 1984

County	Capital Costs	Operation and Maintenance Costs
Brown	General obligation bonds and general revenues	User fee of $8 per ton
Dane	General obligation bonds General revenues plus a promissory note	User fee of $10 per ton User fee of $10 per ton
Eau Claire	General obligation bonds	User fee of $8.05 per ton, plus $11.45 per ton on tax role
Fond du Lac	General revenues	User fee of $15 per ton
Green	Wisconsin State Trust Fund	Local governments are billed a percentage of the total operating costs based on estimated annual tonnage
Juneau	General revenues	User fee of $10 per ton
La Crosse	General obligation bonds	User fee of $8.50 per ton
Lincoln	City of Merrill provided initial capital funds from revenue sharing account. An improvement account and machinery account have been established to cover future capital costs. Dollars for these accounts are provided by revenues generated by landfill operation	City of Merrill pays $4.75 per capita for town residents, $7.16 per capita for city residents
Marathon	Promissory note (repaid by general revenues)	User fee of $14 per ton
Marquette	General revenues	--
Monroe	General revenues	55 percent of the operations budget is acquired through user fees charged to residents, and 45 percent is acquired through user fees charged to commercial and industrial sources
Oneida	General revenues	User fee of $17.50 per ton
Outagamie	Enterprise fund (same principle as municipal revenue bonds with dollars borrowed and repaid by the revenues generated by the landfill operation)	User fee of $10.50 per ton for county users, $15 per ton for noncounty users
Sauk	General revenues	Waste generator factor--municipalities are charged according to the amount of waste generated. Estimates of waste produced per employee are used to calculate commercial and industrial user fee
Shawano	General revenues	Not available
Winnebago	Promissory note (repaid by general revenues)	User fee of $10 per ton for county users, $22 per ton for noncounty users

Source: Wisconsin Department of Natural Resources and SEWRPC.

A variation of the pay-as-you-go system is a reserve fund maintained for future expenditures. This reserve fund would be invested until it is needed. Building up a reserve fund avoids having to pay future interest costs for borrowed money; however, it does involve the use of money collected from taxpayers or users which will be used to support future facilities that those contributors may not use.

The state educational funds, set up by Section 25.01 of the Wisconsin Statutes, include four different funds--the common school fund, the normal school fund, the university fund, and the agricultural college fund. This trust fund will loan money to village, city, or county governments for any projects for which the municipality has borrowing authority. Loans from the state educational fund are general obligations of the community. There is a maximum limit of 20 years and $350,000 for a loan from the state educational fund, and there is approximately $15 to $16 million available per year.

Another form of long-term borrowing is the general obligation bond. Counties, cities, and villages can issue general obligation bonds for the financing of solid waste disposal systems. General obligation bonds pledge the faith of the community for repayment of the bonds. The bonds are rated on the credit rating of the entire community and not the individual project. No general public vote is needed by the local government electorate on the issuing of a general obligation bond unless a petition requesting such a vote of at least 10 percent of the voting public is presented to the local unit of government. The amount of money borrowed under a general obligation bond is limited by the debt limit of the county, city, or village, with the current limit at 5 percent of equalized property value. General obligation bonds are usually suitable for situations in which a minimum of about $500,000 is to be borrowed.

Special assessment bonds can be issued by all local units of government for any project that is to be financed by a special assessment on local property.

Counties, cities, villages, and towns can also issue general obligation-local improvement bonds. Again, these bonds are sold in anticipation of revenues from special assessments. In towns, the voters must give their approval in a referendum to the issuance of general obligation-local improvement bonds.

Public improvement bonds can be issued by all local municipalities to finance public works projects. These bonds must be repaid within 20 years.

Revenue bonds can be issued by towns, villages, and cities for solid waste collection and disposal facilities, with the revenue to be derived from the facility constructed. Revenue bonds are mortgage bonds for periods of less than 40 years. Because the revenue bond is to be repaid by the revenue of the project to be financed, a detailed financial and technical assessment of the project must be carried out in order to market revenue bonds. Revenue bonds generally have higher interest rates than do general obligation bonds. These bonds are generally used for projects requiring larger capital expenditures in the range of $1 million or more. These bonds are not subject to the community's debt limit or to referendum approval.

For short-term borrowing, municipalities can issue promissory notes or bond anticipation notes for the acquisition of land or for public works projects, and are a general obligation of the municipality. Promissory notes are issued for periods of up to 10 years. Bond anticipation notes are for periods of five years or less and represent municipal borrowing up to the period when the bonds are sold.

In short-term situations, contractors' certificates can be used to raise money in anticipation of uncollected special assessments. Contractors' certificates represent liens against the property with special assessments.

Grants from state or federal agencies are another source of capital. At this time, no state grants are available for financing capital expenditures for solid waste management. However, grants are available for solid waste management planning, feasibility studies, and special demonstration projects for solid waste disposal systems under the Wisconsin Fund.

A primary source of financing for utilities and facilities is the Community Development Block Grant (CDBG) program. Milwaukee County is an entitlement entity under the CDBG program and, therefore, is not eligible for funds from the small cities CDBG program administered by the Wisconsin Department of Development. On an annual basis, Milwaukee County receives funding appropriations from the U. S. Department of Housing and Urban Development based upon population levels, poverty levels, overcrowded housing, and age of the housing stock. The objective of this program is to develop viable urban communities with decent housing and suitable living environments, and to expand economic opportunities, principally in low- and moderate-income areas. Activities that are eligible for funding under the CDBG program include: acquisition of real property; acquisition, construction, reconstruction, or installation of public works facilities, and other improvements; and construction of new buildings and rehabilitation of existing buildings. Each year a portion of the Milwaukee County entitlement CDBG funds is utilized directly by the County to implement projects, and another portion is distributed to local units of government within the County for specific projects. The Cities of Milwaukee, Wauwatosa, and West Allis receive their own CDBG funds.

The U. S. Department of Commerce, Economic Development Administration (EDA), provides grants to eligible local units of government for projects in support of public works and other facilities developments which result in the creation of new permanent jobs. EDA funds are available for public works projects for up to 50 percent of eligible project costs. In May 1985, the Milwaukee County overall economic development program plan was approved by the U. S. Department of Commerce, Economic Development Administration. With the approval of this plan, local units of government in Milwaukee County, as well as Milwaukee County itself, are eligible to apply for these funds. It should be noted that federal regulations prohibit the use of EDA funds for public works projects which result in the installation of equipment that generates electricity for public or private use.

As an alternative to a municipality raising money for capital expenditures, leasing land or equipment can be effective. Leasing is a relatively simple method of acquiring needed facilities. Leasing, however, may have high interest or service charges.

Private industry has the following options for financing capital improvements:

- Pay-as-you-go
- Bank loans
- Corporate bonds
- Corporate stock
- Industrial revenue bonds
- Grants
- Leasing

As described earlier, pay-as-you-go means having sufficient revenue to pay bills for capital expenditures as they come due.

Bank loans are commonly used to raise capital for private industry and individuals. Normally, a bank will require detailed analysis of the financial and technical feasibility of the proposed project before proceeding with a loan.

Corporate bonds are frequently used by large businesses to raise capital. These bonds pay interest to the purchaser and the bond is repaid on the redemption date. Corporate bonds are often thought of only for large corporations; however, small corporations also will often issue bonds which are normally sold within the community of the corporation.

Corporate stock is a share of a corporation which can be sold to raise capital. Stock owners own the corporation and have the right to vote on major company policy decisions and to vote for the board of directors. The company is never expected to repay purchasers of its stock their purchase price. The value of the stock is in the dividends it earns and the value it has due to the value of the corporation.

As is the case with municipalities, private industry can sometimes obtain grants for the construction of solid waste disposal facilities. However, at the current time no state or federal grants for sanitary landfills are available for private industry.

The U. S. Department of Commerce, Small Business Administration, Section 503--certified development company program can be used by private industry to finance capital improvements. Certified development companies are organized under provisions set forth by the U. S. Department of Commerce, Small Business Administration, to provide long-term, fixed-assets financing for the acquisition of land; building construction, expansion, and renovation; and the purchase of equipment. Loans are usually available for a term of up to 25 years at below-market interest rates. In addition, the Milwaukee Economic Development Corporation (MEDC) is authorized to provide private financing to companies located in Milwaukee, Ozaukee, Washington, and Waukesha Counties.

The U. S. Department of Commerce, Economic Development Administration, through its business development program, provides loan guarantees to banks that are making loans to businesses for expansion projects. Direct loans to businesses are also available through the business development program.

Industrial development revenue bonding is a method of public financing used to assist private industry in the construction, enlargement, or equipping of business and industrial firms. Industrial development revenue bonds are issued by a local unit of government, and serve to build the community's industrial base, broaden the property tax base, and potentially provide additional employment opportunities. Industrial development revenue bonds are attractive in the bond market because purchasers of the bond are not required to pay taxes on the interest earned by the bond purchased. Industrial development revenue bonds are not general obligations of the issuing local unit of government. The local unit of government issuing industrial revenue bonds is simply in partnership with the business or industry. These bonds are made available on a first-come, first-served basis. The amount of money available statewide in 1984 was based on a $150 per capita limit and totaled $544,900,000.

A city designated as eligible by the U. S. Department of Housing and Urban Development can apply for an urban development action grant, which the city can then lend to a private business or developer for projects involving job creation and rehabilitation and/or construction of public, commercial, industrial, and residential structures. Currently, the City of Milwaukee is the only city in Milwaukee County designated as being eligible for this program.

The Wisconsin Housing and Economic Development Administration (WHEDA) provides low-interest financing to businesses and individuals with current annual sales of $35 million or less through its small enterprise economic development (SEED) program. SEED money can be used for the purchase, expansion, and improvement of land, plants, and equipment, and for depreciable research and development expenditures, so long as such projects result in the creation and maintenance of permanent jobs. Eligible projects include manufacturing establishments and storage and distribution facilities for manufactured products; national or regional headquarters; retail establishments located in Urban Development Action Grant projects or tax incremental financing districts; research and development facilities; recreation and tourism facilities; and facilities involving the production of raw agricultural commodities. The SEED program is most useful to firms purchasing existing facilities, to firms located in municipalities that do not offer industrial development revenue programs, to firms which require fixed-rate, long-term capital, and to creditworthy firms that cannot find a buyer for their bonds.

Along with the preceding methods for raising capital, private industry can lease items, thereby avoiding raising the capital to purchase the items. Leasing is a highly flexible method of acquiring goods, but is usually associated with high interest or service charge costs.

Operation and Maintenance Cost Financing

Operation and maintenance costs, as well as capital costs, must be financed. Governments in Wisconsin have a larger range of options for generating revenues for the operation and maintenance of solid waste management systems than for generating funds for capital expenditures, including user fees, property taxes, special assessments, sales taxes, recycling, and waste management funds.

For solid waste management systems operated by private industries, the options for raising revenue for the operation and maintenance of solid waste management systems are limited to user fees, billing of local units of government, recycling, and waste management funds.

User fees can be based upon the amount of waste disposed of in a landfill or other facility, with the charge for disposal based on the tonnage or volume of waste disposed of. Other landfills will charge user fees based on the difficulty in handling the material. User fees have the advantage of being a very equitable system since payment is based upon use. However, user-fee systems have administrative costs which can be substantial, such as, at landfills, the cost of the scale and the scale operator.

Revenues for solid waste management systems are often generated through taxes. Although private industry cannot levy taxes, private companies that provide solid waste management disposal services for a local unit of government can bill the government and have the town, village, city, or county pass on the cost of solid waste management through a local tax. Three types of taxes that are available in Wisconsin for generating revenue for solid waste management are property taxes, special assessments, and sales taxes. Property taxes are relatively easy to administer, but, with regard to equitability, there is no direct relationship between the value of a property and the amount of solid waste management service received by a property. In fact, in some communities, businesses, and industries do not receive any tax-supported solid waste management services despite the fact that they pay property taxes. One additional disadvantage is that there is a limit on the amount of property tax that local units of government can levy. As previously discussed, towns cannot have a property tax in excess of 1 percent of total assessed valuation. For villages, the limit is 2 percent of equalized assessed valuation; and for cities the limit is 3½ percent of equalized assessed valuation.

Another type of revenue-generating tax is the special assessment. The Wisconsin Statutes allow any town, village, or city to make special assessments against property for the value of service received. Special assessments have an advantage in that they can be more equitable than other taxes, with the assessment equal to the level of service provided. One disadvantage of special assessments is that the administrative costs are higher than for general property taxes. With a special assessment, each property must have a specific assessment related to the level of service. Counties cannot levy special assessments; however, it would be possible for a county to bill each community for solid waste services, with each community then developing a special assessment for the property within its jurisdiction.

A third type of local tax available in Wisconsin is the sales tax. Section 77.71 of the Wisconsin Statutes allows counties to levy a sales tax of up to 0.5 percent of gross retail sales, with the tax going back to the towns, villages, and cities. This tax would be collected and distributed by the State and, therefore, would have relatively low administrative costs for the local jurisdictions.

A well-developed recycling program can reduce the amount of waste that goes into the landfill and provide revenue. However, many resource recovery programs are not profitable. On the other hand, source separation programs can be profitable, as they rely to a great extent on voluntary labor. However, the potential revenues generally are used for operation improvements and for support of the community groups providing the labor.

Another source of revenue is the waste management fund. Legislation enacted in 1978 provides for a state waste management fund. The waste management fund can provide money for the long-term care of solid waste landfills throughout Wisconsin, as well as payment for the clean-up of damage from an unplanned incident at a landfill licensed under the new state regulations. However, these funds are not used for the establishment of new landfills. All landfills are required to contribute to the waste management fund, but only landfills licensed under the new state regulations are eligible to receive funds from the fund.

It appears that user fees, property taxes, and private industry billing of local units of government are viable options for raising revenue for operation and maintenance. The use of a sales tax does not appear to be locally acceptable, while the use of recycling revenues would have only limited benefits since the profits generated from recycling operations may generally be expected to be small, and some revenues may be directed toward other civic projects by the volunteer groups operating the center. The waste management fund is used to provide compensation in the event of an incident at an existing or abandoned landfill that causes environmental damage, and does not provide funds for the establishment of new sanitary landfill facilities.

OPERATIONAL MANAGEMENT AND STAFFING

Operational management and staffing is an important element of any solid waste management system. As already noted, solid waste management can be organized and operated by the county, private contractor, municipalities, or several cooperating municipalities. Various options exist for carrying on day-to-day solid waste management operations, and for assigning policy-making responsibilities.

Day-to-day management may be assigned to public employees at different levels of government or to a private contractor, or can be left entirely in the hands of private operators who then negotiate with individuals or local units of government to provide services. Supervisory responsibility and daily administration may be assigned to a solid waste manager, a department of engineering or public works, a private firm, or a sanitary district staff. Shared staff within a county or between cooperating municipalities should also be investigated.

Overall management of the system must be assigned to a policy-making body. Potential options include a county solid waste management board, the county board itself, sanitary districts, or governing bodies of cities, villages, or towns. Intergovernmental arrangements would require specific assignment of duties and powers between the participating entities.

Potential personnel needs for varying levels of solid waste management service must be considered. A particularly significant decision is whether to use government employee staffing or private firm contracting. Consideration should be given to staff size, experience, training or educational attainment requirements, supervisory needs, and staff location. The number of employees needed to operate a countywide system is dependent upon the type of facilities provided. Table 37 provides an indication of the level of effort needed, listing the employees involved in 15 county landfill operations around the State. Incineration operations may be expected to require from 5 to 40 employees, depending on the size of the operation, the amount of solid waste processed, and the hours of operation.

Table 37

EMPLOYEES INVOLVED IN DAILY OPERATIONS OF SELECTED COUNTYWIDE LANDFILLS: 1984

County	Capacity in Million Cubic Yards Unless Noted	Number of Equipment Operators	Number of Scale Operators	Number of Manager-Supervisors	Number of Clerks
Brown (two landfills)	2.7	2	1	--	--
	2.1	2	1	--	--
Dane (two landfills)	2.1	2	1	1	--
	3.8	1	1	1	1
Eau Claire	1.5	3	1	1	--
La Crosse	880,000 tons	1	1	1	--
Marathon	2.2	3	1	1	1
Oneida	0.9	2	1	--	--
Sauk	--	2	--	1	--
Winnebago	--	5	1	1	--
Fond du Lac	750,000 tons	1 county employee, 2 private contractors	--	--	--
Green	--	3 employees[a]	--	--	--
Juneau	0.6	2 employees	1	1	1 part-time
Lincoln	350,000 tons	2 employees[a]	--	--	--
Monroe	--	1 employee[a]	--	--	--
Outagamie	200,000 tons per year	2 employees	1	1	1
Shawano	--	1 employee	--	--	--

[a]Job assignments not identified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

The management of a solid waste facility involves the following responsibilities:

1. Hiring personnel to operate the waste management system in accordance with appropriate personnel procedures.

2. Negotiating and drafting contracts and agreements.

3. Designing, constructing, maintaining, and operating facilities and services.

4. Selecting and investigating sites and facilities.

5. Purchasing equipment and facilities.

6. Fulfilling state solid waste management approval and licensing requirements.

7. Drafting and enforcing any ordinances and regulations.

8. Preparing budgets.

9. Recommending establishment of service districts.

10. Calculating fees to be assessed to municipalities, businesses, persons, or service districts and recommending methods of fee collection.

11. Collecting fees and establishing billing procedures.

12. Providing payments for services rendered (municipal services, consulting work).

13. Conducting, sponsoring, or directing research.

14. Developing programs for using federal or state grants-in-aid or other assistance programs.

15. Keeping records and accounting.

16. Keeping the public informed.

17. Supplying facts, reports, information, and continuing education as requested and needed by policy-makers.

SUMMARY

Milwaukee County and the local units of government within the County have been granted authority by the State to manage solid wastes. Agencies in addition to the County which may have roles in solid waste management in Milwaukee County are cities and villages in the County, the Milwaukee Metropolitan Sewerage District, and the private sector. There are also several alternative institutional arrangements which may be viable for use in the County. These are: exclusive reliance on privately owned systems, systems owned by more than one local unit of government, and county-owned systems. In the case of systems owned by local units of government, the options of both public and private operation may be viable.

There are numerous options available for financing the capital costs of solid waste management systems. The type of such financing selected will be dependent upon the type of solid waste management system selected. With regard to operation and maintenance costs, it appears that several methods of financing are viable for use in Milwaukee County, including user fees, property taxes, private billing of industry and local units of government, and the waste management fund. Operational management and staffing is an important consideration in the evaluation of alternative systems. Various options exist for carrying out the day-to-day solid waste management operations. Day-to-day management may be assigned to public employees at different levels of government or to a private contractor, or can be left entirely in the hands of private operators who then negotiate with individuals or local units of government to provide services.

Chapter VII

EVALUATION OF SOLID WASTE MANAGEMENT ALTERNATIVES AND PRELIMINARY SELECTION OF RECOMMENDED ALTERNATIVE

INTRODUCTION

The essence of planning is the generation and assessment of alternative means of achieving agreed-upon objectives. The demographic information presented in preceding chapters of this report, together with the solid waste management objectives also presented in preceding chapters, provides the basis for the development and analysis of alternative solid waste management plans for Milwaukee County. In the previous chapter, the available solid waste management techniques were described and evaluated with regard to their applicability to Milwaukee County. Twelve alternative solid waste management plans, consisting of various combinations of applicable techniques, were determined to warrant more detailed evaluation. Also, five additional alternatives, which for the purpose of this evaluation have been termed accessory alternatives, were determined to warrant consideration. This chapter presents the results of these evaluations.

This chapter is divided into three sections. The first section describes each alternative plan to be evaluated, including the social, economic, technical, and regulatory factors which must be considered in a comparative evaluation of the alternatives. The second section provides a comparative evaluation of the alternatives and, based upon that evaluation, sets forth a recommended plan. These first two sections deal with alternative plans for the management of residential, commercial, and nonhazardous industrial solid wastes. The third section of this chapter addresses the management of special solid wastes which must be handled separately from the main solid waste stream, including hazardous wastes, sewage sludges, septic tank wastes, and holding tank wastes. As noted in Chapter V, all of the alternatives considered are concerned with the post-collection solid waste management functions, since the pre-collection storage and collection functions may be expected to continue to be performed by municipal public works departments and by private contractors.

ALTERNATIVE PLANS

Twelve alternative solid waste management plans were identified in Chapter V as being applicable in Milwaukee County. All of the alternatives call for the initiation of a residential solid waste recycling program. This recycling component was not specifically included in the alternative descriptions presented in Chapter V, but is included herein to meet state regulations which require establishment of such a program.

Alternative 1--The first alternative plan consists of the continued use of the entire existing solid waste management system, including existing storage, collection, and transfer station systems; and the establishment of a countywide residential solid waste recycling program. Unrecycled residential, commercial, and industrial solid wastes would be disposed of primarily at six existing commercial general-use landfills, one of which is located within Milwaukee County; and at seven existing private special-use landfills, all of which are located in the County. This alternative includes provisions for the improvement of existing facilities that would continue operating through the plan period, but which are not now in compliance with state solid waste management regulations.

Alternative 2--The second alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; and disposal of unrecycled solid wastes at a single existing commercial general-use landfill located within the County and at seven existing private special-use landfills, all of which are located within the County.

Alternative 3--The third alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; and disposal of unrecycled solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 4--The fourth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at one incinerator designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 5--The fifth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at one incinerator designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 6--The sixth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at two separate incinerators designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 7--The seventh alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at three separate incinerators designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 8--The eighth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at five separate incinerators designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 9--The ninth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at two separate incinerators designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 10--The tenth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at three separate incinerators designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 11--The eleventh alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at five separate incinerators designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

Alternative 12--The twelfth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; conversion of a portion of the unrecycled solid wastes generated in the County into refuse-derived fuel; incineration of the refuse-derived fuel at one incinerator designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes, refuse-derived fuel process residue, and incinerator ash at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

In addition to these 12 basic solid waste management alternatives, five accessory alternatives, including the use of residential solid waste recycling at drop-off centers, and the use of separate pickup of newsprint, composting, bioconversion, and landfill methane recovery, will also be discussed below. The term accessory alternatives is being used to describe these resource recovery techniques because they could, either separately or in combination, be used in conjunction with any one of the 12 "major" alternatives.

Considerations in Evaluation of Alternatives

This chapter provides estimates of the capital and operating costs associated with each of these 12 alternative plans, including the costs of all post-collection functions such as transfer, transportation, resource recovery, incineration, and disposal. The costs of land acquisition, engineering, interest during construction, and construction, as well as of operation and maintenance, are estimated for each alternative as applicable. While these costs are an important consideration, it must be recognized that the selection of a recommended solid waste management plan cannot be based upon economic considerations alone, but must consider other factors such as environmental impacts as well.

Each of the alternatives considered in this chapter is designed to accommodate the total residential, commercial, and industrial solid waste stream expected to be generated in Milwaukee County through the year 2010, excluding that waste which is presently recycled, and excluding special wastes such as hazardous wastes, fly ash, sewage sludge, and septic and holding tank wastes. The solid waste quantities and characteristics used in the design and evaluation of the alternative plans are set forth in Table 38. The total quantity of residential, commercial, and industrial solid wastes for which alternatives have been evaluated is estimated to be 1,035,000 tons per year, or about 2,850 tons per day. This quantity does not include approximately 13,000 tons of residential wastes, 82,500 tons of commercial wastes, 290,430 tons of industrial wastes, 70,000 tons of construction and demolition debris, 10,400 tons of trees and brush, and 1,000 tons of bulk materials which are anticipated to be recycled, incinerated in privately owned small-scale incinerators, or disposed of at places other than licensed landfills, such as at areas needing "clean fill." The quantities of industrial and commercial solid wastes and of construction and demolition debris estimated to be recycled or incinerated privately are shown to increase somewhat over existing levels. This increase is attributed to changes in manufacturing processes, improved systems for waste material exchanges, and a greater emphasis by state solid waste management officials on recycling of these materials. Additional average annual

Table 38

AVERAGE ANNUAL SOLID WASTE QUANTITIES AND COMPOSITION TO BE CONSIDERED IN THE ALTERNATIVE PLANS: 2010

Component	Residential		Commercial		Industrial		Construction and Demolition, Bulk, Trees and Brush		Total	
	Waste Generated (tons)	Percentage by Weight	Waste Generated (tons)	Percentage by Weight	Waste Generated (tons)	Percentage by Weight	Waste Generated (tons)	Percentage by Weight	Waste Generated (tons)	Percentage by Weight
Paper	241,050	47	59,900	50	92,570	30	--	--	393,520	38
Foundry sand	--	--	--	--	95,800	31	--	--	95,800	9
Metal	36,100	7	12,330	10	37,000	12	--	--	83,430	8
Food	65,130	13	14,920	12	--	--	--	--	80,050	8
Plastic	32,150	6	8,950	7	13,000	4	--	--	54,100	5
Yard	66,310	13	--	--	--	--	--	--	66,310	6
Construction and demolition debris	--	--	--	--	--	--	46,800	59	46,800	5
Glass	27,350	5	6,200	5	6,000	2	--	--	39,550	4
Wood	10,800	2	--	--	17,000	6	--	--	27,800	3
Textiles	21,620	4	--	--	5,000	2	--	--	26,620	3
Trees and Brush	--	--	--	--	--	--	25,120	25	25,120	2
Bulk	--	--	--	--	--	--	19,450	16	19,450	2
Unclassified and Miscellaneous	15,050	3	19,400	16	40,000	13	--	--	74,450	7
Total	515,560[a]	100	121,700	100	306,370	100	91,370	100	1,035,000	100

[a]These quantities do not include 13,000 tons of residential wastes, 82,500 tons of commercial wastes, 290,430 tons of industrial wastes, 70,000 tons of construction and demolition debris, and 11,400 tons of trees, brush, and bulk materials which are anticipated to be recycled, reused, and incinerated at existing facilities.

Source: SEWRPC.

quantities of 27,500 tons of commercial wastes, 40,430 tons of industrial wastes, and 13,200 tons of construction and demolition debris are expected to be recycled during the plan period. These estimates were made by the Commission staff based upon review of the state waste reduction and recycling plan prepared by the Wisconsin Department of Natural Resources (DNR), discussions with DNR personnel involved in the state program, and review of the commercial and industrial solid waste inventory information collected for this study. The means by which these materials will be recycled are to be determined in the private sector, and therefore the costs are not included in this report.

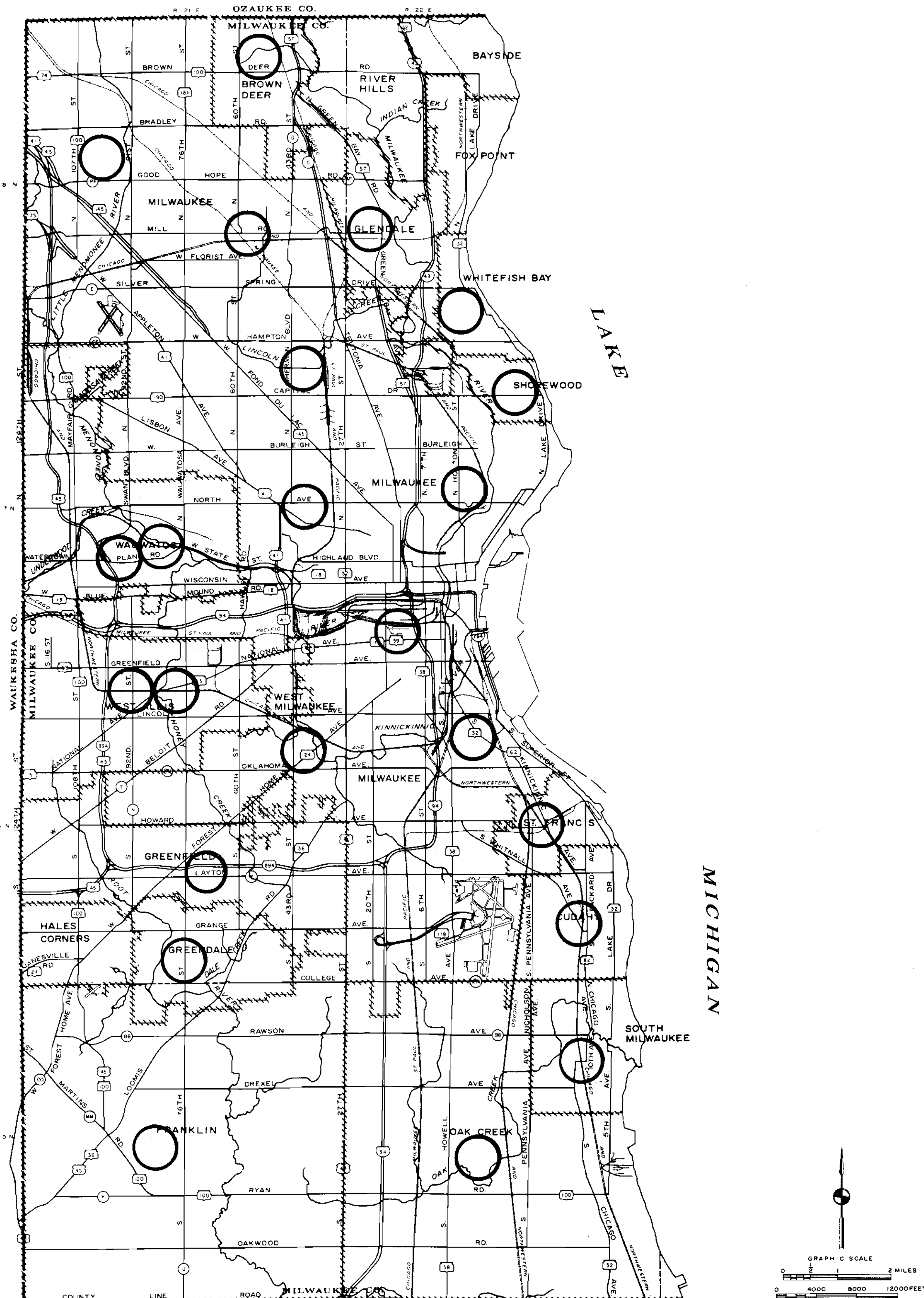
An important component of the alternatives is the establishment of a residential solid waste recycling program, as required by amendments to Chapter 144 of the Wisconsin Statutes. The number of recycling centers required, and the communities in which they are recommended to be located, are: one--Village of Brown Deer, one--Village of Greendale, one--Village of Shorewood, one--Village of Whitefish Bay, one--City of Cudahy, one--City of Franklin, one--City of Glendale, one--City of Greenfield, eight--City of Milwaukee, one--City of Oak Creek, one--City of St. Francis, one--City of South Milwaukee, two--City of Wauwatosa, and two--City of West Allis. The recommended locations of these stations are shown on Map 35. Assuming a moderate level of participation by the public, approximately 25,000 tons per year, or about 5 percent of the residential solid wastes generated, would be recycled by these centers. Most of the recyclable residential solid wastes deposited at these centers, which would include primarily newsprint, glass, aluminum, and plastic, would be transported to the centers by individual residents.

Another important component of each alternative is the continued use of transfer stations. All the alternatives evaluated in this study assume that most residential solid wastes will continue to be transported to transfer stations in the study area prior to transport to disposal sites in a manner similar to the existing system, with some modification depending on the number and location of the disposal sites as described in the following sections. The existing transfer sites include the Northwest transfer station, Americology transfer station, and Lincoln Avenue transfer station, all of which receive solid wastes generated in the City of Milwaukee; the Glendale transfer station, which receives solid wastes generated in the City of Glendale and the Village of Whitefish Bay; the Shorewood transfer station, which receives solid wastes generated in the Village of Shorewood; the Wauwatosa transfer station, which receives solid wastes generated in the City of Wauwatosa; the West Allis transfer station, which receives solid wastes generated in the City of West Allis and the Village of West Milwaukee; and the Cudahy transfer station, which receives solid wastes generated in the City of Cudahy. Solid wastes received at these transfer stations would then be transported to a disposal site. Residential solid waste generated in the Villages of Bayside, Brown Deer, Fox Point, and River Hills is presently transported to a transfer station located in Washington County. Residential solid wastes generated in the Cities of Franklin, Greenfield, Oak Creek, South Milwaukee, and St. Francis and the Villages of Bayside, Brown Deer, Fox Point, Greendale, Hales Corners, and River Hills are presently not transported to any of these transfer stations, but rather are transported directly to disposal sites or to a privately owned and operated transfer station outside Milwaukee County.

The amount of ash to be disposed of in each of the alternatives dealing with incineration is an important consideration. In general, the incineration

Map 35

GENERALIZED LOCATIONS FOR RESIDENTIAL SOLID WASTE RECYCLING CENTERS IN MILWAUKEE COUNTY



Source: SEWRPC.

systems may all be expected to reduce the tonnage of solid waste by about 75 percent, leaving about 25 percent as ash on a dry-weight basis, and about 35 percent on a wet-weight basis if quenching operations are used. In terms of volume reduction, the ash generated would represent approximately 15 percent of the volume of solid waste prior to incineration.

It is important to note that four commercial general-use landfills and several private special-use landfills presently used for disposal of solid wastes generated in Milwaukee County are included only under the first alternative which provides for continued use of the entire current system. It is anticipated that some of these landfills will continue to accept solid wastes generated in the study area during all or a portion of the plan period. However, owing to location, lack of capacity, or restrictions on the types of wastes which can be accepted, these landfills are generally not expected to be used to dispose of significant quantities of solid wastes generated in the study area. Landfills included in this category were: the Heckimovich landfill located in Dodge County; the Land Reclamation Ltd., landfill in Racine County; the Browning and Ferris landfill located in Lake County, Illinois; the Barrett landfill located in the City of New Berlin; the Waste Management of Wisconsin, Inc., landfill located in the City of Muskego; the Allis Chalmers landfill located in the City of Greenfield; the DeRosso landfill located in the City of Oak Creek; and the Industrial Waste Corporation landfill located in the City of New Berlin. More detail on the use of these landfills is presented in Chapter IX.

The principal features and costs of the 12 alternative plans considered are summarized in Table 39, and the alternatives are graphically summarized in Figure 15. Each alternative is described below. The unit-cost and other detailed data utilized in the development of these alternative cost estimates are provided in Appendix E. A more detailed breakdown of the costs of each alternative is included in Appendix F. All costs are expressed in constant 1985 dollars.

Alternative Plan 1: Continued Use of Existing Solid Waste Management Systems

Under Alternative Plan 1, solid wastes generated in the study area would be recycled or landfilled. The principal components of the solid waste management system under Alternative Plan 1 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to either one of the eight existing transfer stations located in the County which serve municipalities in the study area, or one of the privately owned and operated transfer stations located outside the County which also serve municipalities in the study area, followed by transport to a landfill site in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to a landfill; 3) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 4) disposal of all unrecycled solid wastes by landfilling, using six existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The existing solid waste management system is described in detail in Chapter II and shown on Map 22.

The post-collection solid waste transportation system in the study area is similar to the existing system described in Chapter II. Most residential solid wastes would continue to be transported to one of the eight transfer stations

Table 39

PRINCIPAL FEATURES AND COSTS OF SOLID WASTE MANAGEMENT ALTERNATIVES FOR MILWAUKEE COUNTY: 1990-2010

		Cost Estimates: 1990-2010[a]								
			Annual Costs and Revenues							
Alternative	Principal Components	Initial Capital Cost	Annual Amortized Capital Cost[b]	Transport and Transfer	Landfill Disposal[c]	New Facilities Operation and Maintenance	Average Annual Revenue[d]	Total Average Annual Cost	Unit Cost (dollars per ton)	Total Present Worth of Capital and Operation and Maintenance[b]
1. Continued use of existing solid waste management systems	Initiation of a program for a moderate level of residential solid waste recycling Disposal of unrecycled solid wastes at six existing commercial general-use landfills and at seven existing private special-use landfills	$ 563,000	$ 49,000	$9,023,000	$21,222,000[e]	$ 469,000	$ --	$30,763,000	$29.72[e]	$352,852,000
2. Disposal of solid wastes at a single existing commercial general-use landfill and at seven existing private special-use landfills	Initiation of a program for a moderate level of residential solid waste recycling Disposal of unrecycled solid wastes at one existing commercial general-use landfill and at seven existing private special-use landfills	$ 563,000	$ 49,000	$9,913,000	$21,222,000	$ 469,000	$ --	$31,653,000	$30.58	$363,060,000
3. Disposal of solid wastes at two existing commercial general-use landfills and at seven existing private special-use landfills	Initiation of a program for a moderate level of residential solid waste recycling Disposal of unrecycled solid wastes at two existing commercial general-use landfills and at seven existing private special-use landfills	$ 563,000	$ 49,000	$8,830,000	$21,222,000	$ 469,000	$ --	$30,570,000	$29.54	$350,638,000
4. Processing of a portion of the solid wastes at one new incinerator with a capacity of 1,200 tons per day and designed for steam production, with disposal of unincinerated and unrecycled solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at one new incinerator designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$ 86,462,000	$ 7,539,000	$7,834,000	$16,717,000	$ 5,485,000[f]	$10,225,000	$27,350,000	$26.43	$313,704,000
5. Processing of a portion of the solid wastes at one new incinerator with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at a new incinerator designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$100,893,000	$ 8,798,000	$7,834,000	$16,717,000	$ 5,749,000[f]	$ 6,610,000	$32,488,000	$31.39	$372,637,000
6. Processing of a portion of the solid wastes at two new incinerators with a capacity of 1,200 tons per day and designed for steam production with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at two new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$ 97,857,000	$ 8,510,000	$7,236,000	$16,717,000	$ 6,131,000[f]	$10,098,000	$28,496,000	$27.53	$326,849,000
6A. Processing of a portion of the solid wastes at two new incinerators with a capacity of 1,400 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at two new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$114,860,000	$10,016,000	$6,751,000	$15,814,000	$ 7,271,000[f]	$11,841,000	$28,011,000	$27.06	$321,286,000

Table 39 (continued)

Alternative	Principal Components	Cost Estimates: 1990-2010[a]								
			Annual Costs and Revenues							
		Initial Capital Cost	Annual Amortized Capital Cost[b]	Transport and Transfer	Landfill Disposal[c]	New Facilities Operation and Maintenance	Average Annual Revenue[d]	Total Average Annual Cost	Unit Cost (dollars per ton)	Total Present Worth of Capital and Operation and Maintenance[b]
7. Processing of a portion of the solid wastes at three new incinerators with a capacity of 1,200 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at three new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$ 93,400,000	$ 8,144,000	$7,184,000	$16,717,000	$ 6,620,000[f]	$ 9,964,000	$28,701,000	$27.73	$329,200,000
7A. Processing of a portion of the solid wastes at three new incinerators with a capacity of 1,400 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at three new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$105,900,000	$ 9,234,000	$6,724,000	$15,814,000	$ 7,650,000[f]	$11,707,000	$27,715,000	$26.78	$317,891,000
8. Processing of a portion of the solid wastes at five new incinerators with a capacity of 1,200 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at five new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$ 99,587,000	$ 8,684,000	$7,278,000	$16,717,000	$ 7,524,000[f]	$ 9,828,000	$30,375,000	$29.35	$348,401,000
8A. Processing of a portion of the solid wastes at five new incinerators with a capacity of 1,400 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at five new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$115,200,000	$10,045,000	$6,867,000	$15,814,000	$ 8,434,000[f]	$11,572,000	$29,588,000	$28.59	$339,030,000
9. Processing of a portion of the solid wastes at two new incinerators with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at two new incinerators designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$108,870,000	$ 9,493,000	$7,236,000	$16,717,000	$ 6,397,000[f]	$ 5,878,000	$33,965,000	$32.82	$389,579,000
10. Processing of a portion of the solid wastes at three new incinerators with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at three new incinerators designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$104,760,000	$ 9,135,000	$7,184,000	$16,717,000	$ 6,820,000[f]	$ 5,857,000	$33,999,000	$32.85	$389,909,000

Table 39 (continued)

Alternative	Principal Components	Cost Estimates: 1990-2010[a] Initial Capital Cost	Annual Costs and Revenues: Annual Amortized Capital Cost[b]	Transport and Transfer	Landfill Disposal[c]	New Facilities Operation and Maintenance	Average Annual Revenue[d]	Total Average Annual Cost	Unit Cost (dollars per ton)	Total Present Worth of Capital and Operation and Maintenance[b]
11. Processing of a portion of the solid wastes at five new incinerators with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at five new incinerators designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$116,840,000	$10,188,000	$ 7,278,000	$16,717,000	$ 7,884,000[f]	$ 5,148,000	$36,919,000	$35.67	$423,461,000
12. Processing of a portion of the solid wastes into refuse-derived fuel, incineration at one incinerator with a capacity of 1,000 tons per day and designed for electric power generation, and disposal of unincinerated and unrecycled solid wastes, refuse-derived-fuel residue, and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Processing of solid wastes into refuse-derived fuel Incineration of refuse-derived fuel at one new incinerator designed for electric power generation Disposal of unrecycled and unincinerated solid wastes, refuse-derived-fuel residue, and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$ 90,600,000	$ 7,900,000	$ 7,885,000	$16,370,000	$ 5,800,000[f]	$ 5,491,000	$32,464,000	$31.37	$372,362,000

[a]Cost expressed in 1985 dollars.

[b]Economic analysis and amortization rates based upon an annual interest rate of 6 percent, and a 20-year amortization period.

[c]Landfill disposal costs are based on a tipping fee of $21 per ton. This cost incudes both operation and maintenance costs at the landfills, as well as capital costs needed for expansion and upgrading of the landfill facilities. The capital cost is included in the annual costs since the expenditures are expected to be made incrementally over the life of the facility.

[d]Revenues are generated from the sale of steam or electricity produced at the incinerator facilities.

[e]Landfill costs estimated at $21 per ton--the same as for the other alternatives. Using costs presently experienced at landfill sites outside the study area results in a landfill cost of $20,323,000 and a unit cost of $28.86.

[f]This cost does not include the costs of the transport and disposal of incinerator residue. Those costs are included under the transportation and landfilling annual costs.

Source: SEWRPC.

Figure 15

SCHEMATIC DIAGRAM OF SELECTED SOLID WASTE MANAGEMENT ALTERNATIVES

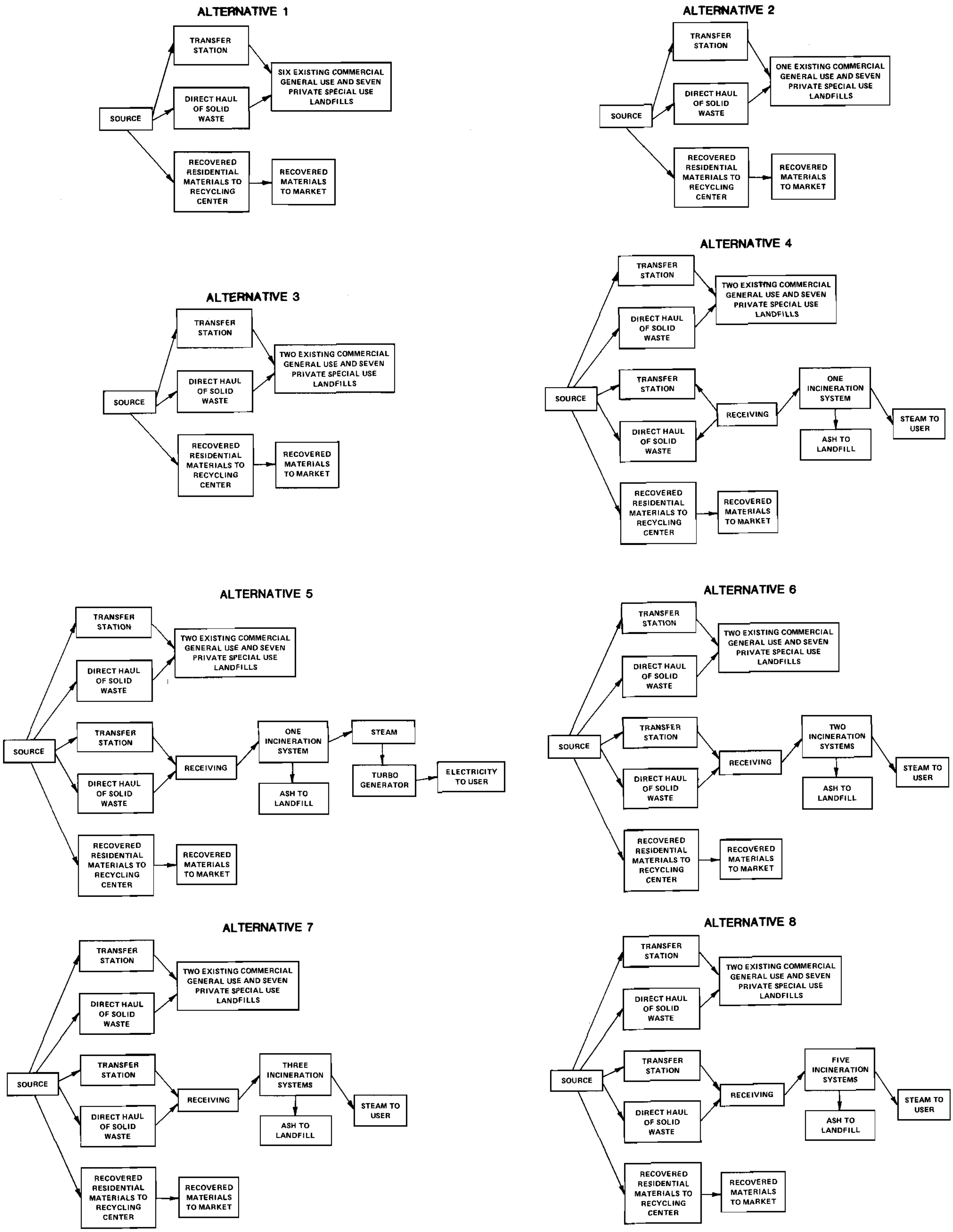
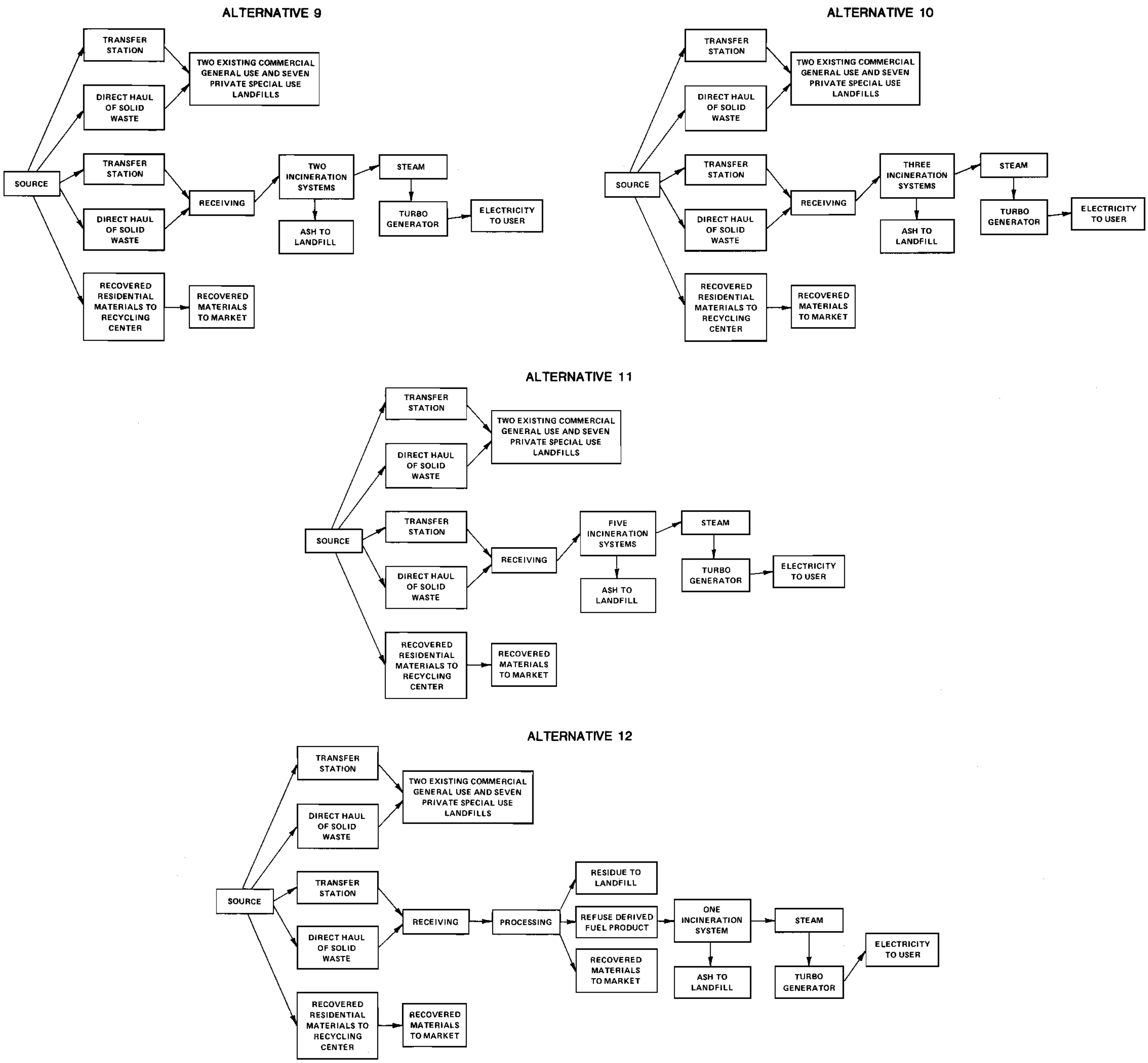


Figure 15 (continued)



Source: SEWRPC.

in the study area. Solid wastes received at these stations would then be transported in large-capacity vehicles to a landfill. Residential solid wastes generated in the Villages of Bayside, Brown Deer, Fox Point, and River Hills would be transported to a privately owned and operated transfer station in Washington County, followed by transport in large-capacity vehicles to a landfill. Residential solid wastes not transported to one of the above-referenced transfer stations would be transported directly to one of the landfills. Commercial and industrial solid wastes would be transported primarily by private contractors to one of the landfills. Of the total quantity of unrecycled solid waste generated, about 449,000 tons, or 44 percent on an average annual basis, would be transferred, with the remaining 561,000 tons, or 56 percent, being hauled directly to a landfill.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily in private vehicles.

The remaining 1,010,000 tons per year, or 98 percent of the average annual solid waste load generated in the study area would be disposed of primarily at landfills--in particular, six existing commercial general-use landfills, including Waste Management of Wisconsin, Inc., landfills located in the City of Franklin in Milwaukee County, the Village of Germantown in Washington County, and the City of Muskego in Waukesha County; the Land Reclamation landfill located in the Town of Mt. Pleasant, Racine County; the Heckimovich landfill located in the Town of Williams, Dodge County; and the Browning and Ferris landfill located in the Town of Benton, Lake County, Illinois. In addition, unrecycled solid wastes generated in the study area would be disposed of at seven existing private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 1 is $563,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $30,714,000. The total average annual cost of capital and operation and maintenance is $30,763,000, or about $30 per ton of solid waste.

Alternative Plan 2: Disposal at a Single Existing Commercial General-Use Landfill and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 2, solid wastes generated in the study area would be recycled or landfilled. The principal components of the solid waste management system under Alternative Plan 2 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to a landfill in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to a landfill; 3) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 4) disposal of all unrecycled solid wastes by landfilling using primarily one existing commercial general-use landfill and seven existing private special-use landfills located within and adjacent to the County. The locations of the primary landfills and transfer stations under Alternative Plan 2, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 36.

The post-collection solid waste transportation system in the study area is similar to the existing system described in Chapter II except that residential waste from the Villages of Bayside, Brown Deer, Fox Point, and River Hills would not be transported to the privately operated transfer station located in Washington County, and the location of the disposal sites is different. Most residential solid wastes would continue to be transported to one of the eight transfer stations in the study area. Solid wastes received at these stations would then be transported in large-capacity vehicles to one of the landfills. Residential solid wastes not transported to transfer stations would be transported directly to one of the landfills. Commercial and industrial solid wastes would be transported primarily by private contractors to one of the landfills. Of the total quantity of unrecycled solid wastes generated, about 434,000 tons, or 43 percent on an average annual basis, would be transferred, with the remaining 576,000 tons, or 57 percent, being hauled directly to a landfill.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to recycling centers primarily in private vehicles.

The remaining 1,010,000 tons per year, or 98 percent of the average annual solid waste load generated in the study area, would be disposed of primarily at landfills--in particular, one existing commercial general-use landfill owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin, and seven existing private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

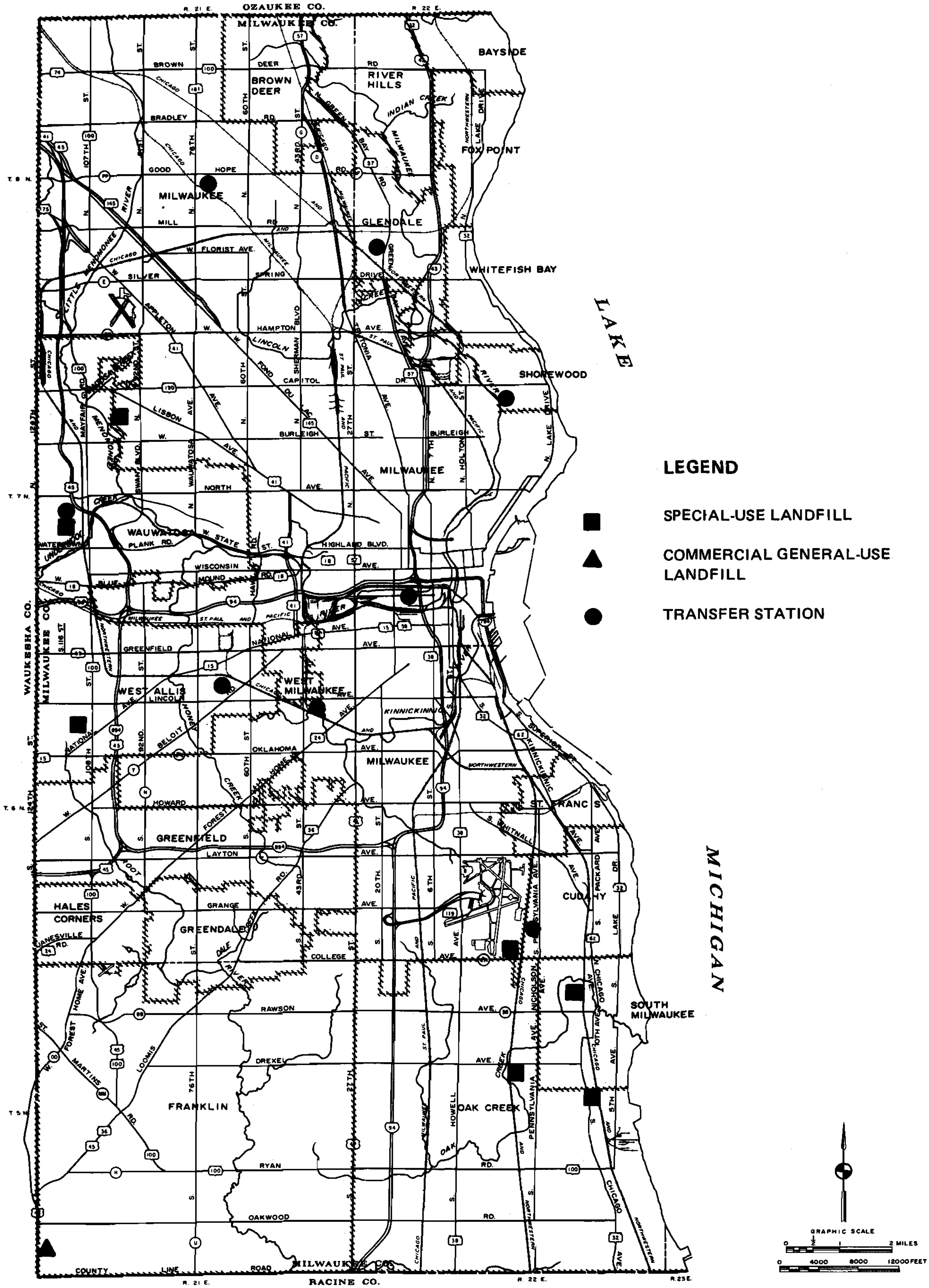
The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 2 is $563,000, with an average annual operation and maintenance cost, including landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $31,604,000. The total average annual cost of capital and operation and maintenance is $31,653,000, or about $31 per ton of solid waste.

Alternative Plan 3: Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 3, solid wastes generated in the study area would be recycled or landfilled. The principal components of the solid waste management system under Alternative Plan 3 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to a landfill in larger capacity

Map 36

ALTERNATIVE 2--DISPOSAL OF SOLID WASTES AT A SINGLE EXISTING COMMERCIAL GENERAL-USE LANDFILL AND AT SEVEN EXISTING SPECIAL-USE LANDFILLS



Source: SEWRPC.

vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to a landfill; 3) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 4) disposal of all unrecycled solid wastes by landfilling, using primarily two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills and transfer stations under Alternative Plan 3, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 37.

The post-collection solid waste transportation system in the study area is the same as was described for Alternative Plan 2 with the exception of the location of the disposal sites. Most residential solid wastes would continue to be transported to one of the eight transfer stations in the study area. Solid wastes received at these stations would then be transported in large-capacity vehicles to one of the landfills. Residential solid wastes not transported to transfer stations would be transported directly to one of the landfills. Commercial and industrial solid wastes would be transported primarily by private contractors to one of the landfills. Of the total quantity of unrecycled solid wastes generated, about 434,000 tons, or 43 percent on an average annual basis, would be transferred, with the remaining 576,000 tons, or 57 percent, being hauled directly to a landfill.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to recycling centers primarily in private vehicles.

The remaining 1,010,000 tons per year, or 98 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

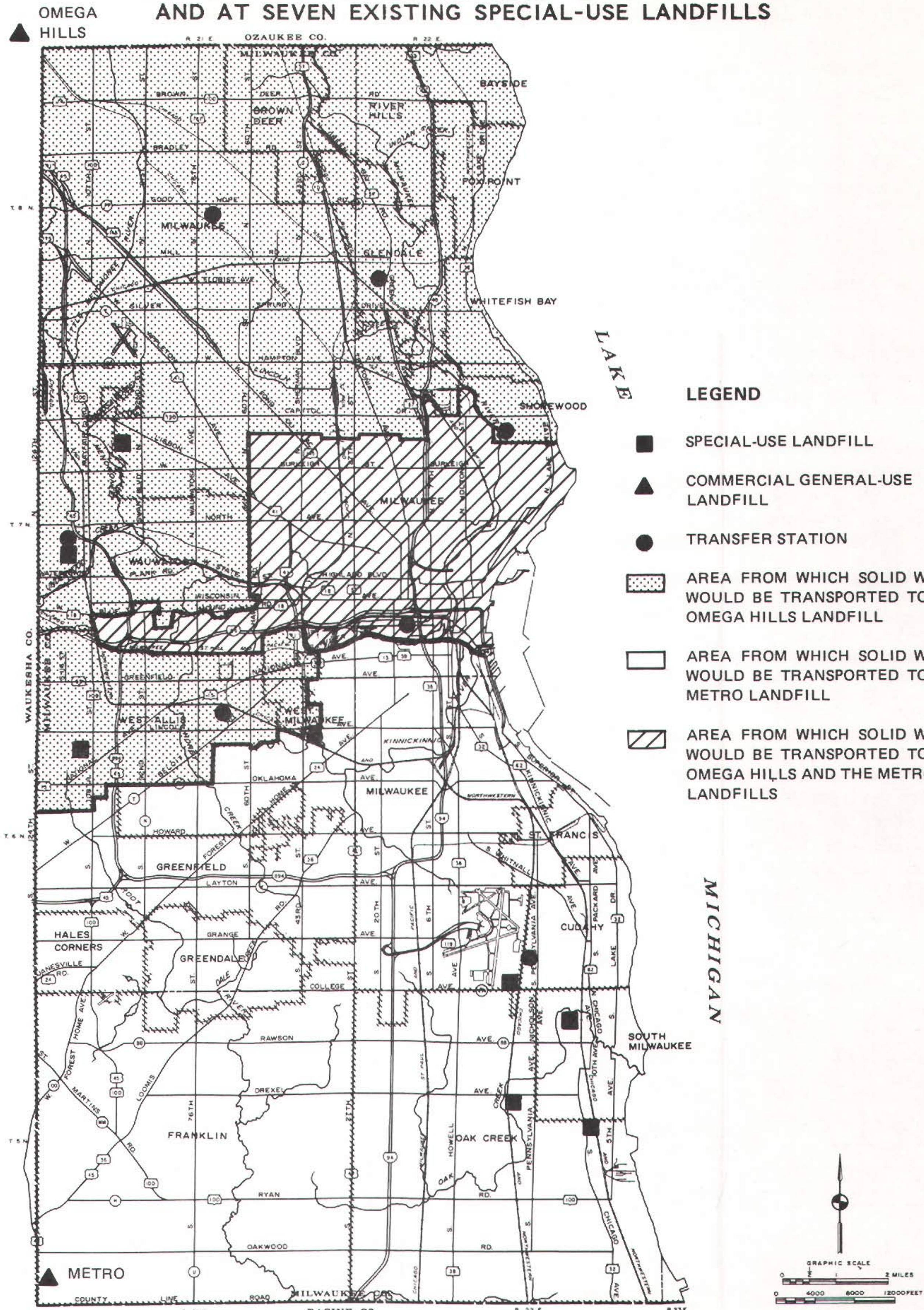
The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 3 is $563,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $30,521,000. The total average annual cost of capital and operation and maintenance is $30,570,000, or about $30 per ton of solid waste.

Alternative Plan 4: Processing of a Portion of the Solid Wastes at a Single Incinerator Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 4, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 4 are: 1) continued transport

Map 37

ALTERNATIVE 3--DISPOSAL OF SOLID WASTES AT TWO EXISTING COMMERCIAL GENERAL-USE LANDFILLS AND AT SEVEN EXISTING SPECIAL-USE LANDFILLS



LEGEND

- SPECIAL-USE LANDFILL
- COMMERCIAL GENERAL-USE LANDFILL
- TRANSFER STATION
- AREA FROM WHICH SOLID WASTE WOULD BE TRANSPORTED TO THE OMEGA HILLS LANDFILL
- AREA FROM WHICH SOLID WASTE WOULD BE TRANSPORTED TO THE METRO LANDFILL
- AREA FROM WHICH SOLID WASTE WOULD BE TRANSPORTED TO THE OMEGA HILLS AND THE METRO LANDFILLS

Source: SEWRPC.

in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to the incinerator or to a landfill in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to the incinerator or to a landfill; 3) processing of a portion of the solid wastes at a new incineration system designed for steam production; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using principally two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerator under Alternative Plan 4, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 38.

The post-collection solid waste transportation system in the study area would consist of the transport of most residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station would be hauled directly to the incinerator site under this alternative. Of the total quantity of unrecycled solid wastes generated, about 328,000 tons, or 32 percent on an average annual basis, would be transferred, with the remaining 682,000 tons, or 68 percent, being hauled directly to the incinerator or to a landfill.

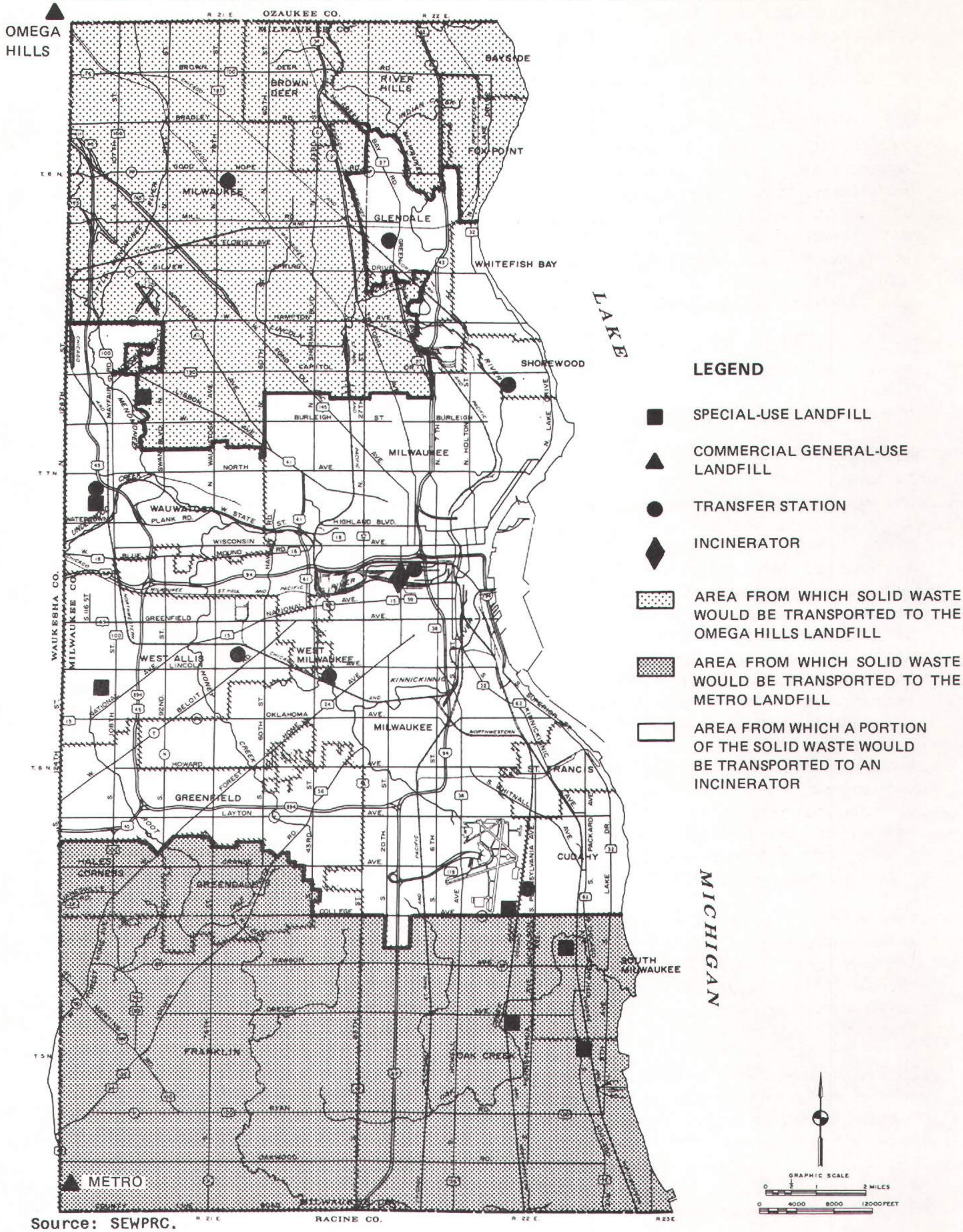
As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the steam energy produced, as well as of the seasonal distribution of the waste generated, a mass burn incineration system with a capacity of 1,200 tons per day was selected. A total of 330,000 tons per year, or about 32 percent of the average annual solid waste load, would be incinerated. The system would have the capacity to produce 6.2 million to 7.0 million pounds of steam per day at a pressure of 200 to 300 pounds per square inch (psi). This alternative includes the costs of extending steam conveyance lines to the district steam heating and cooling system serving the Milwaukee downtown area and other users. For the purpose of this evaluation, it was assumed that the facility would be located at the Americology transfer station site. Approximately 115,500 tons of ash would be generated by this facility per year, which would be disposed of at an approved landfill.

As previously discussed, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling centers primarily in private vehicles.

The remaining 680,000 tons per year, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., and located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including

Map 38

ALTERNATIVES 4 AND 5--PROCESSING OF A PORTION OF THE SOLID WASTES AT AN INCINERATOR, WITH DISPOSAL AT TWO EXISTING GENERAL-USE LANDFILLS AND SEVEN EXISITNG SPECIAL-USE LANDFILLS



Source: SEWPRC.

two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 4 is $86,462,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $19,811,000, and including a credit of $10,225,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $27,350,000, or about $26 per ton of solid waste.

Alternative Plan 5: Processing of a Portion of the Solid Wastes at a Single Incinerator Designed for Electric Power Generation, with Disposal at Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 5, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 5 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to the incinerator, or to a landfill in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to the incinerator or to a landfill; 3) processing of a portion of the solid wastes at a new incineration system designed for electric power generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerator under Alternative Plan 5, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 38.

The post-collection solid waste transportation system in the study area will consist of the transport of most residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station would be hauled directly to the incinerator site under this alternative. Of the total quantity of unrecycled solid wastes generated, about 328,000 tons, or 32 percent on an average annual basis, would be transferred, with the remaining 682,000 tons, or 68 percent, being hauled directly the incinerator or to a landfill.

As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the electric energy produced, as well as of the seasonal distribution of the waste generated, a mass burn incineration system with a capacity of 1,200 tons per day was selected. A total of 330,000 tons per year, or about 32 percent of the average annual solid waste load, would be incinerated. The system would have the capacity to produce 6.0 million to 6.9 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 540,000 and 621,000 kilowatts per day of electricity, of which approximately 502,200 to 577,500 kilowatts per day would be available for sale. For the purpose of this evaluation, it was assumed that the facility would be located at the Americology transfer station site. Approximately 115,500 tons of ash would be generated by this facility per year, which would be disposed of at an approved landfill.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the center primarily by private vehicle.

The remaining 680,000 tons per year, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

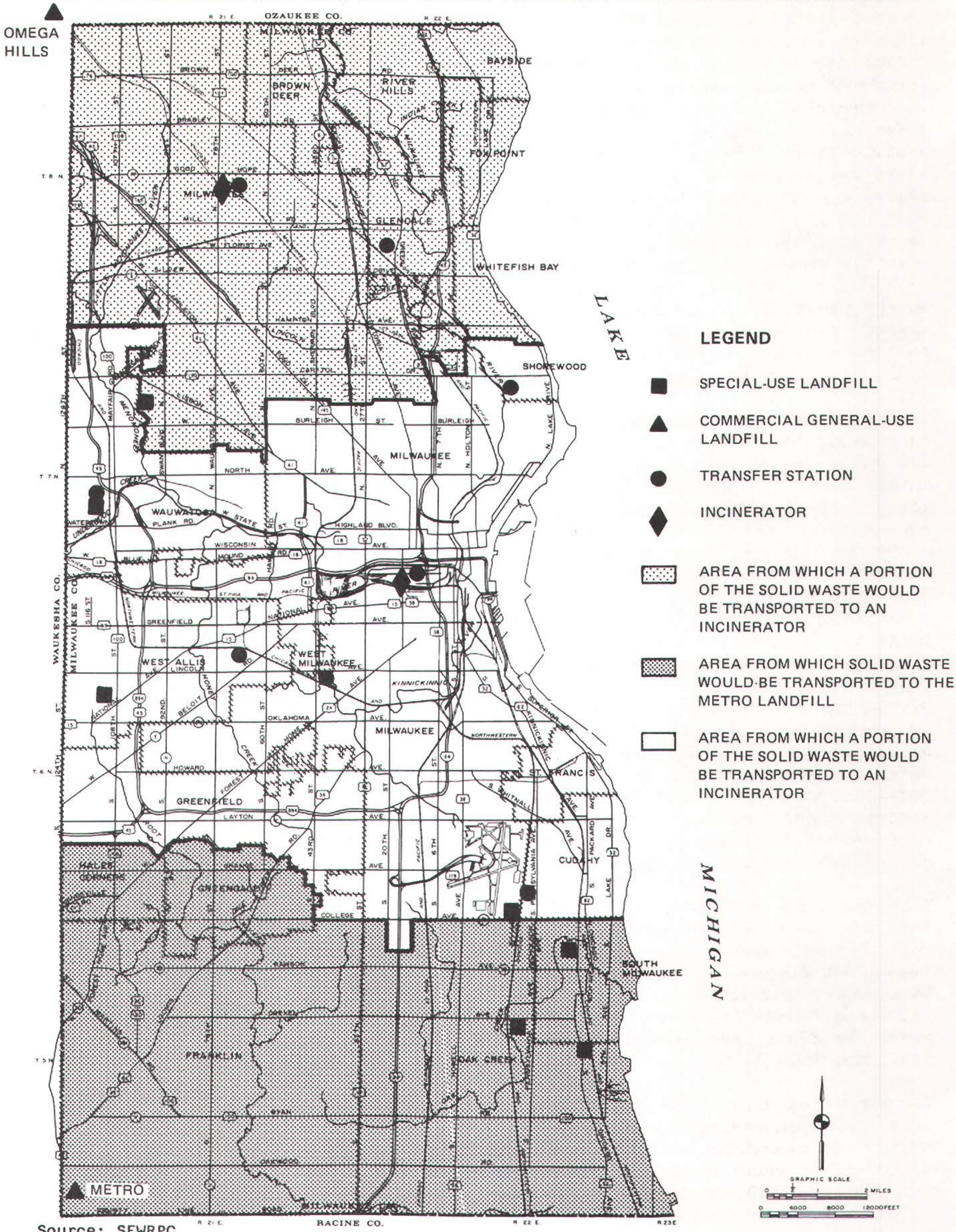
The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 5 is $100,893,000, with an average annual net operation and maintenance cost, including landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $23,690,000, and including a credit of $6,610,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $32,488,000, or about $31 per ton of solid waste.

Alternative Plans 6 and 6A: Processing of a Portion of the Solid Wastes at Two Separate Incinerators Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 6, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 6 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to one of the two separate incinerators, or to landfills in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to one of the two separate incinerators or to a landfill; 3) processing of a portion of the solid wastes at two new incineration systems designed for steam generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily two existing commercial general-use sanitary landfills and seven existing private special use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerators under Alternative Plan 6, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 39.

Map 39

ALTERNATIVES 6 AND 9--PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO INCINERATORS, WITH DISPOSAL AT TWO EXISTING GENERAL-USE LANDFILLS AND SEVEN EXISTING SPECIAL-USE LANDFILLS



Source: SEWRPC.

The post-collection solid waste transportation system in the study area will consist of the transport of most residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station and at the Northwest transfer station would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 272,000 tons, or about 27 percent on an average annual basis, would be transferred, with the remaining 738,000 tons, or 73 percent, being hauled directly to the incinerators or to a landfill.

As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the steam energy produced, as well as of the seasonal distribution of the waste generated, two separate incineration systems, one system with a capacity of 800 tons per day and one system with a capacity of 400 tons per day, were selected. A total of 330,000 tons per year, or about 32 percent of the average annual solid waste load, would be incinerated. The 800-ton-per-day mass burn incineration facility, which for the purpose of this evaluation would be located at the Americology transfer station site, would have the capacity to produce between 4.0 and 4.6 million pounds of steam per day at a pressure of 200 to 300 psi. Approximately 77,000 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill. The 400-ton-per-day mass burn incineration facility, which for the purpose of this evaluation would be located at the Northwest transfer station site, would have the capacity to produce between 2.0 and 2.1 million pounds of steam per day at a pressure of 200 to 300 psi. Approximately 38,500 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill. This alternative includes provisions and associated costs to extend steam conveyance lines from the Americology site to the district heating and cooling system serving downtown Milwaukee and/or other users, and to other users from the Northwest transfer station site.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling centers primarily by private vehicle.

The remaining 680,000 tons, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown; and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 6 is $97,857,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $19,906,000, and including a credit of $10,098,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $28,496,000, or about $28 per ton of solid waste.

As part of the evaluation under Alternative Plan 6, a subalternative--Alternative 6A--was also investigated which also called for processing of a portion of the solid waste generated in the study area at two incinerators providing for steam production. This alternative plan is the same as Alternative 6 as shown on Map 39 with the exception that the incinerator facility located at the Americology transfer station site would have a capacity of 1,000 tons of solid waste per day as opposed to 800 tons of solid waste per day under Alternative Plan 6. With this additional capacity plus the capacity of 400 tons per day at the second incinerator located at the Northwest transfer station site, the amount of solid waste incinerated in most of the areas served by the incinerator systems would be increased from about 40 percent to 60 percent for residential waste and from 20 percent to 30 percent for combustible commercial and industrial solid waste. These increased percentages are comparable to the percentages used in Alternative Plan 4, which serves fewer communities. The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 6A is $114,860,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $17,995,000, and including a credit of $11,841,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $28,011,000, or about $27 per ton of solid waste.

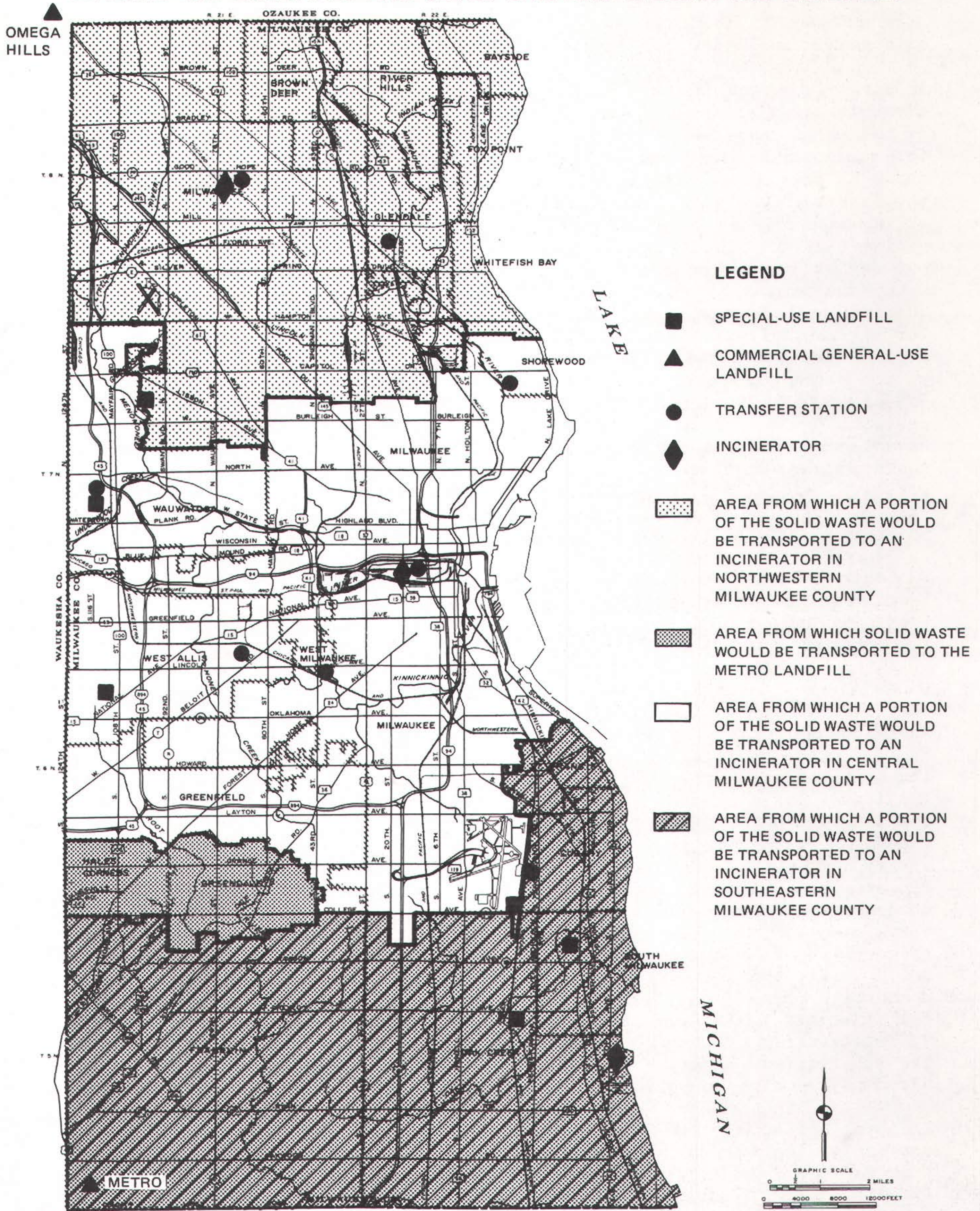
Alternative Plan 7: Processing of a Portion of the Solid Wastes at Three Separate Incinerators Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 7, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 7 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to one of the three separate incinerators, or to landfills in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to one of the three separate incinerators or to a landfill; 3) processing of a portion of the solid wastes at three new incineration systems designed for steam generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerators under Alternative Plan 7, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 40.

The post-collection solid waste transportation system in the study area will consist of the transport of most residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station and at the North-

Map 40

ALTERNATIVES 7 AND 10--PROCESSING OF A PORTION OF THE SOLID WASTES AT THREE INCINERATORS, WITH DISPOSAL AT TWO EXISTING GENERAL-USE LANDFILLS AND SEVEN EXISTING SPECIAL-USE LANDFILLS



Source: SEWRPC.

west transfer station would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 298,000 tons, or about 30 percent on an average annual basis, would be transferred, with the remaining 712,000 tons, or 70 percent, being hauled directly to the incinerators or to a landfill.

As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the steam energy produced, as well as of the seasonal distribution of the waste generated, three separate incineration systems, one system with a capacity of 700 tons per day, one system with a capacity of 300 tons per day, and one system with a capacity of 200 tons per day, were selected. A total of 330,000 tons per year, or about 32 percent of the average annual solid waste load, would be incinerated. The 700-ton-per-day mass burn incineration facility, which for the purpose of this evaluation would be located at the Americology transfer station site, would have the capacity to produce between 3.5 and 4.0 million pounds of steam per day at a pressure of 200 to 300 psi. Approximately 48,100 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill. The 300-ton-per-day modular incineration facility, which for the purpose of this evaluation would be located at the Northwest transfer station site, would have the capacity to produce between 1.4 and 1.6 million pounds of steam per day at a pressure of 200 to 300 psi. Approximately 28,900 tons of ash would be generated by the facility per year, which would have to be disposed of at an approved landfill. The 200-ton-per-day modular incineration facility, which for the purpose of this evaluation would be located at the Milwaukee Metropolitan Sewerage District South Shore sewage treatment plant site, would have the capacity to produce between 1.0 and 1.1 million pounds of steam per day at a pressure of 200 to 300 psi. Approximately 19,200 tons of ash would be generated by the facility per year, which would have to be disposed of at an approved landfill.

As previously discussed, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling centers primarily by private vehicle.

The remaining 680,000 tons, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 7 is $93,400,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $20,557,000, and including a credit of $9,964,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $28,701,000, or about $28 per ton of solid waste.

As part of the evaluation under Alternative Plan 7, a subalternative--Alternative 7A--was also investigated which also called for processing of a portion of the solid waste generated in the study area at two incinerators providing for steam production. This alternative plan is the same as Alternative 7, as shown on Map 40, with the exception that the incinerator facility located at the Americology transfer station site would have a capacity of 900 tons of solid waste per day, as opposed to 700 tons per day under Alternative Plan 7. With this additional capacity plus the capacity of 500 tons per day at the incinerators located at the Northwest transfer station site and at the South Shore sewage treatment plant, the amount of solid waste incinerated in the areas served by the incinerator systems would be increased from about 40 percent to 55 percent for residential waste and from 20 percent to 25 percent for combustible commercial and industrial solid waste. These increased percentages are comparable to those used in Alternative Plan 6, which serves a smaller number of communities. The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 7A is $105,900,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $18,481,000, and including a credit of $11,707,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $27,715,000, or about $27 per ton of solid waste.

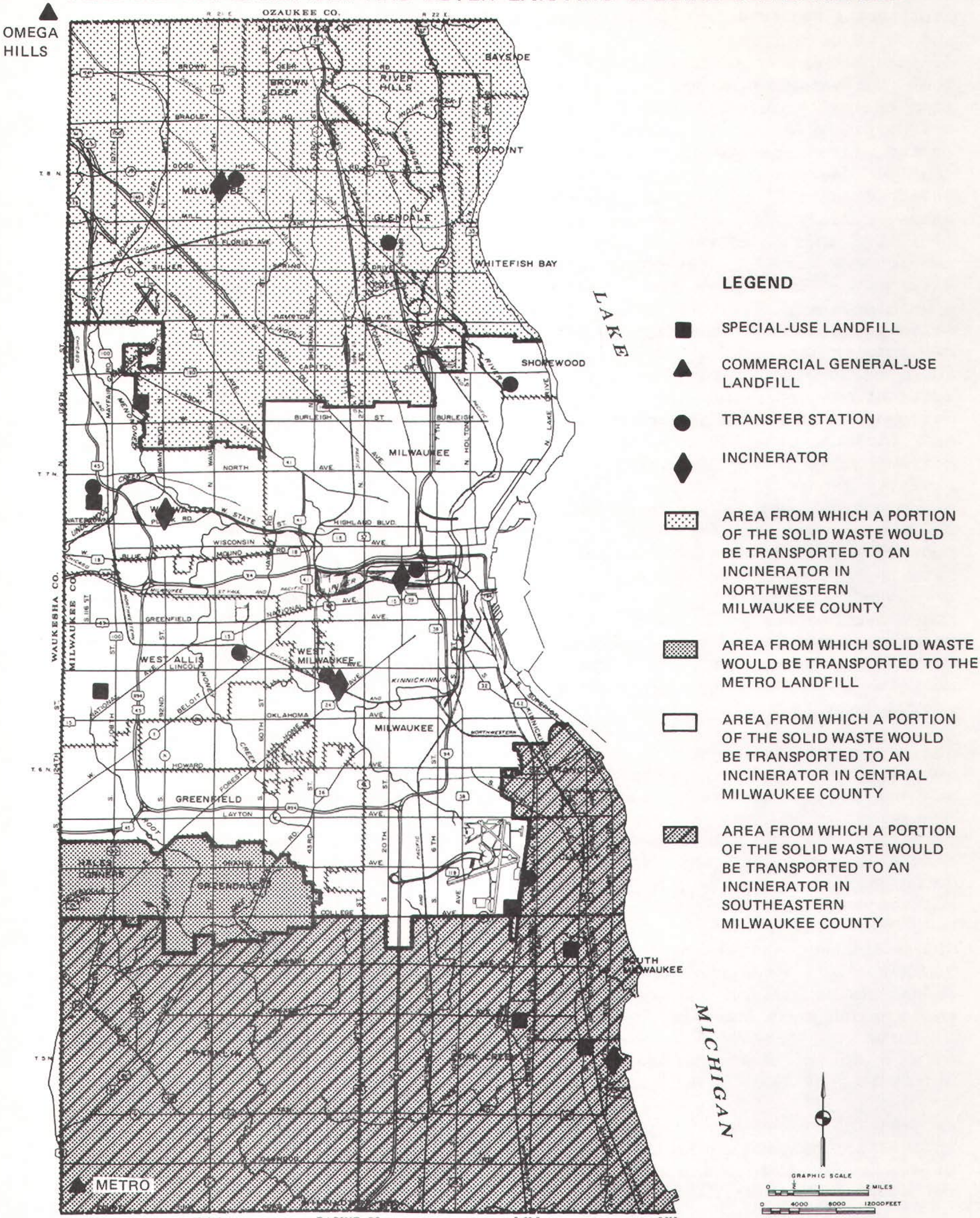
Alternative Plans 8 and 8A: Processing of a Portion of the Solid Wastes at Five Separate Incinerators Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 8, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 8 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes either to one of the eight existing transfer stations located in the County which serve municipalities in the study area followed by transport to one of the five separate incinerators, or to disposal sites in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to one of the five separate incinerators or to landfills; 3) processing of a portion of the solid wastes at five new incineration systems designed for steam generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerators under Alternative Plan 8, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 41.

The post-collection solid waste transportation system in the study area would consist of the transport of a portion of the residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station and at the Northwest transfer station would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 261,000 tons, or about 26 percent on an average

Map 41

ALTERNATIVES 8 AND 11--PROCESSING OF A PORTION OF THE SOLID WASTES AT FIVE INCINERATORS, WITH DISPOSAL AT TWO EXISTING GENERAL-USE LANDFILLS AND SEVEN EXISTING SPECIAL-USE LANDFILLS



Source: SEWPRC.

annual basis, would be transferred, with the remaining 749,000 tons, or 74 percent, being hauled directly to the incinerators or landfill.

As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the steam energy produced, as well as of the seasonal distribution of the waste generated, five separate incineration systems, one system with a capacity of 600 tons per day and four systems with a capacity of 150 tons per day each, were selected. A total of 330,000 tons per year, or about 32 percent of the average annual solid waste load, would be incinerated. The 600-ton-per-day mass burn facility, which for the purpose of this evaluation would be located at the Americology transfer station site, would have the capacity to produce between 3.1 and 3.45 million pounds of steam per day at a pressure of 200 to 300 psi. Approximately 57,800 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill. The 150-ton-per-day modular incineration facilities, which for the purpose of this evaluation would be located at the Northwest transfer station site, the Milwaukee County Institutions site, the Lincoln Avenue transfer station site, and the Milwaukee Metropolitan Sewerage District South Shore sewage treatment plant site, would each have the capacity to produce between 768,000 and 845,600 pounds of steam per day at a pressure of 200 to 300 psi. Approximately 14,400 tons of ash would be generated at each of these facilities per year, which would have to be disposed of at an approved landfill. This alternative includes provisions and associated costs to extend steam conveyance lines to the steam heating and cooling system serving downtown Milwaukee and/or other steam users.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling centers primarily by private vehicle.

The remaining 680,000 tons, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 8 is $99,587,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $21,691,000, and including a credit of $9,828,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $30,375,000, or about $29 per ton of solid waste.

As part of the evaluation under Alternative Plan 8, a subalternative--Alternative 8A--was also investigated which also called for processing of a portion of the solid waste generated in the study area at five incinerators providing for steam production. This alternative plan is the same as Alternative 8, as shown on Map 41, with the exception that the incinerator facility located at the Americology transfer station site would have a capacity of 800 tons of solid waste per day, as opposed to 600 tons under Alternative Plan 8. With this additional capacity, plus the capacity of 600 tons per day at the incinerators located at the Northwest transfer station site, the Milwaukee County Institutions grounds, the Lincoln Avenue transfer station, and the South Shore sewage treatment plant, the amount of solid waste incinerated in the areas served by the incinerator systems would be increased from about 40 percent to 55 percent for residential waste and from 20 percent to 25 percent for combustible commercial and industrial solid waste. These increased percentages are comparable to those used in Alternative Plan 6, which serves a smaller number of communities. The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 8A is $115,200,000, with an average annual net operation and maintenance cost of $19,543,000, including a credit of $11,572,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, is $29,588,000, or about $29 per ton of solid waste.

Alternative Plan 9: Processing of a Portion of the Solid Wastes at Two Separate Incinerators Designed for Electric Power Generation, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 9, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 9 are: 1) continued transport in collection vehicles of unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to one of the two separate incinerators, or to disposal sites in larger capacity vehicles; 2) continued transport by collection vehicles of a portion of the remaining unrecycled solid wastes directly to one of the two separate incinerators or to landfills; 3) processing of a portion of the solid wastes at two new incineration systems designed for electric power generation; 4) initiation of a countywide solid waste residential recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerators under Alternative Plan 9, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 39.

The post-collection solid waste transportion system in the study area would consist of the transport of a portion of the residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station and at the Northwest transfer station would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 272,000 tons, or about 26 percent on an average annual basis, would be transferred, with the remaining 738,000 tons, or 74 percent, being hauled directly to the incinerator or to landfills.

As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the electric energy produced, as well as of the seasonal distribution of the waste generated, two separate incineration systems, one system with a capacity of 800 tons per day and one system with a capacity of 400 tons per day, were selected. A total of 330,000 tons per year, or about 32 percent of the average annual solid waste load, would be incinerated. The 800-ton-per-day mass burn incineration facility, which for the purpose of this evaluation would be located at the Americology transfer station site, would have the capacity to produce between 4.0 and 4.6 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 356,000 and 409,000 kilowatts per day of electricity, of which approximately 331,000 to 381,000 kilowatts per day would be available for sale. Approximately 77,000 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill. The 400-ton-per-day mass burn incineration facility, which for the purpose of this evaluation would be located at the Northwest transfer station site, would have the capacity to produce between 2.0 and 2.1 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 170,000 and 182,000 kilowatts per day of electricity, of which approximately 158,000 to 169,000 kilowatts per day would be available for sale. Approximately 38,500 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling center primarily by private vehicle.

The remaining 680,000 tons, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 9 is $108,870,000, with average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $24,472,000, including a credit of $5,878,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $33,965,000, or about $33 per ton of solid waste.

Alternative Plan 10: Processing of a Portion of the Solid Wastes at Three Separate Incinerators Designed for Electric Power Generation, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 10, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 10 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to one of the three separate incinerators, or to disposal sites in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to one of the three separate incinerators or to landfills; 3) processing of a portion of the solid wastes at three new incineration systems designed for electric power generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerators under Alternative Plan 10, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 40.

The post-collection solid waste transportation system in the study area would consist of the transport of a portion of the residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes at the Lincoln Avenue transfer station and at the Northwest transfer station would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 298,000 tons, or about 30 percent on an average annual basis, would be transferred, with the remaining 712,000 tons, or 70 percent, being hauled directly to the incinerator or to landfills.

As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the electric energy produced, as well as the seasonal distribution of the waste generated, three separate incinerator systems, one system with a capacity of 700 tons per day, one system with a capacity of 300 tons per day, and one system with a capacity of 200 tons per day, were selected. The 700-ton-per-day mass burn incinerator facility, which for the purpose of this evaluation would be located at the Americology transfer station site, would have the capacity to produce between 3.5 and 4.02 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 311,000 and 378,000 kilowatts per day of electricity, of which approximately 300,000 to 340,000 kilowatts per day would be available for sale. Approximately 67,400 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill. The 300-ton-per-day modular incineration facility, which for the purpose of this evaluation would be located at the Northwest transfer station site, would have the capacity to produce between 1.44 and 1.6 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 121,000 and 134,000 kilowatts per day of electricity, of which approximately 109,000 to 121,000 kilowatts per day would be available for sale. Approximately 28,900 tons of ash would be generated by the facility per year, which would have to be disposed of at an approved landfill. The 200-ton-per-day modular incineration facility, which for the purpose of this evaluation would be located at the Milwaukee Metropolitan Sewerage District

South Shore sewage treatment plant site, would have the capacity to produce between 960,000 and 1.1 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 77,000 and 88,000 kilowatts per day of electricity, of which approximately 68,000 to 78,000 kilowatts per day would be available for sale. Approximately 19,200 tons of ash would be generated by the facility per year, which would have to be disposed of at an approved landfill.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling centers primarily by private vehicle.

The remaining 680,000 tons per year, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 10 is $104,760,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $24,864,000, including a credit of $5,857,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $33,999,000, or about $33 per ton of solid waste.

Alternative Plan 11: Processing of a Portion of the Solid Wastes at Five Separate Incinerators Designed for Electric Power Generation, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 11, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 11 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to one of the five separate incinerators, or to disposal sites in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining unrecycled solid wastes directly to one of the five separate incinerators or to landfills; 3) processing of a portion of the solid wastes at five new incineration systems designed for electric power generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily two existing commercial general-use landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and incinerators under Alternative Plan 11, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 41.

The post-collection solid waste transportation system in the study area would consist of the transport of a portion of the residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station and at the Northwest transfer station would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 261,000 tons, or about 26 percent on an average annual basis, would be transferred, with the remaining 749,000 tons, or 74 percent, being hauled directly to the incinerators or landfills.

As part of the evaluation of the incinerator alternatives, it was determined that the system would not be viable unless costs could be offset by benefits from energy produced. Based upon a review of the potential uses of the electric energy produced, as well as of the seasonal distribution of the waste generated, five separate incineration systems, one system with a capacity of 600 tons per day and four systems with a capacity of 150 tons per day each, were selected. A total of 330,000 tons per year, or about 32 percent of the average annual solid waste load, would be incinerated. The 600-ton-per-day mass burn incineration facility, which for the purpose of this evaluation would be located at the Americology transfer station site, would have the capacity to produce between 3.1 and 3.4 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 267,000 and 307,000 kilowatts per day of electricity, of which approximately 248,000 to 285,000 kilowatts per day would be available for sale. Approximately 57,800 tons of ash would be generated by this facility per year, which would have to be disposed of at an approved landfill. The 150-ton-per-day modular incineration facilities, which for the purpose of this evaluation would be located at the Northwest transfer station site, the Milwaukee County Institutions site, the Lincoln Avenue transfer station site, and the Milwaukee Metropolitan Sewerage District South Shore sewage treatment plant site, would each have the capacity to produce between 768,000 and 845,600 pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 57,600 and 63,000 kilowatts per day of electricity, of which approximately 49,000 to 54,000 kilowatts per day would be available for sale. Approximately 14,400 tons of ash would be generated by each of these facilities per year, which would have to be disposed of at an approved landfill.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling centers primarily in private vehicles.

The remaining 680,000 tons, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 11 is $116,840,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $26,731,000, including a credit of $5,148,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $36,919,000, or about $36 per ton of solid waste.

Alternative Plan 12: Processing of a Portion of the Solid Wastes into a Refuse-Derived Fuel for Incineration with Electric Power Generation and with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 12, solid wastes generated in the study area would be either recycled, processed into refuse-derived fuel (RDF) and incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 12 are: 1) continued transport in collection vehicles of a portion of the unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to the RDF processing facility, or to disposal sites in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining solid wastes directly to the RDF processing facility or to landfills; 3) processing of a portion of the solid wastes at the Americology RDF facility following major modifications in the RDF processing equipment; 4) incineration of the RDF at a new incineration system designed for electric power generation; 5) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 6) disposal of all unrecycled and unprocessed solid wastes, RDF residues, unprocessed solid wastes, and incinerator ash by landfilling, using primarily two existing commercial general-use sanitary landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and RDF facility under Alternative Plan 12, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 42.

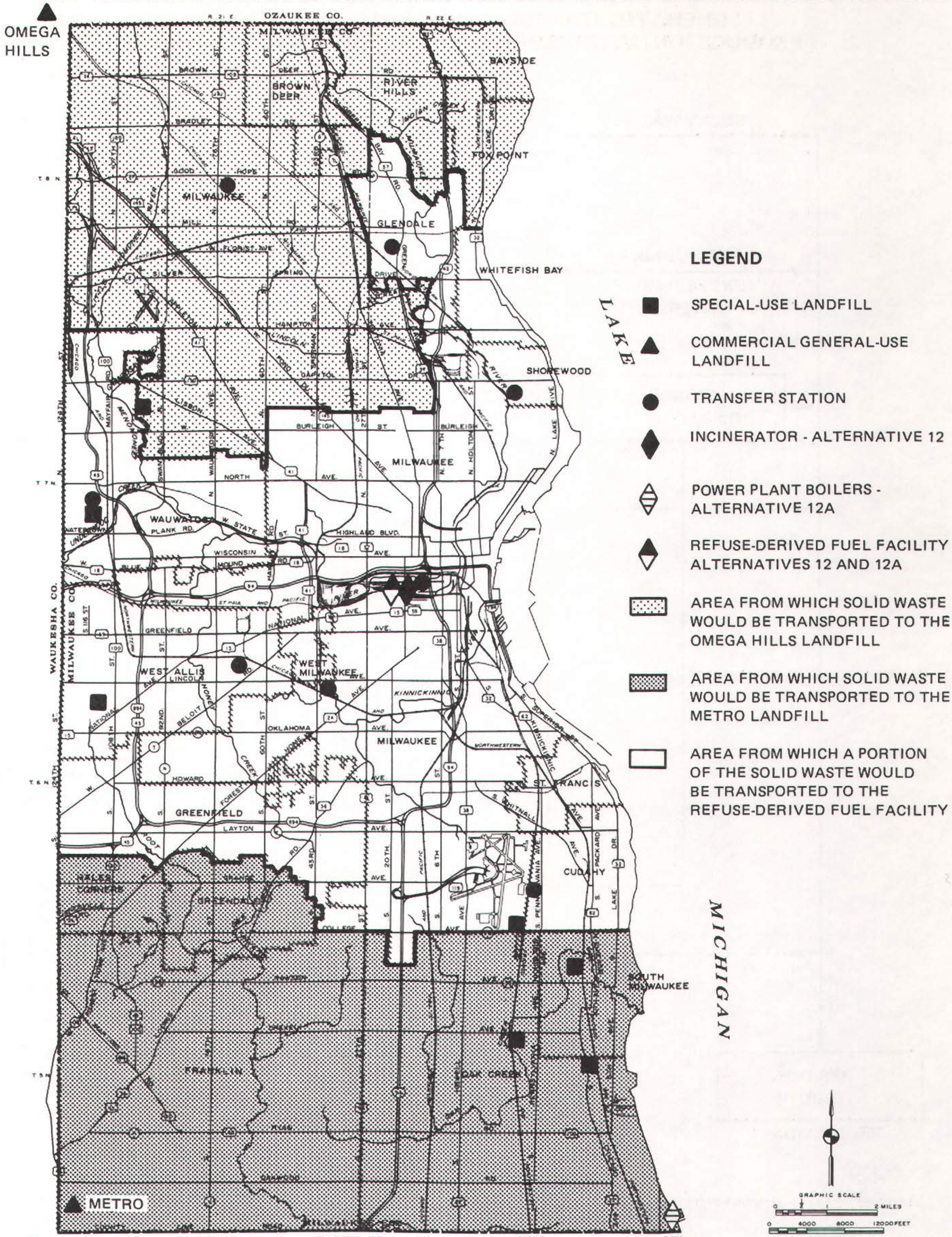
The post-collection solid waste transportation system in the study area would consist of the transport most residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid wastes received at the Lincoln Avenue transfer station would be hauled directly to the RDF processing site under this alternative. Approximately 328,000 tons, or 32 percent of the average annual amount of solid wastes generated in the study area, would be transferred under this alternative, with the remaining 652,000 tons, or 68 percent, being hauled directly to the RDF facility or to landfills.

The RDF preparation would include using the existing Americology processing facility, after modifications were made to the equipment at the plant, to reduce the contamination of the RDF with grit and glass. Contamination of the RDF previously produced at the facility reduced the marketability of the product. A diagram of the process to be used is shown in Figure 16.

The 330,000 tons of waste per year received at the processing facility would be converted into approximately 247,000 tons of RDF product. This material

Map 42

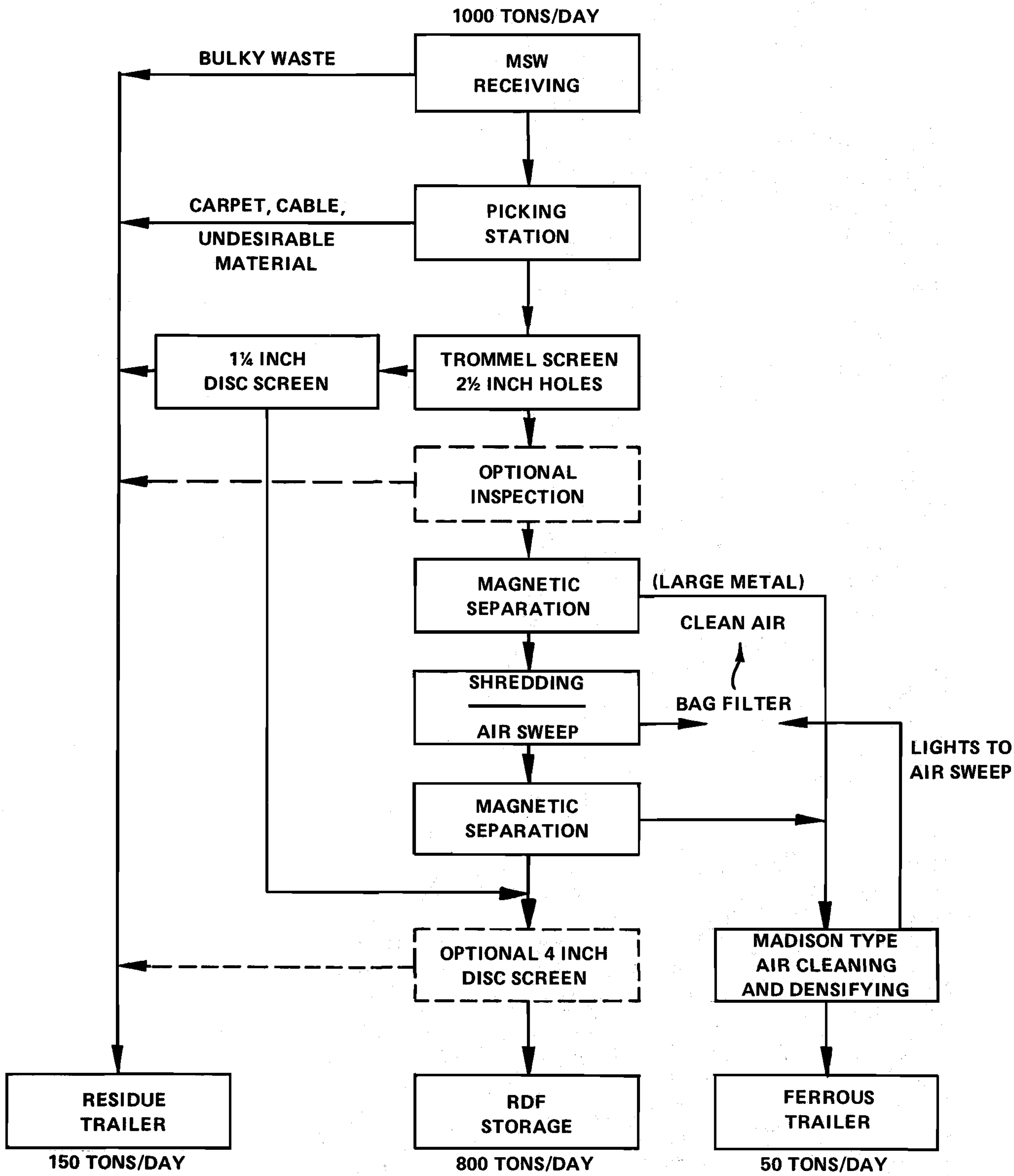
ALTERNATIVES 12 AND 12A--PROCESSING OF A PORTION OF THE SOLID WASTES INTO A REFUSE-DERIVED FUEL FOR INCINERATION, WITH DISPOSAL AT TWO EXISTING GENERAL-USE LANDFILLS AND SEVEN SPECIAL-USE LANDFILLS



Source: SEWRPC.

Figure 16

SCHEMATIC DIAGRAM OF REFUSE-DERIVED FUEL PRODUCTION AT RECONDITIONED AMERICOLOGY FACILITY



Source: Black & Veatch Engineers-Architects.

would be incinerated at a 1,000-ton-per-day incineration system. Approximately 16,500 tons per year of ferrous material recovered as a by-product of processing the solid waste into RDF would be recycled. Waste materials generated as a result of the conversion process would total approximately 66,000 tons per year. These materials would be disposed of in one of the aforereferenced landfills.

The 1,000-ton-per-day incineration facility, which for the purpose of this evaluation would also be located at the Americology transfer station site, would have the capacity to generate approximately 516,000 kilowatts per day of electricity, of which approximately 465,000 kilowatts per day would be available for sale. In addition to the 66,000 tons per year of waste from the RDF processing operation, approximately 33,000 tons of incinerator ash would be generated by this facility per year, which would have to be disposed of at an approved landfill.

As previously discussed, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. The recyclable material would be transported to the recycling centers primarily in private vehicles.

The remaining 680,000 tons, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and at seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 12 is $90,600,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $24,564,000, which includes a credit of $5,491,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $32,464,000, or about $31 per ton of solid waste.

Alternative Plan 12A: Processing of a Portion of the Solid Wastes into a Refuse-Derived Fuel for Use at the Wisconsin Electric Power Company Oak Creek Power Plant as a Supplemental Fuel, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

Under Alternative Plan 12A, solid wastes generated in the study area would be either recycled, processed into refuse-derived fuel for use as a supplemental fuel, or landfilled. The principal components of the solid waste management system under Alternative Plan 12A are: 1) continued transport in collection vehicles of unrecycled solid wastes to one of the eight existing transfer stations located in the County which serve municipalities in the study area, followed by transport to the RDF processing facility, or to disposal sites in larger capacity vehicles; 2) continued transport by collection vehicles of the remaining solid wastes directly to the RDF processing facility or to a landfill; 3) processing of a portion of the solid wastes at the Americology RDF facility following major modifications to the RDF processing equipment; 4) co-firing of the RDF at the Wisconsin Electric Power Company Oak Creek power plant; 5) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 6) disposal of all unrecycled solid wastes, RDF residues, and unprocessed solid wastes by landfilling, using primarily two existing commercial general-use sanitary landfills and seven existing private special-use landfills located within and adjacent to the County. The locations of the landfills, transfer stations, and RDF facility under Alternative Plan 12A, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 42.

The post-collection solid waste transportation system in the study area would consist of the transport of most residential solid wastes to one of the eight transfer stations in the study area, being similar to the existing system except for the location of the disposal sites. Furthermore, portions of the solid waste received at the Lincoln Avenue transfer station would be hauled directly to the RDF processing facility under this alternative, and the RDF would be hauled to the Oak Creek power plant. Approximately 328,000 tons, or 32 percent of the average annual amount of unrecycled solid wastes generated in the study area, would be transferred under this alternative, with the remaining 682,000 tons, or 68 percent, being hauled directly to the RDF facility or to landfills.

The RDF preparation would include using the existing Americology processing facility, after modifications were made to the equipment at the plant, to reduce the contamination of the RDF with grit and glass. Contamination of the RDF previously produced at the facility reduced the marketability of the product. A diagram of the process to be used is shown in Figure 16.

The 330,000 tons of waste per year received at the processing facility would be converted into approximately 247,000 tons of RDF product. This RDF would be co-fired at the Wisconsin Electric Power Company Oak Creek power plant. Approximately 16,500 tons per year of ferrous material recovered as a by-product of processing the solid waste into RDF would be recycled. Waste materials generated as a result of the conversion process would total approximately 66,000 tons per year. These materials would be disposed of in one of the afore-referenced landfills.

Under this alternative, RDF would be transported to the Wisconsin Electric Power Company Oak Creek power plant, units number 1 through 4, where it would be co-fired in new fluidized bed boilers which are anticipated to be installed during a rehabilitation program. It should be noted that the Wisconsin Public Service Commission has not as yet granted the Wisconsin Electric Power Company a license for the reconditioning project. For the purpose of this evaluation, it is assumed that a mixture of 85 percent coal and 15 percent RDF would be co-fired in the boilers; however, the percentage of RDF in the mixture could be increased if optimal operation of the system is not impaired.

As already noted, under this alternative a countywide residential solid waste recycling program would be established for the study area consisting of 23 recycling centers. About 25,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers.

The remaining 680,000 tons, or 66 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills--primarily two existing commercial general-use landfills owned and operated by Waste Management of Wisconsin, Inc., located in the City of Franklin and the Village of Germantown, and seven private special-use landfills, including two City of Milwaukee landfills, the City of Oak Creek landfill, the City of South Milwaukee landfill, the City of Wauwatosa landfill, the City of West Allis landfill, and the Falk Corporation landfill.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 12A, which does not include the cost of replacing the existing boilers at the Wisconsin Electric Power Company Oak Creek power plant, is $14,040,000, with an operation and maintenance cost of $980,000. The capital and operation and maintenance costs associated with the replacement of the boilers have not been determined. Those costs would be part of a very large project estimated to cost $500,000,000. The costs that are appropriate to this evaluation are the incremental costs of providing the ability to burn RDF and coal over and above the cost of the system if designed to burn only coal. Additional information on the costs and benefits of this alternative is provided in the following section of the report.

Accessory Alternatives

As previously noted, there are five additional solid waste management alternatives which may have application in Milwaukee County. These alternatives have been termed "accessory" because generally they will not result in the disposal of large quantities of solid wastes and, in most instances, would be carried out in conjunction with one of the "major" alternatives. These five accessory alternatives are discussed below. The costs of the first three accessory alternatives are shown in Table 40. The costs associated with the last two accessory alternatives have not been fully estimated, as discussed in the text.

Accessory Alternative 1--High Level of Residential Solid Waste Recycling: Under Accessory Alternative 1, a high level of residential solid waste recycling would be initiated using the same 23 recycling centers to be used under each of the 12 major alternatives. However, this alternative would result in the recycling of 50,000 tons of material per year, rather than 25,000 tons as under the major alternatives. The increased amount of recycling would result from the implementation of an extensive information and education program; longer hours of operation for the recycling centers; greater use of nonprofit agencies and organizations for supplying volunteer labor to the stations and for conducting "drives" for recyclables; and the provision of economic incentives, i.e., paying for recyclables.

The estimated capital cost for the development of the solid waste management facilities proposed under Accessory Alternative 1 is $281,000, with an average annual operation and maintenance cost of $1,587,000, including an estimated $753,000 paid to recycled material suppliers. The total average annual cost of capital and operation and maintenance is $1,611,500, or about $64 per ton of recycled solid waste. If the cost of the payment to suppliers for the recycled material were not included in the costs, the total annual cost would be $35 per ton per year. Under this alternative, savings in collection,

Table 40

PRINCIPAL FEATURES AND COSTS OF SOLID WASTE MANAGEMENT ACCESSORY ALTERNATIVES FOR MILWAUKEE COUNTY

		Cost Estimates: 1990-2010[a]											
			Gross Average Annual Costs					Net Total Average Annual Costs					
								Net Total Average Annual Costs Less Revenues			Net Total Average Annual Costs Less Revenues and Savings in Landfill Costs		
Accessory Alternative	Principal Components	Total Capital	Amortized Capital Cost[b]	Transport	New Facilities Operation and Maintenance	Gross Total Average Annual Cost	Gross Unit Cost (dollars per ton)	Revenues	Total	Unit (dollars per ton)	Savings in Landfill Disposal[f]	Total	Unit (dollars per ton)
1. High Level of Residential Solid Waste Recycling.....	Initiation of a program for a high level of residential solid waste recycling	$281,000	$ 24,500	$190,000	$1,397,000[c]	$1,611,500	$64.46[d]	$ --[e]	$1,611,500	$64.46[d]	$525,000	$1,086,500	$43.46[d]
2. Separate Collection of Residential Newsprint for Recycling...........	Initiation of a separate residential newsprint collection program	40,000	3,500	200,000[g]	--	203,500	40.70[h]	100,000	103,500	20.70[h]	105,000	-1,500	-0.30[h]
3. Composting..........	Initiation of a municipal composting program	340,000	29,600	--	525,000[i]	554,600	36.97[j]	--	554,600	36.97[j]	239,600	315,000	15.97[j]

[a] Based on 1985 costs.

[b] Amortized at 6 percent for 20 years.

[c] Includes costs of payment for materials transported to the centers.

[d] Based on an estimated 25,000 tons per year.

[e] Revenues are used to reimburse volunteer labor.

[f] Based on a $21-per-ton tipping fee at landfills.

[g] Based on a per-ton collection and transport rate of $35 per ton.

[h] Based on an estimated 5,000 tons per year.

[i] Based on an operation and maintenance cost of $35 per ton.

[j] Based on an estimated 15,000 tons per year.

Source: SEWRPC.

transportation, and landfill disposal costs would approximate $525,000 per year. Deducting this cost from the total annual cost yields a cost of $1,086,500 per year, or $43 per ton.

Accessory Alternative 2--Separate Collection and Recycling of Newsprint: Under Accessory Alternative 2, a separate curbside collection program to collect and recycle newsprint would be initiated. All collection vehicles, including those which are municipally and privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid wastes. It is important to note that special provisions for the exclusion of newspaper from the rest of the residential solid waste stream already exist in the Villages of Brown Deer and Shorewood, and in the Cities of Cudahy and Glendale. In these communities, either there are special collections for newspaper or newspaper is dropped off at special centers by citizens. This separate collection of newsprint is anticipated to result in the recovery and recycling of 5,000 tons per year, or about 10 pounds per capita per year. This quantity would be over and above the newsprint recycled at the 23 drop-off recycling centers established countywide or in the community programs already in effect.

The estimated capital cost for the development of the solid waste facilities proposed under Accessory Alternative 2 is $40,000, with an average annual operation and maintenance cost of $200,000. The gross total average annual cost of capital and operation and maintenance is $103,500, or about $20.70 per ton. In addition, landfill disposal costs would be reduced by about $105,000 per year which, if deducted from the cost, yields a net surplus of $1,500 per year, or less than $1.00 per ton.

Accessory Alternative 3--Composting: Under Accessory Alternative 3, a comprehensive program for the composting of the vegetative debris contained in solid wastes, including grass clippings, leaves, and brush, would be implemented. Composting is the controlled biological decomposition of organic material in the presence of oxygen to produce humus. Decomposed vegetative materials contain beneficial nutrients and can be used as a soil conditioner in gardens and flower beds and around landscape plants. It is important to note that removal of these materials from the residential solid waste stream would be desirable should one of the alternatives involving incineration be included in the recommended plan. Incineration of these materials lowers the heat content of the incinerated waste because of the high amount of moisture present and can also result in moisture-related operation and maintenance problems at incinerators.

As noted in Table 38, approximately 66,300 tons of yard wastes are anticipated to be generated annually in the County during the plan period. The establishment of composting operations in each of the municipalities in the County is anticipated to result in approximately 15,000 tons being composted, or about 30 percent of the yard wastes generated. The materials would be delivered by individual residents to one of 21 sites in the County. One site would be located in each of 18 communities, with three sites in the City of Milwaukee. The composting sites would generally be located near the recycling centers established under the countywide residential solid waste recycling program. In those communities in which such centers would not be established, including the Villages of Bayside, Fox Point, Hales Corners, River Hills, and West Milwaukee, composting operations are anticipated to be established on property owned by the municipality.

The estimated capital cost for the development of the solid waste management facilities proposed under Accessory Alternative 3 is $340,000, with an average annual operation and maintenance cost of $525,000. The gross average annual cost of capital and operation and maintenance is $554,600, or about $37 per ton of composted solid waste. However, savings in collection and landfill disposal costs would be approximately $239,000 per year, yielding a net average annual cost of $315,000, or about $16 per ton of composted solid waste.

Accessory Alternative 4--Bioconversion: Under Accessory Alternative 4, a bioconversion system would be implemented whereby solid wastes categorized primarily as grass clippings, leaves, and other vegetative debris would be placed in a specially designed facility to undergo anaerobic (without oxygen) decomposition. This process would reduce the volume of the raw materials decomposed and yield methane gas. As discussed under Accessory Alternative 3, removal of a significant portion of the grass clippings, leaves, and other yard wastes from the solid waste stream will be important if incineration is included in the recommended plan for Milwaukee County.

The decomposition of yard wastes anaerobically is a technically feasible technique for converting and partially disposing of vegetative solid waste materials. The results of evaluations carried out to determine the economic benefits of the use of bioconversion systems in lieu of other solid waste disposal systems have been mixed. As an example, a recently completed study conducted in Milwaukee County evaluated the available technology for, and costs of, converting yard wastes into methane by bioconversion. The results of the study indicated that yard wastes are readily digestible, and that the byproducts of the process include pipeline-quality methane gas. In addition, the bioconversion process reduced the volume of the decomposed material by between 60 and 80 percent. Volume reductions can reduce transportation and disposal costs. The economic analysis conducted as part of the study indicated that small satellite conversion units with a capacity of 15 tons per day were not economically feasible to operate.

The cost of this system would be about $50 to $90 per ton, depending on the size of the facility. There appear to be more cost-effective, less capital-intensive methods available to reduce the amount of yard wastes in the Milwaukee County solid waste stream. Consequently, this accessory alternative will not be considered further in this report. However, it should be noted that the costs developed were based upon "scale-up" estimates from experimental laboratory-size facilities, and were estimated conservatively high. Further evaluations may be conducted at the pilot-plant scale and could result in somewhat lower costs which could make this alternative more favorable from an economic view point. If such pilot plant work is done, it may be desirable to reconsider this alternative at a later date as an adjunct to the system plan.

Accessory Alternative 5--Landfill Methane Recovery: Under Accessory Alternative 5, a methane recovery system would be constructed at each of the two commercial general-use landfills at which the majority of solid wastes generated in Milwaukee County are disposed of. As discussed in Chapter V, during 1985, Waste Management of Wisconsin, Inc., announced plans to develop separate methane recovery systems at the Omega Hills Landfill in the Village of Germantown and at the Metro Landfill in the City of Franklin. The systems have since been installed at each of the landfills.

The methane recovery facilities provide methane gas which is burned, with the heat energy used to drive a turbine to generate electricity. A combined total of about 6.5 million cubic feet of methane are recovered each day at the sites. Burning the gas to drive turbines results in the generation of approximately 9,900 kilowatts of electricity per hour. The estimated capital cost of the landfill methane recovery and electric power generation systems is $8.5 million.

The development of a landfill methane recovery system for suitable landfill facilities serving Milwaukee County was determined to be viable for consideration in the evaluation of alternative solid waste management plans. Installation of large-scale landfill methane and electric energy generation systems at the commercial general-use landfills receiving most of the solid wastes generated in Milwaukee County has been completed. Thus, these systems have been assumed to be an integral part of the landfill component of the alternatives in the subsequent considerations.

EVALUATION OF ALTERNATIVES

The preceding section of this chapter presented pertinent information on 12 major and five accessory alternatives for solid waste management in Milwaukee County. This section describes the advantages and disadvantages of each of the alternatives considered, presents a comparison of the alternatives, and identifies a preferred alternative. The evaluation of each alternative considers the technical feasibility, regulatory compliance, practicality of implementation, social acceptance, and economics, as required under Chapter 185 of the Wisconsin Administrative Code, and also considers other objectives established at the outset of the study by the Technical Coordinating and Advisory Committee for the Milwaukee County Solid Waste Management Planning Program, as set forth in Chapter I. Consideration was also given in the analyses to the viability of the alternatives under the range of future conditions which were set forth in Chapter III. The range of future conditions was developed in an attempt to deal with the current uncertainties about key conditions that may be expected to influence the demand for public facilities and services in Milwaukee County. These key conditions with regard to solid waste management include the design year resident population and employment levels in the County and variations in the cost and availability of energy.

Table 41 summarizes the cost and the major advantages and disadvantages of each alternative.

Alternative Plan 1: Continued Use of Existing Solid Waste Management Systems

The major advantage of Alternative Plan 1 is that the system is largely in place, with the only new component being the establishment of 23 residential solid waste recycling centers, as required under amendments to Chapter 144 of the Wisconsin Statutes. Thus, this alternative may be rated high in terms of feasibility of implementation and in terms of compatibility with land use planning and zoning. This alternative is based upon proven, low-level technology systems. Disposal of the solid wastes by landfilling is generally flexible and can be used for nearly all solid wastes with little or no processing.

Table 41

COMPARISON OF PRINCIPAL FEATURES AND COSTS OF MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN ALTERNATIVES

		Key Considerations		
Alternative	Principal Requirements	Unit Cost (dollars per ton)	Advantages	Disadvantages
1. Continued use of existing solid waste management systems	Initiation of a program for a moderate level of residential solid waste recycling Disposal of unrecycled solid wastes at existing commercial general-use landfills and at existing private special-use landfills	$29.72	• No new disposal facilities required • Compatible with existing land use planning and zoning • Utilizes flexible, proven landfilling technology • Not sensitive to fluctuations in loadings	• Potential for rapidly escalating costs • Dependence on facilities outside the County • Dependence on nonoptimum transportation network
2. Disposal of solid wastes at a single existing commercial general-use landfill and at seven existing private special-use landfills	Initiation of a program for a moderate level of residential solid waste recycling Disposal of unrecycled solid wastes at one existing commercial general-use landfill and at seven existing private special-use landfills	$30.58	• No new disposal facilities required • Compatible with existing land use planning and zoning • Utilizes flexible, proven landfilling technology at a site within the County • Economy-of-scale using one major landfill facility	• Potential for rapidly escalating costs • Uncertainty regarding potential for expansion of landfill facilities to meet future disposal needs • Increased transportation distances and costs • No backup system should capacity of one large landfill facility be limited by environmental or other constraints
3. Disposal of solid wastes at two existing commercial general-use landfills and at seven existing private special-use landfills	Initiation of a program for a moderate level of residential solid waste recycling Disposal of unrecycled solid wastes at two existing commercial general-use landfills and at seven existing private special-use landfills	$29.54	• No new disposal facilities required • Compatible with existing land use planning and zoning • Utilizes flexible, proven landfilling technology • Backup provided by the use of more than one large landfill facility • Transportation costs lower than other landfilling alternatives	• Potential for rapidly escalating costs • Uncertainty regarding expansion of landfill facilities to meet future disposal needs • No backup system should landfilling of entire solid waste load be limited by environmental or other constraints
4. Processing of a portion of the solid wastes at one new incinerator with a capacity of 1,200 tons per day and designed for steam production, with disposal of unincinerated and unrecycled solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at one new incinerator designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$26.43	• Provides flexible, integrated long-term disposal facilities using proven technologies • Backup system provided by use of two different disposal methods • Energy produced through incineration of solid wastes • Reduced landfill requirements and lower transportation costs • Potential for substantial cost savings if energy costs escalate	• High initial capital costs and high level of technology • Requires siting and construction of large incinerator facility • Uncertainty concerning markets for energy produced • Uncertainty concerning disposal of incinerator ash and air pollution control requirements • Potential for conflicts with existing land use planning and zoning
5. Processing of a portion of the solid wastes at one new incinerator with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at a new incinerator designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$31.39	• Provides flexible, integrated long-term disposal facilities using proven technologies • Backup system provided by use of two different disposal methods • Energy produced through incineration of solid wastes, with greater flexibility for marketing energy product produced • Reduced landfill requirements and lower transportation costs • Potential for substantial cost savings if energy costs escalate	• High initial capital costs and high level of technology • Requires siting and construction of large incinerator facility • Uncertainty concerning disposal of incinerator ash and air pollution control requirements • Potential for conflicts with existing land use planning and zoning
6. and 6A. Processing of a portion of the solid wastes at two new incinerators with a capacity of 1,200 to 1,400 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at two new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$27.06 to $27.53	• Provides flexible, integrated long-term disposal facilities using proven technologies • Backup system provided by use of two different disposal methods at two separate locations • Energy produced through incineration of solid wastes • Reduced landfill requirements and lower transportation costs • Potential for substantial cost savings if energy costs escalate	• High initial capital costs and high level of technology • Requires siting and construction of two large incinerator facilities • Uncertainty concerning markets for energy produced • Uncertainty concerning disposal of incinerator ash and air pollution control requirements • Potential for conflicts with existing land use planning and zoning
7. and 7A. Processing of a portion of the solid wastes at three new incinerators with a capacity of 1,200 to 1,400 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at three new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$26.78 to $27.73	• Provides flexible, integrated long-term disposal facilities using proven technologies • Backup system provided by use of two different disposal methods at three separate locations • Energy produced through incineration of solid wastes • Reduced landfill requirements and lower transportation costs • Potential for substantial cost savings if energy costs escalate	• High initial capital costs and high level of technology • Requires siting and construction of three large incinerator facilities • Uncertainty concerning markets for energy produced • Uncertainty concerning disposal of incinerator ash and air pollution control requirements • Potential for conflicts with existing land use planning and zoning

Table 41 (continued)

Alternative	Principal Requirements	Key Considerations: Unit Cost (dollars per ton)	Key Considerations: Advantages	Key Considerations: Disadvantages
8. and 8A. Processing of a portion of the solid wastes at five new incinerators with a capacity of 1,200 to 1,400 tons per day and designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at five new incinerators designed for steam production Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$28.59 to $29.35	● Provide flexible, integrated long-term disposal facilities using proven technologies ● Backup system provided by use of two different disposal methods at five separate locations ● Energy produced through incineration of solid wastes ● Reduced landfill requirements and lower transportation costs ● Potential for substantial cost savings if energy costs escalate	● High initial capital costs and high level of technology ● Requires siting and construction of five incinerator facilities ● Higher operation and maintenance costs ● Uncertainty concerning markets for energy produced ● Uncertainty concerning disposal of incinerator ash and air pollution control requirements ● Potential for conflicts with existing land use planning and zoning
9. Processing of a portion of the solid wastes at two new incinerators with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at two new incinerators designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$32.82	● Provides flexible, integrated long-term disposal facilities using proven technologies ● Backup system provided by use of two different disposal methods at two separate locations ● Energy produced through incineration of solid wastes, with greater flexibility for marketing energy product ● Reduced landfill requirements and lower transportation costs ● Potential substantial cost savings if energy costs escalate	● High initial capital costs and high level of technology ● Requires siting and construction of two large incinerator facilities ● Uncertainty concerning disposal of incinerator ash and air pollution control requirements ● Potential for conflicts with existing land use planning and zoning
10. Processing of a portion of the solid wastes at three new incinerators with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid waste and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at three new incinerators designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$32.85	● Provides flexible, integrated long-term disposal facilities using proven technologies ● Backup system provided by use of two different disposal methods at three separate locations ● Energy produced through incineration of solid wastes, with greater flexibility for marketing energy product ● Reduced landfill requirements and lower transportation costs ● Potential for substantial cost savings if energy costs escalate	● High initial capital costs and high level of technology ● Requires siting and construction of three large incinerator facilities ● Uncertainty concerning disposal of incinerator ash and air pollution regulations ● Potential for conflicts with existing land use planning and zoning
11. Processing of a portion of the solid wastes at five new incinerators with a capacity of 1,200 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Incineration of solid wastes at five new incinerators designed for electric power generation Disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$35.67	● Provides flexible, integrated long-term disposal facilities using proven technologies ● Backup system provided by use of two different disposal methods at five separate locations ● Energy produced through incineration of solid wastes, with greater flexibility for marketing energy product ● Reduced landfill requirements and lower transportation costs ● Potential for substantial cost savings if energy costs escalate	● High initial capital costs and high level of technology ● Requires siting and construction of five incinerator facilities ● Higher operation and maintenance costs ● Uncertainty concerning disposal of incinerator ash and air pollution regulations ● Potential for conflicts with existing land use planning and zoning
12. Processing of a portion of the solid wastes into refuse-derived fuel, incineration at one incinerator with a capacity of 1,000 tons per day and designed for electric power generation, and disposal of unincinerated and unrecycled solid wastes, refuse-derived-fuel residue, and incinerator ash at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Processing of solid wastes into refuse-derived fuel Incineration of refuse-derived fuel at one new incinerator designed for electric power generation Disposal of unrecycled and unincinerated solid wastes, refuse-derived-fuel residue, and incinerator ash at two existing commercial general-use landfills and at seven existing private special-use landfills	$31.37	● Provides flexible, integrated long-term disposal facilities ● Backup system provided by use of two different disposal methods ● Energy produced through incineration of high-quality refuse-derived fuel ● Reduced landfill requirements and lower transportation costs and lower transportation costs ● Potential for substantial cost savings if energy costs escalate ● Provides for use of existing Americology facility	● High initial capital costs and high level of technology ● Requires siting and construction of an incinerator ● Uncertainty concerning refuse-derived fuel production and the incinerator technology ● Uncertainty concerning disposal of incinerator ash ● Potential for conflicts with existing land use planning and zoning
12A. Processing of a portion of the solid wastes into refuse-derived fuel for use at the Wisconsin Electric Power Company Oak Creek power plant, with disposal of unprocessed and unrecycled solid wastes and refuse-derived-fuel residue at existing landfills	Initiation of a program for a moderate level of residential solid waste recycling Processing of solid wastes into refuse-derived fuel Incineration of refuse-derived fuel at Wisconsin Electric Power Company Oak Creek power plant	$ --[a]	● Provides flexible, integrated long-term disposal facilities using proven technologies ● Backup system provided by use of two different disposal methods ● Energy produced through incineration of high-quality refuse-derived fuel ● Reduced landfill requirements and lower transportation costs	● High initial capital costs and high level of technology ● Uncertainty concerning refuse-derived fuel production technology ● Uncertainty regarding feasibility and technology of co-firing coal and refuse-derived fuel in fluidized bed electric power generating boilers

Table 41 (continued)

Alternative	Principal Requirements	Key Considerations: Unit Cost (dollars per ton)	Key Considerations: Advantages	Key Considerations: Disadvantages
12A. (continued)	Disposal of unrecycled and unincinerated solid wastes and of refuse-derived fuel residue at two existing commercial general-use landfills and at seven existing private special-use landfills		• Potential for substantial cost savings if energy costs escalate • Provides for use of existing Americology facility	
Accessory Alternatives				
1. High level of residential solid waste recycling	Initiation of a program for a high level of residential solid waste recycling	$43.46 to $64.46	• Recovery of reusable portions of solid waste stream • Reduced landfill requirements • Reduced transportation costs • Reduced amount of incinerator ash due to reduction of non-combustibles	• Uncertainty regarding citizen participation • Uncertainty regarding ability of municipalities to coordinate necessary volunteer activities • Uncertainty regarding reliable markets for recycled materials
2. Separate collection of residential newsprint for recycling	Initiation of a separate residential newsprint collection program	$-0.30 to $40.70	• Recovery of reusable portions of solid waste stream • Reduced landfill requirements	• Requires modifying existing collection vehicles and collection practices • Uncertainty regarding citizen participation • Reduction in heat content of incinerated wastes • Uncertainty regarding reliable market for recycled materials
3. Composting	Initiation of a municipal composting program for vegetative debris	$15.97 to $36.97	• Reduced moisture content and subsequent increase in heat value of incinerated solid wastes • Provision of usable soil conditioner • Reduced disposal costs	• Difficulty in siting composting operations • Uncertainty regarding citizen participation • Difficulty in segregating materials from other residential solid wastes

[a]A detailed cost analysis was not prepared, since the incineration system would be part of a large electricity-generating system proposed by the Power Company.

Source: SEWRPC.

The major disadvantage of this alternative is the reliance on a technology with the potential for rapidly escalating costs and environmental constraints. Landfill disposal costs within the study area have generally risen at rates higher than general price inflation over the past 10 years. Analyses of the landfill tipping fees for private waste haulers at the Omega Hills and Metro landfills for a 10-year period indicate that from 1974 until 1980, tipping fees increased at an annual rate of just under 10 percent. From 1980 through January 1984, the tipping fees increased at an annual rate of about 29 percent. This latter increase may be attributed, in part, to changing public regulations affecting the siting and operation of landfills. As newer landfills, or major expansions of existing landfills, become necessary, the full cost of meeting the most recent landfill siting and groundwater protection regulations may be expected to be included in landfill costs. Further, environmental regulations may eventually preclude the expansion of the landfills which are presently used for disposal of solid wastes from Milwaukee County, or make such expansions expensive. Consequently, continued use of the existing system may prove to be a costly, long-term solution for the disposal of solid wastes generated in Milwaukee County.

With regard to cost, this alternative is in the middle of the alternatives considered. However, the costs do not reflect any escalation. In addition, the transportation cost element is the second highest of all the alternatives considered.

This alternative may be expected to be one of the most sensitive to energy cost increases since it involves transportation costs that are higher than those of all but one of the other alternatives. Therefore, energy cost changes may result in higher cost increases than under other alternatives. This alternative would not be sensitive to reduced population growth since no new facilities would be provided and since expansion of existing facilities would likely be staged to match capacity needs. However, increased population growth could limit the viability of this alternative, since the potential for expansion at the existing landfill sites is limited.

Alternative Plan 2: Disposal at a Single Existing Commercial General-Use Landfill and at Seven Existing Private Special-Use Landfills

The major advantage of Alternative Plan 2 is that the system envisioned would not require any major new facilities for the disposal of solid wastes other than the 23 residential solid waste recycling centers required by state law. Thus, this alternative may be rated high in terms of feasibility of implementation, and in terms of compatibility with land use planning and zoning. This alternative would provide a long-term solution to the solid waste problem, utilizing landfilling--a proven, low-level technology. Disposal by landfilling is generally flexible and can be used for nearly all solid waste with little or no processing. Economies-of-scale could be achieved by using one large commercial general-use landfill for the disposal of the majority of solid wastes generated in the County.

The major disadvantage of this alternative is the reliance on a single, commercial general-use landfill for long-term disposal of the majority of solid wastes anticipated to be generated during the plan period. This alternative assumes that the commercial-use landfill would receive the approvals needed for expansion to accommodate landfilling of the majority of the County's solid wastes. Increasingly stringent environmental regulations regarding the siting, use, and expansion of landfills could preclude adequate expansion or make such expansion very expensive.

With regard to cost, this alternative is in the middle of the alternatives considered. This alternative would result in significantly higher transportation costs than any of the other alternatives because of the need to transport most of the solid wastes to one location rather than to multiple locations. Based upon historical trends and the potential for increases in cost due to new regulations, disposal costs under this alternative could escalate over and above the general inflation rate.

This alternative would be one of the most sensitive to energy cost increases since it would involve higher transportation costs than any of the other alternatives. Therefore, energy cost increases could result in higher cost increases than under other alternatives. This alternative would not be sensitive to reduced population growth since the capital expenditures for the construction of additional landfill capacity would likely be staged to match capacity needs. Increased population growth could limit the viability of this alternative, since the potential for expansion of the existing landfill facilities may be limited.

Alternative Plan 3: Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The major advantage of Alternative Plan 3 is that the system envisioned would not require any major new facilities for the disposal of solid wastes other than the 23 residential solid waste recycling centers. Thus, this alternative may be rated high in terms of feasibility of implementation and compatibility with land use planning and zoning. This alternative would provide a long-term solution to the solid waste problem, utilizing landfilling, a proven, low-level technology. Disposal by landfilling is generally flexible and can be used for nearly all solid waste with little or no processing. This alternative provides more flexibility than Alternative Plan 2 because of the use of two large commercial general-use landfills for disposal of most of the solid wastes generated in the County.

With regard to cost, this alternative is in the middle of the alternatives considered. This alternative would have lower transportation costs than any of the other alternatives that rely primarily on landfilling for the disposal of solid wastes.

This alternative assumes that the two commercial general-use landfills would receive the regulatory agency approvals needed to carry out expansion to accommodate landfilling of the majority of the County's solid wastes. Increasingly stringent environmental regulations regarding the siting, use, and expansion of landfills could preclude adequate expansion or make it very expensive. This alternative is superior to Alternative 2 in this regard, however, since there would be two sites to provide for the needed expansion rather than one. Based upon historical trends and the potential for increases in costs due to new regulations, this alternative also has the potential for increases in disposal costs over and above the general price inflation rate.

This alternative would be one of the most sensitive to energy cost increases since the transportation distances and costs are greater than for most of the other alternatives. This alternative would not be sensitive to reduced population growth since the expansion of existing facilities will likely be staged to match capacity needs. Increased population growth may limit the viability of this alternative, since expanding a landfill is always a potential problem. However, it is possible that such sites could be expanded or utilized more intensively should solid waste quantities increase.

Alternative Plans 4 and 5: Processing of a Portion of the Solid Wastes at a Single Incinerator, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The major advantage of Alternative Plans 4 and 5 is the potential savings in resources and costs which can be achieved by the conversion of solid waste to energy. It should be noted that the only difference between Alternative Plan 4 and Alternative Plan 5 is that under Alternative 4, the incinerator would be designed to generate steam, while under Alternative 5, the incinerator would be designed to generate electricity. The use of the incineration system in conjunction with landfilling provides more flexibility than using landfilling as the primary disposal method. Another major advantage of this alternative is that the life of the approved landfill capacity serving the study area is extended, thus reducing the uncertainty associated with new, unapproved sites.

With regard to costs, Alternative Plan 4, which provides for steam generation and sale, represents one of the lowest cost alternatives, and Alternative Plan 5, which provides for electricity generation and sale, represents one of the most costly alternatives. This difference between the two alternatives indicates the sensitivity of the incineration alternatives to the energy product market value. This can be an advantage in that if energy costs rise and the value of the energy produced rises accordingly, these alternatives can become very cost efficient over time. Further discussion on the relationship between landfill disposal costs and incinerator disposal costs over time under different inflation rate scenarios is presented in the concluding section of this chapter. Careful review of the concluding section indicates that under certain circumstances, within a decade the costs of the incinerator alternatives could be substantially less than the costs of the landfill alternatives. In this regard, it is important to note that under future conditions much of the cost of the incinerator alternatives--about 30 percent--would be fixed as part of the amortization of the initial capital cost and not subject to inflation. Transportation costs would also be lower under these alternatives than under those alternatives relying only on landfills for disposal because of the increased number of disposal sites. Economies-of-scale could be achieved through the use of one incineration facility rather than two or more as called for by other alternatives.

The major disadvantages of these alternatives are the high initial capital costs entailed, and the high technology level of a system requiring special operation and maintenance. Under Alternative Plan 4, which provides for the production of steam, finding a reliable year-round market for the energy is critical, making this alternative potentially difficult to implement. The production of electricity under Alternative Plan 5 would eliminate this energy market problem. Based upon present values of the electric power generated, however, this alternative is substantially less favorable economically than are the alternatives producing steam. An additional disadvantage of this alternative, and of all other alternatives using incineration, is the present uncertainty regarding the disposal of incinerator ash. Incinerator ash resulting from the combustion of residential solid wastes can now be disposed of in commercial general-use landfills. However, regulations regarding the future testing and disposal of incinerator ash could make landfilling this material increasingly expensive. Another disadvantage is that new air pollution regulations may require additional capital and operation and maintenance expenditures. With the construction of a new major facility, there are also potential land use planning and zoning problems.

These alternatives would be relatively insensitive to energy cost increases, since their transportation costs are lower than those of some other alternatives. In addition, higher energy costs would likely increase the demand for the energy generated by the facilities and more than offset any increases in transportation costs. These alternatives would be relatively insensitive to rates of population growth or decline since available waste quantities would have to be transported farther with lower population levels. Increased population levels and the generation of more solid waste would require the landfilling of more materials.

Alternative Plans 6 and 9: Processing of a Portion of the Solid Wastes at Two Separate Incinerators, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The major advantage of Alternative Plans 6 and 9, as well as of the other alternatives using incineration, is the potential savings in resources and cost which can be achieved by the conversion of solid waste to energy. It should be noted that the only difference between Alternative Plan 6 and Alternative Plan 9 is that under Alternative Plan 6, the incinerators would be designed to generate steam, while under Alternative Plan 9, the incinerators would be designed to generate electricity. The use of incineration systems in conjunction with landfilling provides more backup and flexibility than using landfilling as the primary disposal method. Another major advantage of this alternative is that the life of the approved landfill capacity serving the study area is extended, thus reducing the uncertainty associated with new, unapproved sites.

Regarding costs, Alternative Plan 6, which provides for steam generation and sale, is among the lowest cost alternatives, and Alternative Plan 9, which provides for the generation and sale of electric power, is among the highest cost alternatives. This difference between the two alternatives indicates the sensitivity of the incineration alternatives to the energy product market value. As already noted, this can be an advantage in that if energy costs rise and the value of the energy produced rises accordingly, these alternatives can become very cost efficient over time. In this regard, it is important to note that under future conditions, much of the cost of the incinerator alternatives--about 30 percent--is fixed as part of the amortization of the initial capital cost and is not subject to inflation. Transportation costs would also be lower under these alternatives than under alternatives relying only on landfilling, or relying on landfilling and one incinerator.

The major disadvantages of these alternatives are the high initial capital cost and the high technology level of a system requiring special operation and maintenance. Under Alternative Plan 6--which provides for the production of steam--finding reliable, year-round markets for the energy is critical, making this alternative potentially difficult to implement. The production of electricity under Alternative Plan 9 would eliminate this energy market problem. Based upon the present values of the electric power generated, however, this alternative is substantially less favorable economically than are the alternatives producing steam. An additional disadvantage of this alternative is the present uncertainty regarding the disposal of incinerator ash. Incinerator ash resulting from the combustion of residential solid wastes can now be disposed of in commercial general-use landfills. However, regulations regarding the future testing and disposal of incinerator ash could make landfilling this material increasingly expensive. Another disadvantage is that new air pollution regulations may require additional capital and operation and maintenance expenditures.

These alternatives would be relatively insensitive to energy cost increases since their transportation costs are among the lowest of all the alternatives. In addition, energy costs could increase the demand for the energy generated by the facilities and have a positive impact on the economics of these alternatives. These alternatives would be relatively insensitive to population growth or decline since the available waste quantities would have to be transported farther with lower population levels. Increased population levels and the resulting generation of more solid waste would require the landfilling of more materials.

Alternative Plans 7 and 10: Processing of a Portion of the Solid Wastes at Three Separate Incinerators, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The major advantages of Alternatives 7 and 10 are generally the same as those of Alternative Plans 4, 5, 6, and 9--the savings of resources and costs through the conversion of solid waste to energy, and system flexibility. It should be noted that the only difference between Alternative Plan 7 and Alternative Plan 10 is, again, that under Alternative Plan 7, the incinerators would be designed to generate steam, while under Alternative Plan 10, the incinerators would be used to generate electricity. The use of three incineration facilities expands the availability and marketability of the energy produced. Another major advantage of these alternatives is that the life of the approved landfill capacity serving the study area is extended, thus reducing the uncertainty associated with new, unapproved sites.

Regarding costs, Alternative Plan 7, which provides for steam generation and sale, is among the lowest cost alternatives, and Alternative Plan 10, which provides for electricity generation and sale, is among the highest cost alternatives. This difference between the two alternatives indicates the sensitivity of the incineration alternatives to the energy product market value. As already noted, this can be an advantage in that if energy costs rise and the value of the energy produced rises accordingly, these alternatives can become very cost efficient over time. The use of three separate incineration facilities located at three separate locations decreases transportation costs to below the cost of those landfill alternatives and incineration alternatives using fewer incinerators.

The major disadvantages of these alternatives are generally the same as those of Alternative Plans 4, 5, 6, and 9--high initial capital costs and the high technology level of the systems used; concerns about securing stable markets for the energy produced; the uncertainty regarding the disposal of incinerator ash; and the potential for changes in air quality regulations. Also, because Alternative Plans 7 and 10 call for three incineration facilities, they would be more difficult to implement than would any of the previously discussed incineration alternatives. The alternatives would be relatively insensitive to increased energy costs and to decreases or increases in population levels.

Alternative Plans 8 and 11: Processing of a Portion of the Solid Wastes at Five Separate Incinerators, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The major advantages of Alternative Plans 8 and 11 are generally the same as those of the other alternatives involving incineration--the savings of resources and costs through the conversion of solid waste to energy, and system flexibility. It should be noted that the only difference between Alternative Plan 8 and Alternative Plan 11 is, again, that under Alternative Plan 8, the incinerators would be designed to generate steam, while under Alternative Plan 11, the incinerators would be used to generate electricity. The use of five facilities expands the availability and marketability of the energy produced to the greatest extent of any of the alternatives. Another major advantage of these alternatives is that the life of the approved landfill capacity serving the study area is extended, thus reducing the uncertainty associated with new, unapproved sites.

Regarding costs, Alternative Plan 8, which provides for steam generation and sale, is among the lowest cost alternatives, and Alternative Plan 11, which provides for electricity generation and sale, is among the highest cost alternatives. This difference between the two alternatives indicates the sensitivity of the incineration alternatives to the energy product market value. As already noted, this can be an advantage in that if energy costs rise and the value of the energy produced rises accordingly, these alternatives can become very cost efficient over time. The use of five separate incineration facilities results in the lowest transportation cost of any alternative. These two alternatives may be expected to have among the highest operation and maintenance costs for new facilities owing to the lack of economies-of-scale at the incinerator operations.

The major disadvantages of these alternatives are generally the same as those of the other alternatives involving incineration--high initial capital costs and the high level of technology of the systems used; concerns about securing stable markets for the energy produced; the uncertainty regarding the disposal of incinerator ash; and the potential for changes in air quality regulations to require increased capital and operation and maintenance costs. Further, the siting and constructing of five separate facilities may be expected to make this alternative one of the most difficult to implement. The alternatives are relatively insensitive to increased energy costs and to decreases or increases in population levels.

Alternative Plan 12: Processing of a Portion of the Solid Wastes into a Refuse-Derived Fuel for Incineration, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The major advantages of Alternative Plan 12 are the savings of resources through conversion of solid waste to energy, and disposal system flexibility because of the backup capability of using more than one system. However, this alternative also has the advantage of producing a fuel product which has a higher heat content than do unprocessed solid wastes. Consequently, the energy produced per ton of waste would be higher and the amount of incinerator ash produced would be reduced by about two-thirds. In addition, this alternative would provide for the use of the existing Americology waste processing facilities, which under other alternatives would likely be dismantled. Another major advantage of this alternative is that the life of the approved landfill capacity serving the study area is extended, thus reducing the uncertainty associated with new, unapproved sites.

This alternative is among the highest cost alternatives. However, should the cost of energy rise at a rate greater than general price inflation and the value of the energy product rise correspondingly, this alternative could become cost efficient over time.

The major disadvantages of this alternative include high initial capital costs and the high level of technology of the systems used. This alternative would have the added disadvantage of using a relatively new technology to recondition the existing Americology refuse-derived fuel facility. Reconditioning the facility would theoretically result in a fuel product containing less sand and glass. These materials can contaminate refuse-derived fuel and cause operational and maintenance costs to increase at facilities which use it as a fuel or fuel supplement. The use of a fluidized bed incinerator system for burning solid waste is a relatively untried technology in large-scale applications.

This alternative would be moderately sensitive to increased energy costs since the transportation costs are relatively high. However, increases in energy costs would likely result in increases in revenues from the refuse-derived fuel, which would offset the increased costs. The sensitivity of this alternative to decreases or increases in population levels would be limited.

Alternative Plan 12A: Processing of a Portion of the Solid Wastes Into a Refuse-Derived Fuel for Use as a Supplemental Fuel at the Wisconsin Electric Power Company Oak Creek Power Plant, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The major advantages of Alternative Plan 12A are similar to those of Alternative Plan 12--the savings of resources through conversion of solid waste to energy, and disposal system flexibility. This alternative also has the advantage of not requiring the construction of a separate incinerator, because the refuse-derived fuel produced would be burned at a facility owned and operated by the Wisconsin Electric Power Company. That facility is apparently now being planned, but with provisions to burn only coal.

The major disadvantage of this alternative is the uncertainty regarding the feasibility of co-firing coal and refuse-derived fuel in atmospheric fluidized bed boilers designed to generate electricity. A recently completed study evaluated the feasibility of co-firing coal and refuse-derived fuel at the Oak Creek power plant.[1] The major objectives of this study were to assess current technology and experience regarding co-firing coal and refuse-derived fuel in utility design atmospheric fluidized bed combustion units--the type of unit presently being planning for--and to determine if co-firing coal and refuse-derived fuel is technically and commercially viable for the facilities proposed at the Oak Creek power plant. The study also evaluated the status of refuse-derived fuel combustion in the utility industry and the history of co-firing coal and refuse-derived fuel in large utility boilers.

The results of the study indicated that there is presently no known commercial facility which co-fires coal and refuse-derived fuel in atmospheric fluidized bed boilers. Several facilities are co-firing refuse-derived fuel with alternative fuels such as wood waste or sewage treatment plant sludge. However, the facilities which either have completed tests on co-firing these materials or presently operate using refuse-derived fuel and some alternative fuel are not comparable in either size or design to the boiler units proposed for the Oak Creek power plant.

The co-firing of refuse-derived fuel and coal or other fuels in other boiler systems has been successfully demonstrated and is in use at numerous facilities worldwide. The utility units using such a co-firing system employ pulverized coal, cyclone, or stoker-fired boiler designs. The operation of these facilities is significantly different from the operation of atmospheric fluidized bed systems.

The study concluded that commercial experience and supporting data regarding the co-firing of refuse-derived fuel and other fuel types in atmospheric fluidized bed combustion systems is extremely limited and based primarily on the operation of small incineration systems. As already noted, there are no known atmospheric fluidized bed boilers burning refuse-derived fuel in the United States, and the use of such systems worldwide is limited. In addition,

[1]Stone and Webster, Inc., Feasibility Assessment of Co-Firing of Refuse-Derived Fuel in a Commercial Atmospheric Fluidized Bed Boiler, March 1986.

the study concluded that a number of technical and operational problems could occur if coal and refuse-derived fuel were co-fired in the reconditioned Oak Creek power plant units, including:

- Existing space limitations in the design of the reconditioned facility, making acceptable arrangement of the refuse-derived-fuel feeding equipment extremely difficult.

- Potential problems in the proper distribution of the refuse-derived fuel in the combustion chamber.

- Agglomeration of the bed caused by the melting of metals, glass, and other impurities present in the refuse-derived fuel.

- Difficulty in controlling bed temperatures.

- System hardware erosion due to the relatively high percentage of silica and aluminum in refuse-derived fuel.

- Reduced boiler efficiency due to increases in excess air, moisture in the fuel, unburned carbon loss, and air heater outlet temperature.

- The fact that introduction of a new fuel will invalidate existing permits for the facility.

- Reduced availability and increased operation and maintenance costs due to erosion and corrosion of the system and material-handling problems.

- Major design changes that would be necessary to prevent unburned materials contained in refuse-derived fuel from contaminating the ash removal, cooling, and pneumatic disposal systems.

The report concludes that before the co-firing of refuse-derived fuel in large utility units could be recommended, it would be necessary to perform comprehensive refuse-derived fuel firing tests in laboratory facilities; to transfer the technology to small prototype atmospheric fluidized bed combustion units; and ultimately to apply the technology to commercial-size fluidized bed combustion units.

Based on this information and given the uncertainty regarding whether the reconditioned Oak Creek power plant units would be capable of burning a mixture of coal and refuse-derived fuel in a manner acceptable to the Wisconsin Electric Power Company, this alternative was not considered further.

Evaluation of Accessory Alternatives

Accessory Alternative 1--High Level of Residential Solid Waste Recycling:

The major advantage of Accessory Alternative 1 is that no new facilities would be needed. This alternative would use the facilities established under the state-mandated residential solid waste recycling program. A higher level of residential solid waste recycling will reduce solid waste transportation and disposal costs because of the reduction in the amount of waste which would be landfilled, and would also result in the recovery of greater amounts of recyclable materials. This alternative would extend the life of existing landfills.

The major disadvantage of this alternative is the difficulty that could be entailed in reaching its goal--the collection of approximately twice as much recycled material as is anticipated to be collected under the program for a moderate level of residential solid waste recycling. In addition, the cost of recycling these materials is estimated to be high. It is uncertain whether there would be widespread participation of a significant portion of the public in this intensive recycling effort. Without large amounts of recycled materials, this alternative will not be cost-effective. The fluctuating value of recyclable products and availability of reliable markets would also be major considerations under this alternative.

Accessory Alternative 2--Separate Collection and Recycling of Newsprint: The major advantage of Accessory Alternative 2 is that significantly more newsprint would be removed from the residential solid waste stream than under any of the other recycling programs. This reduction in the volume of residential solid wastes would result in minor cost savings in comparison to the disposal of residential solid wastes by either landfilling or incineration.

The major disadvantage of this alternative is that separate collection of newsprint will require the retrofitting of both municipally and privately owned and operated collection vehicles. Also, it is uncertain whether a significant portion of the public would participate in a program to separate newspaper from other household solid wastes to facilitate separate collection. And finally, convincing the local units of government and private operators providing residential solid waste collection service to participate in the program could be a major obstacle to successful implementation of this alternative.

Accessory Alternative 3--Composting: The major advantage of Accessory Alternative 3 would be the reduction, by up to 3 percent, of the residential solid waste stream. Importantly, removal of large quantities of moisture-laden vegetative material from the solid waste stream, should any of the alternatives involving incineration be implemented, would reduce moisture-related operation and maintenance problems which could result from the combustion of these materials. Removal of these materials would also increase the heat content of the material to be incinerated and improve combustion, thus improving the efficiency of the facility. Composting of these vegetative materials would result in the availability of a soil-conditioning material which could be used by residents at home and by local units of government on publicly owned parklands.

The major disadvantage of this alternative is the difficulty that would be entailed in devising a cost-effective system for separating these materials from the other residential solid wastes using a low-level technology. Also, the amount of citizen participation that there would be in a voluntary system is uncertain. Further, siting composting areas in some municipalities may be difficult because of the lack of available space and/or environmental considerations regarding odor, aesthetics, and the runoff or infiltration of polluted water from the site.

ALTERNATIVE SEWAGE SLUDGE, SEPTIC AND HOLDING TANK WASTES, AND HAZARDOUS WASTE MANAGEMENT PRACTICES

Sewage Treatment Plant Sludges

As discussed in Chapter III, approximately 150,000 tons per year of sewage sludge--on a dry-weight basis--may be expected to be generated by sewage treatment plants in Milwaukee County by the year 2010. All of the sewage sludge generated in the County will originate from the Jones Island and South Shore sewage treatment plants of the Milwaukee Metropolitan Sewerage District. The Milwaukee Metropolitan Sewerage District is presently completing long-range plans for the disposal of wastewater sludge. At the present time, the District's facility plan[2] recommends that Milorganite production be continued at Jones Island, and that the product rate be stabilized by the construction and use of a sludge pipeline between the treatment plants. The remaining sludge produced at the South Shore sewage treatment plant would be applied to agricultural land for about two-thirds of the year, and be landfilled for the remaining one-third of the year. Remote storage would not be used. Solids that accumulate in the inline storage system would be landfilled, as would all grit and screenings. A detailed environmental evaluation is presently being prepared for the District which will evaluate a number of sites for their suitability for construction of a sludge landfill. Development of such a facility would provide an environmentally suitable supplementary sludge disposal system to Milorganite production and agricultural land application.

The integrated sewage sludge disposal program of the Milwaukee Metropolitan Sewerage District in Milwaukee County is not a specific consideration in this plan. However, it appears that the ongoing and anticipated future disposal programs would be fully compatible with this report's recommendations. The coordination of this county solid waste management plan with the District's sludge management plan is discussed further in Chapter IX.

Septic and Holding Tank Wastes

As discussed in Chapter III, septic and holding tank wastes are anticipated to total approximately 60 tons of solids per year, on a dry-weight basis, by the year 2010. It is generally recommended in the adopted areawide water quality management plan that septic and holding tank wastes be disposed of by discharge to a municipal sewerage system for treatment at a public sewage treatment plant. In Milwaukee County, essentially all of these wastes will likely be discharged to sewage treatment plant systems. Consequently, the projected quantities and recommendations are reflected in the above-described sewage treatment plant sludge category.

Toxic and Hazardous Wastes

As discussed in Chapter II, an estimated 35,615 tons of toxic and hazardous wastes were generated in Milwaukee County in 1984 by a variety of manufacturing or industrial processes. Such wastes are regulated by the DNR under Chapter NR 181 of the Wisconsin Administrative Code. Approximately 23,450 tons, or about 66 percent of these materials, consisted of pickle liquors which are recycled at sewage treatment plants as an agent in the removal of phosphorus from wastewater. The remaining toxic and hazardous wastes are either recycled through a variety of chemical processes, incinerated at approved facilities, or landfilled at approved sites outside Wisconsin. Disposal of these wastes is a costly and specialized endeavor, the evaluation of which is beyond the scope of this report. Accordingly, this category of wastes is addressed only to the extent necessary to ascertain the extent of the toxic and hazardous waste disposal problem in Milwaukee County. Consideration of alternative plans for resolving the toxic and hazardous waste problems should

[2]Milwaukee Metropolitan Sewerage District, Milwaukee Pollution Abatement Program, Site Specific Analysis, April 1983.

be considered in the context of an area broader than Milwaukee County and may involve statewide considerations.

Households are also sources of toxic and hazardous wastes. The toxic materials used by households typically consist of automotive maintenance supplies, pesticides, paints, solvents, cleaning products, and other compounds used by residents. Based on nationwide investigations and surveys which evaluated the quantities of these materials that are typically contained in residential solid wastes, it was estimated that between 200 and 250 tons of household toxic and hazardous materials are discarded in Milwaukee County annually. This quantity is equal to between 0.8 pound and 1.0 pound of toxic and hazardous waste per ton of residential solid waste. The Wisconsin Department of Natural Resources also regulates hazardous wastes generated by what are termed "small quantity generators" under Chapter NR 181 of the Wisconsin Administrative Code. Small quantity generators are defined as those which produce between 220 and 2,200 pounds of hazardous waste per month and do not accumulate and store, at any time, quantities of hazardous wastes greater than 2,200 pounds. Requirements pertaining to small quantity generators have generally not been as stringent as those applicable to generators of large quantities of hazardous materials with regard to temporary storage, disposal alternatives, documentation of shipments, and accumulation of materials. Consequently, there has not been a reliable means of documenting quantities, waste types, and destinations. Recently implemented new standards require small quantity generators either to manage wastes onsite or to transport wastes offsite within 180 days. In addition, the new regulations do not allow disposal of these materials in sanitary landfills, and full manifesting is now generally required for all shipments of hazardous wastes. Alternative plans for resolving these toxic and hazardous waste problems should be considered in the context of an area broader than Milwaukee County, as recommended in this report for all industrially and commercially generated toxic and hazardous wastes.

The growing concern about the cumulative impact of this diffuse source of toxic and hazardous wastes on the environment has resulted in a widespread management program nationwide. These efforts have typically consisted of a two-element approach to resolution of the problem. The first element is an information and education program which addresses alternatives to the use of products that contain toxic or hazardous substances, and the proper disposal of discarded, unwanted, or unusable products that contain such substances. The second element consists of the supervised collection and disposal of products which contain toxic and hazardous wastes. Nationally, these collection and disposal efforts range from a once-per-year collection in a small municipality where residents bring their materials to a centralized location, to regional or statewide collection and disposal programs. In Wisconsin, Chapter NR 187 of the Wisconsin Administrative Code establishes general conditions and eligibility requirements for the issuance of household hazardous waste collection and disposal grants. Through this program, financial assistance is made available to municipalities to create and operate local programs for the collection and disposal of household hazardous wastes. To date, household hazardous waste collection efforts have taken place in nine counties in Wisconsin, either with cost-share assistance from the State under Chapter NR 187 referenced above, or under a special grant program funded by the U. S. Environmental Protection Agency. Typically, these collection and disposal efforts consist of a widespread public information program to inform citizens of the day, time, and place at which they can bring a variety of household substances containing toxic and hazardous materials. A private contractor that specializes in categorizing, packing, transporting, and disposing of toxic and hazardous substances is hired to conduct these functions. To date, no household hazardous waste collection programs have been held in any municipality in Milwaukee County, although several municipalities in the County have expressed a desire to conduct such a program.

An information and education program regarding the use and disposal of household toxic and hazardous substances and a system for the collection and disposal of such materials need to be developed as part of a solid waste management program. The most feasible and cost-effective way to develop the information and education effort would be to expand the public relations and publicity element of the previously described residential solid waste recycling program. Informational and educational materials developed for the recycling program could include information on household toxic and hazardous waste materials. In Milwaukee County, the development of a program for the collection and disposal of household toxic and hazardous substances can best be undertaken by individual municipalities or, in some cases, by several smaller municipalities acting cooperatively. The cost of a special collection program for toxic and hazardous wastes varies with the types of materials accepted, the amount of advance publicity, the time and personnel necessary for coordination, and the individual contractor used. In Milwaukee County, approximately 10 special collections could be held annually to accept toxic and hazardous substances.

The 10 special collections for household toxic and hazardous substances in the County would cost a total of about $300,000. This would cover the cost of disposal of collected materials, as well as the operation and laboratory testing during the 10 collections. In addition, the public information and education program would cost $25,000 per year.

CONCLUSIONS OF INITIAL ALTERNATIVE ANALYSIS

In order to identify a preferred solid waste management plan for Milwaukee County, it is necessary to address the following five basic issues:

1. Should incineration be incorporated into the plan along with landfilling?

2. If incineration is incorporated, what type of energy product should be generated?

3. How many of each of the major facilities should be provided for and of what size?

4. Where should the major facilities be located?

5. What level of recycling effort should be provided?

Based upon the previously presented data, each of these five issues is addressed in the following sections.

Incineration

The alternative plan evaluation cited three considerations as being important in determining whether or not to include incineration in the recommended solid waste management plan for Milwaukee County. These considerations are monetary cost, environmental cost, and feasibility of implementation.

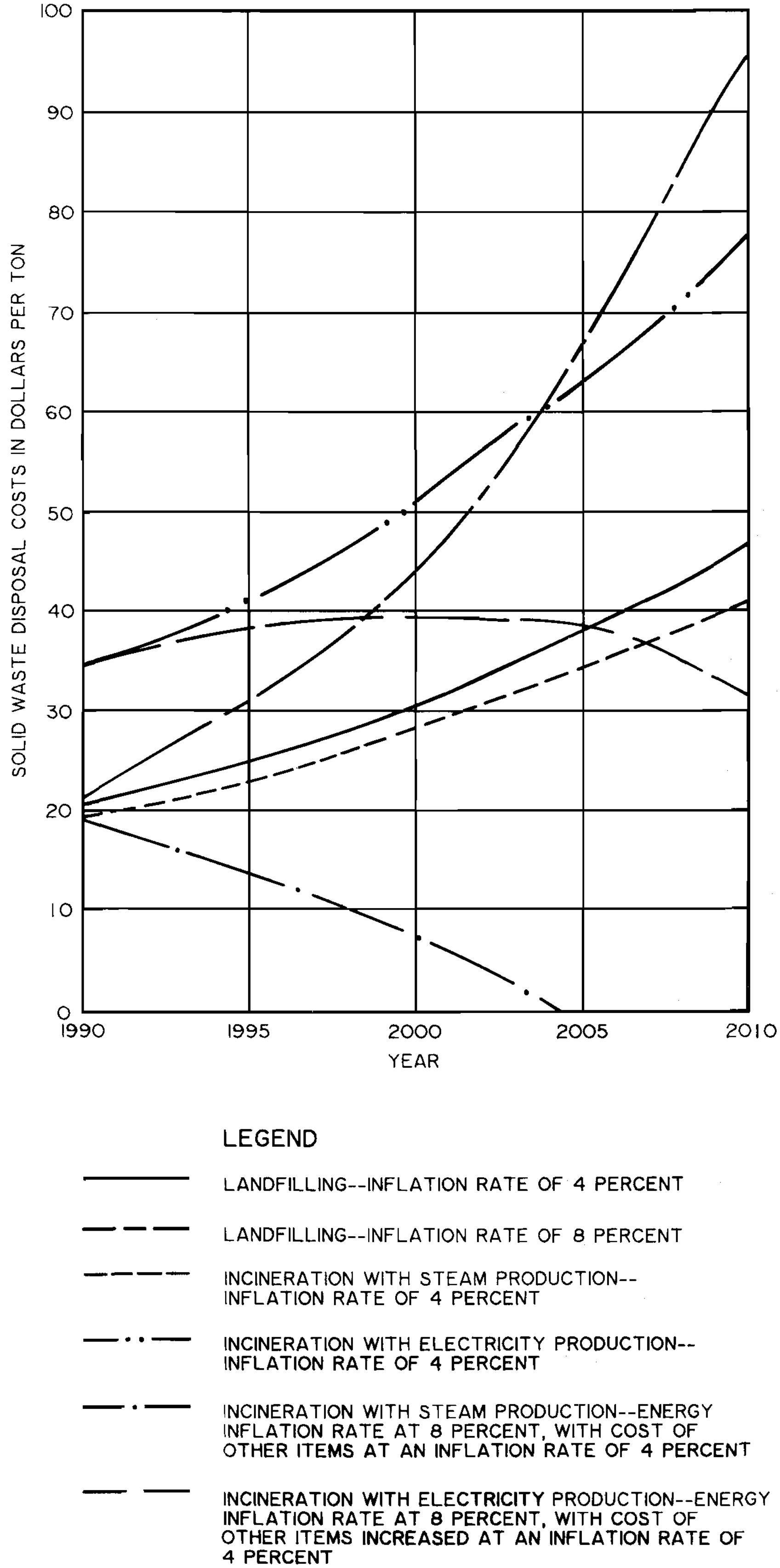
The data on the alternatives indicate that a solid waste management system that includes incineration would cost less than than systems relying primarily on landfilling if it is assumed that a viable market for the steam produced as a result of the incineration of wastes can be found. It is also apparent that incineration is initially more costly than landfilling if it is necessary to produce electric power and to rely for revenue on the sale of that power to the Wisconsin Electric Power Company at current buyback rates. The analyses indicate costs per ton of $21, $24, and $40 for landfilling, incineration with steam production, and incineration with electric power production, respectively. These costs do not include transfer or transportation costs. However, if incineration facility sites are incorporated into the solid waste management plan, transportation costs are reduced owing to the proximity of the incineration system to the major solid waste generation centers. If a credit is considered for the savings in transportation costs provided by the incineration system as a result of the inclusion of the additional disposal sites, the analyses indicate a net cost of $21, $19, and $35 per ton for landfilling, incineration with steam production, and incineration with electric power production, respectively.

The evaluation must also consider the potential impact of inflation on the costs of landfilling and incineration. A review of the detailed cost analyses previously developed indicates that about 30 percent of the cost of the incineration alternatives are fixed as amortization of the initial capital investment. As previously noted, landfilling costs have historically tended to escalate at rates higher than the underlying general price inflation rates. The potential for energy costs to rise at higher rates than the underlying inflation rate must also be considered. Figure 17 illustrates the relationship between landfill and incineration costs under various scenarios relating to varying inflation rates. The curves indicate that under certain circumstances, incineration can be substantially less costly than landfilling even if reliance on electric power production and sale is required over the plan design period.

The comparison of the monetary costs of incineration and landfilling is not conclusive. Under certain conditions, including the availability of a steam user and energy cost inflation, incineration appears to be the favorable alternative. Only under scenarios in which energy and other costs all escalate at the same rates and in which the energy value is base upon sale at the present electricity buyback rate does landfilling appear to be the favorable alternative. However, in evaluating the alternatives, the Technical Advisory Committee considered another cost termed avoided environmental costs. In this regard, it was noted that as of 1985, 18 landfill sites in Milwaukee County and 51 landfill sites in southeastern Wisconsin were considered by the Wisconsin Department of Natural Resources as having significant risks to the environment and requiring potential major expenditures for remedial measures to abate environmental pollution. It is recognized in this respect that any newly constructed or expanded landfill sites must be designed to meet more

Figure 17

PROJECTION OF SOLID WASTE DISPOSAL COSTS UNDER VARYING INFLATION RATES



Source: SEWRPC.

stringent requirements in an attempt to avoid environmental problems. Thus, the serious groundwater contamination problems presently being discovered at older sites will not be repeated at newer or expanded sites. The inclusion of incineration in the plan components can reduce the need for landfilling by between 30 and 40 percent over the plan design period and could reduce the potential for problems requiring remedial actions. This environmental consideration cannot be quantified in terms of monetary costs. However, the Advisory Committee did consider this environmental consideration to weigh significantly in favor of including incineration in the plan recommendations. Another consideration is recently enacted State legislation directed toward reducing the dependence on landfilling of solid wastes in the State. This legislation declares recycling and resource recovery systems preferable to land disposal. Specifically, state policy lists priorities for action in this order: 1) reductions in the amount of waste generated; 2) reuse of solid waste; 3) recycling; 4) composting; 5) energy recovery; and 6) land disposal.

Finally, the feasibility of implementation of the plan components was considered. It is possible that the implementation of an incineration system may, for a number of reasons, be more difficult to achieve than continued landfilling. Thus, on the basis of ease of implementation, landfilling would be the favored alternative. In considering this aspect, however, the Advisory Committee noted that the City of Milwaukee and the Milwaukee Metropolitan Sewerage District had completed the initial phase of a feasibility study of an incineration system. That initial phase concluded that it would be feasible to proceed with the development of a major solid waste incineration system at the site of the Americology plant, with the provision of electric power to the Milwaukee Metropolitan Sewerage District Jones Island sewage treatment plant and to the City of Milwaukee load centers, including the Linnwood Avenue water treatment plant and the Riverside pumping station. In addition, the Milwaukee County Institutions complex is a large potential steam and electric energy user, and could provide the location for a second solid waste incineration system when the coal-fired power plant system serving that complex required replacement and/or expansion. Detailed environmental evaluations would be required in order to determine site viability, however. In addition, several other sites were noted in the generalized siting evaluation documented in Chapter IV as being potentially suitable for the location of smaller, modular incineration systems, with industrial or public works facility users being a possibility, particularly if the costs for conventional energy sources increase. Upon careful consideration of these factors, it was concluded by the Advisory Committee that, while the implementation of an incineration system may be more difficult to achieve than landfilling, it should be possible to implement such a system over the plan design period.

Another consideration in the evaluation of the alternatives was the potential production of refuse-derived fuel. It may be noted by comparing Alternative Plans 5 and 12 that the costs of producing refuse-derived fuel and incinerating that product are only slightly higher than the cost of burning the solid waste directly with minimal processing. In view of the costs and the desirability of relying on proven technology, it was concluded that the recommendations and costs included herein would assume the use of incineration without refuse-derived fuel production. However, it is important to note that the use of refuse-derived fuel may permit the use of fluidized bed incineration technology which can have certain advantages with regard to air pollutant emission control and costs. At this time, however, large-scale operations of such systems have not been tested in the United States. However, should refuse-derived fuel alternatives be shown to be viable and cost favorable as the plan is implemented, consideration could be given to refining the plan with regard to the type of incinerator and the type of pre-incineration processing of the solid wastes.

In view of the potential long-term cost advantages, in order to meet the environmental protection and resource recovery plan objectives, and in order to provide multiple disposal options to ensure facility backup and flexibility, it is recommended that incineration facilities be incorporated into the recommended plan.

Type of Incineration Energy Product

As noted above, the alternative plans which envision the production and sale of steam as an energy product are more cost-effective than alternatives which rely on the sale of electric power at the present buyback rate for revenue. Revenues from the sale of steam based on a rate of $5.00 to $5.75 per thousand pounds of steam, a rate representative of steam rates charged to users in Milwaukee County, range from about $30 to $35 per ton of refuse incinerated. Revenues from the sale of electricity at the current buyback rates range from about $17 to $22 per ton of refuse incinerated. The range in revenue generated by the sale of electric power is based on a relatively low rate of $0.035 per kilowatt hour (kwh) and a relatively high rate of $0.046[3] per kwh. The lower rate, termed the primary weighted average avoidance rate, is the amount paid by the Wisconsin Electric Power Company (WEPCo) for electric power generated by facilities such as solar collection systems, hydro power, or similar electric power-generating equipment outside the WEPCo electric power generating station network. The lower rate was assumed for all alternative incineration facilities except the facilities located at the Americology site and at the County Institutions site. The higher rate, termed the nominal large-user rate, is the amount that the largest users of electric power pay WEPCo. For the purpose of the alternatives analysis, revenues from the sale of electric power generated at the incineration facilities located at the Americology site and at the County Institutions site were based on the higher rate, since it is assumed that electric power could be sold directly to public users in the vicinity, including the Milwaukee Metropolitan Sewerage District Jones Island sewage treatment plant and City and County of Milwaukee facilities. The costs of the electric power transmission lines were included in the total cost for these latter sites.

Based upon the evaluation of the alternatives, it is apparent that the most favorable energy production option would provide for incineration producing steam for use by a viable steam user. The second most favorable energy production system would provide for incineration producing electric power which could be sold directly to a large user, thus securing higher buyback rates.

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[3]During 1987, the nominal large user rate was estimated to be $0.043 per kilowatt hour. This estimated rate is based upon a number of assumptions regarding demand during on- and off-peak hours. The rate is subject to change annually.

Such a system might be possible as a later phase. An incineration system could be installed in or near a developing industrial park, for example, with the initial facility producing electric power, but with a potential for use of steam as new industries are developed in the park. This option could be used as part of an economic development venture which could offer steam energy at attractive rates. The installation of facilities which can be used under either energy product option is desirable in order to assure the capture of the most cost-efficient market, and to provide flexibility to meet changes in customer needs over time. The least favorable energy production system would provide for the sale of the electric power generated by incineration to the Wisconsin Electric Power Company at the present buyback rates. It may be concluded that reliance on the current "avoided cost" buyback rate--$0.035 per kwh--would not be a cost-competitive alternative to landfilling, at least in the early stages of an incineration system. An option in this respect would be to legislatively require the Wisconsin Electric Power Company to adjust its buyback rate upward to more closely approximate the cost charged to its large-user customers. This would have the same effect as producing electric power for a directly connected major user but with the advantage of not requiring the construction of new transmission lines. If such a change were made in the buyback policy of the Wisconsin Electric Power Company, this alternative energy product situation could become more attractive. However, without such a change, the institution of a solid waste management plan providing for an incineration system designed to produce electricity as an energy product for sale to the electric utility would result in initial costs that are greater than the costs for a plan relying on landfilling. These costs may become more attractive as energy values escalate and as fixed-facility capital costs begin to be a factor when compared to other costs which could rise because of inflation.

Considering the economics involved, it is recommended that the long-range plans for the incineration facilities be directed toward the use of facilities that will have a reliable user of steam. The use of facilities which generate electric power is considered an acceptable alternative for an interim period in situations where users of electricity can be secured at a rate of return in the range of costs paid by large users to the Wisconsin Electric Power Company. Reliable customers for the steam will have to be sought as the implementation steps of the incineration siting are accomplished. Alternatively, if electricity buyback rates were revised upward, the cost attractiveness of this alternative could be improved.

Number and Size of Incineration and Landfill Facilities

A comparison of the data for Alternatives 2 and 3 indicates that it is better to have two large general-use landfills than to have one. This conclusion is reached based upon the costs concerned and the need to provide flexibility through backup systems. It also appears desirable to provide an adequate number of special-use landfills to receive such materials as foundry sand, construction demolition debris, and perhaps incinerator ash. Use of such landfills would extend the life of the general-use landfills, thus minimizing problems and the uncertainty associated with major landfill expansions. It is therefore recommended that adequate special-use landfills be maintained.

With regard to the number of incineration systems, a comparison of the data for Alternatives 4, 6, 7, and 8 and Alternatives 5, 9, 10, and 11 indicates that the use of a single, large incineration system is slightly more cost-effective than the use of two, three, or five such facilities, with the costs increasing slightly with the number of facilities. However, in the case where a steam customer may permit the siting of a facility of a specified size, this situation could be reversed. In view of the need to find viable users of the energy produced, it appears desirable to decentralize the incineration system somewhat in order to provide better availability of the energy product and provide for facility sizes better able to match potential customer demands. The selection of a multiple incineration system also tends to minimize transportation costs. Furthermore, the siting of a single large incinerator--particularly in certain air quality nonattainment areas--may be difficult. Thus, it is recommended that the plan include two or three incinerator systems.

With regard to the size of the proposed facilities, a comparison of the data for Alternatives 6 and 6A, 7 and 7A, and 8 and 8A indicates that the facilities burning the higher volumes of solid waste are more favorable assuming the incineration system energy product revenues are equal. Assuming that adequate energy users and revenues will be available over the long term, it is recommended that the plan be designed to incinerate the maximum amount of solid waste practicable. Review of the solid waste quantities and characteristics, the transportation system, and the assumed operating schedule for the incinerator systems indicates that the maximum amount of solid waste which can be expected to be incinerated on an average annual basis is about 420,000 tons, or 85 percent, of the unrecycled residential solid waste; about 50,000 tons, or 40 percent, of the unrecycled commercial solid waste; and about 60,000 tons, or 20 percent, of the unrecycled industrial solid waste. This total of 530,000 tons per year, or about 1,450 tons per day--about 54 percent of the unrecycled solid waste--represents the average annual solid waste loading available for incineration.

The seasonal distribution of available solid waste for incineration is an important consideration in the determination of the capacity of the incineration facilities to be constructed. As noted in Chapter III, quantities of residential solid wastes are generally highest in the spring and early summer during yard cleanup, and again in fall following leaf drop, when yard wastes constitute up to 30 percent, by weight, of the residential solid wastes generated. The lowest quantities of residential solid wastes are generated in the winter months of December, January, and February. During the six months of the growing season, from May to October, approximately 40,000 tons per month of residential solid wastes would be available, and approximately 9,000 tons of commercial and industrial wastes would be available, for a total of 49,000 tons per month, or about 1,630 tons per day. During the period November to April, approximately 27,000 tons per month of residential solid wastes and 9,000 tons of commercial and industrial solid wastes would be available, for a total of about 36,000 tons per month, or about 1,200 tons per day. Because of this seasonal distribution, the incineration systems should be designed to incinerate a base load of about 1,200 tons per day. In order to have a firm capacity of 1,200 tons per day, it will be necessary to have an actual capacity of about 1,700 to 2,000 tons per day to accommodate maintenance and down time on the incineration systems. By making use of this additional standby capacity to the extent practicable, it may be possible to burn up to 1,400 to 1,500 tons per day, or about 530,000 tons per year on an average annual basis.

With regard to landfill capacities, it is assumed that the solid wastes not being incinerated or recycled, as well as the incinerator ash, would be landfilled. Assuming that the incineration systems would be developed over the first 15 years of the planning period, the average amount of solid waste incinerated and recycled is estimated to be 340,000 tons per year, or about 33 percent of the average annual solid waste quantity produced in the County. The remaining 695,000 tons per year of unincinerated and unrecycled solid wastes over the 23-year period 1987 to 2010, together with approximately 100,000 tons of incinerator ash, would have to be landfilled. This would require a landfill capacity of about 18,000,000 tons, or about 33,000,000 cubic yards over the 23-year plan period.

General Location of Major Facilities

It is recommended that the two existing, large, general-use landfills and the seven special-use landfills considered in Alternative Plans 3 through 12 be incorporated into the recommended plan. In addition, consideration should be given to siting of new special-use landfills, including a landfill for incinerator ash. These landfill needs are discussed further in Chapter IX of this report.

Three incineration system siting options appear viable, based on a review of solid waste transportation patterns and of the siting analyses conducted as part of this study, as well as the initial alternatives analysis. The first option is the Americology site. Initial studies conducted by the City of Milwaukee and the Milwaukee Metropolitan Sewerage District, substantiated by separate analyses completed under this planning effort, concluded that a viable solid waste incineration system could be constructed at this site with a relatively large capacity--from about 800 to 1,000 tons per day.

The second option is two or three smaller satellite incineration facilities with capacities of about 200 to 400 tons per day at feasible sites identified in Chapter IV. Of the 15 such sites identified in that chapter, two were identified as having the greatest potential for development: the City of Milwaukee Northwest transfer station site, and the Milwaukee Metropolitan Sewerage District South Shore sewage treatment plant site. These two sites were used in the alternative evaluations presented in this chapter. The evaluations conducted as part of the incineration alternatives analysis assumed that the lack of a reliable steam user necessitated that electric power be generated to produce revenue at these facilities, at least initially. However, it was also recognized that a viable steam user could be obtained over the plan design period either prior to or after construction of the incineration system. Decentralizing the incineration systems would provide the potential to sell steam or electric power produced at the incineration facilities to large industrial or institutional energy users, resulting in higher revenues.

The third siting option is the county grounds in the City of Wauwatosa, where a solid waste incinerator could eventually be located. Presently, all heating and cooling and a portion of the electric power requirements at the complex are provided by a power plant consisting of three coal-fired boilers and one gas-fired boiler. Together, these boilers enable the power plant to generate up to 330,000 pounds of steam per hour. In 1985, approximately 1.1 x 10^9 pounds of steam were generated at the county grounds power plant. The steam was used for heating and cooling buildings located on the county grounds and to drive three turbines to generate electric power. The steam produced meets all of the county complex cooling and heating needs. The electric power generated--approximately 34 million kilowatt hours per year--meets approximately 45 percent of the total electric power needs of the county grounds.

Peak demand for steam is currently between 240,000 and 300,000 pounds per hour and occurs generally during severe cold periods in winter or extremely hot periods in summer. The lowest demand for steam is in the spring and the fall when between 170,000 and 180,000 pounds of steam per hour are needed. It is important to note that the existing power plant boilers have been in operation for approximately 30 years and will be in need of major overhaul or replacement within the next 10 to 20 years to meet the growing demand for steam and electric power at the county grounds.

An analysis was conducted to determine the amount of solid waste which would be needed to operate an incinerator facility at the county grounds large enough to meet the future energy needs of the facilities. Based on discussions with county personnel, it was determined that the energy requirements at the county grounds may be expected to increase by about 20 percent by the year 1990. This increase would result in a peak demand of approximately 204,000 pounds of steam per hour. Annually, approximately 1.3 x 10 pounds of steam would be needed. In addition, it is estimated that electric power demand at the county grounds will be 86 million kilowatt hours per year. To meet the anticipated annual energy needs of 1.3 x 10 pounds of steam, a minimum of between 800 and 900 tons of solid waste per day would need to be incinerated. An important consideration of this analysis is the electric power generation potential of the incineration facility. Presently, the county grounds power plant generates only about 45 percent of the electric power needs of the complex because power is generated only when there are high demands for steam and the plant is operating at peak efficiency. During periods of lower steam demand, it is more cost-effective to purchase electric power from the Wisconsin Electric Power Company. A large incineration facility designed for the generation of steam and electricity could process a relatively constant amount of solid waste because steam, which would ordinarily not be used for heating and cooling during low-demand periods, could be used for generating electric power either for onsite sale or for offsite sale.

It must be recognized that the county grounds site may not be fully available for 10 to 20 years since the existing power plant facilities are in relatively good condition considering the age of the facility--30 years. This can be attributed to a sound maintenance program. However, should the site prove viable following more detailed feasibility studies, there are a number of alternative means of implementing the system. These alternatives range from full installation of a large system at the end of the useful life of the existing boilers to phasing in smaller modules of the full system in order to meet increased demands for energy in the shorter term--5 to 10 years--with additional modules being installed as the need arises. It will be necessary to conduct more detailed studies at this site to ascertain the practicality of a solid waste incineration system at this location.

In view of the three site options for incineration noted above, a refined alternative evaluation was conducted to assist in determining the best combination of sites to be incorporated into the plan. That evaluation is described in a following section of this chapter.

Level of Recycling

Based upon review of the auxiliary alternatives considered, it was concluded that a high level of residential recycling at the community recycling centers, as described in Auxiliary Alternative 1, is not practical because of the high cost and the dependency on recylable market prices.

It does appear that separate collection of newsprint for recycling, as described in Auxiliary Alternative 2, could be considered, since the cost would be less than that of landfilling or incineration. However, a separate collection system may be expected to remove only 5,000 to 15,000 tons per year, or 0.5 to 1.5 percent of the total solid waste stream. Thus, it will probably not have a significant impact on the other plan components. This alternative is, moreover, highly dependent upon recycled newsprint markets. Nevertheless, because of its potential cost-effectiveness, it is recommended that such recycling be incorporated into the final plan. Such recycling could be implemented on a local basis, with each community evaluating the effectiveness within the context of its own collection system.

Consideration was also given to implementing a composting program as set forth in Auxiliary Alternative 3. It is recommended that such a program also be considered a plan component to be evaluated further at the local community level in the context of the individual collection systems. This recommended component would provide for more efficient operations at the incinerator system by reducing the moisture content and variability of the solid wastes received.

REFINED INCINERATION ALTERNATIVES ANALYSIS

A refined analysis was conducted of the incineration alternatives to incorporate the refined solid waste quantities to be incinerated, as well as the three site options described above. The three alternatives evaluated in this section provide for an incineration capacity of approximately 1,800 tons per day to incinerate about 530,000 tons per year. The previously presented alternatives that include incineration as a component assumed a capacity of about 1,200 to 1,400 tons per day to incinerate between 330,000 and 390,000 tons per year. The larger amount of material estimated to be available for incineration under the refined alternatives is due to the higher percentage of the residential waste stream in the County assumed to be available for incineration, assuming participation by all municipalities once the full system is developed, and to higher quantities of industrial and commercial waste assumed to be incinerated, as discussed in the previous section.

The analysis indicated that the economic viability of the incineration component of the alternatives previously evaluated is dependent, to a large extent, upon the revenues generated by the sale of steam and electricity. At this time there is a reliable steam user at only one of the sites being considered--the county grounds. Thus, the incineration facilities considered in this alternatives analysis are designed to co-generate steam and electric power. Revenue from the sale of electric power alone can help offset the average annual capital and operation and maintenance costs. Should a steam customer become available for one or more of the facilities where none now exists, then the additional revenue from the sale of steam would be combined with the revenue from the sale of electric power to further reduce the costs. The evaluations presented below assume that all incineration facilities will be designed with co-generation capabilities and that only the county grounds site will have a reliable steam user.

Refined Alternative A

Under this alternative, three separate incineration systems with a combined capacity of about 1,800 tons per day, or 530,000 tons per year, designed to generate steam and electric power, would be constructed in the County. One facility, with a capacity of 900 tons per day, would be located at the Americology transfer station site; one facility, with a capacity of 450 tons per day, would be located in the northwestern portion of the County; and one facility, with a capacity of 450 tons per day, would be located in the southeastern portion of the County. This alternative is similar to Alternative 7A except that an additional 200 tons per day--or an additional 55,000 tons per year--would be incinerated. The 900-ton-per-day facility would have the capacity to generate approximately 1.2×10^9 pounds of steam per year, and between 85 and 110 million kilowatt hours per year of electricity. It is assumed that the electricity produced at the Americology site would be sold to large users of electricity, such as the Jones Island sewage treatment plant or the City of Milwaukee water treatment facilities. The 450-ton-per-day facilities would each have the capacity to generate approximately 5.4×10^8 pounds of steam per year, and between 40 and 50 million kilowatt hours per year of electricity. The electricity would be sold to the Wisconsin Electric Power Company or, potentially, to a large industrial or institutional user of electric power. The analysis assumed that the electricity generated at the Americology and southeastern sites would have a value of $0.046 per kwh, and at the northwest site, of $0.035 per kwh, since the first two sites are near large public facility electricity users and the northwest site is not. The facilities would have the potential to sell steam if a market developed; however, such sale was not assumed in the analysis.

As shown in Table 42, the capital cost for the development of these solid waste management facilities would be about $149,973,000. Approximately $7,480,000 per year in revenue would be generated from the sale of electricity, resulting in an average annual operation and maintenance cost of $21,066,000, including a landfilling capital cost which was assumed to be made incrementally over the life of each facility. The total average annual capital and operation and maintenance cost of this alternative would be about $34,144,000, or about $33 per ton of solid waste.

The major advantage of this alternative is that the large incineration facility would be located on a site near the City of Milwaukee Americology and Lincoln Avenue transfer stations. Residential wastes received at these two facilities constitute approximately 39 percent of the average annual quantity of residential solid waste expected to be produced countywide over the plan design period. In addition, the Americology site is close to major generators of commercial and industrial wastes. Consequently, transportation costs would be reduced. Further, because of the centralized location of the Americology site in the industrialized Menomonee River Valley, a large steam customer could potentially be found, or a large industrial steam user could be attracted to the Valley. The sale of steam would greatly enhance the economic viability of the incineration system. An additional advantage of this alternative is that the two smaller facilities have sufficient incineration capacity to provide an alternative to landfill disposal to nearly all municipalities in

Table 42

PRINCIPAL FEATURES AND COSTS OF THE REFINED INCINERATION ALTERNATIVES ANALYSIS

Alternative[b]	Cost Estimates: 1990-2010[a]								
		Annual Costs and Revenues							
	Initial Capital Cost	Annual Amortized Capital Cost[c]	Transport and Transfer	Landfill Disposal[d]	New Facilities Operation and Maintenance[e]	Average Annual Revenue	Total Average Annual Cost	Unit Cost (dollars per ton)	Total Present Worth of Capital and Operation and Maintenance
A. Incineration at three new facilities located at the Americology site and at two other sites in the County. Incineration capacity--900 tons per day at Americology, 450 tons per day at each of the other two sites	$149,973,000	$13,078,000	$4,320,000	$15,729,000	$8,497,000	$ 7,480,000[f]	$34,144,000	$32.99	$391,632,000
B. Incineration at three new facilities located at the County Institutions site and at two other sites in the County. Incineration capacity--900 tons per day at the County Institutions and 450 tons per day at the other two sites	$145,237,000	$12,665,000	$4,886,000	$15,729,000	$8,497,000	$13,960,000[g]	$27,817,000	$26.88	$319,061,000
C. Incineration at two new facilities located at the Americology site and at the County Institutions site. Incineration capacity--900 tons per day at each site	$141,290,000	$12,320,000	$5,593,000	$15,729,000	$8,125,000	$14,240,000[h]	$27,527,000	$26.60	$315,735,000

[a]Costs expressed in 1985 dollars.

[b]Includes implementation of a residential solid waste recycling program and disposal of unrecycled and unincinerated solid wastes and incinerator ash at two existing commercial general-use landfills and seven existing private special-use landfills.

[c]Economic analysis and amortization rates based upon an annual interest rate of 6 percent, and a 20-year amortization period.

[d]Landfill disposal costs are based on a tipping fee of $21 per ton. This cost includes both operation and maintenance costs at the landfills and capital costs needed for expansion and upgrading of the landfill facilities. The capital cost is included in the annual costs since the expenditures are expected to be made incrementally over the life of the facility.

[e]This cost does not include the cost of transport and disposal of incinerator residue. Those costs are included under the transportation and landfilling annual costs.

[f]Includes revenue from the sale of electricity produced at the incinerator facilities.

[g]Includes revenue from the sale of steam and electricity produced at the incinerator facility located at the County Institutions site and revenue from the sale of electricity produced at the other two incinerator facilities.

[h]Includes revenue from the sale of steam and electricity produced at the incinerator facility located at the County Institutions site and revenue from the sale of electricity produced at the incinerator facility located at the Americology site.

Source: SEWRPC.

the County. Revenues from these two facilities could be increased if a steam customer could be attracted to either, or both, of the sites.

The major disadvantages of this alternative are the difficulty in siting three separate facilities and the need to staff and maintain three facilities. In addition, the lack of an existing large steam user makes the cost of this alternative initially higher than the cost of those alternatives that rely primarily on landfilling for disposal.

Refined Alternative B

Under this alternative, three separate incineration systems with a combined capacity of about 1,800 tons per day, or 530,000 tons per year, designed to generate steam and electricity, would be constructed in the County. One facility, with a capacity of 900 tons per day, would be located at the Milwaukee County grounds in the City of Wauwatosa; one facility, with a capacity of 450 tons per day, would be located in the northwestern portion of the County; and one facility, with a capacity of 400 to 500 tons per day, would be located in the southeastern portion of the County. This alternative is similar to Refined Alternative A, but differs in that the large incineration facility would be located at the county grounds and that revenues reflect the sale of steam and electricity to the County. The 900-ton-per-day facility would have the capacity to generate approximately 1.2 x 10 pounds of steam per year, and between 85 and 110 million kilowatt hours per year of electricity. The steam and electricity generated by the facility would be sold to the County and should meet the 1990 energy demands at the county grounds. The 450-ton-per-day facilities would each generate approximately 5.4 x 10 pounds of steam per year, and between 40 and 50 million kilowatt hours per year of electricity, which would be sold to the Wisconsin Electric Power Company or, potentially, to a large industrial or institutional user of electric power. The analysis assumed that the electricity would have a value of $0.046 per kwh at the county grounds and the southeastern site, and $0.035 per kwh at the northwest site, since the first two sites are near large public facility electricity users and the northwest site is not. These facilities would also have the potential to sell steam if a market developed; however, such sale was not assumed in the analysis.

As shown in Table 42, the capital cost for the development of these solid waste management facilities would be about $145,237,000. Approximately $13,960,000 per year in revenue would be generated from the sale of steam and electricity, resulting in an average annual operation and maintenance cost of $15,152,000, including a landfilling capital cost which was assumed to be made incrementally over the life of each facility. The total average annual capital and operation and maintenance cost of this alternative would be about $27,817,000, or about $27 per ton of solid waste.

The major advantage of this alternative is that a reliable customer for steam, as well as electric power, exists at the county grounds. In addition, the use of the two smaller facilities presents an opportunity to eventually secure higher revenues from the sale of energy produced should a steam customer be attracted to either, or both, of the sites.

The disadvantages of this alternative are the difficulty in siting three separate facilities, the need to staff and maintain three facilities, and the potential noise and traffic disturbance resulting from trucks delivering solid wastes for incineration. These concerns would have to be resolved by second level planning prior to implementation of the plan. Another disadvantage of this alternative is that the cost for disposal at the two smaller incineration facilities would be greater than the cost of landfilling, even though the countywide average cost would be less than the cost of the alternatives relying on landfilling, owing to the cost advantage at the county incinerator site which offsets the higher costs at the smaller facilities.

Refined Alternative C

Under this alternative, two separate incineration systems with a combined capacity of about 1,800 tons per day, or 530,000 tons per year, designed to generate steam and electricity, would be constructed in the County. One facility, with a capacity of about 900 tons per day, would be located at the Milwaukee County grounds in the City of Wauwatosa and the other facility, with a capacity of 900 tons per day, would be located at the Americology transfer station site in the City of Milwaukee. The 900-ton-per-day facility at the county grounds would have the capacity to generate approximately 1.2 x 10 pounds of steam per year and between 85 and 110 million kilowatt hours per year of electricity. The steam and electricity generated at the site by this facility would be sold to the County and would likely meet the anticipated 1990 energy demands at the county grounds. The 900-ton-per-day facility located at the Americology site would also have the capacity to generate up to 1.2 x 10 pounds of steam per year and between 85 and 110 million kilowatt hours per year of electricity. It is envisioned that the electric power generated at the Americology incinerator would be sold to either the Wisconsin Electric Power Company or a number of large electric power users, including the Jones Island sewage treatment plant and the City of Milwaukee water treatment facilities. The analysis assumed that electricity produced at both sites would have a value of $0.046 per kwh. It is important to note that steam generated at the Americology site facility could also be sold if a market became available.

As shown in Table 42, the capital cost of the development of these solid waste management facilities would be about $141,290,000. Approximately $14,240,000 per year in revenue would be generated from the sale of steam and electricity, resulting in an average annual operation and maintenance cost of about $15,207,000, including a landfilling capital cost which was assumed to be made incrementally over the life of each facility. The total average annual capital and operation and maintenance cost of this alternative would be about $27,527,000, or about $27 per ton of waste.

The major advantage of this alternative is that there is a reliable user for steam as well as electric power at the county grounds. In addition, because of the large capacity provided by the two facilities, the City of Milwaukee would be able to dispose of virtually all of its residential solid waste at either of the two facilities. Initially, the County would dispose of all its solid waste at the Americology facility, but eventually the County would be able to use both sites. These two facilities would also be able to process a large quantity of the industrial and commercial solid wastes that are generated near the two facilities. An additional advantage of this alternative is that it would generate the highest revenues of any of the alternatives, and among the lowest transport and transfer costs and landfill disposal costs. Also, implementation of this alternative would be highly feasible because of the small number of communities that would be using the incinerators, and because of the commitment by the City of Milwaukee to construct a large incinerator at the Americology site.

The major disadvantage of this alternative, when comparing it to the alternative in which the Americology site is not used, is the lack of a market for the steam generated by incineration of wastes at the Americology site. Consequently, the capital and operation and maintenance costs for the Americology facility are somewhat higher than existing landfill disposal costs.

Conclusion of Refined Alternatives Analysis

Based upon a review of the refined alternative evaluation, it may be concluded that the best alternative would include two large incineration facilities, one at the Americology site and one at the county grounds site. However, should the necessary second level planning find these sites not viable, other satellite sites could be considered. However, the cost of solid waste management may be by about 20 percent higher if these satellite sites are used and no viable steam users are available. Should steam users be secured, the costs of using these alternative sites would be comparable to the cost of using the Americology and county grounds sites.

PRELIMINARY RECOMMENDED PLAN

Based upon the evaluation of the 12 alternative plans, the five "accessory alternatives," and the three refined incineration alternatives analysis, it was concluded that the most desirable solid waste management plan for Milwaukee County would consist of a combination of several alternatives carefully designed to meet the needs of the County. This combination alternative envisions the use of source separation and recycling of separated material; incineration of a portion of the solid waste with the production of steam and electric power; and landfilling of the remainder of the solid waste and the incinerator residue at the existing landfills. The alternative is illustrated on Map 43 in Chapter IX. An alternative recommended plan is shown on Map 44 in Chapter IX. This plan is considered a contingency plan which is recommended should the more detailed feasibility studies indicate that the county grounds site is not viable owing to special environmental concerns.

The principal components of the solid waste management system under this combined alternative would be: 1) storage of solid wastes by individual residents and commercial, industrial, and institutional waste generators; 2) the separation of a portion of the recyclable residential solid waste prior to collection, with transport of the separated portion to local recycling centers or composting sites, and including a separate collection of newsprint; 3) initiation of a special household toxic and hazardous wastes management program; 4) continued collection and transport of the remaining solid wastes by collection vehicles for most of the County; 5) continued transport of most residential solid wastes to one of eight existing transfer stations; 6) processing of a portion of the solid wastes at two new incineration systems designed to produce steam and electricity for energy recovery; and 7) disposal of unrecycled and unincinerated solid waste and incinerator ash at landfills within and outside Milwaukee County. This preliminary recommended plan is discussed in more detail in Chapter IX.

Component 1: Storage

Under this component of the combined alternative, solid wastes would continue to be stored primarily by individual residents, and by commercial, industrial, and institutional solid waste generators. Solid wastes are recommended to continue to be stored by residents in galvanized metal cans, heavy-duty plastic trash cans, heavy-duty plastic bags, or, where applicable, specialized carts designed for mechanized collection. Residents of multifamily buildings as well as commercial, industrial, and institutional generators of solid wastes would continue to store wastes in large bulk, portable containers designed for mechanized collection.

Component 2: Recycling and Composting

Under this component of the combined alternative, a countywide recycling program would be initiated which would include the establishment of 23 recycling centers to facilitate the recovery of newsprint, glass, aluminum, and plastic from the solid waste stream, as well as the development of a comprehensive information and education program and publicity campaign to encourage citizen participation. Approximately 25,000 tons, or about 5 percent, of the residential solid waste generated annually would be recycled under this program. Further, a countywide composting program would be initiated under the combined alternative. Yard wastes composed primarily of leaves and grass clippings would be composted at 21 sites distributed throughout the County. These materials would be deposited at these sites by residents and by municipal public works departments during periods of the year when vegetative materials such as leaves are collected separately, usually in the fall. Approximately 15,000 tons of yard wastes, or about 23 percent of the yard wastes generated annually in the County and about 3 percent of the annual residential solid waste load, would be composted. In addition, it is recommended that newsprint be collected separately, with equipment to be installed on existing equipment. Approximately 5,000 tons of newsprint, or about 0.5 percent of the residential solid waste quantity, would be recycled under the separate newsprint collection program.

Component 3: Household Toxic and Hazardous Waste Management

Under this component of the combined alternative, a countywide household toxic and hazardous waste management program would be initiated and used as an interim measure for handling such wastes until a broader toxic and hazardous waste management program is developed on a statewide or regional basis. An information and education program regarding proper use and disposal of a wide variety of household materials containing toxic and hazardous substances would be developed in conjunction with similar efforts proposed for the recycling and composting component. Further, a program of 10 annual "special collections" for household products containing toxic and hazardous substances would be implemented. The coordination and conduct of these collections would be the responsibility of the individual municipalities. It is important to note that economies-of-scale could be realized if several small communities held joint collections. It is estimated that up to 10 tons of material annually could be collected and disposed of under this program.

Component 4: Collection and Transport

Under this component of the combined alternative, the existing collection and transport systems would be maintained. Those municipalities providing residential solid waste collection and transport would continue to do so, and those municipalities served by private contractors would continue to be so served. Most commercial and industrial solid wastes would continue to be collected and transported by private contractors. It is recognized that there may be changes in collection services from municipal to private collection and vice versa over time, with such changes being dictated by cost and service needs.

Component 5: Transfer

Under this component of the combined alternative, the existing transfer systems operating in the County would be maintained. Most residential solid wastes would continue to be transported to one of the eight transfer stations presently operating in the County. In this regard, it is recommended that upon full plan implementation, the communities in the southwestern portion of the County consider utilizing the West Allis-West Milwaukee transfer station in order to limit the number of trucks entering the County Institutions site. The need for this would depend upon transport and access facilities provided at that incinerator site.

Component 6: Incineration

Upon full implementation of this component of the combined alternative, two separate incineration systems designed to generate steam and electric power would be constructed in the County. These systems would be constructed in two phases, and the facilities would have a combined capacity of between 1,700 and 2,000 tons per day, or 530,000 tons per year. The incineration facilities would include two mass burn incinerator systems. The sites with the greatest potential for these facilities are the City of Milwaukee Americology transfer station and the Milwaukee County grounds in the City of Wauwatosa. The facilities that would be constructed at these sites would have a capacity of about 900 tons per day. It is envisioned that the steam and electricity produced at the county grounds incinerator would be used to meet the demands of the complex's health care and support facilities as well as other facilities located on the grounds. Further, electricity generated at the Americology facility would be sold to a large industrial or institutional energy user such as the Jones Island sewage treatment plant or the City of Milwaukee load centers, including the Linnwood water treatment plant and the Riverside water pumping station. It is possible that a steam market could develop so that the steam produced at this facility, as well as the electricity, could be sold.

It should be noted that the amounts of solid waste ultimately needed to meet all energy needs at the county grounds facility may be somewhat more than available, since it is estimated that between 800 and 900 tons per day could be used. Under this plan, only about 1,400 to 1,500 tons per day of solid waste appears to be available countywide on an annual average basis, and only about 1,200 tons per day available during certain months. Assuming that about 50 percent of the waste would be used at the Americology facility, there may be a shortfall of waste available. Thus, arrangements may be needed to direct more waste to that facility upon full implementation. This could be done by securing some wastes from areas of adjacent Waukesha County or by directing wastes from Americology to the County facility during seasons when the least waste is available.

It is envisioned that the first phase of the incineration system would be constructed at the Americology site within approximately the next five years, with the second phase being constructed at the county grounds site in approximately 10 to 15 years as the condition of the system and energy demands dictate. As previously noted, the viability of the county grounds site for an incineration system will need to be confirmed by the conduct of a second level plan designed to consider environmental concerns. Should this more detailed study result in a conclusion not to use this site, there are several other sites that could be used, as set forth in Chapter IV. These sites would have a high potential if a viable steam user were to develop. If no steam user is secured, these satellite sites are still viable but with less potential than the Americology or county grounds locations. If these satellite locations are used, capacities of about 300 to 500 tons per day should be provided for. Thus, two such sites would be used under the contingency plan to replace the county grounds site as the second phase of the incineration component. The contingency recommended plan, including the two smaller satellite plants, is shown on Map 44 in Chapter IX.

Component 7: Disposal by Landfill

Upon full implementation of this component of the combined alternative, unrecycled and unincinerated solid wastes and incinerator ash, which together would total about 620,000 tons per year, would be disposed of primarily at two existing commercial general-use landfills and at seven existing private special-use landfills and at new special-use landfills which would be sited as needs dictate. In Chapter IX, consideration is given to the need for a separate incinerator ash landfill. It is important to note that implementation of the incineration recommendations will be completed in two phases. Thus, during the initial years, smaller quantities of solid wastes will be incinerated than indicated above. Therefore, the average annual quantity of unrecycled and unincinerated solid wastes and incinerator ash landfilled during the plan period would be about 775,000 tons, or about 25 percent more than during full implementation of the incineration systems. Importantly, it is estimated that ash generated as a result of the incineration of solid wastes comprises about 32 percent, by weight, of the total waste incinerated. However, it is important to note that the volume of ash is only about 15 percent as great as the volume of the incinerated material. Consequently, the volume of landfill space required to dispose of wastes generated under the recommended plan, which includes recycling as well as incineration, is anticipated to be reduced from the volume required by the landfilling alternatives by between 30 and 35 percent over the 23 years of the plan period and by about 45 to 50 percent upon full plan implementation.

The commercial general-use landfills are the Omega Hills and Metro landfills owned and operated by Waste Management of Wisconsin, Inc. The private special-use landfills include two facilities owned and operated by the City of Milwaukee, one facility each owned and operated by the City of Oak Creek, the City of South Milwaukee, the City of Wauwatosa, and the City of West Allis, and a landfill owned and operated by the Falk Corporation. These facilities are envisioned as the primary disposal facilities for the unincinerated and unrecycled solid wastes generated in Milwaukee County during the plan period.

However, other landfill facilities, including the Browning and Ferris landfill in Lake County, Illinois; Heckimovich landfill in Dodge County; Waste Management of Wisconsin, Inc., Pheasant Run Landfill in Kenosha County; Waste Management of Wisconsin, Inc., Muskego landfill; Land Reclamation, Ltd., landfill in Racine County; Troy Area landfill in Walworth County; and smaller, private special-use landfills within and outside Milwaukee County, may be expected to continue to receive solid wastes generated in the study area for a portion of the plan period. While the analyses conducted herein were based upon the use of the Omega Hills and Metro landfills as the two most logical sites from a transportation point of view, over the plan period other sites could become less costly as a result of market factors. It is recommended that the use of specific existing sites be based upon competitive market costs, as is presently the case.

Recommended Combined Alternative Plan Costs

The estimated capital cost for the development of the solid waste management facilities under the combined alternative is $141,670,000. Approximately $14,300,000 per year in revenue would be generated from the sale of steam, electric power, and recycled materials, resulting in an average annual operation and maintenance cost of $17,769,000, including a landfilling capital cost which was assumed to be made incrementally over the life of each facility. It is important to note that this estimated revenue is based upon the assumption that steam and electricity generated at the county grounds facility will be sold to the County and that only electricity generated at the Americology facility will be sold to a large institutional or industrial user. The average annual capital and operation and maintenance cost of this alternative would be about $28,551,000, or about $28 per ton of solid waste. The breakdown of these costs is given in Chapter IX. The costs are slightly different from those included in Alternative Plan C since the auxiliary plan components of newsprint recycling, composting, and toxic and hazardous materials collections had been included in the preliminary recommended plan but were not included in the alternative plan.

Chapter VIII

EVALUATION OF SPECIFIC IMPLEMENTATION METHODS

INTRODUCTION

This chapter describes and evaluates alternative implementation options applicable to each of the seven components of the recommended solid waste management plan for Milwaukee County as that plan is described in Chapter VII of this report. The chapter is divided into three sections. The first section considers facility ownership options for each component of the recommended solid waste management plan; the second section considers operational options for each component; and the final section presents the recommended plan implementation measures.

In Chapter VI of this report, facility ownership and financing alternatives were described, and the advantages and disadvantages of each option, as generally applicable to solid waste management systems, were presented. In this chapter, the ownership and operation options more specifically applicable to each of the seven solid waste management components encompassed in the recommended plan are identified and evaluated.

The individual components of the recommended plan, as described in Chapter VII, are as follows:

1. Continued storage of solid wastes by private individuals, commercial establishments, institutions, and industries.

2. Initiation of a source separation program which includes residential solid waste recycling and a yard waste composting program.

3. Initiation of a residential toxic and hazardous waste management program as an interim measure until a broader program for collection and disposal of such wastes is developed, providing for management of such wastes from all sources.

4. Continued collection and transport of solid wastes by municipally and privately owned and operated vehicles.

5. Continued transfer of solid wastes at municipally and privately owned and operated transfer stations.

6. Processing of a portion of the solid wastes at two new incineration facilities designed to produce both steam and electric power.

7. Disposal of unrecycled and unincinerated solid wastes at existing landfills within and outside Milwaukee County, with the siting of new special-use landfills for wastes such as foundry sand and incinerator ash being undertaken on a limited basis as needs dictate.

OWNERSHIP OPTIONS

The following sections briefly describe the advantages and disadvantages of each of the facility ownership options available to implement the recommended plan. In the evaluation of these options, consideration was given to the level of government involvement and control, the need for public capital investment, tax base impacts, achievable economies-of-scale, financing, and the need to develop new facilities and programs versus continued use of existing facilities and programs. Table 43 presents a comparative analysis of ownership options for each of the components of the recommended plan related to these factors.

System Component No. 1: Storage

In most cases, storage facilities consist of simple galvanized metal cans, heavy-duty plastic trash cans, or heavy-duty plastic bags which are used and owned by residents of single-family residences and apartment buildings with up to six units. As noted in Chapter II, cart containers are used for storage of residential solid wastes in the Villages of Brown Deer and Shorewood, in the City of Wauwatosa, and in a portion of the City of Milwaukee. The use of such containers is under consideration by a number of other municipalities in Milwaukee County. The plan recommends that this means of storage be phased into use as found feasible by community evaluations. Residents of larger multi-family residential buildings, as well as operators of commercial and industrial establishments, usually store solid wastes in large, bulk containers designed for mechanized collection. These bulk containers may be owned by the solid waste generator, or, more typically, by a private collection agency.

The only facility ownership option considered for the storage component of the recommended plan was continued ownership of the storage facilities by municipalities, private individuals, and private solid waste collection contractors. The principal advantage of this option is that it represents a system that is working adequately. Also, continuation of this existing system avoids the need for large capital expenditures by local units of government to institute a different system. The principal disadvantage of this option is the limited control by the local units of government concerned over the type and location of some of the storage facilities.

System Component No. 2: Source Separation--Residential Solid Waste Recycling

The source separation recycling component of the recommended plan envisions the provision of 23 recycling centers to facilitate the recovery of newsprint, glass, aluminum, and perhaps plastic and oil from the solid waste stream. These centers would consist primarily of a dedicated area containing storage facilities, including a semitrailer for paper and smaller containers for glass, aluminum, and other material. The area would ideally be fenced and have a small enclosed office area. Five ownership options were considered for these centers: ownership by private nonprofit organizations, by private profit-oriented businesses, by individual municipalities, by a group of municipalities, and by the County.

Ownership by a Private Nonprofit Organization: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by a private nonprofit organization. The principal

Table 43

COMPARISON OF OWNERSHIP OPTIONS FOR THE PRELIMINARY RECOMMENDED SOLID WASTE MANAGEMENT PLAN FOR MILWAUKEE COUNTY

Solid Waste Management System Component	Ownership Option	Level of Local Government Control	Level of County Government Control	Public Capital Expenditure	Tax Base Impact Status	Primary Decision-Making Criteria	Economy-of-Scale	Number of Financing Options	Maintains Existing System	Viability in Milwaukee County	Other
1. Storage of Solid Wastes	Private	Low	Low	No	No significant impact	N/A	Low	N/A	Yes	Viable	--
	Individual municipality	High	Low	Yes	Tax exempt	Cost and level of service	High	N/A	Yes	Viable	Refers to use of cart system in some municipalities
2. Residential Solid Waste Recycling and Composting of Yard Wastes											
Residential Solid Waste Recycling	Private nonprofit	Low	Low	No	Tax exempt	Nonprofit motivated	Low	Low	In some cases	Viable	Provides for community involvement and revenues for nonprofit organizations
	Private profit-oriented	Low	Low	No	No significant impact	Profit-motivated	Low-moderate	Moderate	In some cases	Viable	Technical expertise is available
	Individual municipality	High	Low	Yes	Tax exempt	Cost and level of service	Low	High	In some cases	Viable	--
	Group of municipalities	Moderate	Moderate	Yes	Tax exempt	Cost and level of service	Moderate	Moderate	No	Viable	Intermunicipality coordination required
	County	Low	High	Yes	Tax exempt	Cost and level of service	High	High	No	Viable	Managerial and technical expertise easily retained
Composting of Yard Wastes	Individual municipality and County	High	Low	Yes	Tax exempt	Cost and level of service	Low	High	In some cases	Viable	Costs may be offset by sale of composted material
3. Residential Toxic and Hazardous Waste Management	Private nonprofit	Low	Low	No	Tax exempt	Level of environmental concern	Moderate	Low	N/A	Not viable	Inadequate facilities for widespread, countywide program
	Private profit-oriented	Low	Low	No	No significant impact	Profit-motivated	Moderate	Moderate	N/A	Not viable	--
	Individual municipality	High	Low	Yes	Tax exempt	Cost and level of service	Low	High	N/A	Viable	--
	Group of municipalities	*Moderate*	Low	Yes	*Tax exempt*	*Level of intergovernmental cooperation*	*High*	*High*	*N/A*	*Viable*	*Most applicable for small municipalities*
	County	Moderate	High	Yes	Tax exempt	Cost and level of service	High	High	N/A	Viable	--
4. Collection and Transport of Solid Wastes	Private profit-oriented	Moderate	Low	No	Contributes to tax base	Profit-motivated	Moderate	Moderate	Yes	Viable	--
	Individual municipality	High	Low	Yes	Tax exempt	Cost and level of service	Low	High	Yes	Viable	--
5. Transfer of Solid Wastes	Private profit-oriented	Moderate	Low	No	Contributes to tax base	Profit-motivated	Moderate	Moderate	Yes	Viable	--
	Individual municipality	High	Low	Yes	Tax exempt	Cost and level of service	Low	High	Yes	Viable	--
6. Incineration of Solid Wastes	Private profit-oriented	Low	Low	No	Contributes to tax base	Profit-motivated	Low-moderate	Moderate	N/A	Viable	Technical expertise is available
	Individual municipality	High	Low	Yes	Tax exempt	Cost and level of service	Low-moderate	High	N/A	Viable only for largest municipalities	Need to obtain required technical expertise
	Group of municipalities	Moderate	Moderate	Yes	Tax exempt	Cost and level of service	Moderate	High	N/A	Viable	Need to obtain required technical expertise
	County	Low	High	Yes	Tax exempt	Cost and level of service	High	High	N/A	Viable	Costs distributed over larger tax base
7. Disposal of Solid Wastes by Landfilling	Private profit-oriented	Low	Low	No	Contributes to tax base	Profit-motivated	Moderate	Moderate	Yes	Viable	--
	Individual municipality	High	Low	Yes	Tax exempt	Cost and level of service	Low	High	Yes	Viable	Used only for limited quantities of waste

NOTE: N/A indicates information is not applicable.

Source: SEWRPC.

advantage of such ownership is that the local units of government would not need to incur a large capital expenditure for development of the recycling centers. Some recycling centers within the County are already owned by nonprofit organizations. These existing centers may be considered substitutes for some of the 23 residential solid waste recycling centers recommended in the plan. The principal disadvantage of this option is that local units of government would have limited control over the location and operation of the centers. Also, nonprofit organizations may have difficulty in financing construction of adequate recycling centers. This ownership option is considered to have only limited applicability in Milwaukee County.

Ownership by a Private Profit-Oriented Business: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by a private, profit-oriented business. The principal advantages of this option are that local units of government would not have to incur a capital expenditure for development of the recycling centers, and some economies-of-scale may be provided, particularly if the owners are already involved in other private recycling programs. Another advantage is that the recycling facilities could be located at the site, or sites, of the purchaser or purchasers of recycled materials, thus reducing the need to transport the recycled materials. The principal disadvantage of this option is that the local units of government would have limited control over the location and operation of the centers. Additionally, there are only a limited number of sites at presently operating recycling businesses, and the establishment of new facilities for this purpose may not be viable since costs may exceed the revenues at such facilities if labor is required to be a fully reimbursed cost.

Substantial recycling of residential solid wastes does occur at private profit-oriented businesses in Milwaukee County--most notably the recycling of large amounts of cardboard and paper generated at commercial facilities. These private operations are recommended to be maintained and expanded. A small number of recycling centers can be provided in conjunction with ongoing private recycling operations. However, the sites available may be expected to provide only a portion of the sites needed in the County. Thus, this type of recycling center ownership alone would not provide for the comprehensive residential recycling program envisioned under this component of the recommended plan.

Ownership by Individual Municipalities: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by the individual municipalities concerned. The advantages of this option include the level of control provided to local governments and the availability of sites used for other purposes which can accommodate recycling as an additional compatible use. Also, a larger number of options would be available to municipalities for financing construction of the recycling centers than would be available to private organizations, particularly private nonprofit organizations. The principal disadvantage of this option is that a public capital expenditure would be incurred by the individual municipalities for development of the recycling centers.

Ownership by a Group of Municipalities: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by a group of municipalities. The principal advantages of this option are the level of control provided to the local units of government, the increased economies-of-scale associated with operation of a system which serves more than one municipality, and the availability of compatible sites. The principal disadvantages of this system are that a public capital expenditure would be incurred by the participating municipalities to construct the recycling centers, and that a high degree of municipal cooperation and coordination would be required.

Ownership by the County: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by the County. The principal advantage of this option is the centralized control that would be provided. In this respect, the County would be better able to retain the expertise needed to manage the facilities. A wide range of options would be available to the County for financing construction of the centers. It might also be possible to secure lower prices for equipment and facilities if a single agency were to secure these for multiple sites. Similarly, it may be possible to secure higher revenues from the recycled materials if larger quantities are dealt with. The principal disadvantage of this option is that a capital expenditure would be incurred by the County to construct the numerous recycling centers required. Furthermore, administrative facilities and a dedicated staff would be required to coordinate the activities at all of the centers.

Summary: Implementation of the recycling component of the recommended plan requires the establishment of 23 residential solid waste recycling centers within the County. It is recommended that ownership be provided through a combination of two of the options discussed above--private profit-oriented businesses and individual municipalities. Recycling of residential solid wastes is occurring and will continue to occur in the County at facilities owned by private nonprofit organizations and municipalities. Because of the potential profit involved in recycling, private ownership is considered viable, but is recommended only where the recycling center can be located at the site of an existing commercial recycling business. This is expected to provide for the ownership of a limited number of the needed recycling centers. For all of the other recycling centers, it is recommended that the individual municipalities assume the responsibility for ownership.

System Component No. 2: Source Separation--Composting of Yard Wastes

The composting facilities incorporated into the recommended plan include a fenced area for compost processing and storage, the use of large temporary storage containers, and intermittently used equipment such as a chipper and material-handling equipment at 21 composting facilities.

The only facility ownership option considered for this component of the recommended plan was ownership of the composting facilities by individual local units of government and the County. The profit potential of these operations is limited, thereby precluding implementation by private concerns. In this respect, the ongoing composting program conducted by the County for processing vegetative debris originating on county park and open space lands would continue. The individual composting sites would be located on municipally owned or controlled land, and equipment owned by local public works departments could be used for the limited amount of materials handling necessary. The principal advantage of this option is the high level of control by local governments and the reduced transportation and disposal costs attributed to residential solid wastes as a result of removing vegetative materials from the residential solid waste stream. The principal disadvantages are the need for municipalities to undertake an additional program, and uncertainty about whether a program under which residents have to transport yard wastes to a centralized location for composting would be successful.

System Component No. 3: Residential Toxic and Hazardous Waste Management

The residential toxic and hazardous waste management program to be incorporated into the recommended plan envisions the use of temporary sites which provide for a building or enclosure and material-handling equipment for carrying out a program of 10 annual special collections for household products containing toxic and hazardous substances. Five ownership options were considered for these facilities: ownership by private nonprofit organizations, by private profit-oriented businesses, by individual municipalities, by groups of municipalities, and by the County.

Ownership by a Private Nonprofit Organization: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by one or more private nonprofit organizations. The principal advantage of this option is that local units of government would need to neither incur capital expenditures for the facilities, nor allocate space at municipally owned facilities for this purpose. The principal disadvantage is that facilities owned or controlled by nonprofit organizations may be expected to be inadequate in most situations to accommodate the equipment, materials, and temporary storage area necessary for such special collections.

Ownership by a Private Profit-Oriented Business: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by private, profit-oriented businesses. A comprehensive household toxic and hazardous waste management program would require the location of facilities in a number of communities throughout the County. The establishment of these facilities by private business for use once or twice per year per site does not appear to be viable.

Ownership by Individual Municipalities: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous wastes would be owned by the individual local units of government. Communities throughout the State that have conducted special residential toxic and hazardous waste collections have found that facilities owned by local units of government are often the most convenient and least objectionable locations for drop-off sites. The principal advantage of this alternative is the high level of control by local units of government and the ability to use sites and facilities normally used for other municipal purposes. The principal disadvantage is the need to find adequate facilities on existing municipally owned property and the need to coordinate the collection so as to not conflict with ongoing municipal services and activities at the site or sites to be used.

Ownership by a Group of Municipalities: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by a group of municipalities. The principal advantage of this system is that smaller municipalities, which individually might not have adequate space or facilities for the conduct of a residential toxic and hazardous waste collection program, could cooperate to find a site which could be jointly used. The principal disadvantage is the degree of intermunicipal cooperation that would be required.

Ownership by the County: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by the County. An advantage of this option is the large number of sites that may be available because of the widespread ownership of lands by the County. It may also be possible to utilize a single set of equipment and personnel at the multiple sites because of the centralized control provided by this option. Because of the scale involved, the County may also be able to better secure a disposal method and may be able to negotiate lower costs. The principal disadvantage of this option is the management effort that would be entailed in coordinating the collection frequencies and site-specific locations for the 10 annual collections called for by the recommended program.

Summary: Implementation of the residential toxic and hazardous waste management component of the recommended plan requires the establishment of convenient, centrally located buildings and grounds for the collection and temporary storage of the materials collected. In most cases, such facilities can best be provided by individual municipalities, or by a group of smaller municipalities at a mutually agreed-upon, centrally located site.

System Component No. 4: Collection and Transport of Solid Wastes

The collection and transportation component envisioned to be incorporated into the recommended plan includes the continued use of the collection and transportation vehicles and auxiliary equipment presently owned by the municipalities and private contractors in Milwaukee County. It should be noted that the separate collection and transport of newsprint for recycling is included under this plan component, since this operation would be carried out as part of the routine collection and transportation. As discussed in Chapter VII, the separate collection of newsprint is envisioned to be carried out by a combination of municipally and privately owned and operated residential solid waste collection services. Recycling of this material would be carried out by the municipalities in conjunction with their residential solid waste recycling programs, as previously discussed in this chapter.

The only facility ownership option considered for this component of the recommended plan was continued ownership of the existing collection and transportation equipment and facilities by municipalities and private contractors. The principal advantage of this option is that it represents an existing system which functions adequately. In addition, the private operations contribute to the tax base. The principal disadvantage of this alternative is the limited degree of local government control over the management and operation of the privately owned and operated portion of the system. Such control could expedite special solid waste management efforts such as the collection of newsprint.

System Component No. 5: Transfer of Solid Wastes

The transfer component envisioned to be incorporated into the recommended plan includes the maintenance of the eight transfer stations already operating in the County. Most residential solid wastes would continue to be transported to one of these transfer stations.

The only facility ownership option considered for this component of the recommended plan was continued municipal ownership of the existing eight transfer stations by the municipalities concerned. The principal advantages of this option are that no new facilities would need to be constructed and, consequently, local units of government would not need to incur capital expenditures. The principal disadvantage of this option is that upon full plan implementation, intergovernmental arrangements would need to be completed to allow transfer of residential solid wastes from a community without a transfer station to a transfer station located in another community.

System Component No. 6: Incineration of Solid Wastes

The incineration component envisioned to be incorporated into the recommended plan includes two separate mass burn incineration facilities constructed in two phases with a combined capacity of about 1,800 tons per day, or 530,000 tons per year, designed to generate both steam and electricity. The facility envisioned to be built in the first phase would be located at the City of Milwaukee Americology transfer station. The facility envisioned to be built in the second phase would be located at the Milwaukee County grounds. Four ownership options were considered for the incineration component of the recommended plan: ownership by a private profit-oriented business, by individual municipalities, by groups of municipalities, and by the County.

Ownership by a Private Profit-Oriented Business: Under this option, the facilities necessary for the incineration component of the recommended plan would be owned by a profit-oriented business. The principal advantages of this option are that the County or local units of government would not incur the large capital expenditures required for construction of the facility, and ownership of the facility would contribute to the tax base. Also, the technical and managerial expertise needed to construct and manage the incinerator facilities would be readily available in the private sector. The principal disadvantages of this option are that local units of government would have only limited control over the management and operation of the system, fewer alternatives would be available to finance construction of the facilities, and the facility would be operated under a profit motive, which could increase tipping fees over the long term. Implementation under this ownership alternative would be dependent entirely on economic considerations.

Ownership by Individual Municipalities: Under this option, the incinerator facilities would be owned by individual municipalities. Because of the major capital expenditures involved and because the plan recommends the construction of relatively large facilities, it was concluded that this option would be viable only for the City of Milwaukee. The principal advantage of this option is the high level of control which local units of government would have over the management and operation of the facilities. The principal disadvantage of this option is the high capital cost that would be incurred by the municipalities in which the incinerators are constructed.

Ownership by a Group of Municipalities: Under this option, the incinerator facilities would be owned by groups of municipalities. The principal advantages of this system are the level of local control that would be provided over the management and operation of the facilities, and the larger number of options that would be available for financing construction of the facilities. Implementation under this ownership option could be based upon considerations other than solely economic ones. The principal disadvantage of this option is the large public capital investment that would be required by the local units of government that cooperatively owned the facility. An additional disadvantage would be the need to create the framework necessary for the required coordination and cooperation between not only the owner municipalities, but also other user municipalities.

Ownership by the County: Under this option, the incinerator facilities would be owned by the County. The principal advantages of this option are the high level of control and coordination that would be provided and the larger number of options that would be available for financing construction of the facilities. Implementation under this option could be based upon considerations other than solely economic ones. The principal disadvantage of this option is the large capital investment that would be required by the County, and the complex coordination necessary to ensure adequate amounts of waste for optimum operation of the system.

Summary: The recommended plan envisions the construction of the necessary mass burn incinerator facilities in two phases. The first phase would be the construction of an incinerator at the Americology site by the City of Milwaukee. The second phase would be the construction of an incinerator at the Milwaukee County grounds site by Milwaukee County. The City of Milwaukee is considered the logical owner of the first phase facility. The second phase facility would be built at the county grounds site and would be owned by Milwaukee County. Under each of these situations, it would be possible to have a partnership arrangement with a private for-profit owner. When the second phase is undertaken, consideration should be given to the creation of a countywide solid waste management authority under the aegis of the County. At that time, a portion of the solid wastes generated by the City of Milwaukee may be more efficiently delivered to the county grounds site, while solid wastes from some other municipalities in the County may be more efficiently delivered to the Americology site. As the second phase is undertaken, a flow control system should be instituted within the County.

System Component No. 7: Disposal of Solid Wastes By Landfilling

The landfilling component envisioned to be incorporated into the recommended plan includes the continued use of two existing commercial general-use landfills and the presently operating private special-use landfills.

The only facility ownership option considered for this component of the recommended plan was continued ownership of the two existing commercial general-use landfills by private owners and of the seven private special-use landfills by private owners and municipalities. The development of new, and expansion of existing, privately operated special-use landfills is also envisioned in this plan. The principal advantage of this alternative is that expansion of the existing commercial landfills anticipated to be used for disposal of most of the unincinerated and unrecycled solid wastes and incinerator ash would require no large capital investment by local units of government, since these facilities are privately owned. In addition, management of these facilities would rest with owners with experience in this field. It is important to note that the six existing private special-use landfills owned by local units of government are not anticipated to require large capital expenditures for expansion. The plan does envision the need for expansion of certain existing special-use landfills, and the siting of additional such landfills to serve industrial disposal needs such as foundry sand disposal. It is recommended that these facilities be owned by the waste generators, as under the existing arrangement. The principal disadvantages of this system are that local units of government would have limited control over management and operation of the privately owned facilities, and could incur increased disposal costs, owing to the profit motivation of the private sector.

OPERATIONAL OPTIONS

The operation of the facilities necessary for the seven components of the recommended solid waste management plan, while influenced by the facility ownership, need not necessarily be determined by the ownership. In some cases, it may be preferable for the facility owner also to be responsible for the operation. In other cases, the operation of the facilities may be better performed by an agency other than the owner. The evaluation of operational options included consideration of the level of local or county governmental control, flexibility, availability of technical expertise, potential for equipment sharing, and efficiency of operation. Table 44 presents a comparative analysis of the various operational options considered for the recommended solid waste management plan.

System Component No. 1: Storage

Storage facilities consist of small storage containers which are owned by individuals; storage carts which are owned by municipalities; and large bulk containers which are owned by the contractors or by the multifamily residential complexes, commercial establishments, and industries served. The small storage containers are generally placed on the curbside by the individual owners on a weekly or bi-weekly basis for pickup. In some communities the storage containers are still picked up from garages or the rear of the residence. Most industrial and commercial solid wastes are placed into large bulk containers which are subsequently emptied by a waste collection contractor.

The only option considered for this component was continued operation of the required storage facilities under existing arrangements by private individuals and solid waste collection contractors.

System Component No. 2: Source Separation--Residential Solid Waste Recycling

The source separation recycling facilities envisioned to be incorporated into the plan include 23 recycling centers to facilitate the recovery of newsprint, glass, aluminum, and plastic from the solid waste stream. Five operation options were considered for the operation of these facilities: operation by private nonprofit organizations, by private profit-oriented businesses, by individual municipalities, by groups of municipalities, and by the County.

Operation by a Private Nonprofit Organization: Under this option, the residential solid waste recycling component facilities would be operated by a private nonprofit organization. The principal advantage of this option is that volunteer labor from nonprofit organizations would be utilized to operate the

Table 44

COMPARISON OF OPERATION ALTERNATIVES FOR THE PRELIMINARY RECOMMENDED SOLID WASTE MANAGEMENT PLAN FOR MILWAUKEE COUNTY

Solid Waste Management System Component	Operation Alternative	Level of Local Government Control	Level of County Government Control	Level of Flexibility	Decision-Making Criteria	Potential Availability of Technical Expertise	Potential for Equipment Sharing by Government Departments	Efficiency of Operation	Maintains Existing System	Viability in Milwaukee County
1. Storage of Solid Wastes	Private	Low	Low	High	N/A	N/A	N/A	Moderate	Yes	Viable
	Individual municipality	High	Low	Low	Cost and level of Service	High	N/A	High	Yes	Viable
2. Residential Solid Waste Recycling and Composting of Yard Wastes										
Residential Solid Waste Recycling	Private nonprofit	Low	Low	Low	Level of involvement	Moderate	N/A	Moderate	In some cases	Viable
	Private profit-oriented	Low	Low	Moderate	Profit-motivated	High	N/A	High	In some cases	Viable
	Individual municipality	High	Low	Moderate	Cost and level of service	Moderate	High	Moderate	In some cases	Viable
	Group of municipalities	Moderate	Moderate	Moderate	Cost and level of service	Moderate	Moderate	High	No	Viable
	County	Low	High	High	Cost and level of service	High	High	High	No	Viable
Composting of Yard Wastes	Individual municipality	High	Low	Moderate	Cost and level of service	Moderate	High	High	In some cases	Viable
3. Residential Toxic and Hazardous Waste Management	Private profit-oriented	Moderate	Low	High	Profit-motivated	High	N/A	High	N/A	Viable
4. Solid Waste Collection and Transportation	Private profit-oriented	Moderate	Low	High	Profit-motivated	High	N/A	High	Yes	Viable
	Individual municipality	High	Low	Moderate	Cost and level of service	High	High	Moderate	Yes	Viable
5. Transfer of Solid Wastes	Private profit-oriented	Low-moderate	Low	Moderate	Profit-motivated	High	N/A	High	Yes	Viable
	Individual municipality	High	Low	Moderate	Cost and level of service	Moderate	High	High	Yes	Viable
6. Incineration System	Private profit-oriented	Low	Low	Moderate	Profit-motivated	High	N/A	High	N/A	Viable
	Individual municipality	High	Low	Moderate	Cost and level of service	Low	High	Moderate	N/A	Viable
	Group of municipalities	Moderate	Moderate	Moderate	Cost and level of service	Low	Moderate	Moderate	N/A	Viable
	County	Low	High	Moderate	Cost and level of service	Moderate	High	High	N/A	Viable
7. Landfill Disposal	Private profit-motivated	Low	Low	Moderate	Profit-motivated	High	N/A	Moderate	Yes	Viable
	Individual municipality	High	Low	Moderate	Cost and level of service	Moderate	High	Moderate	Yes	Viable

NOTE: N/A indicates information is not applicable.

Source: SEWRPC.

recycling centers, with revenues from the sale of recycled materials being used to operate the centers and compensate the organizations supplying volunteers. This option may be the only way to operate these facilities in the foreseeable future without a net operational loss. This option has proven to be effective where local organizations have an interest in recycling for environmental and other nonprofit-motivated reasons. The principal disadvantages of this option are the potential lack of technical expertise; the potential problems of maintaining interest over time in a program based upon nonprofit motivation; and the difficulty in coordinating work schedules for operation of the recycling centers. Residential solid waste recycling centers are presently operated by private nonprofit organizations in Milwaukee County. Consequently, it is likely that such organizations could assist municipalities in the operation of municipally owned recycling centers through the provision of organizational expertise and volunteer labor.

Operation by a Private Profit-Oriented Business: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by a private profit-oriented business. The principal advantage of this system is the technical and managerial expertise which could be readily provided by the private sector in operating the facility and securing markets for the recycled materials. Furthermore, the operation of a residential solid waste recycling center in conjunction with an ongoing private recycling business could result in efficiencies by being located at, and operated by, a major recycling operation which is the ultimate user, or seller, of the recyclables. The principal disadvantage of this system is the lack of control by local units of government over the management and operation of the centers. It is unlikely that private operators would solicit this type of work owing to the low profitability when the labor costs are fully incurred. Some recycling of solid wastes--primarily cardboard and paper from commercial operations--may be expected to continue in any case at private profit-oriented businesses.

Operation by Individual Municipalities: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by individual municipalities. The principal advantage of this system is the level of control that would be provided by local governments over management and operation of the centers. The principal disadvantage is the need to obtain technical expertise in both operating the facilities and securing stable markets for the recycled materials. This option also has the potential disadvantage of being an added tax burden on the community since labor costs may not be fully offset by revenues.

Operation by a Group of Municipalities: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by a group of municipalities. The principal advantages and disadvantages of this system are similar to those of a system operated by an individual municipality. An additional disadvantage of this system is the need to coordinate operation of the centers to ensure efficiency and generate an optimum amount of recyclable materials.

Operation by the County: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by the County. The principal advantage of this component is that it would provide for a coordinated countywide recycling system. In addition, the

County may be better able to market the recyclables at a larger scale, and thus increase the revenues. The principal disadvantage of this option is the lack of control by local units of government. In addition, the County would be assuming a new responsibility in operating and administering the program.

Summary: Implementation of this component requires the establishment of 23 recycling centers. Recycling may be expected to continue to occur at facilities owned by private nonprofit and private for-profit organizations. It is envisioned that the 23 recycling centers will be operated by a combination of private nonprofit organizations, private for-profit businesses, municipalities, and the County. The private for-profit businesses would be involved where residential solid waste recycling centers are located at already operating commercial recycling businesses. In other cases, it is recommended that a combination of private nonprofit organizations and municipalities be responsible for the operation of the centers. It is also recommended that the County take the lead in providing, on a countywide basis, organizational assistance, recyclable material marketing, and public education through the county University of Wisconsin-Extension office.

System Component No. 2: Source Separation--Composting of Yard Wastes

The composting facilities envisioned to be incorporated into the recommended plan include the use of large temporary storage containers, a fenced area for compost windrows, and intermittently used processing equipment, such as a chipper, and material-handling equipment, such as an end loader, at 21 composting sites. The ongoing composting program conducted by the County for processing vegetative debris originating in county park and open space areas would continue under the plan. The composting sites would be located on municipally owned land, and existing equipment owned by local public works departments would be used for handling the materials to be composted. The only option considered for this component of the recommended plan was continued operation of the composting facilities by individual local units of government. It is recommended that the County assist in this operation by providing public education and information through the University of Wisconsin-Extension office in a coordinated effort with the residential recycling program discussed above.

System Component No. 3: Residential Toxic and Hazardous Waste Management

The residential toxic and hazardous waste management program envisioned to be incorporated into the recommended plan includes temporary sites which provide for a building, or enclosure, and material-handling equipment for carrying out a program of 10 annual special collections for household products containing toxic and hazardous substances. The only option evaluated for this component was the conduct of a residential toxic and hazardous waste program by a private, profit-oriented business. This business would be responsible for classifying, cataloging, packing, transporting, and disposing of household toxic and hazardous materials. Because of the technical and very specialized nature of this type of program, it is best carried out by a licensed private contractor with experience and expertise in the handling of these types of wastes. The local units of government would be responsible for publicizing the special collections; hiring a private contractor to collect and dispose of the wastes collected; and securing, maintaining, and monitoring the site where the special collections are made. It is recommended that the County assist in this operation by providing public education and information through the University of Wisconsin-Extension office.

System Component No. 4: Collection and Transport of Solid Wastes

The collection and transport component envisioned to be incorporated into the recommended plan includes continued use of the collection and transportation vehicles and auxiliary equipment owned by the municipalities and private contractors in Milwaukee County in a manner similar to the existing situation. The separate collection and transport of newsprint for recycling is included under this plan component, since this operation would be carried out in conjunction with the routine collection and transportation. The only option evaluated for this component was continued operation of the collection and transportation facilities by municipalities and private contractors. This option represents the existing system, which works successfully, and under this option, local units of government can have sufficient control either by operating a municipal system or by hiring a private contractor.

System Component No. 5: Transfer of Solid Wastes

The transfer component envisioned to be incorporated into the recommended plan includes the maintenance of the existing transfer stations operating in the County. Most residential solid wastes would continue to be transported to one of these transfer stations. The only option evaluated for this component was continued operation of the eight transfer stations by municipalities and private contractors, as under the existing system. The principal advantage of this option is that no changes to the existing method of operation would be needed. Under this system, it will be necessary upon full plan implementation for special intergovernmental arrangements to be made to provide transfer stations for those municipalities that do not presently use transfer facilities.

System Component No. 6: Incineration of Solid Wastes

The incineration component envisioned to be incorporated into the recommended plan includes two separate incineration systems constructed in two phases. The incineration facilities would include two mass burn incinerator systems. The facility constructed as the first phase would be located at the City of Milwaukee Americology transfer station, and the second phase facility would be located at the Milwaukee County grounds in the City of Wauwatosa. Four operation options were considered for the incineration component of the recommended plan: operation by a private profit-oriented business, by individual municipalities, by a group of municipalities, or by the County.

Operation by a Private Profit-Oriented Business: Under this option, the facilities necessary for the incineration system component would be operated by a profit-oriented business. The principal advantage of this option is that the private sector would have the expertise to operate and manage a complex, high technology system which such facilities represent. The principal disadvantage is the additional expense of having the facility operated by a private profit-oriented company rather than by municipal employees.

Operation by Individual Municipalities: Under this option, the facilities necessary for the incineration system component would be operated by individual municipalities. This option, like the ownership option, is considered viable only for a large municipality such as the City of Milwaukee. The principal advantage of this option is the high level of control which the municipality would have over the management and operation of the system and subsequently the costs. The principal disadvantage is the need to maintain a staff of highly trained technical personnel to operate and maintain the facilities.

Operation by a Group of Municipalities: Under this option, the facilities necessary for the incineration system component would be operated by a group of municipalities. The principal advantage of this system is that the expenses for operation and maintenance of the facilities would be shared among a group of communities, and thus this system could result in overall lower costs due to economies-of-scale. The principal disadvantage of this option is uncertainty concerning the level of cooperation that would be achieved among the communities involved.

Operation by the County: Under this option, the facilities necessary for the incineration system component would be operated by the County. The principal advantage of this option is the high level of control that could be exercised by the county over the services provided and operation and maintenance decisions. The principal disadvantages of this system are the need to retain specific technical personnel to operate the facilities, and uncertainty concerning the level of coordination and cooperation that would be achieved among the communities involved.

Summary: As already noted, the recommended plan envisions implementation of the incineration component in two phases, with the first facility being constructed at the Americology site and the second facility being constructed at the Milwaukee County grounds site. The recommended plan envisions that the Americology facility will be initially operated by the City of Milwaukee, and the county grounds facility by the County. Eventually, upon full implementation of the recommended plan, it is envisioned that the incineration facilities will be operated under a countywide solid waste authority, created under the aegis of the County. In all cases, a viable option would be to develop an agreement with a private firm to operate the facilities under contract to the owner. This option would be most likely to be practical at the Americology facility, since an existing staff with expertise in operating incineration systems is in place at the county grounds.

System Component No. 7: Disposal of Solid Wastes by Landfilling

The landfilling component envisioned to be incorporated into the recommended plan includes the continued use of two existing commercial general-use landfills and the existing private special-use landfills. The only option evaluated for this component was continued operation of the two existing commercial general-use landfills and the privately owned special-use landfill by the private sector, and continued operation of six of the special-use landfills by local units of government. The principal advantage of this option is that the technical expertise needed to properly operate the facilities already exists. The principal disadvantage of this system is that the operation of the large commercial general-use landfills which will be used to dispose of most of the solid wastes generated during the plan period is profit-motivated, and may result in increasingly expensive tipping fees.

SUMMARY

The advantages and disadvantages of the ownership and operational options available for implementation of each component of the recommended solid waste management plan were evaluated in order to determine which options might best facilitate implementation of the recommended plan. Maintenance of the existing ownership and operation is recommended as the best option for four of the seven plan components--storage, collection and transportation, transfer, and landfill disposal. For the other three plan components--residential solid waste recycling and composting, residential toxic and hazardous waste management, and incineration--a flexible set of recommendations is proposed.

The storage component of the recommended plan envisions the continued use of small storage containers owned by individuals; storage carts which are owned by municipalities; and large bulk containers which are owned by private contractors or by the multifamily residential complexes, commercial establishments, and industries served. The small storage containers are generally placed on the curbside by the individual owners on a weekly or bi-weekly basis for pickup. Most industrial and commercial solid wastes are placed into large bulk containers which are subsequently emptied by a waste collection contractor. This ownership pattern is recommended to be continued. Continued operation of these storage facilities under existing arrangements by private individuals and solid waste collection contractors is also recommended.

The residential solid waste recycling component of the recommended plan would provide for 23 recycling centers consisting of a dedicated area with storage facilities and a small office area. The evaluation of the advantages and disadvantages of the ownership and operation options for these recycling centers indicated that a flexible approach should be considered, providing for a combination of options. With regard to ownership, private profit-oriented ownership is recommended for recycling centers that are located at ongoing commercial recycling businesses. This may be expected to provide for 5 to 10 of the recommended 23 facilities. The other recycling centers are recommended to be owned by the individual municipalities. Similarly, private profit-oriented operation is recommended at recycling centers located at ongoing commercial recycling businesses. For the remaining facilities, joint operation by private nonprofit organizations and the municipal owners is recommended. It is envisioned that the centers will be operated during weekends, utilizing primarily volunteer labor supplied by local nonprofit organizations. The organizations represented in these operations would receive a share of the revenue generated as a result of selling the materials for recycling. Operation assistance, including municipally owned and operated equipment, would be provided by the municipalities. It is also recommended that the County take the lead in providing organizational assistance, recyclable material marketing development, and public education through the county University of Wisconsin-Extension office.

The composting component of the recommended plan consists of 21 sites providing large temporary storage containers, a fenced area for composting, and the intermittent use of processing equipment such as a chipper and material-handling equipment such as an endloader. The evaluation of implementation options for the composting portion of the residential solid waste recycling component indicated that ownership and operation by individual municipalities would be the most viable approach. County involvement is recommended for organizational assistance and for the provision of public education and information through the University of Wisconsin-Extension office in coordination with the recycling program discussed above.

The residential toxic and hazardous waste management component of the recommended plan includes the temporary use of 10 sites which provide a building and material-handling equipment for carrying out a program of 10 annual special collections within the County for household products containing toxic and hazardous substances. The evaluation of the advantages and disadvantages of the ownership options for this component indicated that buildings and grounds that are owned by local units of government would be the most viable for the collection and temporary storage of the materials collected. Municipally owned collection areas could be used for individual municipalities. In the case of smaller municipalities, several could share in the use of a single, agreed-upon site located in one of the participating communities. With regard to operation, the specialized nature of classifying, transporting, and disposing of these materials dictates that the collection program be operated by a private contractor working under contract with the individual municipality or group of municipalities that would be responsible for publicizing the collection. It is recommended that the County provide assistance through the University of Wisconsin-Extension office in organizational and public information efforts for this program. The assistance of nonprofit organizations such as the League of Women Voters should also be sought for public informational efforts.

The collection and transport component of the recommended plan includes the use of collection and transportation vehicles and auxiliary equipment owned and operated by the municipalities and private contractors in Milwaukee County as under the existing arrangements. The separate collection and transport of newsprint for recycling is included under this plan component, since this operation would be carried out in conjunction with the routine collection and transportation. The only option evaluated for these components was continued ownership and operation of a flexible system for the collection and transportation facilities by municipalities and private contractors.

The transfer component envisioned to be incorporated into the recommended plan includes the maintenance of the existing transfer stations operating in the County. Most residential solid wastes would continue to be transported to one of these transfer stations. The only option evaluated for this component was continued ownership and operation of the existing eight transfer stations by municipalities and private contractors, as under the existing system. Under this system, it will be necessary upon full plan implementation for special intergovernmental arrangements to be made to provide transfer stations for those municipalities that do not presently use transfer facilities.

The incineration component envisioned to be incorporated into the recommended plan includes two separate mass burn incinerators constructed in two phases. The facility constructed under the first phase would be located at the City of Milwaukee Americology transfer station. The second phase facility would be located at the Milwaukee County grounds. The evaluation of the advantages and disadvantages of the ownership and operation options for the incineration system component indicated that a combination of ownership and operation options would be the most viable: 1) ownership and operation by the City of Milwaukee of the Americology facility; and 2) ownership and operation by the County of the county grounds facility. Under each of these situations, it would be feasible to have a partnership arrangement with a private profit-oriented owner and/or operator. Once the incineration system is fully implemented, it is recommended that the ownership and operation of both facilities be controlled under a countywide intergovernmental solid waste authority provided under the aegis of the County.

The landfilling component envisioned to be incorporated into the recommended plan includes the continued use of two existing commercial general-use landfills and seven existing private special-use landfills. It is recommended that ownership and operation be provided by the private owners of the two existing commercial general-use landfills and by the private and municipal owners of the private special-use landfills, as is presently the case.

Chapter IX

RECOMMENDED SOLID WASTE MANAGEMENT PLAN AND IMPLEMENTATION ACTIONS

INTRODUCTION

Based upon the inventories, analyses, forecasts, and alternative plan evaluations presented in this report, a recommended means for meeting the existing and probable future solid waste management needs of Milwaukee County was developed. The selection of the recommended plan and the means to implement it followed an extensive review by the Technical Coordinating and Advisory Committee, a subcommittee of the County Solid Waste Management Task Force, of the technical feasibility, economic viability, environmental impacts, potential public acceptance, and practicality of the various alternative solid waste management plans considered.

This chapter describes the recommended solid waste management plan for Milwaukee County and analyzes the attendant costs. The chapter also contains an evaluation of the ability of the recommended plan to meet the adopted solid waste management plan objectives formulated by the Technical Coordinating and Advisory Committee, as well as a discussion of the importance of and need for implementing the recommended plan, and of the procedures that should be followed in plan implementation. In addition, a schedule for implementing each of the components of the recommended plan is presented.

RECOMMENDED PLAN COMPONENTS

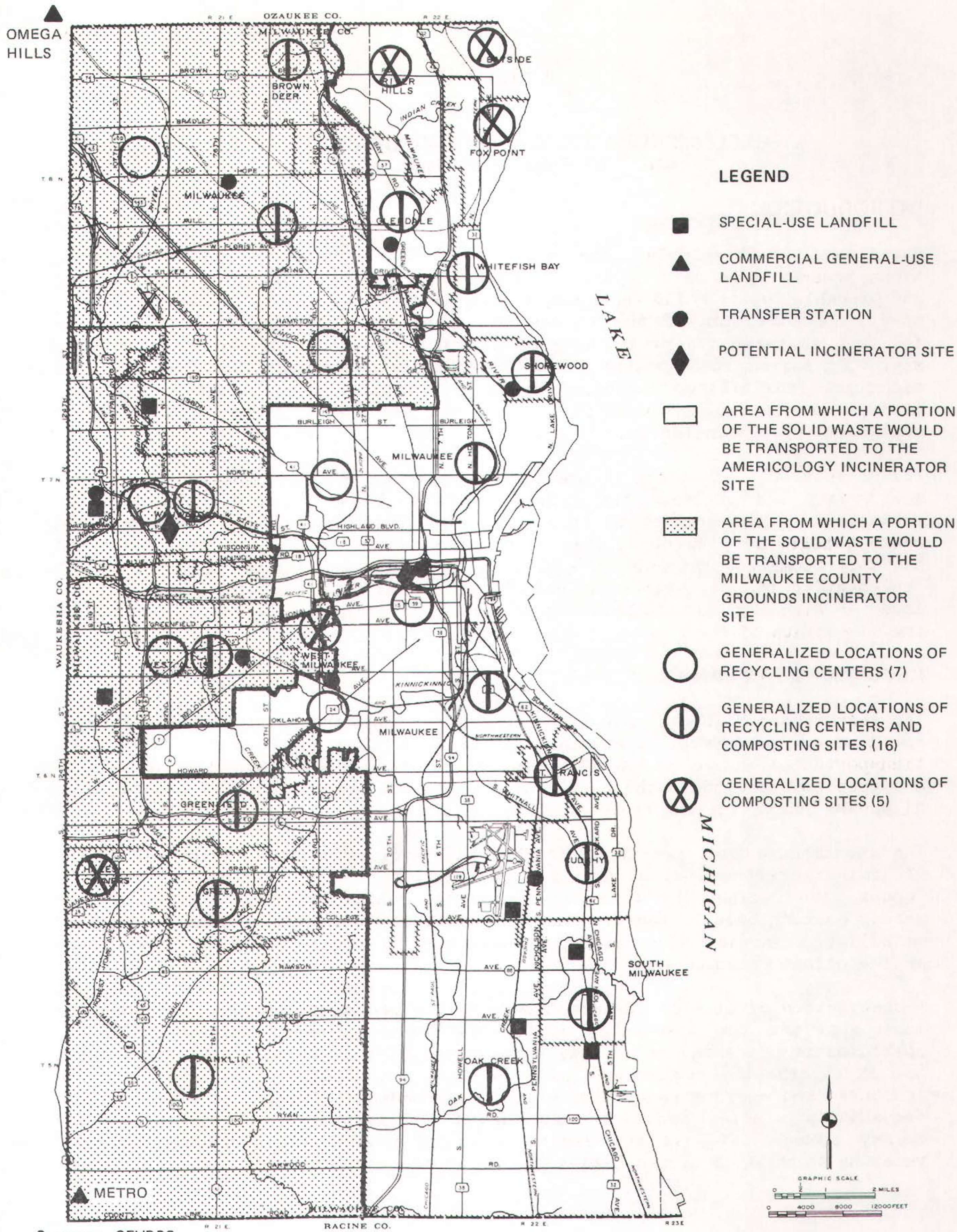
The recommended Milwaukee County solid waste management plan consists of seven solid waste management components--storage, source separation, collection, transportation, transfer, processing, and disposal. The recommended plan is designed to accommodate the total solid waste load expected to be generated in Milwaukee County through the year 2010.

The recommended plan set forth in this chapter represents a refinement of the preliminary recommended alternative plan set forth in Chapter VII of this report. The refinements were based upon the public comments received at the public hearing held on the alternative plans, and upon the results of further detailing regarding the two-phase approach to constructing a solid waste incineration system to serve the County.

A description of each of the components of the recommended solid waste management plan and the associated institutional arrangements for ownership and operation is presented below. The recommended plan is shown graphically on Map 43. An alternative recommended plan is shown graphically on Map 44. This plan is considered a contingency plan which is recommended should the more detailed feasibility studies indicate that one of the initially selected sites--the county grounds site--is not viable owing to special environmental concerns relating to the type of facilities located at that complex.

Map 43

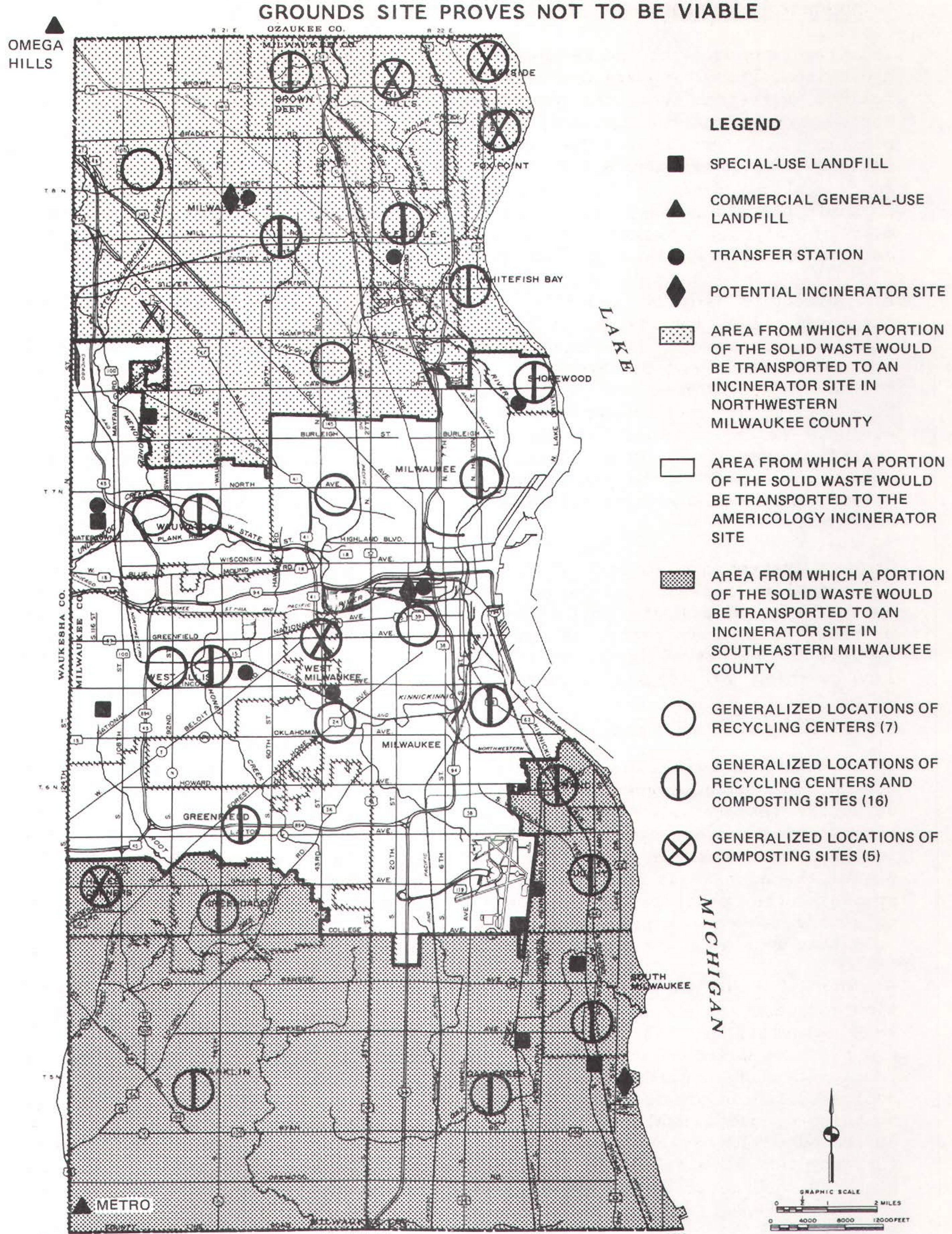
PRELIMINARY RECOMMENDED SOLID WASTE MANAGEMENT PLAN



Source: SEWRPC.

Map 44

ALTERNATIVE RECOMMENDED SOLID WASTE MANAGEMENT PLAN TO BE USED IF THE COUNTY GROUNDS SITE PROVES NOT TO BE VIABLE



Source: SEWRPC.

Component 1: Storage

The first component of the recommended solid waste management plan is the storage system. Proper storage practices are an important element of an efficient collection system. Under the recommended plan, it is envisioned that residents would utilize either standard, leak-proof, galvanized metal or heavy-duty plastic trash cans with a 20- to 32-gallon capacity and equipped with tight-fitting lids, heavy-duty plastic bags, or wheeled carts with a capacity of 75 to 90 gallons designed for mechanized collection. The use of larger, bulk, portable containers designed for mechanized collection can reduce the time and cost of collection for certain commercial and industrial establishments, and in some multifamily residential areas.

Pre-collection storage primarily affects the design, operation, and cost of the local collection system. In Milwaukee County it is expected that this function will continue to be dominated by a combination of municipally owned and operated systems and private collection operations. Decisions on the type of collection and storage system can accordingly best be made at the local level. However, it is recommended that all local units of government continue to evaluate means of improving the efficiency of collection service. In this regard, conversion to large, bulk, portable containers designed for mechanized collection appears to be gaining wider acceptance in many of the communities, based upon local decision-making considering cost, labor, and environmental concerns.

Storage systems are envisioned to continue to be owned and operated by the individual solid waste generators, municipal solid waste collection services, and private solid waste collection firms. It is recognized that there will probably be a shift over time from the use of small containers owned by individuals to the use of larger municipally owned containers suitable for mechanized hoisting into collection trucks.

Component 2: Source Separation

The second component of the recommended solid waste management plan is a source separation program. The program would consist of four elements: 1) a voluntary residential solid waste recycling program for paper, glass, metal, and plastic, whereby residents would transport these materials to a recycling center; 2) a voluntary curbside collection program for newsprint, whereby municipal and private solid waste collection vehicles would be equipped with special racks for temporary storage and transport of separated newsprint; 3) a voluntary composting program for the processing of yard wastes; and 4) a voluntary household toxic and hazardous waste management program.

Residential Solid Waste Recycling: The first element of the source separation component is a residential solid waste recycling program whereby recyclable materials consisting primarily of paper, glass, aluminum, other metals, and plastics would be transported by individuals to one of the 23 recommended local recycling centers. These recycling centers would typically consist of a dedicated fenced area for storage, parking for about 8 to 12 vehicles, storage containers, and a small office area. It is expected that the materials to be collected will vary over the plan period, depending upon market fluctuations for recyclables. A schematic drawing of a typical recycling center is shown in Figure 8 in Chapter V. The generalized locations of these centers are shown on

Maps 43 and 44. Because of the importance of local interest to making this type of center successful, the specific location of these facilities should be determined by the local units of government. With full implementation throughout the County and with a moderate level of participation in the recycling program, about 25,000 tons of material would be recycled per year, or about 5 percent of the estimated average annual residential solid waste quantity and about 2.5 percent of the total average annual solid waste quantity.

The recommended plan envisions a flexible approach to ownership and operation of the recycling centers. It is recommended that ownership of the centers be provided through a combination of private profit-oriented businesses and individual municipalities. Recycling of residential solid wastes is occurring and will continue to occur in the County at facilities owned by private nonprofit organizations and municipalities. Because of the potential profit involved in recycling, private ownership is considered viable, but is recommended only where the recycling center can be located at the site of an existing commercial recycling business. This is expected to provide for the ownership of from 5 to 10 of the recommended 23 recycling centers. For all of the other recycling centers, it is recommended that the individual municipalities assume the responsibility for ownership.

It is envisioned that the 23 recycling centers will be operated by a combination of private nonprofit organizations, private for-profit businesses, municipalities, and the County. The private for-profit businesses would consist of the already operating commercial recycling businesses. In other cases, it is recommended that a combination of private nonprofit organizations and municipalities be responsible for the operation of the centers. It is also recommended that the County take the lead in providing, on a countywide basis, organizational assistance, recyclable material marketing, and public education through the county University of Wisconsin-Extension office.

It is envisioned that the centers will be operated primarily on weekends, utilizing either volunteer labor supplied by local nonprofit organizations, or, in the case of privately owned and operated facilities, paid employees who would likely also perform other functions while manning the centers. If the centers are owned by local units of government, volunteers representing nonprofit organizations would receive a share of the revenue generated as a result of selling the recycled materials. With regard to the establishment of a recycling center, it is important to note that the centers will be successful only with strong local support and leadership.

Curbside Collection of Newsprint: The second element of the source separation component is a separate curbside collection for newsprint. This separate collection program is considered an optional plan element to be implemented in all areas where practicable. In certain areas such as narrow alleys where vehicle maneuverability and size may be restricted, such a program may not be practicable. Decisions regarding such a program should be made in conjunction with other collection system evaluations. Where this component is implemented, collection vehicles--whether municipally or privately owned and operated--would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid waste for transport to the recycling centers or storage locations. This separate collection program is anticipated to result in the recovery and recycling of 5,000 tons of newsprint annually, or about 10 pounds per capita per year. This quantity would, by weight, be about 1.0 percent of the average annual residential solid waste stream, or less than 0.5 percent of the total waste stream. The newsprint recycled under this separate collection program would be over and above the newsprint recycled at the 23 drop-off recycling centers proposed to be established. It is important to note that several communities in Milwaukee County, including the Cities of Cudahy and Glendale and the Villages of Brown Deer and Shorewood, presently operate a separate collection system for newsprint and, as such, are meeting the objectives of this recommendation. Upon implementation of the incineration element of the recommended plan, it is recommended that newsprint recycling be reevaluated based upon current market conditions and calculations of the waste energy value concerned. It is possible that the value of the newsprint to the incineration system compared to the recycled market values less costs will result in this component being an interim measure to be carried out until the incineration element is implemented in each community.

The facilities necessary for the collection of newsprint would continue to be owned and operated by municipalities and private industry. The collected material could either be transported to and recycled at a center described under the recycling component above, or be sold directly to an existing commercial recycling operator that purchases newsprint.

Composting: The third element of the source separation component is a program whereby vegetative debris, including grass clippings, leaves, and brush, generated from residential and institutional sources would be composted. As previously discussed, composting is the controlled biological decomposition of organic material in the presence of oxygen to produce humus. Humus contains beneficial nutrients and can be used as a soil conditioner. The material would be transported by individual residents, or, in the case of debris generated on publicly owned parklands, parkways, or green spaces, by county or municipally operated vehicles, to one of approximately 21 processing sites situated throughout the County. The composting sites would include a fenced storage area for compost to storage, including in some sites a leachate barrier and stormwater runoff prevention measures such as berms or dikes. The stored compost would periodically be turned over and handled using available equipment such as an end load. Other equipment such as a branch chipper may be used. The generalized locations of these centers are shown on Maps 43 and 44.

The composting program is anticipated to result in the removal of 15,000 tons of material from the solid waste stream. This quantity, by weight, would be about 23 percent of the average annual quantity of vegetative debris generated, or about 1.5 percent of the total solid waste stream. Removal of this material would reduce the moisture content of residential wastes to be incinerated and result in a long-term cost savings for the disposal of this particular portion of the solid waste stream. It should be noted that composting is also carried out by the Milwaukee County Parks Department in conjunction with the park operations. Those materials composted by the County were not included in the solid waste quantities and are expected to continue to be composted by the County.

For convenience and economy, most of the sites are recommended to be located near the above-referenced recycling centers. A site would be located in each of 18 communities, with three sites in the City of Milwaukee.

It is envisioned that the composting sites would be municipally owned and operated. It is recommended that the County provide organizational assistance and public education and information through the University of Wisconsin-Extension office in coordination with other recycling programs discussed above.

Household Toxic and Hazardous Waste Management: The fourth element of the source separation component is a household toxic and hazardous waste management program. This program would consist of about 10 annual "special collections" whereby residents could bring materials containing toxic and hazardous substances to a pre-arranged location on specific dates for disposal. In addition, the program would consist of a comprehensive information and education effort to inform citizens of the types of substances which can be disposed of under these special collections, and of nonhazardous alternatives to household products presently used. Approximately 10 tons of material would be collected annually under this program, or from 5 to 10 percent of the average annual quantity of toxic and hazardous wastes presently discarded by residents along with conventional residential solid wastes. The information and education program would also likely reduce, to an undetermined extent, the amount of such substances that are used and eventually discarded.

This recommendation is considered an interim component recommendation pending development of programs at a regional or state level for disposal of such materials from residential sources, as well as commercial and industrial sources. Thus, it is further recommended that a plan be developed for the disposal of all toxic and hazardous wastes. However, that plan should have a geographic area broader than the County and should be conducted at the regional or state level.

The availability of convenient locations to which residents can bring their hazardous materials is paramount to the program's success. Consequently, it is recommended that the necessary facilities for the collection, classification, and temporary storage of such materials be located on municipally owned property. This will provide for a high level of control by individual municipalities and will not necessitate the expenditure of public funds for construction of a facility expressly for this use. Because of the technical and specialized nature of collecting, packaging, transporting, and disposing of toxic and hazardous wastes, a private, profit-oriented business should operate the special collection program. The municipality, or perhaps groups of municipalities acting jointly, would secure the services of a licensed private contractor and thereby maintain control of the collection programs. It is envisioned that the public information and education program would consist of a cooperative effort between the local units of government, the County, and the University of Wisconsin-Extension Service. The assistance of nonprofit organizations such as the League of Women Voters should also be sought in conducting the public information efforts.

Components 3 and 4: Collection and Transportation

The third and fourth components of the recommended solid waste management plan are the collection and transportation systems. The recommended plan envisions the collection function to continue to be carried out in a manner similar to the existing system which involves the use of municipally and privately owned and operated collection vehicles. As previously discussed, municipal collection service for residential solid wastes is provided in the Cities of Cudahy, Glendale, Milwaukee, Oak Creek, South Milwaukee, Wauwatosa, and West Allis, and in the Villages of Bayside, Fox Point, Greendale, River Hills, Shorewood, West Milwaukee, and Whitefish Bay.[1] Private collection contractors are used for residential waste collection in the Cities of Franklin, Greenfield, and St. Francis, and in the Villages of Brown Deer and Hales Corners. Importantly, private contractors will continue to provide the majority of collection services throughout the County for commercial and industrial solid wastes. It also is important to note that the collection and transport functions of the separate newsprint recycling element of the residential solid waste recycling program are included herein. As discussed above, it is recommended that municipally and privately owned and operated collection vehicles be modified to temporarily store and transport separated newsprint.

Decisions pertaining to the collection of solid wastes will continue to be made by local officials and the private collection industry, with the necessary equipment and facilities to be owned and operated by a combination of municipally and privately owned and operated systems. It is recognized that there may be some changes from municipal to private ownership and operation based upon individual municipal cost and service evaluations. Thus, a flexible ownership and operation approach is recommended.

The transportation function is closely related to the collection function, and thus decisions regarding the specific type of collection vehicle transport will continue to be made by local units of government and the private sector. Municipally and privately collected solid wastes, and incinerator ash generated at the new incineration facilities, are recommended to be transported to a transfer station or disposal site, consisting, as applicable, of a landfill, incinerator, or recycling facility, in either municipally or privately owned and operated vehicles. Recyclable materials that are source-separated by residents, including paper, glass, metal, vegetative debris, and toxic and hazardous materials, are recommended to be transported primarily by individual residents in privately owned vehicles.

As discussed under the collection component, decisions pertaining to the transport of solid wastes will continue to be made by local officials and the private sector.

Component 5: Transfer

The fifth component of the recommended solid waste management plan is the use of transfer stations for the consolidation of solid wastes. Most of the residential solid wastes collected in the Cities of Cudahy, Glendale, Milwaukee, Wauwatosa, and West Allis, and the Villages of Bayside, Brown Deer, Fox Point, River Hills, Shorewood, West Milwaukee, and Whitefish Bay, would continue to be transported to one of nine transfer stations. Upon full implementation of the recommended plan, approximately 291,000 tons, or about 56 percent of the anticipated average annual residential solid waste quantity, would be transferred at one of the eight transfer stations shown on Maps 43 and 44.

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[1]In 1987, the City of Glendale changed from operating a municipal collection system to contracting with a private collection system.

It is recommended that upon full plan implementation, the communities in the southwestern portion of the County consider utilizing the West Allis-West Milwaukee transfer station in order to limit the number of trucks entering the county grounds site. The need for this would depend upon the transport and access facilities provided at that incinerator site.

The facilities necessary for the transfer of solid wastes would continue to be owned and operated by a combination of municipalities and private industry.

Component 6: Processing

The sixth component of the recommended solid waste management plan is a processing system comprised of two or three separate incinerators designed ultimately to co-generate steam and electricity. A schematic diagram of a typical installation is shown in Figure 10 in Chapter V. The combined capacity of the facilities would be between 1,700 and 2,000 tons of waste per day, and the facilities would burn about 530,000 tons of waste per year. Approximately 170,000 tons of incinerator ash annually would be produced at these facilities upon full implementation.

The proposed incineration system is recommended to be constructed in two phases. The highest potential sites for these facilities are the City of Milwaukee Americology transfer station and the Milwaukee County grounds in the City of Wauwatosa. The capacity of the facilities to be constructed at these sites should be between 800 and 1,100 tons per day at each location. It is envisioned that the steam and electricity produced at the county grounds incinerator would be used to meet the demands of the grounds' health care and support facilities, as well as other facilities located on the grounds. The second incineration facility would have the capacity to generate up to 1.2 times 10 pounds of steam at a pressure of 500 to 600 pounds per square inch per year. The steam would be used for heating and cooling and for the generation of electricity. Electricity generated at the Americology incinerator is anticipated to be sold to a large industrial or institutional energy user such as the Jones Island sewage treatment plant or the City of Milwaukee load centers, including the Linnwood water treatment plant and the Riverside water pumping station. It is estimated that between 80 and 120 million kilowatt hours of electricity per year would be produced at this facility. It is possible that a steam market could develop in the vicinity of the incineration facility so that the steam as well as the electricity produced at this facility would be sold.

It should be noted that the amounts of solid waste ultimately needed to meet all energy needs at the county grounds facility may be somewhat more than available, since it is estimated that between 800 and 900 tons per day could be used. Under this plan, only about 1,400 to 1,500 tons per day of solid waste would be available countywide on an annual average basis, and only about 1,200 tons per day available during certain months. Assuming that 50 percent of the waste would be used at the Americology facility, there may be a shortfall of available waste. Thus, arrangements may be needed to direct more waste to that facility upon full implementation. This could be done by securing some wastes from adjacent areas of Waukesha County or by directing wastes from Americology to the county facility during seasons when the least waste is available.

It is envisioned that the first phase of the incineration system will be constructed at the Americology site within approximately the next five years, with the second phase being constructed at the county grounds site in approximately 10 to 15 years, as the existing system condition and energy demands dictate. As previously noted, the viability of the county grounds site for an incineration system will need to be confirmed by the conduct of a second level plan designed to consider the environmental aspects of siting an incinerator at that special-use site. That study should include more detailed pricing and economic analyses, and should examine:

1. The need for dual fuel capability to assure that uninterrupted service is maintained.

2. The options for ash disposal. Onsite storage and disposal may be found to be inconsistent with the current health care setting usage, and questions regarding concentrations of hazardous wastes must be resolved.

3. The environmental effects of truck traffic volumes, including noise, air pollution, hours of operation constraints, etc.

4. The volume of waste that will need to be delivered to maintain a constant supply of steam/ electricity to users.

5. The potential implications of county versus noncounty ownership of the current and/or a new facility.

6. The implications of air quality impacts and Wisconsin Public Service Commission regulatory requirements.

7. Air pollutant emission concerns relating to the health facilities and surrounding residential areas.

8. The potential for utilization of burning technologies other than mass burn.

9. The potential for retrofitting the existing plant as opposed to new construction.

Should this more detailed feasibility study result in a conclusion not to use this site, several other alternative sites also exist as described in Chapter IV. These sites would have a high potential if a viable steam user were to develop. If no steam user is secured, these satellite sites would still be viable but with less potential than the two above-mentioned locations. If these satellite locations are used, capacities of about 300 to 500 tons per day should be provided for. Thus, two such sites would be used under the alternative contingency recommended plan to replace the county grounds site as the second phase of the incineration component. The contingency recommended plan, including the two smaller satellite plants, is shown on Map 44.

The recommended plan envisions that the ownership of the incineration systems will be, in part, dependent upon the users served. However, it was concluded by the Technical Coordinating and Advisory Committee that the City of Milwaukee and Milwaukee County should share responsibility for implementation of the incineration recommendations. As such, both units of government would be involved in the ownership and operation of the recommended incineration systems, with the City owning and operating the incineration facility at the Americology site and the County owning and operating the incineration facility at the county grounds site. Under each of these ownership situations, it would be viable to have a partnership arrangement with a private profit-oriented owner and/or operator. Should the alternative smaller satellite sites be used, the best ownership option would depend in part upon the energy user and could include the County, several municipalities, or industrial energy users. Once the incineration system is fully implemented, it is recommended that the ownership and operation of both facilities be controlled by a countywide intergovernmental solid waste authority provided under the aegis of the County.

Auxiliary Processing Component

As discussed in Chapter II, there are an estimated 800,000 waste tires generated in Milwaukee County annually. The growing number of tires is an important concern because of the limited methods available for proper disposal. Landfill operators often charge high disposal fees because tires do not compact, occupy an inordinate amount of space, and tend to "float" to the surface of landfills causing potential maintenance problems. In addition, existing markets for tires that are reused or recycled are limited, or may not be available near Milwaukee County. As a result, many of the tires generated in the County are stored in unsightly piles which could be fire hazards.

One way to dispose of tires is to burn them in specially designed incinerators. A private commercial owner-operator of this type of incinerator has proposed to build a facility in the Menomonee Valley capable of processing up to 4,000 tires an hour. Heat generated by burning the tires would be used to generate up to 40,000 pounds of steam per hour. The steam would be sold to the Wisconsin Electric Power Company for use in its central steam heat system in the City of Milwaukee, which provides heat to downtown office and commercial buildings. The Wisconsin Department of Natural Resources has issued the air quality permits necessary for construction and operation of the facility. The owner of the commercial enterprise is currently trying to secure financing for construction of the facility.

Thus, it would appear that a specially designed incineration system capable of processing substantially more than the 800,000 waste tires generated per year will be constructed in the County by a commercial operator. Consequently, disposal of waste tires during the plan implementation period is expected to be handled by the private sector.

Component 7: Disposal

The seventh component of the recommended solid waste management plan is the disposal system for solid wastes. This component is an integral part of the overall solid waste management system recommended for the study area in that it provides for the disposal of the unrecycled and unincinerated portion of the solid waste stream, as well as of the residue and ash generated by the incineration of wastes.

The recommended plan envisions that the majority of unincinerated and unrecycled solid wastes will be disposed of by landfilling. The unincinerated and unrecycled solid wastes are expected to be landfilled primarily at two existing commercial, general-use landfills--the Omega Hills landfill in the Villages of Germantown and Menomonee Falls and the Metro landfill in the City of Franklin. Further, seven existing private special-use landfills within the County are envisioned to be used for disposal, including two facilities owned and operated by the City of Milwaukee, one facility each owned and operated by the City of Oak Creek, the City of South Milwaukee, the City of Wauwatosa, and the City of West Allis, and a landfill owned and operated by the Falk Corporation. In addition, other special-use landfills may be sited within and adjacent to the County. These private, special-use facilities would be used for wastes comprised primarily of materials presently being disposed of in these facilities, including construction and demolition debris, clean fill, and other non-combustible materials. Finally, existing landfill facilities outside Milwaukee County may also be expected to continue to receive limited amounts of solid wastes generated in the study area during the plan period, as discussed in the following section.

There is some concern that the disposal of incinerator ash in conventional landfills may result in general contamination due to the possible presence in the ash of heavy metals and other contaminants which may leach out from the ash when placed in the acidic leachate environment of the conventional solid waste fill. Thus, it is recommended that the provision of a new incinerator ash landfill be considered, or, alternatively, the segregation of a portion of an existing landfill for incinerator ash.[2] Approximately 100,000 tons per year of incinerator ash, or 2,100,000 cubic yards, is expected to be generated over the plan period, resulting in the need for a landfill site of about 80 acres. Consideration could be given to using this special ash landfill to receive ash from other incinerators in adjacent and nearby counties.

It is recommended that the landfills continue to be owned and operated by the private owners of the two existing commercial general-use landfills and by the private and municipal owners of the private special-use landfills. It is recommended that the owners and operators of the incineration systems--the City and the County of Milwaukee, in conjunction with any private profit-oriented partner selected--own and operate any new special-use landfill for incinerator ash. Should a portion of an existing landfill be segregated for the disposal of incinerator ash, the owner/operator of the entire landfill would be responsible for the area so dedicated.

Further Landfill Considerations

As discussed in Chapter II, as of spring 1987 there were 21 active landfills receiving wastes generated in Milwaukee County. Subsequently, two landfills, the City of West Allis landfill in the City of West Allis and the Gordon DeRosso landfill in the City of Oak Creek, have submitted closure plans which have been approved by the Wisconsin Department of Natural Resources (DNR). Although these sites are still licensed to accept some wastes generated in the

[2]As of July 1987, the U. S. Environmental Protection Agency and the Wisconsin Department of Natural Resources were engaged in studies to determine if incinerator ash should be considered a hazardous waste and whether requirements for disposal of the ash should be made more stringent.

County, they will not be active for more than about two years. As such, these two sites are not considered to be significant sites for the disposal of wastes during most of the planning period and will not be discussed in the plan recommendations. In addition, two sites operated by the Wisconsin Electric Power Company, one located in the City of Oak Creek and one in the Town of Grafton in Ozaukee County, are licensed to accept fly ash and bottom ash produced from the burning of coal for electric power generation. These sites will remain active during most or all of the planning period and are considered components of the recommended plan. However, because they are licensed to accept only fly ash and bottom ash, these sites were not considered further in the study. Two private special-use landfills located in the City of New Berlin in Waukesha County, the Barrett landfill and the Industrial Waste Corporation landfill, should continue to accept limited quantities of wastes generated in Milwaukee County during most of the planning period. However, because these sites are not expected to accept significant quantities of waste generated in Milwaukee County, they will not be included in the plan recommendations.

Six commercial general-use landfills--the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois; the Greidanus Enterprises landfill in the Town of Darien, Walworth County; the Heckimovich landfill in the Town of Williams, Dodge County; the Land Reclamation, Ltd., landfill in the Town of Mt. Pleasant, Racine County; the Valley Sanitation landfill in the Town of Koshkonong, Jefferson County; and the Waste Management of Wisconsin Muskego landfill in the City of Muskego, Waukesha County--all were receiving wastes generated in Milwaukee County at the time the inventories were conducted in 1984 and 1985. Three other commercial general-use landfills subsequently either were receiving solid waste from Milwaukee County or were determined to have the potential to receive such waste. These landfills are the Pheasant Run landfill in the Town of Paris, Kenosha County; the Majerus landfill in the Town of Byron, Fond du Lac County; and the Troy Area landfill in the Town of Troy, Walworth County. These sites are not considered to be logical sites for large quantities of wastes generated in Milwaukee County because they either are located too far away from the County, have limited remaining capacities, or have uncertain site lives. Thus, these sites are not discussed in detail herein. However, these landfills, as well as smaller private special-use landfills outside the County, may be used for the disposal of limited quantities of solid wastes, with the specific sites being selected based upon competitive market costs, as is presently the case.

The remaining nine landfills--two commercial general-use and seven private special-use facilities discussed in Chapter II--were specifically included in the plan, and recommendations are discussed below. The seven private special-use landfills were of particular concern because they are all located in Milwaukee County and were generally not constructed to meet the present stringent environmental standards. Consequently, the Commission staff, in cooperation with the Department of Natural Resources, evaluated past landfill disposal practices, and conducted a field inspection to determine the general condition of each site. Below is a summary of those investigations.

City of Milwaukee Landfill (College Avenue): The City of Milwaukee owns and operates a landfill located in the southwest one-quarter of Section 34, Township 6 North, Range 22 East, City of Milwaukee. This private, special-use landfill is used to dispose of noncombustible materials and demolition debris generated by the City of Milwaukee. The licensed area of the landfill is

Figure 18

CITY OF MILWAUKEE LANDFILL--COLLEGE AVENUE

View of landfill, looking south.

Source: SEWRPC.

Figure 19

CITY OF MILWAUKEE LANDFILL--OLD HARTUNG QUARRY

View of landfill, looking north.

Source: SEWRPC.

Figure 20

CITY OF OAK CREEK LANDFILL

View of landfill, looking north.

Source: SEWRPC.

Figure 21

CITY OF SOUTH MILWAUKEE LANDFILL

View of landfill, looking east.

Source: SEWRPC.

45 acres in areal extent. A photograph of the site is presented in Figure 18. In 1986, about 4,500 tons of material were disposed of at the site. The remaining service life of the site is estimated to be two to five years. Disposed-of materials are covered as necessary following deposition.

The field inspection of this site conducted in March 1987 revealed that the active filling at the site encompasses about 10 acres. Newly deposited spoil materials were not graded at the time of this inspection since the material was obtained from water main break repair work and was frozen when deposited at the site. The City of Milwaukee staff indicated that these materials are graded as soon as practical in the spring. Runoff from the site discharges to a tributary of Oak Creek and has the potential to have an adverse impact on water quality. Wisconsin Department of Natural Resources staff indicated that groundwater monitoring may be required at the site when the City's current license for the site is renewed.

City of Milwaukee Landfill (Old Hartung Quarry): The City of Milwaukee owns and operates a landfill located in the southwest one-quarter of Section 8, Township 7 North, Range 21 East, City of Wauwatosa. This private, special-use landfill is used to dispose of noncombustible materials and demolition debris generated by the City of Milwaukee. The licensed area is 17 acres in areal extent. A photograph of the site is presented in Figure 19. In 1986, about 40,000 tons of material were disposed of at the site. The service life of the site is expected to extend to the end of the planning period. Disposed-of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

The field inspection of the site conducted in March 1987 indicated that the active filling at the site encompasses approximately 15 acres in areal extent. Newly deposited soil material is being dumped into the quarry and is sloped to the existing grade. At the time of the visit, there was an open water area approximately 5.0 acres in areal extent. An attendant at the site indicated that a pump would be installed by mid-April to pump out the water that had accumulated from precipitation and groundwater inflow. This water was proposed to be discharged untreated to the Menomonee River. Wisconsin Department of Natural Resources personnel indicated that the water pumped from the quarry should be tested and analyzed periodically to verify that it could have no adverse water quality impacts on the Menomonee River.

City of Oak Creek Landfill: The City of Oak Creek owns and operates a landfill located in the southeast one-quarter of Section 10, Township 5 North, Range 22 East, City of Oak Creek. This public, special-use landfill is used to dispose of small amounts of noncombustible materials and demolition debris generated by the City of Oak Creek. The licensed area of the landfill is 7.0 acres in areal extent. A photograph of the site is presented in Figure 20. In 1986, about 100 tons of material were disposed of at the site. The remaining service life of the site is less than three years. Disposed-of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

The field inspection of the site conducted in March 1987 revealed that all but approximately 1.0 acre of the site is graded. The site has a thick cover of perennial grasses. Deposited at the site were limited quantities of soil material. The active fill area is less than 1.0 acre in areal extent. The site appeared to have had no adverse impacts on offsite groundwater or surface water.

City of South Milwaukee Landfill: The City of South Milwaukee owns and operates a landfill located in the southeast one-quarter of Section 14, Township 5 North, Range 22 East, City of South Milwaukee. This private, special-use landfill is used to dispose of noncombustible materials and demolition debris generated by the City of South Milwaukee. The licensed area of the landfill is 10.7 acres in areal extent. A photograph of the site is presented in Figure 21. In 1986, 500 tons of material were disposed of at the site. The remaining service life of the site is about five years. Disposed-of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

Field inspection of the landfill conducted in March 1987 revealed that active disposal of materials is occurring at several areas scattered around the site. The surface is covered with soil material, stones, and rubble. Perennial vegetative cover is well established around the perimeter of the site. The site appeared to have had no adverse impacts on offsite groundwater or surface water.

City of Wauwatosa Landfill: The City of Wauwatosa owns and operates a landfill located in the southeast one-quarter of Section 19, Township 7 North, Range 21 East, City of Wauwatosa. This public, special-use landfill is used to dispose of noncombustible materials, wood matter, and clean fill materials generated by the City of Wauwatosa. The licensed area of the landfill is 100 acres in areal extent. An aerial photograph of the site is presented in Figure 22. In 1986, 700 tons of material were disposed of at the site. At the present rates of disposal, the service life of the site is expected to extend beyond the end of the planning period. Disposed-of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

Field inspection of the landfill conducted in March 1987 indicated that active disposal of materials is occurring in an area approximately 2.0 acres in extent adjacent to the City of Wauwatosa public works facilities. Material being deposited at the site included brush and bulk residential refuse, including furniture and tires. Appliances are temporarily stored at the site and then recycled. The remainder of the site has been used at various times in the past and is of varying topography and soil covered with scattered vegetation. The site appeared to have had no adverse impacts on offsite groundwater or surface water.

City of West Allis Landfill: The City of West Allis owns and operates a landfill located in the northwest one-quarter of Section 7, Township 6 North, Range 21 East, City of West Allis. This private, special-use landfill is used to dispose of noncombustible materials generated by the City of West Allis. The licensed area of the landfill is 18 acres in areal extent. A photograph of the site is presented in Figure 23. In 1986, 1,500 tons of material were disposed of at the site. The site is no longer licensed and in the future will be used only to dispose of soil and other clean fill material, the disposal of which is not regulated by the Wisconsin Department of Natural Resources. The remaining service life of the site for disposal of these materials is estimated to be three years. Disposed-of materials are covered as necessary following deposition. Groundwater monitoring is not required at the site, and there have been no reported incidences of groundwater contamination in the area.

Field inspection of the site conducted in March 1987 indicated that very little disposal activity was occurring. The surface of the site was composed primarily of soil materials that had been graded to a nearly level slope. The site appeared to have had no adverse impacts on offsite groundwater or surface water.

<u>Falk Corporation Landfill</u>: The Falk Corporation owns and operates a landfill located in the southwest one-quarter of U. S. Public Land Survey Section 2, Township 5 North, Range 22 East, City of South Milwaukee. This private, special-use landfill is used to dispose of noncombustible materials, including foundry wastes and sludges generated in the operation of the Corporation business. The licensed area of the landfill is 17.6 acres in areal extent. A photograph of the site is presented in Figure 24. In 1986, 9,000 tons of material were disposed of at the site. The service life of the site is expected to extend to the end of the planning period. Disposed-of materials are covered as necessary following deposition. Groundwater monitoring is conducted at the site; however, there have been no reported incidences of groundwater contamination in the area.

The field inspection of this site conducted in March 1987 did not reveal any unusual circumstances that need to be remedied. An extensive groundwater monitoring network has been installed and experimental revegetation plots have been established to evaluate the best means of stabilizing those areas of the site that are no longer subject to filling.

<u>Waste Management of Wisconsin-Metro Landfill</u>: Waste Management of Wisconsin owns and operates a landfill located in the southwest one-quarter of Section 31, Township 5 North, Range 21 East, City of Franklin. This commercial, general-use landfill is used to dispose of a variety of materials, including noncombustible wastes, wood matter, trash refuse, garbage, and demolition debris originating from residential, commercial, and industrial sources throughout southeastern Wisconsin. This landfill is a major disposal area for Milwaukee County wastes. The licensed area of the landfill is 96 acres in areal extent. A photograph of the site is presented in Figure 25. In 1986, 380,000 tons of material were disposed of at the site. The remaining service life of the licensed portion of the site is approximately five years. However, a feasibility study for expansion of the site has been submitted to the Wisconsin Department of Natural Resources. The feasibility study evaluated an expansion encompassing 12 acres of adjacent area. This new site would, upon approval by the DNR, have a capacity of about 6,700,000 cubic yards, which is sufficient capacity, at current fill rates, for the disposal of refuse for approximately eight years. The new fill would have a five-foot recompacted clay liner and a leachate collection system. Importantly, Waste Management has ownership of extensive lands adjacent to the existing landfill. Much of the land could probably be used for landfilling throughout the plan implementation period.

Disposed-of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and some groundwater

Figure 22

CITY OF WAUWATOSA LANDFILL

Aerial photograph, April 1984.

Source: City of Wauwatosa.

contamination has been reported in the older areas of the site. The DNR reports that actions taken by Waste Management to correct such contamination, including collection, have generally reduced groundwater contamination in the area.

Waste Management of Wisconsin Omega Hills Landfill: Waste Management of Wisconsin owns and operates a landfill located in the southern one-half of Section 36, Township 9 North, Range 20 East, Village of Germantown, and in the eastern one-half of Section 1, Township 8 North, Range 20 East, Village of Menomonee Falls. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. This site is a major disposal area for much of the residential, commercial, and industrial solid waste generated in Milwaukee County. The licensed area of the landfill is 166 acres in areal extent. In 1986 about 350,000 tons of material were disposed of at the site. A photograph of the site is presented in Figure 26. The remaining service life of the licensed portion of the site is less than five years. Disposed-of materials are required to be covered daily following deposition. Groundwater monitoring is required at the site, and some groundwater contamination has been reported in the area. As a result of this contamination, Waste Management has undertaken a number of engineering modifications, including the pumping and treatment of leachate originating from the site.

As of May 1987, no plans for expansion of the existing site had been submitted to the DNR. However, it is anticipated that the preliminary steps necessary to receive approval for a site expansion will be initiated during 1987. It appears that there is sufficient area adjacent to the site to accommodate disposal of refuse through the plan implementation period, providing that safe disposal can eventually be achieved.

Air Quality Considerations

As discussed in Chapter IV, air quality is one of the most important considerations associated with operation of a large mass burn incineration facility in Milwaukee County. The following is an overview of air quality issues related to the recommended incineration facilities.

The principal air pollution regulatory programs applicable to the recommended incineration facilities are the National Ambient Air Quality Standards (NAAQS), the Nonattainment Area New Source Review Program, the Prevention of Significant Deterioration (PDS) Program, and the New Source Performance Standards (NSPS). Each of these regulatory programs is discussed below.

National Ambient Air Quality Standards and Nonattainment Area New Source Review Program: The National Ambient Air Quality Standards (NAAQS) Program sets the maximum allowable ambient concentrations that provide protection against significant health effects. Primary NAAQS have been established for carbon monoxide, nitrous oxides, sulfur dioxide, particulate matter, lead, and ozone. Areas in which the ambient concentrations of a pollutant exceed a NAAQS are classified as "nonattainment" areas for that pollutant. These nonattainment areas are delineated in Chapter IV. The Americology project site lies within sulfur dioxide and ozone primary nonattainment areas and a secondary nonattainment area for particulates. The Milwaukee County grounds project site lies within the ozone primary nonattainment area.

Figure 23

CITY OF WEST ALLIS LANDFILL

View of landfill, looking northeast.

Source: SEWRPC.

Figure 24

FALK CORPORATION LANDFILL

View of landfill, looking south.

Source: SEWRPC.

Figure 25

WASTE MANAGEMENT OF WISCONSIN METRO LANDFILL

View of landfill, looking southwest from access road.

Source: SEWRPC.

Figure 26

WASTE MANAGEMENT OF WISCONSIN OMEGA HILLS LANDFILL

View of landfill, looking northwest from County Line Road.

Source: SEWRPC.

The U. S. Environmental Protection Agency (EPA) has not yet approved Wisconsin's strategy for controlling sulfur dioxide emissions. It is important to note that there have been no exceedances of the permissible level of sulfur dioxide in that portion of Milwaukee County designated as a sulfur dioxide nonattainment area since 1978. Consequently, the Wisconsin Department of Natural Resources requested that the EPA redesignate the sulfur dioxide nonattainment area in Milwaukee County as an attainment area. The EPA has yet to act on this request. However, it is likely that such a redesignation will occur at the time the environmental impact statement for this project is prepared and the preliminary engineering phase of the project begun.

The particulate nonattainment designation invokes several restrictions upon the project. One of these restrictions is that compliance with the lowest achievable emission rate (LAER) for each of the nonattainment pollutants must be achieved. LAER is defined as the lowest emission rate achieved by a similar facility or determined achievable by the EPA or DNR. Initial conversations with the DNR have indicated that LAER particulate emission limits would be about 0.025 grain per dry standard cubic foot of gas (gr/dscf)--corrected to 12 percent carbon dioxide--for flue gas from refuse burning.

Another restriction applicable to a new or modified air pollution source in a nonattainment area is that its emissions of the nonattainment pollutant must be "offset" by reductions in emissions of the nonattainment pollutant by other facilities or sources in the general area of the proposed facility. These emissions reductions must be greater (1.2:1) than the amount of the nonattainment pollutant emitted by the proposed facility. If offsets are not available, it is possible that the facility will not be able to be built.

<u>Prevention of Significant Deterioration Program:</u> The second major regulatory air pollution control program applicable to the recommended incineration facilities is the Prevention of Significant Deterioration (PSD) Program. Particulate emissions fall under the Nonattainment Area New Source Review requirements and are not subject to the PSD Program constraints. However, all of the incineration facilities proposed in the plan will burn more than 250 tons of municipal refuse a day, and it is anticipated that emissions of at least one pollutant from the facilities will exceed 100 tons per year. Consequently, the requirements of the PSD Program will apply to any pollutant emitted by the facilities (after the installation of pollution equipment) in excess of the "significance" amounts listed in Table 45.

The principal requirements of the PSD Program are:

1. To comply with the NAAQS and PSD growth increments;
2. To conduct an ambient air quality analysis; and
3. To install the best available control technology (BACT).

Achievement of the first requirement usually involves using dispersion modeling to predict the ambient air quality impacts of the facility's emissions. It is anticipated that with proper control equipment, such modeling will show that the facilities will comply with the NAAQS and PSD sulfur dioxide growth increments.

The purpose of the second requirement, the conduct of an ambient air quality analysis, is to assess the potential impact of a facility's emissions on

Table 45

ESTIMATED AIR EMISSIONS AND CONTROL REQUIREMENTS FOR THE RECOMMENDED 800-900-TON-PER-DAY INCINERATION FACILITIES

Parameter	Estimated Emissions with Particulate Controls (tons/year)	Estimated Emissions with Acid Gas and Particulate Controls (tons/year)	Significance Amounts (tons/year)	Level of Control	Likely Method of Control
Total Suspended Particulates......	48	N/A	25	LAER	Baghouse or ESP
Sulfur Dioxide.....	892	392	40	BACT	Dry scrubber
Nitrogen Oxides....	892	N/A	40	BACT	Combustion control
Carbon Monoxide....	110	N/A	100	BACT	Combustion control
Nonmethane Hydrocarbons......	20	N/A	40	BACT	--
Lead...............	4	N/A	0.6	BACT	Baghouse or ESP
Sulfuric Acid......	69	31	7	BACT	Dry scrubber
Hydrogen Fluoride..	28	3	--	BACT	--
Hydrochloric Acid..	1,616	179	--	--	Dry scrubber
Cadmium............	0.146	N/A	0.005	BCACT	Baghouse or ESP
Chromium...........	0.072	N/A	0.005	LHER	Baghouse or ESP
Nickel.............	0.050	N/A	0.005	LHER	Baghouse or ESP
Arsenic............	0.02	N/A	0.05	LHER	Baghouse or ESP
Mercury............	1.6	N/A	0.1	BACT	Dry scrubber and baghouse or ESP
Beryllium..........	0.0006	N/A	0.0004	BACT	Dry scrubber
Polyaromatic Hydrocarbons......	0.08	N/A	--	BCACT	--
Polychlorinated Biphenyls.........	0.05	N/A	--	LHER	--
Dioxin.............	0.0000007	N/A	--	LHER	Combustion control

NOTE: LAER - Lowest Achievable Emission Rate
BACT - Best Available Control Technology
LHER - Lowest Hazardous Emission Rate
BCACT - Best Commercially Available Control Technology
ESP - Electrostatic Precipitation
N/A - Not Applicable

Source: Wisconsin Department of Natural Resources.

existing ambient air quality. Usually, a year of ambient air quality monitoring data must be obtained for the analysis. It is likely that a full environmental impact statement will be required as part of the facility planning. The preparation of such a statement will require extensive air quality impact evaluations.

The other major requirement of the PSD Program is to install the best available control technology (BACT) for the reduction of emissions. The selection of the appropriate BACT for the incineration facilities will depend upon a balancing of the energy, environmental, and economic impacts of various emission control measures. The BACT selection for nitrous oxides and carbon monoxide will focus on methods of firing refuse, combustion temperatures, and amounts of excess air. It is currently anticipated that sulfur dioxide pollution control equipment will not be required as long as the facilities' sulfur dioxide emissions do not cause any violations of the sulfur dioxide NAAQS. However, the regulatory trend is clearly moving toward requiring use of flue gas scrubbers to minimize emissions of sulfur dioxide, hydrochloric acid, and exotic hydrocarbons, e.g., dioxin.

It is uncertain whether formal BACT discussion will be required for any other PSD pollutants because of uncertainties in quantifying the amounts emitted and the lack of specific emission control technology.

New Source Performance Standards: Another regulatory program applicable to the project is the federal New Source Performance Standards (NSPS). The NSPS sets emission limits for certain substances from specific groups of sources. The proposed resource recovery facilities would probably be classified as incinerators. The incinerator NSPS require that particulate emissions not exceed 0.08 grain per dry standard cubic foot.[3] Importantly, a lower particulate emission limit will be required under the LAER regulations, as previously discussed.

The Wisconsin Department of Natural Resources has made preliminary emission estimates for the proposed mass burn facilities, and has indicated that under the above-referenced regulations, the following pollutants will need to be addressed in the permit application: total suspended particulates (TSP), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), nonmethane hydrocarbons (NMHC), lead (Pb), sulfuric acid (H_2SO_4), hydrogen fluorides (HF), hydrochloric acid (HCl), cadmium (Cd), chromium (Cr), nickel (Ni), arsenic (As), mercury (Hg), beryllium (Be), polyaromatic hydrocarbons (PAH), polyclorinated biphenyls (PCB), and dioxin (2,3,7,8-TCDD). Table 45 provides estimated emission rates, level of control, and control technology for these pollutants. These pollutants are regulated under the current permit program and under proposed air toxic requirements. The emission of other pollutants such as zinc, antimony, and formaldehyde should be addressed for informational purposes. Emission rates and applicable control technology or methods should be addressed. Each technology/method should be analyzed for achievable levels of control, capital and operating costs, energy consumption, and significant environmental impacts.

Table 45 also presents likely emission control technology/methods. It appears that a dry scrubber-baghouse or dry scrubber-electrostatic precipitator control system would be necessary. Such assumptions were assumed in the cost of the plan. Since the Americology site is likely to still be in nonattainment status for TSP when it is constructed, this pollutant would require control equipment capable of achieving the lowest achievable emission rate as required under Section 144.393(2) of the Wisconsin Statutes. Several newer resource recovery facilities have been approved with TSP emission limits as low as 0.015 gr/dscf at 12 percent CO_2 (i.e., Dutchess County, New York; Commerce, California; Baltimore, Maryland; and Brooklyn Navy Yard, New York). Fabric filter baghouses or electrostatic precipitators have been proposed for these facilities.

The BACT for SO_2, HF, and H_2SO_4 taking into account HCl emissions would merit the use of a scrubbing system. Dry scrubbing as opposed to wet scrubbing is preferable because it involves no wastewater discharge, is compatible with the TSP control systems, and, in theory at least, provides better control of condensable pollutants (i.e., trace metals and hydrocarbons). The BACT will also be required for NO_x and CO. At a minimum, these pollutants should be controlled using a well-designed and -controlled combustion system. However, the use of add-on controls for NO_x such as ammonia injection should be investigated.

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[3]Instead of relying upon an incinerator NSPS, the EPA is currently developing NSPS specific to resource recovery facilities. Such NSPS would apply to the project if the standards were proposed before construction was commenced or contracted for by the owner/operator of the facility.

Further, Pb, Be, and Hg will require the BACT. The Pb and Be can be controlled by highly efficient control systems such as the baghouse or electrostatic precipitator. Mercury will not be affected by these controls, although the use of the dry scrubber may encourage condensation of Hg so that it can be collected downstream in the baghouse or electrostatic precipitator.

Under proposed requirements for the control of hazardous air pollutants, or air toxics, some pollutants will require a high level of control. Cr, Ni, and As would likely require high-efficiency TSP control equipment to meet the lowest hazardous emission rate (LHER), but may have to be enhanced by use of an upstream dry scrubber. Cd and PAH's would require the best commercially available control technology (BCACT). The baghouse or an electrostatic precipitator would likely fulfill this requirement. Emissions of PCB's and 2,3,7,8-TCDD (dioxins) would require the LHER. In either case, the use of a well-designed and -controlled combustion system should fulfill this requirement. Dioxin emissions have been shown to achieve the lowest levels encountered at recently built resource recovery facilities in other locations nationwide.

Air Quality Discussion

Residential solid wastes and refuse-derived fuels contain potential high levels of metals and chlorine, both of which are pollutants of concern when evaluating air emission rates from their combustion. The metals are ubiquitous in the waste, being present in pigments, inks, paperstock, and plastics. A large portion of the chlorine is in plastics, primarily polyvinyl chloride. The amount of the metals that will be emitted is dependent on furnace design. Most of the chlorine will be emitted as hydrogen chloride. Because of the high moisture content and heterogenous nature of residential solid wastes, efficient combustion conditions sometimes are not easily maintained. Trace amounts of products of incomplete combustion, such as polyaromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), and polychlorinated dibenso-p-dioxin (PCDD) can be emitted.

Air pollution regulations require residential solid waste incinerators to have particulate control equipment. This equipment will collect some of the trace metals and condensable organic compounds but only negligible amounts of hydrogen chloride or gaseous organic compounds. The condensed trace metals and hydrocarbons are present in the size ranges where particulate control equipment is least efficient. As overall particulate emissions are reduced further by use of high-efficiency electrostatic precipitators or baghouses, fine particle control is also improved. Some states, notably Massachusetts and New Jersey, now require high-efficiency particulate controls for all new refuse-burning facilities. This high-efficiency equipment is required specifically to minimize trace metal emissions, and reflect the state-of-the-art in control technology.

In addition to having particulate control equipment, more incineration facilities nationwide are being constructed with flue gas scrubbers. This equipment is designed to neutralize acidic gaseous pollutants such as hydrogen chloride and sulfur dioxide. However, it is now recognized that the use of scrubbers improves the collection of trace metals and organic compounds. When combined with high-efficiency particulate control equipment, significant reductions in all metals (including mercury) and toxic organics result. Because of these multiple control benefits, some states are now requiring the use of scrubbers in addition to high-efficiency particulate controls.

Trace organic compound emissions can also be reduced by better management of the combustion process. Use of a dry scrubbing system in conjunction with high-efficiency particulate control equipment would reduce organic compound emissions further.

The long-term impact analyses of the toxic air emissions from a residential solid waste incinerator have to date focused on the carcinogenic risk of airborne trace metals and organics. During late 1987, the U. S. Environmental Protection Agency is expected to release a comprehensive report on the air emissions, control technologies, and environmental impacts of municipal solid waste incineration in the United States. The control technologies will include methods necessary to provide good combustion of the refuse and thus minimize the emission of trace organics. The air impacts will be evaluated considering atmospheric dispersion and deposition; and exposure by ingestion, accumulation in the terrestrial food chain, surface runoff, and groundwater contamination will also be addressed. Also by late 1987, the EPA is expected to decide whether or not to develop regulations to control incinerator emissions, including trace metals and organics. In addition, testing programs are presently being conducted by various states, Canada, and the American Society of Mechanical Engineers. These programs are expected to produce data that will show how to best minimize residential solid waste incinerator emissions.

In conclusion, it is apparent that the evaluation that will be conducted prior to issuance of the permits necessary for construction of the recommended solid waste facilities will be exhaustive, highly technical, and system-specific. However, with proper control technology, the proposed facilities should receive the permits necessary to operate in a manner which will meet the requirements of the existing air pollution regulations.

Cost Analysis

In order to assist public officials and concerned citizens in evaluating the financial feasibility of the recommended solid waste management plan, a schedule of capital and operation and maintenance costs was prepared. This schedule includes costs for both the publicly and privately owned and operated solid waste management functions identified in the plan recommendations. Summary costs for all the components of the recommended solid waste management plan over the 20-year implementation period, expressed in 1986 dollars, are presented in Table 46.

The capital investment cost of implementing the recommended Milwaukee County solid waste management plan is estimated at $141,670,000 over the 20-year plan implementation period. Of this total, about $140,727,000, or 99 percent, would be required to construct the two recommended incinerator facilities. The incinerator at the Americology site, which is recommended to be constructed first, would have a capital cost of approximately $74,958,000; and the incinerator at the county grounds site, which is recommended to be constructed 10 to 15 years into the plan period, would have an estimated capital cost of $65,769,000. The difference in the capital cost of the two facilities is due primarily to differences in land acquisition costs and to the availability of steam and utility transmission line facilities at the county grounds site. The remaining capital costs include $943,000, or about 1 percent of the total, for recommended recycling facilities, including recycling stations ($563,000), composting sites ($340,000), and collection equipment retrofitting for curbside newsprint collection ($40,000). These costs include the estimated expenditures for land

Table 46

SUMMARY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS OF THE RECOMMENDED SOLID WASTE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 1988-2010

Plan Subelement	Capital Costs	Annual Operation and Maintenance	Average Annual Operation and Maintenance 1990-2010
I. Storage	$ --	$ --	$ --
II. Source Separation			
Residential Solid Waste Recycling....	$ 563,000	$ 469,000	$ 469,000
Curbside Collection of Newsprint	40,000	75,000	75,000
Composting	340,000	525,000	525,000
Household Toxic and Hazardous Waste Management..................	--	325,000	325,000
Subtotal	$ 943,000	$ 1,394,000	$ 1,394,000
III. Collection	$ --	$ --	$ --
IV. Transportation	$ --	$ 4,173,000	$ 4,173,000
V. Transfer	$ --	$ 832,000	$ 832,000
VI. Waste To Energy Incineration			
A. Phase I			
Equipment	$ 47,940,000	$ --	$ --
Construction.......................	15,258,000	--	--
Land Acquisition...................	5,000,000	--	--
Electric Lines.....................	6,760,000	--	--
Facility Operation and Maintenance..	--	4,029,000	3,020,000
Ash Transport and Disposal.........	--	1,938,000	1,453,000
Less Average Annual Revenue.........	--	(4,355,000)	(3,266,000)
Subtotal	$ 74,958,000	$ 1,612,000	$ 1,207,000
B. Phase II			
Equipment..........................	$ 47,940,000	$ --	$ --
Construction.......................	14,470,000	--	--
Land Acquisition...................	--	--	--
Steam and Electric Lines...........	3,359,000	--	--
Facility Operation and Maintenance..	--	3,716,000	1,486,000
Ash Transport and Disposal.........	--	1,884,000	750,000
Less Average Annual Revenue.........	--	(9,945,000)	(3,978,000)
Subtotal	$ 65,769,000	$-4,345,000	$-1,742,000
VII. Solid Waste Landfill	$ --	$14,103,000[a]	$14,103,000[a]
Total	$141,670,000	$17,769,000	$19,967,000

NOTE: Total Average Annual Cost = $28,551,000, or about $28 per ton of solid waste handled.

[a]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

Source: SEWRPC.

acquisition, site preparation, equipment, construction, engineering, construction interest, legal services, and environmental investigations. These costs are based upon an incinerator size of 900 tons per day at each of the two locations and do not include inflation or bond-related interest or service charges. The costs are e.pressed in 1986 dollars.

Upon full implementation of the plan, the average annual operation and maintenance cost of the recommended plan, excluding revenues from the sale of energy products generated at the incineration facilities, is estimated to be $32,069,000. This cost includes a landfilling capital cost component which was assumed to be incurred incrementally over the life of each landfill. Of this total, $14,103,000, or 44 percent, would be for the disposal of unprocessed solid wastes in landfills; $4,173,000, or 13 percent, would be for solid waste transportation; $1,394,000, or 4 percent, would be for the operation and maintenance of the recycling facilities and equipment; $832,000, or 3 percent, would be for transfer of solid wastes at existing transfer facilities; and $11,567,000, or 36 percent, would be for the operation and maintenance of the incineration facilities, including incinerator ash landfilling. These operation and maintenance costs would be partially offset by revenues of $14,300,000 from the sale of electricity and steam generated at the incineration facilities--$9,945,000, at the county grounds facility and $4,355,000 at the Americology facility--resulting in a net operation surplus of $2,732,000 for the incineration facilities and a net operation and maintenance cost for all the solid waste management facilities of $17,769,000.

The average annual cost of carrying out the recommended plan, including the construction of new facilities and the operation and maintenance of those facilities, may be expected to total $28,551,000, or $27.58 per ton of solid plan area, the total average annual cost would be about $31 per capita. Figure 27 illustrates the relationship between the recommended plan cost and continued landfill costs under various scenarios relating to varying inflation rates. The curves indicate that under certain circumstances, the costs for the recommended plan could be substantially less than the cost of landfilling. In addition, even under the worst case scenario presented, with both the recommended plan costs and landfilling costs being escalated at the same rate, the difference in the cost of the recommended plan and the cost of landfilling is maintained at about $7.00 through the year 2010. The costs of the recommended plan and of landfilling were estimated to be $28 and $21 per ton, respectively, in 1990 and about $52 and $46 per ton, respectively, in the year 2010 under this worst case scenario. Should the facility life extend beyond 20 years, the recommended plan cost would be reduced by over 30 percent after the year 2010.

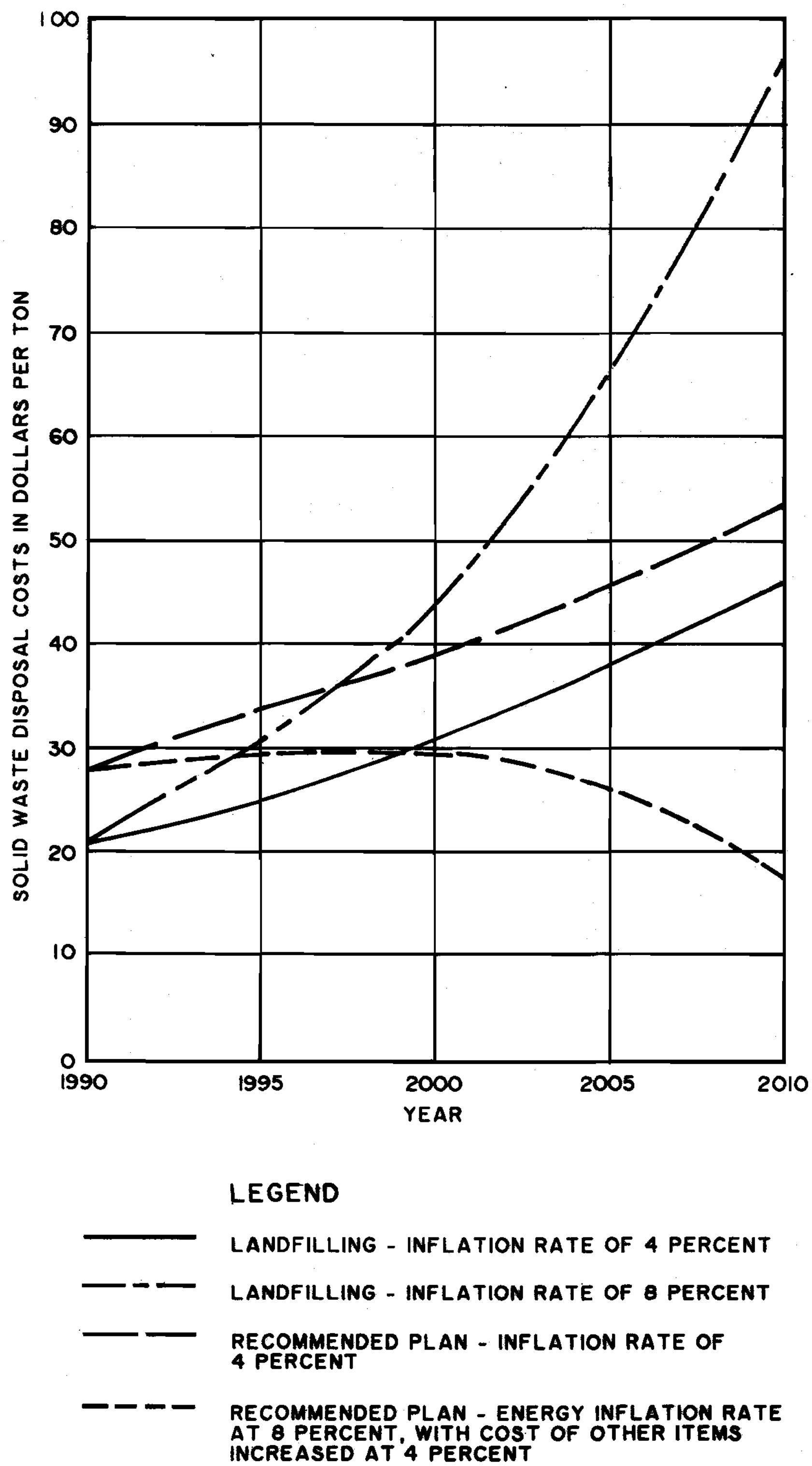
ABILITY OF THE RECOMMENDED PLAN TO MEET THE AGREED-UPON OBJECTIVES

In the most basic sense, planning is a rational process for establishing and meeting objectives. The 11 solid waste management objectives presented in Chapter I of this report were, accordingly, developed and adopted by the Technical Coordinating and Advisory Committee. These objectives provided the basis for the design and evaluation of alternative solid waste management plans.

The recommended plan meets the objectives by providing a flexible, cost-effective, integrated, environmentally sound, long-term solution to the solid waste needs of the study area. The plan calls for the use of measures to recover the energy contained in solid waste by incineration and subsequent

Figure 27

PROJECTION OF SOLID WASTE DISPOSAL COSTS FOR THE RECOMMENDED PLAN AND LANDFILLING UNDER VARYING INFLATION RATES



Source: SEWRPC.

generation of steam and electricity, and for a moderate level of recycling to recover reusable materials. In addition, the landfill capacity required to dispose of that portion of the solid waste stream that is not incinerated or recycled is also provided for in the plan. A summary of the agreed-upon solid waste management objectives is set forth in Table 47, together with comments on the extent to which the recommended solid waste management plan meets those objectives.

PLAN IMPLEMENTATION

While the recommended, comprehensive, solid waste management plan for Milwaukee County is designed to attain the adopted objectives, the plan is not complete in a practical sense until the steps required to implement it--that is, to convert the plan into action policies and programs--are specified. This section, accordingly, is intended as a guide for use in the implementation of the Milwaukee County solid waste management plan.

Before identifying specific plan implementation responsibilities, it is useful to consider certain basic concepts and principles that relate to implementation of the recommended solid waste management plan. One of the basic principles adhered to was the use of existing institutional structures, and, wherever possible, the plan implementation recommendations have been based upon, and related to, the existing governmental structure and existing governmental programs. In addition, the plan implementation recommendations were predicated upon existing enabling legislation with one exception, that exception being the need to provide for modification in the flow control legislation which would make implementation of the solid waste flow control practical. Another important concept in implementation is the importance of formal plan adoption. As an initial step in the plan implementation process, the affected units and agencies of government should formally endorse, adopt, or acknowledge the recommended solid waste management plan. Such formal endorsement, adoption, or acknowledgement by local legislative bodies and local, areawide, and state agencies serves to signify agreement with the recommendations contained in the plan.

The implementation of the recommended plan will require the cooperative actions of local units of government, individual citizens, and private enterprise. The plan represents a long-term solution to solid waste management problems, and full implementation will take several years. It is recognized that the viability of the components of the plan is specifically related to many factors, including energy costs, availability of local funds, interest rates, market value of recyclables, and cost of alternative solid waste disposal methods. All of these factors are dynamic in nature, and subject to both long-term and short-term changes. Because of the relationship of the plan components to these constantly changing conditions, it is recommended that the plan be carried out in a phased manner involving several decision points during the implementation period, as shown in Figure 28. At each decision point in the implementation process, an evaluation of conditions can be made prior to proceeding with the next phase. Conditions such as energy cost, current value and trends in value for recyclables, and cost for alternative methods of solid waste disposal, as well as availability of local funds and current interest rates, should be evaluated at these decision points in order to determine whether or not to proceed with subsequent steps and whether or not the plan implementation schedule should be accelerated or decelerated. By utilizing this phased approach, it will be possible to proceed with the plan implementation in a manner that will minimize uncertainty and risk.

Table 47

ABILITY OF THE RECOMMENDED MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN TO MEET ESTABLISHED OBJECTIVES

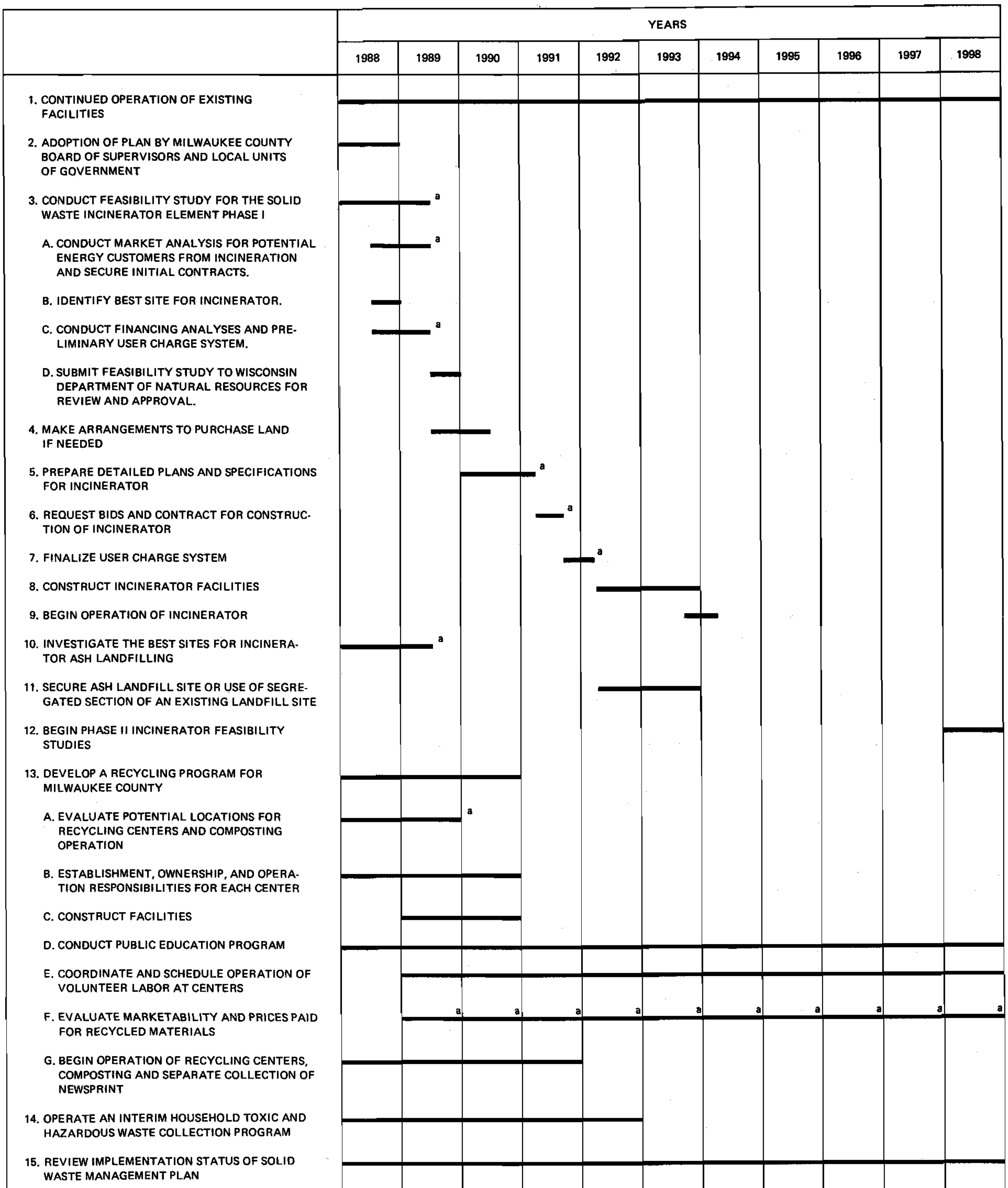
Number	Objective Description	Degree to Which Objective is Met
1	The development of a solid waste management system which will effectively protect the public health and welfare and quality of life within Milwaukee County.	Met
2	The development of a solid waste management system which will effectively protect the quality of the groundwater and surface water resources and minimize the possibility of pollution and depletion.	Met
3	The development of a solid waste management system which will be properly related to the natural resources and which will enhance the overall quality of the environment.	Met
4	The development of a solid waste management system which will effectively serve existing and future land uses and promote implementation of sound land use planning concepts and zoning practices.	Met
5	The development of a solid waste management system which will accommodate existing and future residential, commercial, institutional, and industrial development.	Met
6	The development of a solid waste management system which will maximize the recovery and utilization of both material and energy resources contained in the solid waste stream.	Met
7	The development of a solid waste management system which will be compatible with the waste management plans of adjoining counties and which will be adaptable to development of a regional solid waste management plan.	Met
8	The development of a solid waste management system which will meet pertinent local, state, and federal regulations.	Met
9	The development of a solid waste management system which will efficiently and effectively meet all of the other stated objectives at the lowest cost possible.	Could be met
10	The development of a solid waste management system which will be flexible and readily adaptable to changing needs.	Met
11	The development of a solid waste management plan which is compatible with major private resource recovery plans.	Could be met

Source: SEWRPC.

Implementation of the recommended Milwaukee County solid waste management plan is entirely dependent upon the cooperative actions of a number of local, areawide, and state units and agencies of government. These agencies include general-purpose local units of government, such as cities and villages; special-purpose districts; state agencies, such as the Wisconsin Department of Natural Resources; and private enterprise. More specifically, the following implementation actions are recommended:

Figure 28

SUMMARY IMPLEMENTATION SCHEDULE FOR THE MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN



NOTE: This proposed implementation schedule represents a point of departure for intergovernmental negotiations and actions by local units of government.

[a]Decision point where the evaluation of the market value of potential energy products and recyclables, construction and operation and maintenance costs, and financing would be reviewed to determine the current feasibility of proceeding with solid waste incineration and recycling operations. Schedule would be subject to revision at each decision point.

Source: Milwaukee County and SEWRPC.

Milwaukee County

1. It is recommended that the Milwaukee County Board of Supervisors formally adopt the Milwaukee County solid waste management plan by resolution after a report and recommendation by the Department of Engineering, Energy and Environment Committee.

2. It is recommended that the Milwaukee County Board of Supervisors, whose authority to plan, organize, finance, and implement solid waste management programs is predicated on Chapter 30 of the Wisconsin Statutes, assume primary responsibility for overseeing implementation of the recommended solid waste management plan. Accordingly, the overall management and administration of the plan implementation program should be directed by a standing committee of the County Board with guidance from the currently in place Milwaukee County Solid Waste Planning Task Force, or by a newly created countywide solid waste management authority. This committee or authority would be responsible for the following actions:

   a. Review, adopt, and maintain current the recommended solid waste management plan.

   b. Coordinate the implementation of the various components of the recommended solid waste management plan with the state and local units and agencies of government concerned.

   c. Provide coordination and public education assistance to source separation and recycling centers.

   d. Review and approve contracts necessary to implement Phase II of the plan--construction and operation of the incineration and associated energy recovery facilities at the Milwaukee County grounds site.

   e. Develop means of financing Phase II of the plan.

   f. Oversee the feasibility study for and the construction and operation of the recommended incineration system including ash disposal under Phase II of the plan.

   g. Adopt a countywide residential solid waste flow control ordinance upon completion of the incineration and energy recovery systems under Phase II of the plan.

   h. Administer all solid waste management processing and disposal functions in the County upon completion of the incineration and energy recovery systems under Phase II of the plan.

Local Units of Government

1. It is recommended that the governing bodies of the cities and villages within Milwaukee County adopt the Milwaukee County solid waste management plan by resolution after a report and recommendation by appropriate committees and local plan commissions.

2. It is recommended that the cities and villages work cooperatively with the County, each other, local nonprofit groups, and private profit-oriented recycling firms to develop the recommended source separation

and recycling center operations, the curbside newsprint collection system, and the household toxic and hazardous waste management program.

3. It is recommended that the cities and villages work cooperatively with the County and each other to develop the vegetative debris composting operations.

4. It is recommended that the cities and villages, as appropriate, continue to use transfer stations for the consolidation of residential solid wastes.

5. It is recommended that the municipal operators of existing landfills serving selected communities continue to operate such facilities to dispose of limited quantities of solid wastes in an environmentally safe manner.

6. It is recommended that the local units of government work with the County to ensure adequate contributions of solid waste to the planned incinerator system. As previously discussed, the most effective means for achieving this is through adoption of a countywide solid waste flow control ordinance.

7. It is recommended that the City of Milwaukee:

   a. Develop the incineration and associated energy recovery and ash disposal facilities proposed under Phase I of the plan.

   b. Continue to administer the disposal of unrecycled and unincinerated residential solid wastes, and, upon completion of the incineration system, incinerator ash.

   c. Upon the assumption by the County Board or special authority of the disposal function, transfer the city incineration system and any attendant contracts for disposal of unrecycled and unincinerated solid wastes and incinerator ash to the County under mutually agreed-upon arrangements.

Private Sector

1. It is recommended, where appropriate, that the private collection system operators continue to work cooperatively with the local units of government to improve the efficiency of present storage, collection, and transportation systems.

2. It is recommended that private profit-oriented recycling firms and private nonprofit organizations in the County work cooperatively with the local units of government to develop and operate a system of source separation and recycling centers, and the toxic and hazardous waste management program.

3. It is recommended that the private operators of existing landfills serving the County continue to provide that service.

Wisconsin Department of Natural Resources

1. It is recommended that the Wisconsin Department of Natural Resources approve the Milwaukee County solid waste management plan and utilize the plan as a basis for its review of planned and expanded solid waste management facilities in the County and environs.

University of Wisconsin-Extension

1. It is recommended that the University of Wisconsin-Extension provide the public education assistance needed for plan implementation.

SUMMARY

This chapter has presented a recommended solid waste management plan for Milwaukee County and the recommended means and associated costs of implementation. The plan was formulated to meet a set of adopted solid waste management objectives which were designed to address existing and probable future solid waste management needs in the study area.

The recommended plan consists of seven components. The first component provides for a storage system for solid waste. The second component provides for source separation and a recycling program whereby residents would: 1) transport previously separated paper, glass, and metals to one of 23 local recycling centers in the study area; 2) transport vegetative debris to one of 13 sites; 3) cooperate in a separate newsprint collection program; and 4) participate in a household toxic and hazardous waste management program. The third, fourth, and fifth components are the continued use of the collection, transportation, and transfer systems. The sixth component calls for the two-phased construction of incinerator facilities to burn solid wastes to produce steam and electricity. The seventh component calls for the continued use of existing landfill facilities in and around the study area for the disposal of unrecyclable materials, incinerator ash, and that portion of the solid waste load not incinerated.

In addition to describing each of the foregoing components of the plan, this chapter presented information on the costs of implementing the plan, recommended financing mechanisms, and the extent to which the recommended plan may be expected to achieve the solid waste management objectives established as a basis for plan design and evaluation.

This chapter also provides a schedule for implementing the recommended solid waste management plan, and discusses the responsibilities of various units and agencies of government and the private sector in carrying out the plan.

It is recommended that the Milwaukee County Board of Supervisors adopt the plan and designate a committee to oversee and monitor solid waste management activities in the study area. In addition, it is recommended that the governing bodies and planning commissions of the various cities and villages in the study area adopt the plan and cooperate in its implementation.

Chapter X

PUBLIC INVOLVEMENT

Public involvement was regarded as an important component of the Milwaukee County solid waste management planning study from its inception. This emphasis on public involvement stems from the philosophy that an informed public, if given the opportunity, can and should contribute meaningfully to the identification of needs, the formulation of alternative plans to meet those needs, and the selection of a final plan. Public involvement also increases the probability that the recommended plan will be accepted and that timely implementation will be supported. Thus, public involvement is viewed as a two-way communication process in which the public is kept informed, and, in turn, provides information to guide the planning process.

The public involvement component of the Milwaukee County solid waste plan was conducted by the Southeastern Wisconsin Regional Planning Commission staff in cooperation with the University of Wisconsin-Extension Service and the Milwaukee County Department of Engineering, Energy and Environment. It consisted of three major elements. The elements included the formation of the Technical Coordinating and Advisory Committee, a subcommittee of the Milwaukee County Solid Waste Management Planning Task Force, and the holding of seven public meetings of that subcommittee; the preparation of summary documents presented to the Milwaukee County Solid Waste Management Planning Task Force, and of a SEWRPC newsletter devoted to the findings and recommendations of the study; and the holding of a formal public hearing. Each is described and the results thereof summarized in this chapter.

ADVISORY COMMITTEE STRUCTURE

The Milwaukee County Solid Waste Management Planning Task Force and its technical subcommittee--the Milwaukee County Solid Waste Management Technical and Coordinating Advisory Committee--guided the conduct of the study. These two bodies were composed of elected and appointed local officials, representatives of industry and higher education, representatives of the Wisconsin Department of Natural Resources, and interested and concerned citizens. These two bodies provided a broadly based approach to the solid waste management planning effort. Full listings of the Task Force and Technical Advisory Committee memberships are provided on the inside front cover of this planning report.

The Task Force met six times and the Technical Advisory Committee seven times throughout the conduct of the study. The two bodies carefully reviewed all of the chapters of this report in draft form, making such changes in the draft as deemed necessary and desirable. Concerns expressed by Task Force and Technical Advisory Committee members were addressed as the work proceeded, and the two groups were instrumental in the selection of a recommended plan. All of the Task Force and Advisory Committee meetings were open to the public, and participation was encouraged. Minutes of the meetings were prepared and made available for public review at the offices of the Milwaukee County Public Works Department and the Southeastern Wisconsin Regional Planning Commission. Notices of the meetings were sent to local newspapers.

INFORMATIONAL SUMMARIES

Summary documents were prepared and distributed at each of the Task Force meetings and at the public hearing, which highlighted the findings and recommendations of the study.

The Regional Planning Commission bimonthly Newsletter was used as a public information mechanism to convey information about the Milwaukee County solid waste management planning study in a separate issue published for this purpose. This newsletter has a total distribution of approximately 1,250 copies. Elected officials, agency representatives, and interested citizens are the target audience for this publication. The newsletter addressing the solid waste study was SEWRPC Newsletter Vol. 27, No. 2: March-April 1987. The article in this newsletter, entitled "Solid Waste Management Plan Completed for Milwaukee County," described the organization of the study; the objectives of the study; the steps entailed in the preparation of the solid waste management plan; the study findings; and the plan recommendations.

FORMAL PUBLIC HEARING

A formal public hearing on a recommended plan for solid waste management in Milwaukee County was conducted on the afternoon of May 14, 1987, in the Milwaukee County Courthouse Annex Assembly Room. This hearing was designed to meet the requirements of Chapter NR 185.06(3) of the Wisconsin Administrative Code, and was attended by 42 persons representing local units of government, private businesses, and industrial groups, and also including individual citizens. The public hearing was publicized by news releases to area newspapers; the placement of a formal notice in the Milwaukee Sentinel and Milwaukee Journal; the posting of a notice at the Milwaukee Courthouse in accordance with normal county procedures; and the transmission of a notice of the meeting to all Task Force members, one or more of whom represent all the incorporated communities in Milwaukee County. Copies of selected newspaper articles written on the plan are presented in Appendix G.

The hearing was conducted in two phases--the first being a presentation of the preliminary findings and recommendations of the solid waste planning study, and the second being a period for public comment. Appendix H contains the minutes of the public hearing, and Appendix I presents all written comments pertaining to the hearing, along with responses to the comments.

To assist in the plan presentation, a summary statement of the findings and recommendations of the solid waste planning study was distributed to all attendees. The following information was provided in the statement: a brief description of the existing solid waste management situation in Milwaukee County; the objectives of the study; the findings of the landfill siting analysis; the alternative solid waste management plans considered; and the preliminary plan recommendation.

The following summarizes the comments received at the hearing:

1. The Mayor of the City of Oak Creek, Mr. Milo G. Schocker, expressed concern over the location of one of the alternative incinerator sites proposed under the preliminary plan. That site is located in the vicinity of the Milwaukee Metropolitan Sewerage District South Shore sewage

treatment plant. The concern related to the capability of the existing roadways in that area to carry the additional heavy trucking that would be attendant to the site; and second, to the need for a more central location in the County in order to make the site more accessible to areas where more of the solid waste stream is generated.

With regard to the first concern, it may be noted that an incinerator facility located at this site could be expected to receive 20 to 30 trucks per day carrying solid waste based on a size of about 300 tons per day. These trucks would generally be in operation nine hours per day. Thus, the truck traffic would average about three to four vehicles per hour. The truck trips concerned would likely originate from within the Cities of Cudahy, Franklin, Oak Creek, St. Francis, and South Milwaukee, and the Villages of Greendale and Hales Corners. Those trucks would likely travel on STH 100 (Ryan Road), Puetz Road, and STH 32 (Chicago Road). While some of these routes to the potential incinerator site may need improvement, as of 1986 there were no reported bridge restrictions or roadway weight limits in effect on the routes concerned. It would be necessary to further evaluate needed roadway improvements in relation to solid waste transport vehicle routing as part of the detailed facility planning for the incinerator site. However, it does not appear that roadway improvement needs or traffic problems would preclude the siting of an incinerator at that location.

With regard to the second concern raised, the incinerator site was, by design, located in the southern portion of the County in order to provide a reasonable countywide distribution of incinerators of solid waste facilities, with one being located in the northwest portion of the County, one being located centrally, and one being located in the southeastern portion of the County. It would be possible to improve the transportation distances involved by locating the incinerator in the southern portion of the County, to the west of the initially recommended location. More importantly, however, a potential use for the energy generated was available in the southeastern location. Because of this latter consideration, the southeastern site location was chosen. The plan would not preclude reconsideration of that site location should a viable user for the energy produced by the incinerator be found at some other location in the southern portion of the County.

2. Representatives of the City of Franklin in Milwaukee County and the Town of Raymond in Racine County objected to the present operation of the Waste Management of Wisconsin Metro landfill located in U. S. Public Land Survey Section 31, Township 5 North, Range 21 East in the City of Franklin. In addition, one Racine County citizen raised concerns regarding the operation of another landfill in Racine County. These representatives cited what they felt were existing and potential problems with the existing landfill, and opposed the continued reliance on landfilling for solid waste disposal. They supported the inclusion of recommendations to develop incineration systems in the plan. They further suggested that the incineration system be implemented as soon as possible.

3. Mr. Neil Palmer, representing the Wisconsin Electric Power Company (WEPCo), presented a written statement which is presented in Appendix I. Mr. Palmer indicated that his firm had a supportive policy regarding

solid waste incineration systems that generate energy products and noted that WEPCo would cooperate in the projects that were recommended, including the siting of incinerators that generate electricity. However, Mr. Palmer noted that energy buyback rates, service reliability, wheeling of energy, and matching loads to facility needs should be carefully examined as the system plan elements are refined during the facility planning stage. He recommended that all waste-to-energy systems stand on their own economic merits and not be justified by a subsidy from other energy suppliers, or those suppliers' customers.

4. Mr. Mark Brode, representing The Environmental Alliance, raised questions regarding the potential problem of disposal of the ash that would be generated by the incineration system. He particularly cited the disposal of ash in conventional landfills as a problem. A copy of Mr. Brode's letter to the Commission staff and a response thereto are included in Appendix I.

   It was noted in the written response to Mr. Brode that the Technical Coordinating and Advisory Committee had carefully considered this issue and had concluded that the plan should specifically include a recommendation to develop a separate landfill system for the disposal of the incinerator ash. This would prevent the mixing of conventional solid waste and incinerator ash, which may result in the leaching of contaminants from the ash. It further provides an opportunity to design such a separate landfill system to the highest standards that would be required.

   Mr. Brode also raised questions regarding the air pollutant emissions that would be generated from the incinerator system.

   With regard to this issue, it should be noted that the plan specifically addresses the problem of air pollutant emissions by the incinerators. Furthermore, the plan indicates that much more detailed site-specific evaluations of the air quality impacts associated with each each incinerator would be required as part of the facility planning that will have to precede the siting of the incinerators. Such evaluation would require the collection of at least one year of baseline air quality monitoring data at each site and extensive air quality modeling. Deliberations on this issue at the May 8, 1987, Technical Coordinating and Advisory Committee meeting concluded in a recommendation that the language regarding such studies be strengthened to indicate that further environmental impact studies will be needed to fully evaluate the air quality implications.

5. Mr. Peter I. Slaby suggested that there was a need for better disposal methods for toxic wastes generated in households. He also suggested that a mandatory recycling program be instituted. The second suggestion was supported by Ms. Christina Herrera.

   With respect to the first question, it is noted that the plan does contain interim recommendations for the collection and safe disposal of residential toxic and hazardous wastes. The plan further recommends that a plan for the disposal of all toxic and hazardous wastes generated in the County be developed, with that plan being developed for a larger area, such as the Southeastern Wisconsin Region or the State.

The plan specifically recommends implementation of a voluntary, as opposed to a mandatory, recycling program. The plan would provide for 23 recycling centers, the installation and operation of 21 composting systems, and the separate collection of newsprint. Based upon the deliberations of the Task Force and its Technical Coordinating and Advisory Committee, it would appear that achieving the level of recycling recommended in the plan may, in fact, be ambitious. However, should this level of recycling not be achieved under a voluntary approach, there would be nothing to prevent consideration of a mandatory recycling program.

6. In addition to Messrs. Slaby and Brode, two other persons, Ms. Susan Carlson, and Ms. Christine Bastian, a member of the Technical Coordinating and Advisory Committee, suggested that a higher emphasis be placed on recycling.

   As already noted, the plan does recommend a significant increase in the amount of recycling presently carried out. Should that level of recycling be achieved, the plan could be readily modified as it is periodically updated to include an even greater level of recycling. Other elements of the plan, including the incineration system design, should not be sensitive to incorporation of a higher level of recycling and source separation.

7. Ms. Christine Bastian also recommended that if additional landfill sites are required, they not be located in the City of Oak Creek. She referenced Chapter IV of the report which stated that of the 11 sites with the highest potential in the County, seven are located in the City of Oak Creek. She noted that the City of Oak Creek presently has within its boundaries a major metropolitan public sewage treatment plant and a landfill site for incinerator ash. She urged that such facilities not be concentrated in one community but rather be located in a number of areas.

   With regard to the potential location of a new landfill in the City of Oak Creek, the countywide plan does not recommend the location of any new general-use landfills in the City of Oak Creek. However, it is noted that special-use landfills, including an incineration ash landfill, will be needed. These special landfills may be sited within or outside Milwaukee County. Should a new landfill site be developed, that process would involve a lengthy public information and hearing procedure as part of the initial siting evaluations and as part of the Wisconsin Department of Natural Resources feasibility study review. Citizens of the City of Oak Creek would have to participate in that process and would be able to express their concerns. The analysis included in Chapter IV represented a siting analysis based primarily upon physical considerations. The report in that chapter notes that there are certain nonphysical factors which must also be considered in evaluating the suitability of potential landfill sites. However, those considerations were not addressed in the system level planning effort, but would have to be addressed in the more detailed evaluations that would be required prior to the siting of a new landfill.

8. One person, Ms. Christina Herrera, questioned who would conduct the environmental impact statement of the incineration system and asked if there would be separation of metals and toxic chemicals before incineration.

With regard to the first question, it is noted that the Wisconsin Department of Natural Resources would be the agency primarily responsible for the conduct of the environmental impact statement. With regard to the second comment, it was envisioned there would not be major separation steps ahead of the incineration system other than those needed to implement the recommended level of recycling. Thus, some noncombustible materials in the solid waste stream would be incinerated. The plan did also note that as the technology concerned develops, the detailed feasibility studies may reconsider the use of additional separation ahead of the incineration.

9. A letter was received from the Citizens for a Better Environment, the Milwaukee Audubon Society, and the West End Community Association. That letter addressed the same issues as those raised by Mr. Brode in his letter, requesting increased emphasis on recycling and resource recovery rather than on incineration, and raising concerns regarding incinerator ash disposal and air quality impacts. A copy of that letter and the proposed response are included in Appendix I.

   The response to these issues is the same as for the issues raised by Mr. Brode.

10. At the end of the meeting, several questions were raised. Ms. Susan Carlson asked if flow control would be necessary and whether it would impact on the recycling efforts. The question was answered by stating that flow control would be needed to fully implement the plan but that the sizing of the incinerator had not included those elements of the solid waste stream that were recommended to be recycled, and the flow control would not require receiving such materials.

   Mr. Sanders, who operates a firm called Wisconsin Environmental Service, indicated that his firm, and others like it, could have a positive impact on solid waste management in Milwaukee County. He indicated that his firm is a not-for-profit firm which provides assistance to participants in supporting themselves and their dependents by providing guidance and training on projects which involve the recycling of furniture and other usable materials. Mr. Sanders provided a description of his firm's work efforts. The program provides for the refurbishing of usable items, including office equipment, furniture, and other merchandise, and the recycling of other materials such as metals, paper, fabrics, and chemicals.

   Upon review of the work activities involved in Mr. Sanders' operation, it was concluded that such an effort could, in fact, be considered to be consistent with the plan recommendations, and that Mr. Sanders may wish to contact the owners of the recycling facilities that are recommended in the plan as these facilities become operational to make arrangements for collecting other materials which could then be refurbished.

   Mr. Brode asked how the $75 million incineration facility cost translated into an estimated $28-per-ton cost for incineration of solid waste. He noted that the cost per ton would be much higher based upon his calculations. It was responded that the cost of the incinerator system was amortized over a 20-year period, with that capital cost actually resulting in a cost of only \$23 per ton of solid waste incinerated. Additional costs were incurred in operation and maintenance, including ash disposal. These costs were in part offset by revenues from the sale of steam and electricity. The average unit cost of the recommended solid waste management system would approximate \$28 per ton. This cost is not only for the incineration element, but also for the cost of transportation, landfilling, and recycling of all the solid wastes gathered in the County.

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Chapter XI

SUMMARY

INTRODUCTION

Solid waste management is becoming a matter of increasing concern to local public officials and citizens. This concern is due, in part, to the growing amounts of solid waste to be disposed of, the associated rapidly rising costs, and the growing awareness of the need to process and dispose of these wastes in an environmentally safe manner.

The term "solid waste" refers to all solid materials discarded by residents, commerce, and industry. It includes materials ranging from old refrigerators to household food wastes, from demolition debris and construction wastes to scrap metals and wastepaper. In addition to materials such as sewage sludges, it may also include toxic and hazardous substances.

In 1960 the total amount of residential and commercial solid waste generated in the United States was about 2.7 pounds per person per day. By 1970, this figure had risen to about 3.5 pounds per person per day, and by 1980 to 3.9 pounds per person per day. It is estimated that in 1984, the total amount of residential solid waste generated in Milwaukee County stood at 2.6 pounds per person per day, or about 447,500 tons per year. Furthermore, about 585,400 tons, or about 3.4 pounds per person per day, of residential, commercial, industrial, and construction and demolition wastes, bulk wastes, and trees and brush were generated in 1984. In all, about 1,033,000 tons annually, or 6.0 pounds per capita per day, were generated in 1984. The collection, transportation, and disposal of these wastes in Milwaukee County cost about $60 per ton, or a total of about $62 million per year.

Proper long-range planning can minimize the costs associated with the management of these wastes, as well as assure protection of the overall quality of the environment. This is especially important in Milwaukee County because of the large quantities of wastes generated, the growing concern about the availability, cost, and environmental problems related to the use of landfills for the long-term disposal of solid wastes, and the potential to make productive use of this resource.

Under a countywide solid waste management study, a practical, long-range plan for solid waste management can be developed which considers solid waste as a potential resource rather than as just a disposal problem. The solid waste management alternatives available offer choices which can minimize the long-term solid waste problems of the County, while maximizing long-range resource recovery benefits. The current solid waste management practices in the County should lend themselves to improvement through a positive, comprehensive countywide approach.

The development of a county solid waste management plan, as outlined in a project description prepared by the Commission in May 1984, was approved by the

Milwaukee County Board in July 1984. A Wisconsin Fund grant application was submitted on December 21, 1983, pursuant to Chapters NR 185 and 186 of the Wisconsin Administrative Code. A state grant was received on June 25, 1984, and work was initiated on the study early in 1985. To provide for the more active participation of the interests concerned, the study was conducted under the guidance of a Technical Coordinating and Advisory Committee. This Committee is a subcommittee of the Countywide Solid Waste Task Force which was created in 1984 jointly by the Intergovernmental Cooperation Council, Milwaukee County, and the City of Milwaukee.

The primary purpose of the plan preparation effort was to provide an assessment of solid waste management needs and to develop a strategy for meeting those needs to the year 2010 while providing for the protection of public health and the environment. Eleven solid waste management objectives were established to guide plan preparation:

1. The development of a solid waste management system which will effectively protect the public health, welfare and quality of life within Milwaukee County.

2. The development of a solid waste management system which will effectively protect the quality of the groundwater and surface water resources and minimize the possibility of pollution and depletion.

3. The development of a solid waste management system which will be properly related to the natural resources and which will enhance the overall quality of the environment.

4. The development of a solid waste management system which will effectively serve existing and future land uses and promote implementation of sound land use planning concepts and zoning practices.

5. The development of a solid waste management system which will accommodate existing and future residential, commercial, institutional, and industrial development.

6. The development of a solid waste management system which will maximize the recovery and utilization of both material and energy resources contained in the solid waste stream.

7. The development of a solid waste management system which will be compatible with the waste management plans of adjoining counties and which will be adaptable to development of a regional solid waste management plan.

8. The development of a solid waste management system which will meet pertinent local, state, and federal regulations.

9. The development of a solid waste management system which will efficiently and effectively meet all of the other stated objectives at the lowest cost possible.

10. The development of a solid waste management system which will be flexible and readily adaptable to changing needs.

11. The development of a solid waste management system which is compatible with major private resource recovery plans.

INVENTORY AND ANALYSES

The man-made and natural features which form the environment of Milwaukee County are important considerations in solid waste management planning. An understanding of these features, in addition to a knowledge of the existing solid waste sources, the quantity and character of the solid wastes generated, and the existing solid waste management systems, is essential to sound solid waste management planning.

Population and Economic Activity

The geographic area considered in the Milwaukee County solid waste management study was defined as all of Milwaukee County, which has an areal extent of about 242.5 square miles. A total of 19 general-purpose local units of government and one special-purpose unit of government are located within the study area, including 10 cities and 9 villages. The special-purpose local unit of government is the Milwaukee Metropolitan Sewerage District. Milwaukee County is the most heavily urbanized county in the State; however, there remains ample opportunity for continued growth and development. The County is the heart of the highly urbanized seven-county Southeastern Wisconsin Region and is bounded by Racine County and the Racine urbanized area on the south, the rapidly urbanizing Waukesha County on the west, and the rapidly urbanizing Ozaukee County on the north. Still largely rural, Washington and Walworth Counties lie to the northwest and southwest, respectively, while Kenosha County and the Kenosha urbanized area lie to the south beyond Racine County but within ready commuting distance. The large Chicago urbanized area lies about 85 miles to the south.

Land Use and Zoning

The type, intensity, and spatial distribution of the various urban and rural land uses are important determinants of the solid waste management needs of an area. As of 1980, urban land uses comprised 164 square miles in the County, or 68 percent of the total area of the County, with residential land use comprising 74 square miles, or 45 percent of the total urban land uses and 30 percent of all land uses in the County. Transportation land use was the next most predominant urban land use, constituting about 56 square miles, or 34 percent of the urban land uses and about 23 percent of all land uses in the County. The remaining urban land uses--commercial, industrial, governmental and institutional, and recreational--made up about 34 square miles, or 21 percent of the urban land uses and about 15 percent of the total land uses in the County. Rural land use still occupied about 78 square miles, or about 32 percent of the total area of the County, in 1980. The predominant rural land use was agricultural, encompassing about 36 square miles, or about 46 percent of the rural land uses and about 15 percent of all the land uses in the County. The remaining rural land uses--surface waters, wetlands, woodlands, and other open land--made up about 42 square miles, or 54 percent of the rural land uses and about 17 percent of all the land uses in the County.

Municipalities within Milwaukee County generally follow sound land use zoning practices to direct urban growth into those areas most suitable for such growth, while protecting the most significant environmental features present.

There is no county zoning in Milwaukee County, as all of the County lies within incorporated areas. A review of the zoning ordinances of the 19 communities in the County indicated that most do not presently have zoning districts that permit solid waste management facilities such as sanitary landfills or incinerators. However, five communities--the Cities of Franklin, Glendale, and West Allis and the Villages of Brown Deer and Hales Corners--have zoning districts that do permit solid waste disposal, processing, or incineration facilities.

Public Utility and Transportation Systems

Urban development is highly dependent upon the public utility systems and transportation networks which serve the various urban land uses with power, light, communications, water, and sewerage, and with person and goods transport. Public utility and transportation systems are of particular importance to solid waste management planning owing to their impact on solid waste quantities, the need for and cost of transporting solid waste, and the constraints which the location of these systems may place on the siting of solid waste management facilities. Such systems are of indirect concern in solid waste management planning because of their influence on land use development. The two large public sewage treatment plants in the study area which serve most Milwaukee County residents are also of importance to solid waste management planning because they may be expected to continue to generate solid waste in the form of sludge, and because landfill leachate treatment and disposal may involve a municipal sewage treatment facility. Transportation systems in the County also have a direct impact on solid waste management. Vehicle vertical clearances and weight limits on various types of roadways had to be taken into consideration during the review of alternative transportation systems to determine the most feasible, cost-effective means for transporting the solid waste to disposal facilities. In addition, the locations of the nine airports and landing strips in the County were reviewed with regard to landfill siting restrictions near airports.

Natural Resource Base

The natural resource base is an important factor shaping the economic base of Milwaukee County and an important determinant of the development potential of the County. Accordingly, the natural resource base must be carefully considered in any solid waste management planning effort to ensure the environmentally safe and economic processing and disposal of solid wastes. The principal elements of the natural resource base pertinent to solid waste management planning that were evaluated under the study were climate, topography, geology, soils, vegetation, fish and wildlife habitat, and groundwater and surface water resources. The resulting data were utilized in the evaluation of areas that may be suitable for the siting of solid waste disposal facilities.

Climate has a significant impact on the operation of landfills. Snow cover, low temperatures, and frost penetration can all affect the operation of solid waste disposal facilities during winter. Glaciation has largely determined the topography, geology, and soils of the County. The principal topographic features in the County include ground moraines, outwash terraces, steep escarpments along Lake Michigan, wetlands, streams, and lakes. Bedrock formations underlying the unconsolidated surface deposits consist of dolomitic limestone, shale, sandstone, and crystalline rocks. The diverse nature of the soils found in Milwaukee County is indicated by the results of the detailed operational soil surveys which have been completed for the entire County under the regional planning program. Those results are documented in SEWRPC Planning Report No. 8, Soils of Southeastern Wisconsin. Suitability ratings of the various soils for landfill construction are available which, together with the detailed soils maps, provide an important basis for the evaluation of potential landfill sites. Definitive knowledge of the topography, geology, and soils is particularly important to an evaluation of the suitability of potential landfill sites.

The most important elements of the natural resource base of Milwaukee County occur in a roughly linear pattern in the landscape termed environmental corridors. These corridors contain the best remaining woodlands, wetlands, wildlife habitat areas, surface waters and associated undeveloped shorelands and floodlands, areas of organic soils, areas containing rough topography and significant geological formations, existing and potential park and open space sites, historic sites and structures, and scientific and natural areas. In all, about 9,700 acres, or about 6.3 percent of the County, have been classified as primary environmental corridors. The preservation of these corridors in essentially natural, open space uses will do much to protect the overall quality of the environment, to avoid the creation of serious and costly environmental problems such as flooding and water pollution, and to avoid the creation of developmental problems such as failing foundations for roads and structures, excessive stormwater infiltration into sewer systems, and wet basements.

Solid Waste Sources, Quantity, and Character

A knowledge of the characteristics, amount, and sources of solid waste is essential to the development of an efficient and environmentally sound solid waste management plan. In 1984 the solid wastes generated in Milwaukee County that were considered in the development of the management plan were categorized as residential, commercial, industrial, and special, and totaled about 1,033,000 tons, or 6.0 pounds per capita per day. Of this total, about 447,500 103,000 tons, or 0.6 pound per capita per day, were classified as special wastes. Special wastes generally included bulk materials such as appliances and furniture, construction and demolition debris, and trees and brush. It should be noted that the above quantities do not include approximately 13,000 tons of residential, 250,000 tons of industrial, 55,000 tons of commercial, and 62,000 tons of special solid wastes which are estimated to be recycled annually. Paper, comprising about 399,000 tons, or 39 percent of the total, was estimated to constitute the largest portion of the solid waste stream in 1984, with foundry sand, metal, food, construction and demolition debris, and glass representing 9, 8, 7, 6, and 5 percent, respectively. The remaining components of the solid waste load, including plastic, yard wastes, lumber, textiles, and bulk and unclassified materials, made up about 26 percent of the total solid waste stream.

The seasonal variation of solid waste is a significant factor in Milwaukee County. The highest amounts are generated in the months of May, June, and August, about 95,000 tons per month. The lowest amounts are generated in the months of December, January, and February, about 75,000 tons per month.

Existing Solid Waste Management Systems

Solid waste management functions include storage, source separation, collection, transportation, transfer, processing, and disposal.

Storage of solid waste is defined as the temporary holding of the material in containers either prior to collection, or following collection at a transfer or processing station. Proper storage is an important element of an efficient collection system. Most private residents in the study area utilize standard, leak-proof, galvanized metal or heavy-duty plastic trash cans, mobile carts, or heavy-duty plastic bags. In addition to these individual containers, larger, bulk portable containers designed for mechanized collection are used at most commercial and industrial establishments, and in some multifamily residential areas.

Source separation and recycling programs can be divided into pre-collection, whereby recyclable goods are separated prior to recycling, and post-collection, which requires removal of recyclable items after they have been mixed with the rest of the solid waste stream. Solid wastes are recycled in several ways within the County. Most significant are the recycling programs that are routinely carried out by many of the industries in the County. The industrial wastes recycled in the County total about 250,000 tons, or 42 percent of the total of such wastes produced, and include paper and cardboard, scrap aluminum, scrap steel, oil and grease, chemicals, and plastics. Similarly, it is estimated that 55,000 tons, or 29 percent, of the commercial wastes generated are recycled. These wastes are recycled both by internal manufacturing processes and by transportation to recycling centers, both within and outside the County. A second type of recycling which is practiced in the County is source separation by citizens of paper, aluminum, glass, and oil with collection by local community groups. Most of these recycling activities are carried out by private nonprofit groups such as local service clubs, scout groups, and high school classes. Another type of source separation recycling that is conducted in the County is the separation of bulky "white goods," such as discarded stoves and refrigerators. This separation is done both by individuals prior to collection and by landfill operators following receipt of collected solid wastes. In all, it is estimated that 13,000 tons, or 3 percent, of the residential solid wastes generated annually in the County are recycled.

Collection and transportation of solid wastes includes the gathering or picking up of solid wastes from the various sources and the hauling of these wastes to the locations where the contents of the collection vehicles are emptied. Municipal and private collection services are the two methods of collection and transportation presently utilized in the study area. Municipalities provide the majority of the residential solid waste collection and transportation services in Milwaukee County in the Cities of Cudahy, Glendale, Milwaukee, Oak Creek, South Milwaukee, Wauwatosa, and West Allis, and the Villages of Bayside, Fox Point, Greendale, River Hills, Shorewood, West Milwaukee, and Whitefish Bay.[1] Private collection and transportation contractors haul residential

[1]During 1987, the City of Glendale changed from a municipal to a private collection system.

wastes in the Cities of Franklin, Greenfield, and St. Francis, and in the Villages of Brown Deer and Hales Corners. There are 115 licensed private collection services operating in the study area which serve residential, commercial, and industrial waste generators.

Transfer and transportation of solid wastes refers to the means, facilities, and equipment used to transfer wastes from small collection vehicles to larger vehicles and to transport the wastes to either processing centers or disposal sites. Transfer stations are an important aspect of solid waste management efforts in Milwaukee County. There are presently eight transfer stations operated in the County. They are owned and operated by municipalities and the private sector. These eight stations serve as temporary disposal and consolidation points for all or part of the residential and some commercial refuse collected in the Cities of Cudahy, Glendale, Milwaukee, Wauwatosa, and West Allis, and the Villages of Shorewood, West Milwaukee, and Whitefish Bay. In addition, small compactors are used to consolidate a portion of the solid wastes generated in the City of Greenfield and the Village of Greendale. It is estimated that 390,000 tons, or about 87 percent, of the residential solid wastes generated annually in Milwaukee County are transported to one of these eight transfer stations.

Processing of solid wastes refers to the transformation of the physical or chemical characteristics of solid waste by mechanical, chemical, or biological processes. Processing is practiced either to improve the efficiency of hauling and disposing of wastes, to recover recyclable materials, or to convert the waste to intermediate products or to energy by incineration or biodigestion. This processing involves the use of chippers to reduce the volume of trees and brush, with subsequent disposal in landfills or compost piles. Processing of residential, commercial, and industrial wastes that are recycled also occurs. Further, approximately 40 active small-scale incinerators are operated by commercial, industrial, and institutional generators of solid and some liquid wastes throughout the County.

Disposal of the majority of solid wastes in the study area is accomplished by landfilling. As of 1984, there were 21 licensed active landfills receiving wastes from Milwaukee County. Of these 21 sites, 12 are located in Milwaukee County.

Importantly, more than 75 percent of the solid wastes generated in the County that are the subject of this study are landfilled at four commercial general-use landfills: two large landfills owned and operated by Waste Management of Wisconsin, one located in the City of Franklin in Milwaukee County, and one located in the Villages of Germantown in Washington County and Menomonee Falls in Waukesha County; the Browning and Ferris landfill located in the Town of Barton, Lake County, Illinois; and the Land Reclamation landfill located in the Town of Mt. Pleasant, Racine County.

Utilizing the inventory data collected, the costs of existing solid waste management in the County were estimated. The cost in 1984 of the collection, transportation, and disposal of residential, commercial, and industrial wastes in the study area was estimated to be $56,162,242, or about $60.39 per ton and $60.13 per capita per year.

ANTICIPATED GROWTH AND CHANGE

The Milwaukee County solid waste management planning effort is intended to identify the solid waste management needs of the County through the year 2010 and to propose the best means of meeting the future as well as existing needs. Formulation of such a long-range solid waste management plan requires information regarding future population, household numbers, and employment levels in the study area in order to assess the probable quantity, character, and spatial distribution of the solid wastes generated.

Traditionally, long-range system planning has involved the preparation of a single forecast of future levels of population, economic activity, and land use demand, and the use of this forecast in the design, test, and evaluation of alternative system plans. This approach has worked well in periods of relative stability, when historic trends in the factors underlying and influencing changes in population and economic activity levels could be reasonably expected to extend over the plan design period. During periods of major changes in social and economic conditions, a different approach to long-range system planning becomes necessary.

Under this approach, the development, test, and evaluation of alternative plans is based not upon a single most probable forecast of future conditions, but rather upon a number of futures chosen to represent a range of conditions that may be expected to occur over the plan design period. The purpose of this approach is to permit the evaluation of alternative plans over a variety of possible future conditions so as to identify those alternatives that perform well under a wide range of such conditions. The alternative futures used under this approach are selected to represent the reasonable extremes of a range of conditions on the assumption that alternative plans which perform well under the extremes of a range will also perform well at intermediate points in the range. In this way, plans that can be expected to remain viable under greatly varying future conditions can be identified. The Commission utilized the "alternative futures" approach to develop the series of projections presented herein. Using this approach, three alternative future scenarios were postulated, two intended to identify extremes and one intended to identify an intermediate future--that is, a future that lies between the extremes. Critical social and economic factors that could be expected to have an impact on mortality, fertility, and migration rates over the next 25 years within the United States, the State, and the Region were examined, and a reasonably extreme range of values was established for each component of population change by logically linking various rates of component change to the critical social and economic factors. This provided "most reasonably optimistic" and "most reasonably pessimistic" scenarios of population change by combining all factors that were internally consistent and would create favorable conditions for economic and population growth within the Region, and by similarly combining all factors that would create unfavorable conditions for economic and population growth within the Region.

Population, Households, and Employment Utilized in Alternative Plan Design

Following review of potential future conditions, it was concluded that the development of alternative solid waste management plans should be based upon the intermediate future population and employment levels. Using this alternative, the solid waste management plan would be based upon a year 2010 resident county population of about 911,300 persons, a level slightly below the 1980 resident population level, but a reasonable indication of possible future conditions given efforts to halt the continued decline of population levels in the County, and providing a reasonably conservative approach to facility sizing. Under this assumed condition, approximately 403,000 households, an increase of about 11 percent over 1980 levels, were also anticipated for the year 2010.

Solid Waste Types, Quantities, and Sources Utilized in Alternative Plan Design

Estimates of the quantities of solid wastes that may be expected to be generated in the study area through the year 2010 were developed. The estimates were based upon anticipated solid waste generation rates and assumed future population and economic activity levels under moderate growth, centralized land use pattern conditions. About 1,122,000 tons per year of solid waste may be expected to be generated within the study area by the year 2010. This represents an increase of about 89,000 tons per year, or 9 percent, over the 1984 average annual solid waste load. Residential and commercial solid wastes would increase to about 665,000 tons per year, or 14 percent; industrial waste loads would remain at about 347,000 tons per year; and special wastes would increase to about 110,000 tons per year, or 7 percent. The composition of the solid waste stream has been assumed to be about the same as under existing 1984 conditions.

The monthly variation of solid wastes, and the combustibility of solid wastes, are important considerations in the development and evaluation of solid waste management alternatives. Generally, the greatest quantities of solid wastes are generated during the summer and fall, with lesser amounts produced in the winter. For example, in May, June, and August, solid waste quantities are projected to be 107 percent, 116 percent, and 109 percent, respectively, of the monthly average, while in December, January, and February, solid waste quantities are projected to be about 89 percent, 89 percent, and 87 percent, respectively, of the monthly average. However, if only residential solid wastes are considered, solid waste quantities are anticipated to range from about 145 percent of the monthly average in June, to about 70 percent of the monthly average in February. The heating value of the total solid waste stream was estimated to be 4,500 British thermal units (BTU's) per pound, with a moisture content of 27 percent by weight and an ash content of 22 percent by weight.

LANDFILL AND INCINERATOR SITING ANALYSIS

A sanitary landfill is a necessary component of any county solid waste management system. Even alternative solid waste management systems incorporating a high degree of resource recovery, including incineration of waste for the generation of energy, require landfill disposal of incinerator ash and of materials which cannot be removed from the waste stream and otherwise recycled. Landfill disposal is also required as a backup system during periods when the resource recovery systems are not operational. An important aspect of the Milwaukee County solid waste management planning effort is the development of an alternative solid waste management plan based upon incineration of combustible wastes. Accordingly, the planning effort included an analysis designed to identify areas having high, moderate, and low potential for landfill siting, and also included an incinerator siting analysis. The general siting analysis consisted of an evaluation of the available data on the cultural and natural resource base of the planning area in relation to pertinent environmental protection, engineering, and regulatory criteria. The criteria utilized in the analysis were based on the requirements of Chapter 144 of the Wisconsin Statutes and Chapters NR 140 and NR 180 of the Wisconsin Administrative Code, and on other pertinent engineering and transportation requirements for the initial screening of potential landfill or incinerator sites. The information from the analyses was utilized in considering the feasibility of the landfill and incineration components included in the alternative plans as described in Chapters V and VII of this report.

The system planning level siting analyses are designed to be followed by more site-specific analyses of the best sites within Milwaukee County. The findings of this report were limited to the results of the general system level analyses.

The criteria applied in the landfill siting analysis were categorized as relating to geology, topography, soils, groundwater, surface water, environmentally significant areas, urban land uses, transportation routes, and historical and archaeological sites. In some cases, application of the criteria precluded use of a proposed landfill site, while in other cases, it limited the site's potential. For the purposes of the general siting analysis, the criteria were applied in a conservative manner in order not to categorically eliminate sites that may have potential for landfill development when further evaluated on a site-specific basis.

The criteria applied in the incinerator siting analysis were categorized as relating to existing urban land uses, location of transfer stations, transportation routes, potential energy users, historic sites, and air quality. As in the landfill siting analysis, application of criteria may sometimes preclude use of a proposed incinerator site, while in other cases it may only limit the site potential.

Site Location Ranking

Three suitability classifications were used for landfill siting, as shown on Map 33 in Chapter IV. The total area of the County--155,193 acres--was initially considered for landfill development in the study area. Of this total, approximately 154,413 acres, or 99 percent, were categorized as having a low potential for landfill siting. The large extent of this area is due primarily to the extent of urbanization within the County. In addition, approximately 780 acres, or less than 1 percent of the total area of the County, were classified as having only moderate potential for landfill siting. This potential, however, is somewhat limited, as any sites located in these areas may be expected to require more intensive engineering and to entail high site development costs. It can be noted that no areas of the County are considered to have a high potential for a landfill site. However, the general siting analyses have focused on physical criteria that have been used chiefly for evaluating sites for general, mixed-refuse solid waste landfills. There are somewhat different design requirements for landfills designated only for particular solid wastes, such as incinerator ash. Sites with low or moderate potential might be more readily engineered for these special-use landfills. These areas should be given first consideration in future landfill siting studies should it be concluded that a new landfill is to be part of the recommended plan.

With regard to incinerator siting, 17 potential sites were determined to have high enough potential to warrant further consideration, as shown on Map 34 in Chapter IV. More detailed analysis of these sites is necessary to determine their cost-effectiveness and overall feasibility.

INVENTORY AND GENERAL EVALUATION OF SOLID WASTE MANAGEMENT TECHNIQUES

The development of a solid waste management plan requires an evaluation of potential techniques for each solid waste management function which may be applicable within the study area, including source reduction, source separation, storage, collection, transfer, transportation, processing, treatment, resource recovery, and disposal. The solid waste management functions and techniques considered viable for application in Milwaukee County and accordingly considered further in the development of the alternative plans were as follows:

1. Source separation consisting of pre-collection separation of solid wastes into recoverable and nonrecoverable fractions by segregating one or more materials, such as paper, glass, plastic, or metal, with subsequent transport to recycling centers.

2. Storage of solid wastes in a manner similar to existing practices utilizing cans, bags, carts, and bulk containers.

3. Collection of solid wastes utilizing the existing municipal and private collection systems.

4. Transfer of solid wastes from individual vehicles to bulk containers and from collection trucks to large-capacity trucks or bulk containers.

5. Transportation of solid wastes in large-capacity vehicles.

6. Processing of solid wastes by shredding and/or incineration.

7. Resource recovery through combustion of a portion of the solid waste to produce steam and/or electricity or processing of solid waste to produce refuse-derived fuel.

8. Disposal utilizing sanitary landfilling technology.

ALTERNATIVE SOLID WASTE MANAGEMENT PLANS CONSIDERED

Fifteen major alternative and three accessory alternative solid waste management plans were formulated and evaluated. The evaluation considered the capital and operating costs and environmental impacts of each alternative. Each of the major alternatives considered was designed to accommodate the total residential, commercial, industrial, and special waste streams anticipated to be generated in Milwaukee County through the year 2010. On the average, this quantity was estimated to be 1,035,000 tons of solid waste per year.

Alternative Plan 1: Continued Use of Existing Solid Waste Management Systems

The first alternative plan consists of the continued use of the entire existing solid waste management system, including existing storage, collection, and transfer station systems, and the establishment of a countywide residential solid waste recycling program. Unrecycled residential, commercial, and industrial solid wastes would be disposed of primarily at six existing commercial general-use landfills, one of which is located within Milwaukee County. The seven existing private special-use landfills that are located in the County would continue to receive the materials these landfills are intended to handle. This alternative includes provisions for the improvement of existing facilities anticipated to continue operating through the plan period, but which are not now in compliance with state solid waste management regulations.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 1 is $563,000 for the needed recycling centers, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $30,714,000. The total average annual cost of capital and operation and maintenance is $30,763,000, or about $30 per ton of solid waste.

Alternative Plan 2: Disposal at a Single Existing Commercial General-Use Landfill and at Seven Existing Private Special-Use Landfills

The second alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; and disposal of unrecycled solid wastes at a single existing commercial general-use landfill located within the County and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 2 is $563,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $31,604,000. The total average annual cost of capital and operation and maintenance is $31,653,000, or about $31 per ton of solid waste.

Alternative Plan 3: Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The third alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; and disposal of unrecycled solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 3 is $563,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $30,521,000. The total average annual cost of capital and operation and maintenance is $30,570,000, or about $30 per ton of solid waste.

Alternative Plan 4: Processing of a Portion of the Solid Wastes at a Single Incinerator Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The fourth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at one incinerator with a capacity of 1,200 tons of solid waste per day designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 4 is $86,462,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $19,811,000, and including a credit of $10,225,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $27,350,000, or about $26 per ton of solid waste.

Alternative Plan 5: Processing of a Portion of the Solid Wastes at a Single Incinerator Designed for Electric Power Generation, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The fifth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at one incinerator with a capacity of 1,200 tons of solid waste per day designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 5 is $100,893,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $23,690,000, and including a credit of $6,610,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $32,488,000, or about $31 per ton of solid waste.

Alternative Plans 6 and 6A: Processing of a Portion of the Solid Wastes at Two Separate Incinerators Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The sixth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at two separate incinerators with a combined capacity of 1,200 tons per day designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid waste at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 6 is $97,857,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $19,986,000, and including a credit of $10,098,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $28,496,000, or about $28 per ton of solid waste.

As part of the evaluation under Alternative Plan 6, a subalternative--Alternative 6A--was also investigated which also provided for processing of a portion of the solid waste generated in the study area at two incinerators providing for steam production. This alternative plan is the same as Alternative 6 except that the incinerator facility located at the Americology transfer station site would have a capacity of 1,000 tons of solid waste per day, as opposed to 800 tons per day. With this additional capacity plus the capacity of 400 tons per day at the second incinerator located at the Northwest transfer station site, the capacity of the incineration system would be 1,400 tons of solid waste per day under the subalternative, compared to 1,200 tons per day under Alternative 6.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 6A is $114,860,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $17,995,000, and including a credit of $11,841,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $28,011,000, or about $27 per ton of solid waste.

Alternative Plan 7: Processing of a Portion of the Solid Wastes at Three Separate Incinerators Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The seventh alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at three separate incinerators with a combined capacity of 1,200 tons of solid waste per day designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 7 is $93,400,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $20,557,000, and including a credit of $9,964,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $28,701,000, or about $28 per ton of solid waste.

As part of the evaluation under Alternative Plan 7, a subalternative--Alternative 7A--was also investigated which also provided for processing of a portion of the solid waste generated in the study area at three incinerators providing for steam production. This alternative plan is the same as Alternative 7 except that the incinerator facility located at the Americology transfer station site would have a capacity of 900 tons of solid waste per day, as opposed to 700 tons per day. With this additional capacity plus the capacity of 500 tons per day at the incinerators located at the Northwest transfer station site and at the South Shore sewage treatment plant, the capacity of the incineration facilities would be 1,400 tons per day, compared to a capacity of 1,200 tons per day for the facilities included under Alternative 7.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 7A is $105,900,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $18,481,000, and including a credit of $11,707,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $27,715,000, or about $27 per ton of solid waste.

Alternative Plans 8 and 8A: Processing of a Portion of the Solid Wastes at Five Separate Incinerators Designed for Steam Production, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The eighth alternative plan consists of continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at five separate incinerators with a combined capacity of 1,200 tons of solid waste per day designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 8 is $99,587,000, with an average annual net operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $21,691,000, and including a credit of $9,828,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance is $30,375,000, or about $29 per ton of solid waste.

As part of the evaluation under Alternative Plan 8, a subalternative--Alternative 8A--was also investigated which also provided for processing of a portion of the solid waste generated in the study area at five incinerators providing for steam production. This alternative plan is the same as Alternative 8 except that the incinerator facility located at the Americology transfer station site would have a capacity of 800 tons of solid waste per day, as opposed to 600 tons per day. With this additional capacity, plus the capacity of 600 tons per day at the incinerators located at the Northwest transfer station site, the Milwaukee County grounds, the Lincoln Avenue transfer station, and the South Shore sewage treatment plant, the capacity of the incineration facilities is 1,400 tons per day, compared to a capacity of 1,200 tons per day under Alternative 8.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 8A is $115,200,000, with an average annual net operation and maintenance cost of $19,543,000, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, and including a credit of $11,572,000 from steam sale revenues. The total average annual cost of capital and operation and maintenance, including all landfilling costs, is $29,588,000, or about $29 per ton of solid waste.

Alternative Plan 9: Processing of a Portion of the Solid Wastes at Two Separate Incinerators Designed for Electric Power Generation, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The ninth alternative plan consists of continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at two separate incinerators with a combined capacity of 1,200 tons of solid waste per day designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 9 is $108,870,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $24,472,000, including a credit of $5,878,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $33,965,000, or about $33 per ton of solid waste.

Alternative Plan 10: Processing of a Portion of the Solid Wastes at Three Separate Incinerators Designed for Electric Power Generation, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The tenth alternative plan consists of continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at three separate incinerators with a combined capacity of 1,200 tons of solid waste per day designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 10 is $104,760,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $24,864,000, including a credit of $5,857,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $33,999,000, or about $33 per ton of solid waste.

Alternative Plan 11: Processing of a Portion of the Solid Wastes at Five Separate Incinerators Designed for Electric Power Generation, with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The eleventh alternative plan consists of continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at five separate incinerators with a combined capacity of 1,200 tons of solid waste per day designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 11 is $116,840,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $26,731,000, and including a credit of $5,148,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $36,919,000, or about $36 per ton of solid waste.

Alternative Plan 12: Processing of a Portion of the Solid Wastes into a Refuse-Derived Fuel for Incineration with Electric Power Generation, and with Disposal at Two Existing Commercial General-Use Landfills and at Seven Existing Private Special-Use Landfills

The twelfth alternative plan consists of continued use of the existing solid waste storage, collection, and transfer station systems; initiation of a countywide residential solid waste recycling program; conversion of a portion of the unrecycled solid wastes generated in the County into refuse-derived fuel (RDF); incineration of the refuse-derived fuel at one incinerator with a capacity of 1,000 tons of processed solid waste per day designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes and refuse-derived fuel process residue at two existing commercial general-use landfills, one of which is located within the County, and at seven existing private special-use landfills, all of which are located within the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 12 is $90,600,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period, of $24,564,000, including a credit of $5,491,000 from electricity sale revenues. The total average annual cost of capital and operation and maintenance is $32,464,000, or about $31 per ton of solid waste.

The use of refuse-derived fuel as a supplemental fuel was also considered. Under this subalternative--Alternative Plan 12A--portions of the solid wastes would be hauled directly to the RDF processing facility, followed by transport to the Wisconsin Electric Power Company Oak Creek power plant. This RDF would be transported to the Oak Creek plant, units number 1 through 4, where it would be co-fired in new fluidized bed boilers which are anticipated to be installed during a rehabilitation program. It should be noted that the Wisconsin Public Service Commission has not as yet granted the Wisconsin Electric Power Company a license for the reconditioning project. For the purpose of this evaluation, it is assumed that a mixture of 85 percent coal and 15 percent RDF would be co-fired in the boilers.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 12A, not including costs associated with replacement of the existing boilers at the Wisconsin Electric Power Company Oak Creek power plant, is $14,040,000, with an operation and maintenance cost of $18,300,000, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period. The capital and operation and maintenance costs associated with the replacement of the existing boilers at the Oak Creek power plant have not been estimated. Those costs would be part of a very large project estimated to cost $500,000,000.

Refined Incineration Alternatives Analysis

A refined analysis was conducted of the incineration alternatives to incorporate the refined solid waste quantities to be incinerated, as well as the three site options described above. The three alternatives evaluated in this section provide for an incineration capacity of approximately 1,800 tons per day to incinerate about 530,000 tons per year. The previously presented alternatives that include incineration as a component assumed a capacity of about 1,200 to 1,400 tons per day to incinerate between 330,000 and 390,000 tons per year. The larger amount of material estimated to be available for incineration under the refined alternatives is due to the higher percentage of the residential waste stream in the County assumed to be available for incineration, assuming participation by all municipalities once the full system is developed, and to the higher quantities of industrial and commercial waste assumed to be incinerated.

Refined Alternative A: Under this alternative, three separate incineration systems with a combined capacity of about 1,800 tons per day, or 530,000 tons per year, designed to generate steam and electric power, would be constructed in the County. One facility, with a capacity of 900 tons per day, would be located at the Americology transfer station site; one facility, with a capacity of 450 tons per day, would be located in the northwestern portion of the County; and one facility, also with a capacity of 450 tons per day, would be located in the southeastern portion of the County. This alternative is similar to Alternative 7A except that an additional 200 tons per day--or an additional 55,000 tons per year--would be incinerated. The 900-ton-per-day facility would have the capacity to generate approximately 1.2 x 10^9 pounds of steam per year, and between 85 and 110 million kilowatt hours per year of electricity. It is assumed that the electricity produced at the Americology site would be sold to large users of electricity, such as the Jones Island sewage treatment plant or the City of Milwaukee water treatment facilities. The 450-ton-per-day facilities would each have the capacity to generate approximately 5.4 x 10^8 pounds of steam per year, and between 40 and 50 million kilowatt hours per year of electricity. The electricity would be sold to the Wisconsin Electric Power Company or, potentially, to a large industrial or institutional user of electric power. The facilities would have the potential to sell steam if a market developed; however, such sale was not assumed in the analysis.

The estimated capital cost for the development of these solid waste management facilities is $149,973,000. Approximately $7,480,000 per year in revenue would be generated from the sale of electricity, resulting in an average annual operation and maintenance cost of $21,066,000, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period. The total average annual capital and operation and maintenance cost of this alternative would be about $3,144,000, or about $33 per ton of solid waste.

Refined Alternative B: Under this alternative, three separate incineration systems with a combined capacity of about 1,800 tons per day, or 530,000 tons per year, designed to generate steam and electricity, would be constructed in the County. One facility, with a capacity of 900 tons per day, would be located at the Milwaukee County grounds in the City of Wauwatosa; one facility, with a capacity of 450 tons per day, would be located in the northwestern portion of the County; and one facility, also with a capacity of 450 tons per day, would be located in the southeastern portion of the County. This alternative is similar to Refined Alternative A, but differs in that the large incineration facility would be located at the county grounds and that revenues reflect the sale of steam and electricity to the County. The 900-ton-per-day facility would have the capacity to generate approximately 1.2 x 10^9 pounds of steam per year, and between 85 and 110 million kilowatt hours per year of electricity. The steam and electricity generated by the facility would be sold to the County and should meet the anticipated 1990 energy demands of the county grounds. The 450-ton-per-day facilities would each generate approximately 5.4 x 10^8 pounds of steam per year, and between 40 and 50 million kilowatt hours per year of electricity, which would be sold to the Wisconsin Electric Power Company or, potentially, to a large industrial or institutional user of electric power. These facilities would also have the potential to sell steam if a market developed. However, that was not assumed in the analysis.

The estimated capital cost for the development of these solid waste management facilities is $145,237,000. Approximately $13,960,000 per year in revenue would be generated from the sale of steam and electricity, resulting in an average annual operation and maintenance cost of $15,152,000, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period. The total average annual capital and operation and maintenance cost of this alternative would be about $27,817,000, or about $27 per ton of solid waste.

Refined Alternative C: Under this alternative, two separate incineration systems with a combined capacity of about 1,800 tons per day, or 530,000 tons per year, designed to generate steam and electricity, would be constructed in the County. One facility, with a capacity of about 900 tons per day, would be located at the Milwaukee County grounds in the City of Wauwatosa, and the other facility, also with a capacity of 900 tons per day, would be located at the Americology transfer station site in the City of Milwaukee. The 900-ton-per-day facility at the county grounds would have the capacity to generate approximately 1.2×10^9 pounds of steam per year, and between 85 and 110 million kilowatt hours of electricity. The steam and electricity generated at the site would be sold to the County and would likely meet the anticipated 1990 energy demands of the county grounds. The 900-ton-per-day facility located at the Americology site would also have the capacity to generate up to 1.2×10^9 pounds of steam per year and between 85 and 110 million kilowatt hours per year of electricity. It is envisioned that the electric power generated at the Americology incinerator would be sold either to the Wisconsin Electric Power Company or to a number of large electric power users, including the Jones Island sewage treatment plant and the City of Milwaukee water treatment facilities. It is important to note that steam generated at the Americology site facility could also be sold if a market became available.

The estimated capital cost for the development of these solid waste management facilities is $141,290,000. Approximately $14,240,000 per year in revenue would be generated from the sale of steam and electricity, resulting in an average annual operation and maintenance cost of $15,207,000, including all landfilling capital costs which were assumed to be incurred incrementally over the plan period. The total average annual capital and operation and maintenance cost of this alternative would be about $27,527,000, or about $27 per ton of solid waste.

Accessory Alternatives

It was determined that three additional solid waste management alternatives may be applicable for disposal of a portion of the solid wastes generated in Milwaukee County. These alternatives have been termed "accessory" because generally they will not result in the disposal of large quantities of solid wastes and, in most instances, would be carried out in conjunction with one of the "major" alternatives.

Accessory Alternative 1--High Level of Residential Solid Waste Recycling: Under Accessory Alternative 1, a high level of residential solid waste recycling would be initiated using the same 23 recycling centers included in each of the 12 major alternatives. However, this accessory alternative would result in the recycling of 50,000 tons of material annually, rather than 25,000 tons as under the major alternatives. The increased amount of recycling would result from the implementation of an extensive information and education program; longer hours of operation for the recycling centers; greater use of nonprofit agencies and organizations for supplying volunteer labor to the stations and for conducting "drives" for recyclables; and the provision of economic incentives, i.e., by paying for recyclables.

The estimated capital cost for the development of the solid waste management facilities proposed under Accessory Alternative 1 is $281,000, with an average annual operation and maintenance cost of $1,587,000, including an estimated

$753,000 paid to recycled material suppliers. The total average annual cost of capital and operation and maintenance is $1,616,000, or about $64 per ton of recycled solid waste. If the cost of the payment to suppliers for the recycled material were not included in the costs, the total annual cost would be $35 per ton. Under this alternative, savings in collection, transportation, and landfill disposal costs would approximate $525,000 per year. If this cost were deducted from the total annual cost, this would yield a cost of $1,086,500 per year, or $43 per ton.

Accessory Alternative 2--Separate Collection and Recycling of Newsprint: Under Accessory Alternative 2, a separate curbside collection program to collect and recycle newsprint would be initiated. All collection vehicles, including those which are municipally and privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid wastes. This separate collection of newsprint is anticipated to result in the recovery and recycling of 5,000 tons per year, or about 10 pounds per capita per year. This quantity would be over and above the newsprint recycled at the 23 drop-off recycling centers established countywide or in community programs already in effect.

The estimated capital cost for the development of the solid waste facilities proposed under Accessory Alternative 2 is $40,000, with an average annual operation and maintenance cost of $200,000. The gross average annual cost of capital and operation and maintenance is $103,500, or about $21 per ton. In addition, landfill disposal costs would be reduced by about $105,000 per year which, if deducted from the cost, would yield a surplus of $1,500 per year, or $1 per ton.

Accessory Alternative 3--Composting: Under Accessory Alternative 3, a comprehensive program for the composting of vegetative debris contained in residential solid wastes, including grass clippings, leaves, and brush, would be implemented. Approximately 66,300 tons of yard wastes and trees and brush are anticipated to be generated annually in the County during the plan period. The establishment of composting operations in each of the municipalities in the County is anticipated to result in 15,000 tons being composted, or about 23 percent of the yard wastes generated. The materials would be delivered by individual residents to one of 21 sites in the County.

The estimated capital cost for the development of the solid waste management facilities proposed under Accessory Alternative 3 is $340,000, with an average annual operation and maintenance cost of $525,000. The gross average annual cost of capital and operation and maintenance is $555,000, or about $37 per ton of composted solid waste. However, savings in collection and landfill disposal costs would be approximately $240,000 per year, yielding a net average annual cost of $315,000, or about $16 per ton of composted solid waste.

PLAN IMPLEMENTATION

A wide range of means are available to counties to carry out a solid waste management system plan. Under the study, the alternatives were evaluated with respect to three important plan implementation issues. These issues were: 1) the institutional structure and legal mechanisms required, 2) the intergovernmental cooperative arrangements required, and 3) financing.

Institutional Structure and Legal Mechanisms

The solid waste management plan for Milwaukee County emphasizes, to the extent practicable, implementation measures based upon, and related to, the existing governmental structure, existing governmental programs, and existing legislation. Under Wisconsin law, counties, cities, villages, towns, and special institutional districts have authority to manage solid waste alone or in cooperation with one another. The private sector, including both individuals and organizations, also have authority to carry out solid waste management activities.

Organizational and Cooperative Agreements

Solid waste management services, including collection, transport, processing, and disposal, are most frequently provided under one of four basic arrangements or a variation of these:

1. As public services, usually by a governmental department. Under this arrangement, services are provided by county or local units of government with public employees and publicly owned equipment.

2. By private firms under contract to a governmental unit. Under this arrangement, the contractor retains the labor and owns the equipment involved, and must meet all performance criteria set forth in the contract governing the provision of the services.

3. By private firms in open competition, with little, if any, governmental regulation. Under this approach, the private contractor makes arrangements for the provision of services directly with the households, businesses, and industries generating solid wastes.

4. By private firms operating under exclusive franchises by which each is licensed to operate alone in a given area.

Numerous variations of these four basic types of public and private solid waste management operations are possible. Following an analysis of the various arrangements, it was determined that the following were viable for all major solid waste management functions, including landfills and incinerators, in Milwaukee County:

1. Privately owned and operated systems.

2. Multi-municipally owned systems operated by a private contractor.

3. Multi-municipally owned and operated systems.

4. County-owned systems operated by private contractors.

5. County-owned and -operated systems.

In addition, the following arrangements were considered viable for selected solid waste management system functions, such as incinerators, transfer stations, and recycling centers:

1. Individual municipally owned and privately operated systems.

2. Individual municipally owned and operated systems.

3. Multicounty solid waste management systems.

Alternative Financing Mechanisms

A practical financing plan for a solid waste management system is dependent upon the type of management organization utilized, since each type of organization has certain legal financing options associated with its structure. The financing needs for solid waste management can be broken down into two categories: 1) capital financing, and 2) operation and maintenance financing.

The development of solid waste management systems often requires large expenditures. Individual local units of government and private industry may not have sufficient capital on hand to develop the system without borrowing. The cost of interest over the lifetime of a loan can be substantial. An evaluation of the various capital cost financing alternatives indicated that pay-as-you-go, reserve fund, general obligation bonds, public improvement bonds, and promissory notes were the most practical and often used financing systems for solid waste management facilities and services. These capital financing systems were also considered the most viable for further consideration in Milwaukee County.

Along with the costs of facilities and equipment, operation and maintenance costs must also be financed. Governments have a greater range of options for generating revenues for the operation and maintenance of solid waste management systems, including user fees, property taxes, special assessments, sales taxes, recycling, and the waste management fund. Private operators would be limited to user fees and direct billing of governmental units or individual custome.s.

Based upon a review of the options available, it appeared that the user fee, the property tax, private industry billing of local units of government or individuals, and the use of the waste management fund are viable options for raising revenues for the operation and maintenance of solid waste management systems in Milwaukee County.

RECOMMENDED PLAN

The selection of the recommended plan and the means to implement it followed an extensive review by the Technical Coordinating and Advisory Committee of the technical feasibility, economic viability, environmental impacts, potential public acceptance, and practicality of the various alternative solid waste management plans considered, as well as the degree to which the various alternatives met the adopted solid waste management objectives. In addition, the plan recommendations reflect comments and suggestions from private citizens and public officials received during the public hearing. The public involvement component of the solid waste management study is summarized later in this chapter.

Plan Components

The recommended plan consists of seven solid waste management functions--storage, source separation, collection, transportation, transfer, processing, and disposal. In addition, the plan recommendations recognize that the transfer of solid wastes across county boundaries, both into and out of Milwaukee County, may be expected to continue.

A description of each of the components of the recommended plan and the associated institutional arrangements for ownership and operation is presented below.

Storage: The first component of the recommended solid waste management plan is the storage system. Proper storage practices are an important element of an efficient collection system. Under the recommended plan, it is envisioned that most residents in residential areas would utilize either standard, leak-proof, galvanized metal or heavy-duty plastic trash cans with a 20- to 32-gallon capacity and equipped with tight-fitting lids, wheeled carts with a capacity of 75 to 90 gallons, or heavy-duty plastic bags. Large, portable bulk containers designed for mechanized collection should continue to be used at most commercial and industrial establishments, and in some multifamily residential areas. Conversion to large bulk portable containers for mechanized collection appears to be gaining wider acceptance in many communities, based upon local decision-making considering cost, labor, and environmental concerns.

The storage systems are envisioned to continue to be owned and operated by the individual solid waste generators, municipal solid waste collection services, and private solid waste collection firms.

Source Separation: The second component of the recommended solid waste management plan is a source separation program. The program would consist of four elements: 1) a voluntary residential solid waste recycling program for paper, glass, metal, and plastic, whereby residents would transport these materials to a recycling center; 2) a voluntary curbside collection program for newsprint, whereby municipal and private solid waste collection vehicles would be equipped with special racks for the temporary storage and transport of separated newsprint; 3) a voluntary composting program for the processing of yard wastes; and 4) a voluntary household toxic and hazardous waste management program.

Residential Solid Waste Recycling--The first element of the source separation component would consist of a residential solid waste recycling program whereby recyclable materials consisting primarily of paper, glass, aluminum, other metals, and plastics would be transported by individuals to one of the 23 recommended local recycling centers. It is estimated that, with full implementation throughout the County and with a moderate level of participation in the recycling program, 25,000 tons of material would be recycled per year, or about 5 percent of the estimated average annual residential solid waste quantity and about 2.5 percent of the total average annual solid waste quantity.

The recommended plan envisions a flexible approach to ownership and operation of the recycling centers, with a combination of private profit-oriented business, private nonprofit organizations, and individual municipalities assuming the primary functions. It is also recommended that the County take the lead in providing, on a countywide basis, organizational assistance, recyclable material marketing, and public education through the county University of Wisconsin-Extension office.

Curbside Collection of Newsprint--The second element of the source separation component is a separate curbside collection for newsprint. All collection vehicles, including those which are municipally and privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid wastes for transport to a recycling station or storage location. This separate collection program is anticipated to result in the recovery and recycling of 5,000 tons of newsprint annually, or about 10 pounds per capita per year. This quantity would, by weight, be about 1.0 percent of the average annual residential solid waste stream, or less than 0.5 percent of the total waste stream. The newsprint recycled under this program would be over and above the newsprint recycled at the 23 drop-off recycling centers to be established.

This program for separate collection of newsprint is considered an optional plan element recommended to be implemented in all areas where practicable. In certain areas where vehicle maneuverability and size may be restricted due to narrow alleys, such a program may not be practicable. Decisions regarding such a program should be made in conjunction with other collection system evaluations. Collection vehicles in areas where this component is implemented, including both those which are municipally and privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid waste for transport to the recycling centers or storage locations.

Upon implementation of the incineration element of the recommended plan, it is recommended that this plan element be reevaluated based upon current market conditions and calculations of the waste energy value being incinerated. The value of the newsprint to the incineration system compared to the recycled market values less costs may result in this component being an interim measure to be carried out until the incineration element is implemented in each community.

The facilities necessary for the collection of newsprint would be owned and operated by a combination of municipalities and the private sector. The material could either be transported to and recycled at a center described under the recycling component above, or be sold to an existing commercial recycling operator that purchases newsprint.

Composting--The third element of the source separation component is a program whereby vegetative debris generated from residential and institutional sources, including grass clippings, leaves, and brush, would be composted. The composting program is anticipated to result in the removal of 15,000 tons of material from the solid waste stream. This quantity, by weight, would be about 23 percent of the average annual quantity of vegetative debris generated and about 1.5 percent of the total solid waste stream. The material would be transported by individual residents, or, in the case of debris generated on publicly owned parklands, parkways, or green spaces, by county-operated or municipally operated vehicles to one of approximately 21 processing sites situated throughout the County. As a matter of convenience, most of the sites are recommended to be located near the recycling centers. A site would be located in each of 18 communities, with three sites in the City of Milwaukee. It is envisioned that the composting sites will be municipally owned and operated.

Household Toxic and Hazardous Waste Management--The fourth element of the source separation component is a household toxic and hazardous waste management program. This program would consist of about 10 annual "special collections" whereby residents could bring materials containing toxic and hazardous substances to a pre-arranged location on specific dates for disposal. In addition, the program would consist of a comprehensive information and education effort to inform citizens of the types of substances which can be disposed of under these special collections and alternatives to household products presently used. Approximately 10 tons of material would be collected under this program. The information and education program would also likely reduce, to an an undetermined extent, the amount of such substances which are used and eventually discarded. It is envisioned that the public information and education program would consist of a cooperative effort between the local units of government, the County, and the University of Wisconsin-Extension Service.

This recommendation is considered an interim component recommendation pending development of programs at a regional or state level for disposal of such materials from residential sources, as well as commercial and industrial sources. Thus, it is further recommended that a plan be developed for the disposal of all toxic and hazardous wastes. However, that plan should have a geographic area greater than the County and should be conducted at the regional or state level.

The necessary facilities for collection and temporary storage would be located on municipally owned property. Because of the very specialized nature of collecting, packaging, transporting, and disposing of toxic and hazardous wastes, a private, profit-oriented business should operate the special collection program.

Collection and Transportation: The third and fourth components of the recommended solid waste management plan are the collection and transportation systems. The recommended plan envisions the collection function to continue to be carried out in a manner similar to the existing system, which involves the use of municipally and privately owned and operated collection vehicles.

Decisions pertaining to the collection and transport of solid wastes would continue to be made by local officials and the private collection industry, with the necessary equipment and facilities to be owned and operated by a combination of municipalities and private operators. It is recognized that there may be some changes from municipal to private ownership and operation based upon individual municipal cost and service evaluations. Thus, a flexible ownership and operation approach for either option is recommended.

Transfer: The fifth component of the recommended solid waste management plan is the use of transfer stations for the consolidation of solid wastes. Upon full implementation of the recommended plan, approximately 291,000 tons, or about 56 percent of the anticipated average annual residential solid waste quantity, will be transferred.

The facilities necessary for the transfer of solid wastes would continue to be owned and operated by a combination of municipalities and private operators.

Processing: The sixth component of the recommended solid waste management plan is a processing system comprised of two separate mass burn incinerators designed to co-generate steam and electricity. The two facilities, each with a capacity of between 800 and 1,100 tons of wastes per day, are recommended to be constructed at the City of Milwaukee Americology transfer station site and at the Milwaukee County grounds in the City of Wauwatosa. The combined capacity of the facilities would be between 1,700 and 2,000 tons of waste per day, and the facilities would burn about 530,000 tons of waste per year. Upon full plan implementation, approximately 170,000 tons of incinerator ash annually would be produced at these facilities.

It is envisioned that the steam and electricity produced at the county grounds incineration facility would be used to meet the anticipated demands of the health care and support facilities at the grounds, as well as other facilities located on the grounds. The county grounds facility would have the capacity to generate up to 1.2×10^9 pounds of steam at a pressure of 500 to 600 pounds per square inch per year. The steam would be used for heating and cooling and for the generation of electricity. Electricity generated at the Americology incineration facility is anticipated to be sold to a large industrial or institutional energy user such as the Jones Island sewage treatment plant or the City of Milwaukee load centers, including the Linnwood water treatment plant and the Riverside water pumping station. It is estimated that between 80 and 120 million kilowatt hours of electricity per year would be produced at this facility. It is possible that a steam market could develop in the vicinity of the incineration facility so that the steam, as well as the electricity, produced at this facility would be sold.

The proposed incineration system is recommended to be constructed in two phases. The first phase would be constructed at the Americology site within approximately the next five years, with the second phase being constructed at the county grounds site in approximately 10 to 15 years, as the existing system condition and energy demands dictate. As previously noted, an incineration system would not be developed at the county grounds site until the viability of that site is confirmed by a second level plan designed to consider the environmental concerns associated with siting an incineration system at that special-use site. Major elements to be included in that study are listed in Chapter IX. Should this more detailed study result in a conclusion not to use this site, there are several other sites that could be considered, as presented in Chapter IV. These sites would have a high potential if a viable steam user were to develop. Even if no steam user is secured, however, these sites should still be viable, generating electric power. If these satellite locations are used, capacities of about 300 to 500 tons per day should be provided for. Thus, two such sites would be used under the alternative contingency recommended plan to replace the county grounds site as the second phase of the incineration component.

The recommended plan envisions that the ownership of the incineration systems would be, in part, dependent upon the users served. However, it was concluded by the Technical Coordinating and Advisory Committee that the City of Milwaukee and Milwaukee County should initially own and operate the incineration facility at the Americology site. Once the plan is fully implemented, and the construction of an incinerator at the county grounds imminent, it is recommended that the ownership and operation of both facilities be transferred to a county-wide intergovernmental solid waste authority provided under the aegis of the

County. Under each of these ownership situations, it would be viable to have a partnership arrangement with a private profit-oriented owner and/or operator. Should the alternative smaller satellite sites be used, the best ownership option would depend in part upon the energy user and could include the County, several municipalities, or industrial energy users.

Auxiliary Processing Component: There are an estimated 800,000 waste tires generated in Milwaukee County annually, which is an important concern because of the limited methods available for proper disposal. One way to dispose of these tires is to burn them in specially designed incinerators. A private commercial owner/operator of this type of incinerator has proposed to build a facility in the Menomonee Valley capable of processing up to 4,000 tires an hour. Heat generated by burning the tires would be used to generate up to 40,000 pounds of steam per hour. The steam would be sold to the Wisconsin Electric Power Company for use in its central steam heat system in the City of Milwaukee, which provides heat to downtown office and commercial buildings. The Wisconsin Department of Natural Resources has issued the air quality permits necessary for construction and operation of the facility. The owner of the commercial enterprise is currently trying to secure financing for construction of the facility.

Disposal: The seventh component of the recommended solid waste management plan is the disposal system. The recommended plan envisions that the majority of unincinerated solid wastes and unrecycled solid wastes will be disposed of by landfilling, primarily using two existing commercial, general-use landfills--Omega Hills landfill in the Villages of Germantown and Menomonee Falls and the Metro landfill in the City of Franklin. Further, seven existing special-use landfills within the County are envisioned to be used for disposal, including two facilities owned and operated by the City of Milwaukee, one facility each owned and operated by the Cities of Oak Creek, South Milwaukee, Wauwatosa, and West Allis, and one landfill owned and operated by the Falk Corporation. It is also expected that other special-use landfills will be sited within and adjacent to the County. These special-use facilities would continue to receive materials presently disposed of at these sites, comprised primarily of construction and demolition debris, clean fill, foundry sand, and other noncombustible materials. Other existing commercial general-use landfills outside Milwaukee County may be expected to continue to receive limited amounts of solid wastes generated in the study area during the plan period. These landfills include: the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois; the Greidanus Enterprises landfill in the Town of Darien, Walworth County; the Heckimovich landfill in the Town of Williams, Dodge County; the Land Reclamation, Ltd., landfill in the Town of Mt. Pleasant, Racine County; the Valley Sanitation landfill in the Town of Koshkonong, Jefferson County; the Waste Management of Wisconsin Muskego landfill in the City of Muskego, Waukesha County; the Pheasant Run landfill in the Town of Paris, Kenosha County; the Majerus landfill in the Town of Byron, Fond du Lac County; and the Troy Area landfill in the Town of Troy, Walworth County. It recognized that these commercial general-use landfills, as well as smaller special-use landfills outside the County, may be used for the disposal of limited quantities of solid wastes, with the specific sites being selected based upon competitive market costs, as is presently the case.

There is concern that the heavy metals and other contaminants in incinerator ash could leach out from the ash when placed in the acid leachate environment of the conventional solid waste fill. Thus, it is recommended that a new incinerator ash landfill or, alternatively, the segregation of a portion of an existing landfill for incinerator ash be considered. Approximately 100,000 of ash tons per year, or 2,100,000 cubic yards, is expected to be generated over the plan period, resulting in the need for a landfill site of about 80 acres. Consideration could be given to using this special ash landfill to receive ash from other incinerators in adjacent and nearby counties.

It is recommended that the two existing commercial general-use landfills and the private special-use landfills continue to be owned and operated by their present owners. It is recommended that the owners and operators of the incineration systems--the City and the County of Milwaukee, in conjunction with any private profit-oriented partner selected, be the owner and operator of any new special-use landfill for incinerator ash. Alternatively, a segregated portion of an existing landfill could be dedicated to incinerator ash, with the owner of the entire landfill being responsible for the area so dedicated.

Cost Analysis

In order to assist public officials and concerned citizens in evaluating the financial feasibility of the recommended plan, a schedule of capital and operation and maintenance costs was prepared. This schedule includes costs for both publicly and privately owned and operated solid waste management functions identified in the plan recommendations.

The capital investment cost of implementing the recommended Milwaukee County solid waste management plan is estimated at $141,670,000 over the 20-year plan implementation period. Of this total, about $140,727,000, or 99 percent, would be required to construct the two recommended incinerator facilities. Importantly, the incinerator at the Americology site, which is recommended to be constructed first, would have a capital cost of approximately $74,958,000; and the incinerator at the county grounds site, which is recommended to be constructed 10 to 15 years into the plan period, would have an estimated capital cost of $65,769,000. The difference in the estimated capital cost of the two facilities is due primarily to the differences in land acquisition costs and to the availability of extensive steam and utility transmission line facilities at the Americology site. The remaining capital costs include $943,000, or about 1 percent of the total, for recycling stations ($563,000), composting sites ($340,000), and collection equipment retrofitting for curbside newsprint collection ($40,000). These costs include the estimated expenditures for land acquisition, site preparation, equipment, construction, engineering, construction interest, legal services, and environmental investigations. The costs do not include inflation costs or bond-related interest and service charges.

Upon full implementation of the plan, the average annual operation and maintenance cost of the recommended plan, excluding revenues from the sale of energy products generated at the incineration facilities, is estimated to be $32,069,000. This cost includes a landfilling capital cost component which was assumed to be incurred incrementally over the life of each landfill. Of this total, $14,103,000, or 44 percent, would be for the disposal of unprocessed solid wastes in landfills; $4,173,000, or 13 percent, would be for solid waste transportation; $1,394,000, or 4 percent, would be for the operation and maintenance of the recycling facilities and equipment; $832,000, or 3 percent, would be for transfer of solid wastes at existing transfer facilities; and $11,567,000, or 36 percent, would be for the operation and maintenance of the incineration facilities, including incinerator ash landfilling. These operation and maintenance costs would be partially offset by revenues of $14,300,000 from the sale of electricity and steam generated at the incineration facilities--$9,945,000, at the county grounds facility and $4,355,000 at the Americology facility--resulting in a net operation surplus of $2,732,000 for the incineration facilities and a net operation and maintenance cost for all the solid waste management facilities of $17,769,000.

The total average annual cost of carrying out the recommended plan, including the construction of new facilities and the operation and maintenance of those facilities, may be expected to approximate $28,551,000, or $28 per ton of solid waste handled. Based on the anticipated design year resident population of the plan area, the total average annual cost would be about $31 per capita.

Ability of the Recommended Plan to Meet the Agreed-Upon Objectives

The recommended plan meets the solid waste management objectives formulated by providing a flexible, cost-effective, environmentally sound, long-term solution to the solid waste needs of the study area. The plan calls for the use of measures to recover the energy contained in solid waste by incineration and subsequent generation of steam and electricity, and for a moderate level of recycling to recover reusable materials.

Public Involvement

Public involvement was regarded as an important component of the Milwaukee County solid waste management planning study from its inception. The incorporation of public involvement into the planning process stems from the philosophy that an educated and informed public, if given the opportunity, can and should contribute meaningfully to the formulation of alternatives and the selection of a final plan. Public contribution also increases the probability that the recommended plan will be accepted and that implementation will be supported in a timely fashion. Thus, public involvement is viewed as a two-way communication process in which the public is kept informed and, in turn, provides feedback to guide the decision-making process.

The public involvement component of the Milwaukee County solid waste plan was conducted by the Southeastern Wisconsin Regional Planning Commission staff in cooperation with the University of Wisconsin-Extension and the Milwaukee County Department of Engineering, Energy and Environment. It consisted of three major elements, including formation of the previously discussed Technical Coordinating and Advisory Committee, a subcommittee of the Milwaukee County Solid Waste Task Force, and the holding of seven public meetings of that subcommittee; the preparation of informational summary documents which were presented to the Milwaukee County Solid Waste Task Force at six meetings, and the preparation of one SEWRPC newsletter article devoted to the findings and recommendations of the plan; and the holding of a formal public hearing.

As previously indicated, the recommended plan reflects the comments and suggestions received from private citizens and public officials at the various Task Force meetings and the public hearing.

Plan Implementation

While the recommended comprehensive solid waste management plan for Milwaukee County is designed to attain the agreed-upon objectives, the plan is not complete in a practical sense until the steps required to implement it--that is, to convert the plan into action policies and programs--are specified.

Implementation of the recommended Milwaukee County solid waste management plan is entirely dependent upon the cooperative actions of a number of local, areawide, and state units and agencies of government. These agencies include general-purpose local units of government, such as cities and villages; state agencies, such as the Wisconsin Department of Natural Resources; and private enterprise.

Milwaukee County

1. It is recommended that the Milwaukee County Board of Supervisors formally adopt the Milwaukee County solid waste management plan by resolution after a report and recommendation by the County Committee on Energy, Environment and Extension Education.

2. It is recommended that the Milwaukee County Board of Supervisors, whose authority to plan, organize, finance, and implement solid waste management programs is predicated on Chapter 30 of the Wisconsin Statutes, assume primary responsibility for implementing the recommended solid waste management plan. Accordingly, the overall management and administration of the plan implementation program should be directed by a standing committee of the County Board, or a newly created countywide solid waste management authority with input from the currently in-place Milwaukee County Solid Waste Task Force. This committee or authority would be responsible for the following actions:

   a. Review, adopt, and maintain current the recommended solid waste management plan.

   b. Coordinate the implementation of the various components of the recommended solid waste management plan with the state and local units and agencies of government concerned.

   c. Provide coordination and public education assistance to source separation and recycling centers.

   d. Review and approve contracts necessary to implement Phase II of the plan--construction and operation of the incineration and associated energy recovery facilities at the Milwaukee County grounds site.

   e. Develop means of financing Phase II of the plan.

   f. Oversee the feasibility study for and the construction and operation of the recommended incineration system including ash disposal under Phase II of the plan.

   g. Adopt a countywide residential solid waste flow control ordinance upon completion of the incineration and energy recovery systems under Phase II of the plan.

h. Administer all solid waste management processing and disposal functions in the County upon completion of the incineration and energy recovery systems under Phase II of the plan.

Local Units of Government

1. It is recommended that the governing bodies of the cities and villages within Milwaukee County adopt the Milwaukee County solid waste management plan by resolution after a report and recommendation by appropriate committees and local plan commissions.

2. It is recommended that the cities and villages work cooperatively with the County, each other, local nonprofit groups, and private profit-oriented recycling firms in developing the recommended source separation and recycling center operations, the curbside newsprint collection system, and the household toxic and hazardous waste management program.

3. It is recommended that the cities and villages work cooperatively with the County and each other to develop the vegetative debris composting operations.

4. It is recommended that the cities and villages, as appropriate, continue to use transfer stations for the consolidation of residential solid wastes.

5. It is recommended that the municipal operators of existing landfills serving selected communities continue to operate such facilities to dispose of limited quantities of solid wastes in an environmentally safe manner.

6. It is recommended that the local units of government work with the County to ensure adequate contributions of solid waste to the planned incinerator system. As previously discussed, the most effective means for achieving this is through adoption of a countywide solid waste flow control ordinance.

7. It is recommended that the City of Milwaukee:

   a. Develop the means of financing the incineration and energy recovery facilities under Phase I of the plan.

   b. Oversee the feasibility study under Phase I of the plan, as well as the construction and operation of the recommended incineration system.

   c. Continue contracting for disposal of unrecycled and unincinerated residential solid wastes, and, upon completion of the incineration system, incinerator ash.

   d. Relinquish control over the incineration system and contracts for disposal of unrecycled and unincinerated solid wastes and incinerator ash, and give such control to a standing committee of the County Board or a countywide solid waste authority.

Private Sector

1. It is recommended that, where appropriate, the private collection system operators continue to work cooperatively with the local units of government to improve the efficiency of present storage, collection, and transportation systems.

2. It is recommended that private profit-oriented recycling firms and private nonprofit organizations in the County work cooperatively with the local units of government to develop and operate a system of source separation and recycling centers.

3. It is recommended that the private operators of the existing landfills serving the County continue to provide that service, and provide for the expansion of the landfills as required.

4. It is recommended that private profit-oriented business work with the County to determine the most cost-effective means of building and operating the incinerator systems proposed in Phase II of the plan.

Wisconsin Department of Natural Resources

It is recommended that the Wisconsin Department of Natural Resources approve the Milwaukee County solid waste management plan and utilize the plan as a basis for its review of planned and expanded solid waste management facilities in the County and environs.

University of Wisconsin-Extension

It is recommended that the University of Wisconsin-Extension provide the public education assistance needed for plan implementation.

An implementation schedule for each component of the recommended plan was developed, as shown in Figure 28 in Chapter IX. Actual implementation will be dependent, in part, upon availability of funds and county priorities.

CONCLUSION

The solid waste management plan for the Milwaukee County study area presented herein sets forth the recommended means, costs, and implementation methods for meeting the existing and forecast year 2010 solid waste management needs of the study area. The plan is the result of an extensive effort conducted by the Milwaukee County Solid Waste Task Force and a subcommittee, the Milwaukee County Technical Coordinating and Advisory Committee; the Milwaukee County Department of Public Works; and the Southeastern Wisconsin Regional Planning Commission. Adoption and implementation of this plan will provide for the sound management of solid waste in the study area in an efficient, environmentally safe, and cost-effective manner, and will at the same time result in the recovery of valuable recyclable materials and the generation of energy from waste materials which would have otherwise required landfilling. The recommendations in this report provide Milwaukee County with a comprehensive, long-term solution to the resolution of the county solid waste management problem.

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APPENDICES

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Appendix A

MILWAUKEE COUNTY INTERGOVERNMENTAL SOLID WASTE MANAGEMENT TASK FORCE

Daniel Cupertino, Jr. Co-Chairman	Supervisor, Milwaukee County Board
Robert A. Anderson Co-Chairman	Alderman, City of Milwaukee
Jack Barlich Co-Chairman	Mayor, City of West Allis
Susan L. Baldwin	Supervisor, 21st District, Milwaukee County
Kurt W. Bauer*	Executive Director, Southeastern Wisconsin Regional Planning Commission
Brian Bowser*	Resource Recovery Coordinator, City of Milwaukee
James A. Brundahl	Mayor, City of Wauwatosa
F. R. Dengel	President, Village of Fox Point
Paul R. Erickson*	Director, Enviro Energy Technology Center, Rexnord, Inc.
Donald Fieldstad, Jr.	Manager, Village of Greendale
Chester M. Grobschmidt	Mayor, City of South Milwaukee
Paul A. Henningson	Alderman, City of Milwaukee
Robert H. Holder*	Vice-President and Chief Engineer, Wisconsin Gas Company
Norbert J. Hynek	Mayor, City of Glendale
Ronald Jurvis	General Electric Medical Systems Business Group
David A. Kaczynski	Mayor, City of Greenfield
William Kappel*	Superintendent, Sanitation Services, City of Milwaukee
Robert W. Kasten	President, Village of River Hills
Lawrence P. Kelly	Mayor, City of Cudahy
Lawrence J. Kenny	Supervisor, 8th District, Milwaukee County
Richard A. Keyes*	Environmental Engineer, Milwaukee County
David A. Kuemmel*	Commissioner of Public Works, City of Milwaukee
John J. Mann	President, Village of Shorewood
F. Patrick Matthews	President, Village of Whitefish Bay
Gloria L. McCutcheon*	Director, Southeast District, Wisconsin Department of Natural Resources
Earl W. McGovern	President, Village of Brown Deer
Mark E. Miazga	Mayor, City of Franklin
Henry J. Poehler	President, Village of Hales Corners
Fred R. Rehm*	Environmental Consultant
Thomas J. Rutkowski*	Corporate Energy Manager, Briggs & Stratton Corporation

Milo G. Schocker....................................Mayor, City of Oak Creek
Jenny Schuler...........................President, Village of West Milwaukee
Fred C. Schulz*..............................President, EnerVation, Inc.
Gerald Schwerm*..................Director of Transportation, Milwaukee County
Joseph A. Tanski...............................Manager, Village of Bayside
Howard R. Tietz..............................Alderman, City of Milwaukee
Milton Vretener...............................Mayor, City of St. Francis
Alphonse E. Zanoni*............................Professor, Department of Civil
Engineering, Marquette University

*Member of Countywide Technical Coordinating and Advisory Committee, a subcommittee of the full Task Force.

Additional Countywide Technical Coordinating and Advisory
Subcommittee Members not Included on the Full Task Force

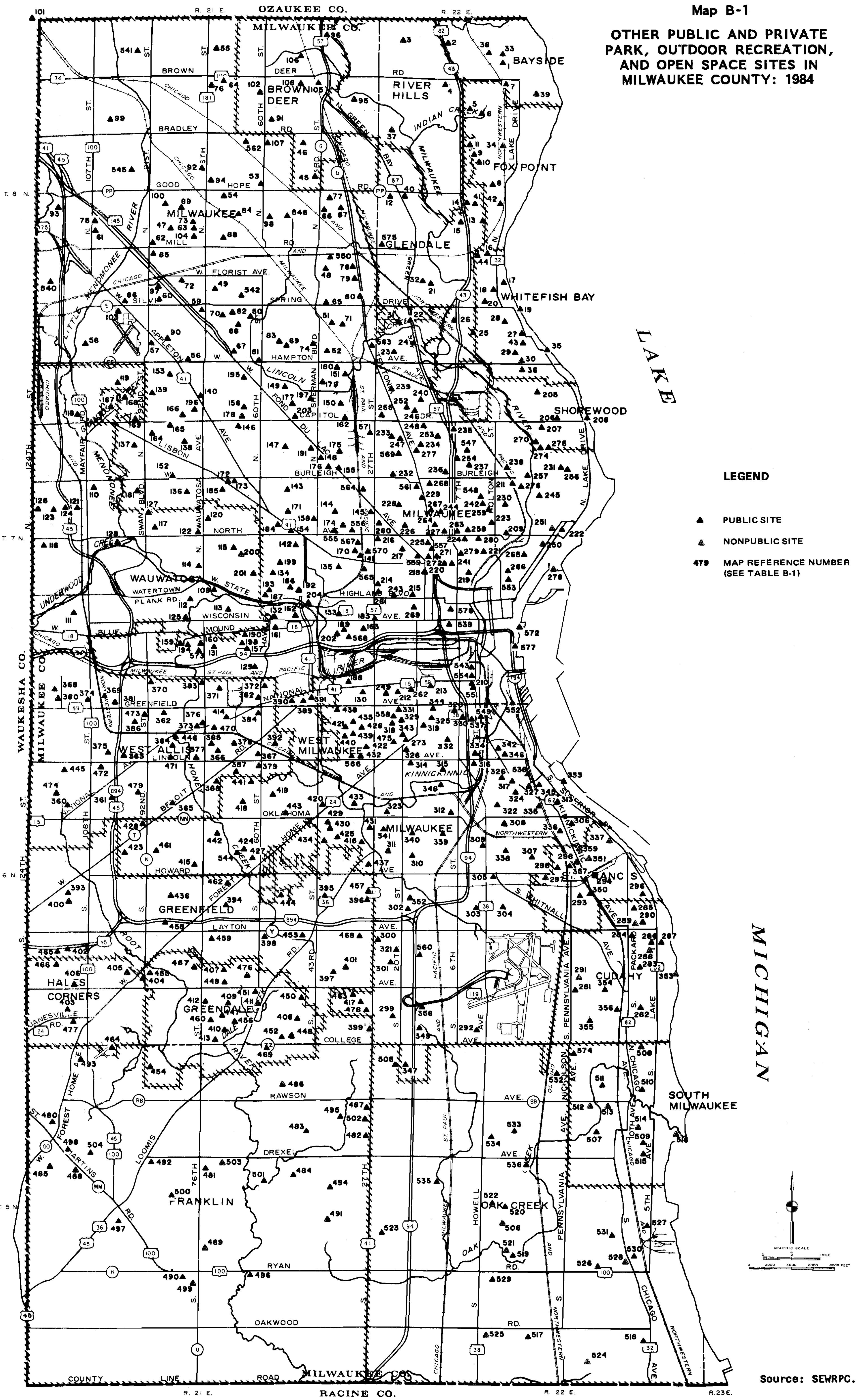
Shirl C. Abbey.................................Manager, Village of Shorewood
Christine B. Bastian........................Representative, City of Oak Creek
John M. Bennett.............................City Engineer, City of Franklin
Joseph P. Heil, Jr.....................Representative, Village of River Hills
LeRoy Krafcheck..................Director of Public Works, City of West Allis
Frederick J. Patrie..................Administrator, Village of West Milwaukee
Gerald J. Seeber..............................Manager, Village of Brown Deer
Norbert S. Theine......................Administrator, City of South Milwaukee
S. Howard Young.....................Engineering and Operations Administrator,
City of Wauwatosa

Appendix B

INVENTORY OF PARK AND OPEN SPACE SITES: MILWAUKEE COUNTY

Map B-1

OTHER PUBLIC AND PRIVATE PARK, OUTDOOR RECREATION, AND OPEN SPACE SITES IN MILWAUKEE COUNTY: 1984



Source: SEWRPC.

Table B-1

OTHER PUBLIC AND PRIVATE PARK, OUTDOOR RECREATION, AND OPEN SPACE SITES IN MILWAUKEE COUNTY: 1984

Map Reference Number	Site Number[a]	Ownership Code[b]	Site Name	Location[c]	Civil Division[d]	Acreage
1	0001S	08	Bayside School	0822-04	401	11
2	0003	12	Lakeshore Recreation Club	0822-05	401	6
3	0007S	12	University School	0822-06	412	43
4	0009S	08	Indian Hill School	0822-08	412	8
5	0010S	08	Mapledale School	0822-08	404	8
6	0011	05	Indian Creek Park	0822-08	404	10
	0012	03	Doctors Park	0822-10	401	49
7	0013	05	Open Space	0822-09	401	3
8	0014	05	Longacre Park and Stormonth Junior High School	0822-16	404	19
9	0016S	08	Dunwood School	0822-17	404	8
10	0017S	10	St. Eugene School	0822-17	404	5
11	0018S	10	St. John's Lutheran School	0822-17	404	3
	0019	03	Kietzsch Park	0822-19	406	119
12	0020S	08	Good Hope School	0822-19	406	13
13	0021S	10	Cardinal Stritch College	0822-20	406	37
14	0022S	08	Green Tree School	0822-20	406	3
15	0023S	08	Nicolet High School	0822-20	406	27
16	0025S	12	University Schools of Milwaukee	0822-29	419	21
17	0026	05	Klode Park	0822-28	419	15
18	0027S	08	Richards School	0822-28	419	4
19	0028	05	Silver Spring Park	0822-28	419	1
20	0029S	10	St. Monica School, Dominican High School	0822-29	419	15
	0030	03	Milwaukee River Parkway	0822-30	406	117
21	0031S	08	Parkway School	0822-30	406	9
22	0032S	10	St. Nicholas School	0822-31	410	3
23	0033S	08	N. 24th Street School	0822-31	410	7
	0034	03	Lincoln Creek Parkway	0822-31	410	113
24	0035S	08	Silver Spring School	0822-31	410	2
25	0036S	08	Lydell School	0822-32	419	4
26	0037	12	Bavarian Club Grounds	0822-32	406	8
	0038	03	Lincoln Park	0822-32	406	316
27	0039S	08	Henry Clay School	0822-33	419	2
28	0040	05	Triangle Park	0822-33	419	1
29	0042	05	Cahill Square	0822-33	419	8
	0044	03	Big Bay Beach	0822-33	419	8
30	0045S	10	Holy Family School	0822-33	419	2
31	0047	04	Long Island Drive Totlot	0822-31	410	1
32	0048	04	City Hall Park	0822-30	406	7
33	0050	05	Ellsworth Park	0822-04	401	8
34	0051	12	Town Club	0822-16	404	9
35	0052	05	Buckley Park	0822-33	419	1
36	0054S	08	Cumberland School	0722-04	419	8
37	0056	12	Milwaukee Country Club	0822-07	412	195
38	0065	05	Village Hall Open Space	0822-05	401	6
39	0066	10	Schlitz Audubon Center	0822-09	401	164
40	0067	12	Le Club	0822-19	406	1
41	0068	04	Green Tree Rink	0822-20	406	3
42	0069	05	Village Swimming Pool	0822-21	404	3
43	0070S	08	Whitefish Bay High School	0822-33	419	8
44	0072	05	Village Park	0822-29	419	6
45	0251	12	Tripoli Country Club	0821-14	402	157
46	0253S	08	Algonquin School	0821-14	402	5
	0256	03	Algonquin Park	0821-14	402	10
47	0257	04	N. 84th and Burbank Playlot	0821-21	410	1
48	0258	04	Berry Land Playground	0821-25	410	2
49	0259	04	Carmen Playfield	0821-27	410	4
50	0260	04	Westlawn Park	0821-34	410	4
51	0261	04	Custer Playfield	0821-36	410	5
52	0262	04	Stark Playfield	0821-36	410	5
	0263	03	Dretzka Park	0821-07	410	327
	0264	03	Brown Deer Park	0821-13	410	365
	0265	03	Noyes Park	0821-21	410	81
	0266	03	Schoenecker Park	0821-26	410	18
	0267	03	McGovern Park	0821-35	410	70
	0268	03	Smith Park	0821-36	410	20
53	0269	12	Brynwood Golf Course	0821-15	410	191
	0270	03	Granville Park	0821-08	410	11
54	0272	12	Milwaukee Polo Field	0821-22	410	43
55	0273	12	North Ridge Lakes	0821-03	410	59
56	0274S	08	Grantosa School	0821-33	410	5
57	0275S	08	Engleburg School	0821-33	410	2
58	0276S	08	Parkview School and Playfield	0821-31	410	9
59	0277S	08	Browning School	0821-33	410	5
60	0278S	08	Bryant School and Playfield	0821-28	410	11
61	0280S	08	Maple Tree School	0821-20	410	8
62	0281S	08	Bruce School	0821-21	410	5
63	0282S	08	Irving School	0821-21	410	3
64	0283S	08	Happy Hill School	0821-10	410	5
65	0286S	08	Carleton School	0821-25	410	3
66	0288S	08	Hawthorne School	0821-24	410	3
67	0289S	08	Lancaster School	0821-34	410	5
68	0290S	08	Kilbourn School	0821-34	410	4
69	0291S	08	Hampton School and Playfield	0821-35	410	10
70	0293S	08	Muir Junior High School	0821-34	410	5
71	0294S	08	Edison Junior High School and 36th Street School	0821-36	410	1
72	0295S	08	Madison High School	0821-28	410	5
73	0296S	08	Burroughs Junior High School	0821-21	410	8
74	0297S	08	Custer High School and Stadium	0821-35	410	19
75	0298S	10	Salem Lutheran School	0821-20	410	5
76	0300S	10	St. Catherine School	0821-10	410	4
77	0301S	10	Our Lady of Good Hope School	0821-24	410	4
78	0302S	10	North Trinity School	0821-25	410	2
79	0303S	10	St. Albert School	0821-25	410	5
80	0304S	10	Christ Memorial School	0821-25	410	1
81	0306S	10	Mt. Lebanon School	0821-34	410	2
82	0307S	10	St. Philip Neri School	0821-34	410	4
83	0308S	10	Mother of Perpetual Help School	0821-35	410	3
	0332	03	Vogel Park	0821-33	410	12
	0333	03	Little Menomonee River Parkway	0821-31	410	883
84	0334	04	N. 67th and Spokane Playlot	0821-22	410	2
85	0335	04	Bender Playlot	0821-28	410	3
86	0336	04	N. 97th Street and Thurston Playlot	0821-29	410	2
87	0337	04	Darien and Kiley Playlot	0821-24	410	3
88	0338	04	Clovernook Playlot	0821-22	410	7
89	0339S	10	St. Bernadette School	0821-21	410	10
90	0340S	10	Corpus Christi School	0821-33	410	8
91	0343S	08.	Brown Deer Public Schools	0821-11	402	74
92	0345	11	Leglers Golf	0821-16	410	17
93	0346	11	Joy Farm Riding Club	0821-19	410	30
94	0349	11	Northside Recreation Center	0821-15	410	3
95	0350	12	River Tennis Club	0821-12	412	5
96	0351	12	North River Raquet Club	0821-01	402	8

Table B-1 (continued)

Map Reference Number	Site Number[a]	Ownership Code[b]	Site Name	Location[c]	Civil Division[d]	Acreage
97	0352	11	Go-Kart Track	0821-28	410	1
	0354	03	Wyrick Park	0821-23	410	20
98	0355S	08	Webster Junior High School and Barton School	0821-23	410	5
99	0356S	08	Goodrich School	0821-08	410	6
100	0357S	08	Stuart School	0821-21	410	3
101	0358	11	Four Seasons Supper Club	0920-36	410	14
102	0359S	10	S. Mark Lutheran School	0821-10	402	1
103	0360	10	Northwest Little League	0821-32	410	4
104	0361S	10	St. Paul's Lutheran School	0821-21	410	8
105	0362S	08	Deerwood School	0821-12	402	3
106	0364	05	Village Park	0821-02	402	17
107	0365S	08	Henry David Thoreau School	0821-14	410	15
108	0366	12	Badger Meter Golf Course	0821-11	402	30
109	0502	04	Hart Park	0721-22	416	16
	0503	03	Chippewa Park	0721-30	416	10
	0504	03	Menomonee River Parkway and Nursery	0721-06	416	643
	0505	03	Currie Park	0721-07	416	209
	0506	03	Grantosa Parkway	0721-08	416	11
	0508	03	Hoyt Park	0721-21	416	35
	0509	03	Jacobus Park	0721-27	416	33
	0510	03	Honey Creek Parkway	0721-28	416	160
	0511	03	Wisconsin Avenue Park	0721-29	416	18
110	0512	12	Bluemound Country Club	0721-17	416	193
	0513	03	Underwood Creek Parkway	0721-20	416	386
111	0514S	08	Underwood School	0721-30	416	11
112	0515S	08	Wilson School	0721-28	416	2
113	0516S	08	Jefferson School	0721-27	416	1
114	0517S	08	Lincoln School	0721-21	416	1
115	0518S	08	Washington School	0721-22	416	1
116	0519S	08	Fisher School and Athletic Field	0721-19	416	15
117	0520S	08	McKinley School	0721-16	416	2
118	0521S	08	Webster School	0721-06	416	3
119	0522S	08	Madison School	0721-05	416	8
120	0523S	08	Roosevelt School	0721-15	416	2
121	0524S	08	Whitman Junior High School	0721-18	416	15
122	0525S	08	Longfellow Junior High School	0721-16	416	6
123	0526S	08	Eisenhower School	0721-18	416	4
124	0527S	08	Wauwatosa West High School	0721-18	416	18
125	0528S	10	St. Jude School	0721-28	416	2
126	0529S	10	St. Joseph's School	0721-18	416	8
127	0531S	10	Christ King School	0721-16	416	1
128	0532S	10	Our Redeemer Lutheran School	0721-20	416	1
129	0536S	08	Burbank School and Playfield	0721-34	410	12
130	0537S	08	Doerfler School	0721-36	410	1
131	0538S	08	Blaine School	0721-27	410	1
132	0539S	08	Hawley School	0721-26	410	1
133	0540S	08	Story School	0721-25	410	2
134	0541S	08	Neeskara School	0721-23	410	3
135	0542S	08	N. 37th Street School	0721-24	410	1
136	0543S	08	N. 81st Street School	0721-16	410	3
137	0544S	08	N. 95th Street School	0721-08	410	4
138	0545S	08	N. 82nd Street School	0721-09	410	7
139	0546S	08	Emerson School	0721-04	410	2
140	0547S	08	Craig School	0721-04	410	2
141	0548S	08	N. 31st Street School	0721-24	410	2
142	0549S	08	Hi Mount School	0721-23	410	2
143	0550S	08	Sherman School	0721-14	410	2
144	0551S	08	N. 38th Street School	0721-13	410	1
145	0552S	08	Clarke Street School	0721-13	410	3
146	0553S	08	N. 65th Street School and Playfield	0721-10	410	5
147	0554S	08	N. 53rd Street School	0721-11	410	6
148	0555S	08	Townsend School	0721-12	410	2
149	0556S	08	Congress School	0721-02	410	3
150	0557S	08	Clemens School	0721-01	410	4
151	0558S	08	N. 35th Street School	0721-01	410	1
152	0559S	08	Wright Junior High School	0721-09	410	5
153	0560S	08	Morse Junior High School	0721-04	410	9
154	0561S	08	Steuben Junior High School	0721-14	410	2
155	0562S	08	Peckham Junior High School	0721-12	410	3
156	0563S	08	Marshall Junior and Senior High Schools	0721-03	410	7
157	0564S	08	Juneau Junior and Senior High School	0721-27	410	2
158	0566S	08	Washington High School	0721-14	410	5
159	0571S	10	Wisconsin Lutheran High School	0721-28	410	7
160	0572S	10	St. Anthony of Padua School	0721-28	410	1
161	0575S	10	Holy Cross School	0721-26	410	4
162	0576S	10	Sacred Heart School	0721-26	410	2
163	0578S	10	St. Rose School	0721-25	410	1
164	0580S	10	St. Aemilian and Mary Schools	0721-09	410	26
165	0581S	10	St. Matthew School	0721-09	410	1
166	0582S	10	Northwest Lutheran School	0721-04	410	4
167	0583S	10	Divine Savior-Holy Angels High School	0721-05	410	16
168	0584S	10	Milwaukee Lutheran High School	0721-05	416	24
169	0585S	10	Gloria Dei-Bethesda School	0721-05	410	1
170	0587S	10	Bethany Lutheran School	0721-24	410	1
171	0590S	10	St. Catherine School	0721-14	410	1
172	0592S	10	Mother of Good Counsel School	0721-15	410	3
173	0593S	08	Robinson Junior High School	0721-15	410	1
174	0594S	10	St. Anne School	0721-13	410	1
175	0595S	10	St. John De Nepomuc School	0721-12	410	1
176	0596S	10	Walther School	0721-12	410	1
177	0597S	10	St. Stephen School	0721-02	410	2
178	0598S	10	Our Lady of Sorrow School	0721-03	410	4
179	0599S	10	Atonement Lutheran School	0721-01	410	1
180	0600S	10	Holy Redeemer School	0721-01	410	1
181	0602S	10	Mount Mary College	0721-17	410	75
182	0606	04	N. 36th and Toronto Open Space	0721-01	410	4
183	0607S	08	Wisconsin Avenue School	0721-25	410	1
184	0608	04	Wright Street Playground	0721-14	410	1
185	0609	04	Enderis Playfield	0721-15	410	10
186	0610	04	Wick Field	0721-23	410	36
187	0611	04	Hawthorne Glen Playfield	0721-26	410	23
188	0612	04	S. 35th and Pierce Playlot	0721-36	410	3
	0613	03	Wahl Park	0721-02	410	14
	0614	03	Columbus Park	0721-03	410	8
	0615	03	Lindsay Park	0721-04	410	10
	0616	03	Nash Park	0721-09	410	7
	0617	03	Kops Park	0721-09	410	8
	0618	03	Dineen Park	0721-10	410	59
	0619	03	Sherman Park	0721-13	410	21
	0620	03	Center Street Park	0721-15	416	5
	0621	03	Cooper Park	0721-16	410	8
	0622	03	Washington Park	0721-23	410	135

Table B-1 (continued)

Map Reference Number	Site Number[a]	Ownership Code[b]	Site Name	Location[c]	Civil Division[d]	Acreage
	0623	03	Highland Park	0721-25	410	3
	0624	03	Valley Park	0721-25	410	2
	0625	03	Bluff Park	0721-26	410	7
	0626	03	Zoo Milwaukee County	0721-29	410	170
	0627	03	Stadium Milwaukee County	0721-26	410	102
189	0628	04	Merrill Park Playfield	0721-25	410	9
	0629	03	Cannon Park	0721-29	410	9
	0631	03	Madison Park	0721-05	416	59
190	0632	04	Juneau Playfield	0721-27	410	8
191	0634	04	N. 45th and W. Keefe Totlot	0721-11	410	1
192	0635	04	N. 49th and Juneau Totlot	0721-23	410	1
193	0636	04	N. 57th and McKinley Totlot	0721-23	410	1
194	0637	04	Dyer Playfield	0721-28	410	11
195	0638	04	N. 65th and Medford Playlot	0721-03	410	1
196	0639	04	N. 78th and Fiebrantz Playlot	0721-04	410	2
197	0640	04	Parklawn Playground	0721-02	410	5
198	0644	04	N. 65th and Stevenson Totlot	0721-27	410	2
199	0646S	10	St. Sebastian School	0721-23	410	1
	0654	03	Mitchell Boulevard	0721-26	410	16
200	0655	12	Revere Drive Park	0721-22	416	1
201	0656	12	Martha Washington Parkway	0721-22	416	5
202	0657S	10	Marquette Stadium	0721-25	410	9
203	0658S	08	Pleasant View School	0721-02	410	1
204	0659S	12	Milwaukee Montessori School	0721-26	410	1
205	0751S	08	Lake Bluff School	0722-04	414	10
206	0752S	08	Atwater School	0722-03	414	5
207	0753S	08	Shorewood Junior and Senior High Schools	0722-09	414	16
208	0755	05	Atwater Beach Park	0722-03	414	7
	0756	03	Estabrook Park	0722-04	414	115
209	0757	04	Kilbourn Park	0722-21	410	25
	0759	03	Burns Triangle	0722-21	410	1
210	0760S	08	Vieau School and Playground	0722-32	410	2
	0761	03	Atkinson Triangle	0722-08	410	1
	0762	03	Kern Park	0722-09	410	28
	0763	03	Pleasant Valley Park	0722-09	410	7
	0764	03	Lake Park	0722-15	410	137
	0765	03	Gordon Park	0722-16	410	14
	0766	03	Riverside Park	0722-16	410	22
211	0767	04	Bremen Street Totlot	0722-16	410	1
	0768	03	Rose Park	0722-17	410	9
	0769	03	Carver Park	0722-20	410	20
	0771	03	Caesars Pool	0722-21	410	2
	0773	03	Cathedral Square	0722-28	410	2
	0775	03	Mitchell Park	0722-31	410	61
	0776	03	Clark Square	0722-31	410	2
	0777	03	Walker Square	0722-32	410	2
212	0778S	08	Longfellow School	0722-31	410	3
213	0779S	08	Kagel School	0722-32	410	3
214	0782S	08	N. 27th Street School	0722-19	410	1
215	0784S	08	MacDowell School	0722-30	410	2
216	0790S	08	Elm School	0722-19	410	1
217	0791S	08	Brown Street School	0722-19	410	2
218	0792S	08	Siefert School	0722-19	410	2
219	0793S	08	Meir School	0722-20	410	1
220	0794S	08	N. 9th Street School	0722-20	410	3
221	0795S	08	Palmer School	0722-20	410	2
222	0796S	08	Maryland School	0722-15	410	3
223	0797S	08	Holmes School	0722-16	410	3
224	0798S	08	Garfield School	0722-20	410	1
225	0799S	08	Lloyd Street School	0722-19	410	4
226	0800S	08	N. 20th Street School	0722-18	410	2
227	0801S	08	Lee School	0722-17	410	2
228	0802S	08	N. 21st Street School	0722-18	410	3
229	0803S	08	Hopkins School	0722-18	410	2
230	0807S	08	Pierce School	0722-16	410	2
231	0810S	08	Hartford School	0722-10	410	2
232	0811S	08	Auer Avenue School	0722-07	410	9
233	0812S	08	Franklin School	0722-07	410	1
234	0813S	08	Keefe School	0722-07	410	2
235	0814S	08	Green Bay Avenue School	0722-08	410	3
236	0815S	08	La Follette School	0722-08	410	3
237	0816S	08	Berger School	0722-08	410	1
238	0817S	08	Fratney School	0722-09	410	2
239	0818S	08	Garden Homes School	0722-06	410	9
240	0819S	08	Phillip School	0722-06	410	2
241	0821S	08	Roosevelt Junior High School	0722-20	410	7
242	0822S	08	Fulton Junior High School	0722-17	410	2
243	0825S	08	West Division High School	0722-30	410	2
244	0827S	08	North Division High School	0722-17	410	2
245	0828S	08	Riverside High School	0722-16	410	3
246	0829S	08	King High School and N. Stadium	0722-06	410	8
247	0830S	10	Siloah Lutheran School	0722-07	410	1
248	0831S	10	Gospel School	0722-07	410	1
249	0832S	10	St. Matthew's School	0722-31	410	1
250	0852S	10	Holy Rosary School	0722-21	410	1
251	0853S	10	St. Peter & Paul School	0722-15	410	1
252	0857	04	N. 20th and Olive Playlot	0722-06	410	1
253	0867S	10	Holy Angels School	0722-08	410	2
254	0868S	10	Holy Ghost Lutheran School	0722-08	410	1
255	0871S	10	St. Agnes School	0722-06	410	1
256	0874S	02	University of Wisconsin-Milwaukee	0722-10	410	25
257	0879S	08	Gaenslen School	0722-09	410	3
258	0881	04	N. 4th and Meinecke Totlot	0722-17	410	1
	0882	03	Garden Homes Square	0722-06	410	2
	0883	03	Lindbergh Park	0722-07	410	3
	0884	03	Prospect Triangle	0722-15	410	1
	0885	03	Gilmans Triangle	0722-15	410	- -[e]
	0886	03	Lake Michigan Waterfront North	0722-22	410	96
	0887	03	Clas Park	0722-29	410	1
	0888	03	Pere Marquette Park	0722-29	410	2
	0889	03	Red Arrow Park	0722-29	410	1
259	0892	04	Richards and Center Totlot	0722-17	410	1
260	0893	04	N. 26th and Medford Totlot	0722-18	410	1
261	0894	04	N. 26th and Juneau Totlot	0722-19	410	1
262	0897	04	S. 18th and Washington Totlot	0722-31	410	1
263	0898	04	N. 7th and North Totlot	0722-17	410	1
264	0899	04	N. 12th and Wright Playlot	0722-17	410	1
265	0900	04	Pulaski Street Playfield	0722-21	410	3
266	0901	04	Cass Street Playground	0722-21	410	2
267	0902	04	Franklin Square	0722-18	410	2
268	0903	04	Columbia Playfield	0722-18	410	3
269	0905	04	Norris Playfield	0722-30	410	2

Table B-1 (continued)

Map Reference Number	Site Number[a]	Ownership Code[b]	Site Name	Location[c]	Civil Division[d]	Acreage
270	0906	05	Hubbard Park	0722-09	414	7
271	0915	04	N. 11th and Reservoir Totlot	0722-20	410	1
272	0925	04	N. 13th and Reservoir Totlot	0722-19	410	1
273	0947	04	S. 20th and Vilter Lane Totlot	0622-06	410	1
274	0950	05	River Park	0722-09	414	4
275	0957	05	Humble Park	0722-10	414	1
	0971	03	King	0722-19	410	21
276	0976	04	Pumping Station Playfield	0722-16	410	7
	0977	03	Zeidler Park	0722-29	410	1
	0978	03	Doyne Park	0721-26	410	35
277	0980S	08	Parkman Junior High School	0722-07	410	2
	0982	03	Tiefenthaler Park	0722-19	410	11
278	0983	12	Milwaukee Yacht Club	0722-22	410	2
279	0985	04	Lapham Park Playground	0722-20	410	1
280	0986	04	N. 2nd and Garfield Totlot	0722-20	410	1
281	1001S	08	Parkview School	0622-34	403	8
282	1002S	08	J. E. Jones School	0622-35	403	2
283	1003S	08	Kosciuszko School	0622-26	403	3
284	1004S	08	Washington School	0622-26	403	1
285	1005S	08	Lincoln School	0622-23	403	2
286	1006S	08	Cudahy Junior High School East	0622-26	403	6
287	1007S	08	Cudahy High School	0622-25	403	20
288	1009S	10	St. Joseph School	0622-26	403	1
289	1010S	10	St. Frederick's School	0622-23	403	1
290	1011S	10	St. Paul's Lutheran School	0622-23	403	1
	1013	03	Sheridan Park	0622-25	403	78
	1014	03	Pulaski Park (Cudahy)	0622-26	403	17
	1015	03	Warnimont Park	0622-36	403	302
291	1016	11	South Woods of Cudahy	0622-27	403	11
292	1017	04	Uncas Totlot	0622-32	410	3
293	1018S	08	Willow Glen School	0622-22	413	9
294	1019S	08	Thompson School	0622-22	413	2
295	1020S	08	Faircrest School	0622-15	413	2
296	1021S	08	St. Francis High School	0622-23	413	20
297	1022S	10	St. Paul's School	0622-22	413	3
298	1023S	10	Sacred Heart of Jesus School	0622-15	413	1
	1024	03	Bay View Park	0622-14	413	31
	1025	03	Greene Park	0622-23	413	38
299	1026S	08	Victory School	0622-31	410	3
300	1027S	08	Liberty School	0622-30	410	1
301	1028S	08	Cooper School	0622-30	410	7
302	1030S	08	Lowell School	0622-19	410	8
303	1031S	08	Whittier School	0622-20	410	6
304	1032S	08	Burdick School	0622-21	410	2
305	1033S	08	Tippecanoe School	0622-21	410	1
306	1034S	08	Fernwood School	0622-15	410	3
307	1035S	08	Clement Avenue School	0622-16	410	3
308	1036S	08	Humboldt Park School	0622-16	410	2
309	1037S	08	Warnimont School	0622-17	410	3
310	1038S	08	Morgandale School	0622-18	410	1
311	1039S	10	Centennial Lutheran School	0622-18	410	2
312	1040S	08	Clement J. Zablocki School	0622-08	410	2
313	1041S	08	Trowbridge School	0622-10	410	2
314	1042S	08	Lincoln Avenue School	0622-07	410	2
315	1043S	08	Hayes School	0622-08	410	1
316	1044S	08	Riley School	0622-08	410	2
317	1045S	08	Dover Street School	0622-09	410	2
318	1047S	08	Mitchell School	0622-06	410	1
319	1048S	08	Forest Home School	0622-06	410	2
320	1049S	08	Allen-Field School	0622-05	410	2
321	1050S	08	Sholes Junior High School	0622-30	410	11
322	1051S	08	Fritsche Junior High School	0622-09	410	9
323	1052S	08	Pulaski High School	0622-07	410	17
324	1053S	08	Bay View High School	0622-09	410	5
325	1054S	08	South Division High School	0622-06	410	2
326	1066S	10	St. Augustine School	0622-09	410	1
327	1068S	10	Immaculate Conception School	0622-09	410	2
328	1069S	10	St. Adalbert School	0622-06	410	1
329	1072S	10	St. Vincent de Paul School	0622-06	410	1
330	1075S	10	Notre Dame High School and St. Stanislaus Church	0622-05	410	4
331	1078S	10	Christ Lutheran School	0622-06	410	1
332	1084S	08	Kosciuszko Junior High School and S. Stadium	0622-05	410	8
333	1086	12	South Shore Yacht Club	0622-10	410	4
334	1087	04	Lincoln Field	0622-05	410	7
335	1088	04	Sijan Playfield	0622-09	410	15
336	1089	04	Ellen Street Playlot	0622-15	410	5
337	1090S	10	St. Francis de Sales College	0622-14	413	20
338	1091	04	Adams Playfield	0622-16	410	12
339	1092	04	Ohio Playfield	0622-17	410	4
340	1093	04	Holt Playfield	0622-18	410	4
341	1094	04	Southlawn Playground	0622-18	410	2
	1095	03	Kosciuszko Park	0622-05	410	35
	1096	03	Pulaski Park	0622-07	410	18
	1097	03	Baran Park	0622-08	410	32
	1098	03	Humboldt Park	0622-09	410	71
	1099	03	South Shore Park	0622-10	410	48
	1100	03	Tippecanoe Park	0622-16	410	15
	1101	03	Saveland Park	0622-17	410	4
	1102	03	Wilson Park	0622-19	410	78
	1103	03	Mitchell Airport Park	0622-21	410	19
	1104	03	Holler Park	0622-29	410	16
	1105	03	Copernicus Park	0622-31	410	22
	1106	03	Cudahy Park	0622-34	403	18
342	1107	04	Zillman Park	0622-04	410	1
343	1108	04	S. 21st and Rogers Totlot	0622-06	410	1
344	1109	04	S. 13th and Lapham Totlot	0622-05	410	1
345	1110	04	Lewis Playfield	0622-09	410	4
346	1112	04	S. Allis Street Totlot	0622-04	410	1
347	1113	04	Jewel Playfield	0522-06	410	5
348	1114	04	Cleveland Playfield	0622-08	410	3
349	1115	04	S. 15th and Kimberly Playlot	0622-31	410	1
350	1116	04	City Hall Playground	0622-22	413	1
351	1121S	10	St. John's School for the Deaf	0622-15	413	4
352	1122S	10	St. Roman School	0622-19	410	6
353	1123	11	Cudahy Gun Club	0622-25	403	8
	1124	03	Morgan Triangle	0622-15	410	1
354	1127S	08	Cudahy Junior High School West	0622-35	403	3
	1129	03	Wilson Park Recreation Center	0622-19	410	58
355	1130S	08	General Mitchell School	0622-34	403	8
356	1131	10	Ladish Little League Park	0622-35	403	3
357	1132	04	Elizabeth Street Playground	0622-15	413	1
	1133	03	Maitland Park	0622-31	410	27

Table B-1 (continued)

Map Reference Number	Site Number[a]	Ownership Code[b]	Site Name	Location[c]	Civil Division[b]	Acreage
358	1135S	08	Garland School	0622-31	410	3
359	1136S	10	Thomas Moore High School	0622-15	413	12
360	1251S	08	Parkway School	0621-07	417	2
361	1252S	08	General Mitchell School	0621-08	417	7
362	1253S	08	Wilson School	0621-04	417	2
363	1254S	10	Woodlawn Lutheran School	0621-05	417	3
364	1257S	08	Franklin School	0621-04	417	1
365	1258S	08	Johnson School	0621-09	417	5
366	1259S	08	Jefferson School	0621-03	417	6
367	1260S	08	Longfellow School	0621-03	417	2
368	1261S	08	Walker School	0721-31	417	6
369	1262S	08	Madison School	0721-32	417	4
370	1263S	08	La Follette School	0721-33	417	2
371	1264S	08	McKinley School	0721-34	417	4
372	1265S	08	Roosevelt School	0721-35	417	3
373	1266S	08	Dewey Junior High School Lincoln Schools	0621-04	417	2
374	1270S	08	Lane Junior High School	0721-31	417	3
375	1272S	08	Irving School	0621-05	417	9
376	1274S	10	Jordan Lutheran School	0621-04	417	1
377	1277S	10	St. Paul's Lutheran School	0621-04	417	1
378	1278S	10	St. Augustine School	0621-03	417	2
379	1279S	10	St. Rita School	0621-10	417	3
380	1280S	10	Immaculate Heart of Mary School	0721-31	417	5
381	1281S	10	Good Shepherd School	0721-32	417	1
382	1282S	10	St. Mary Help of School	0721-34	417	1
383	1286	04	Kopperid Park (east and west)	0721-34	417	4
	1287	03	LaFollette Park	0721-32	417	18
	1288	02	State Fairgrounds	0721-33	417	214
384	1289	04	Washington Playground	0621-03	417	6
385	1290	04	Rogers Park	0621-03	417	1
386	1291	04	S. 96th Street Playfield	0621-05	417	10
387	1292	04	Jefferson Playground	0621-10	417	4
388	1293	04	Veterans Housing Park	0621-10	417	4
	1294	03	Root River Parkway	0621-07	417	3,953
	1295	03	Greenfield Park	0621-06	417	295
	1296	03	McCarty Park	0621-09	417	61
389	1297S	08	Pershing School	0721-35	418	2
390	1298S	08	West Milwaukee High School	0721-35	418	3
391	1299S	10	St. Florian School	0721-35	418	1
392	1300	04	S. 56th Street Playground	0621-02	417	1
	1301	03	West Milwaukee Park	0621-02	418	20
393	1302S	08	Jefferson School	0621-19	408	7
394	1303S	08	Maple Grove School	0621-22	408	5
395	1304S	08	Hillcrest School	0621-24	408	7
396	1305S	08	Badger School	0621-24	408	3
397	1306S	08	Elmdale School	0621-25	408	5
398	1309S	08	Greenfield High School	0621-26	408	32
399	1310S	10	Our Father Lutheran School	0621-36	408	8
400	1314	10	Greenfield 4-H Park	0621-19	408	1
401	1315	12	Tuckaway Club Enterprises	0621-25	408	5
402	1316S	08	Whitnall High School	0621-30	408	29
403	1317S	08	Hales Corners School	0621-31	409	4
404	1318S	08	Valley View School	0621-29	409	7
405	1319S	10	St. Mary School	0621-29	409	2
406	1320S	10	Hales Corners Lutheran School	0621-30	409	1
	1321	03	Hales Corners Park	0621-31	409	35
407	1322S	08	Ambruster School	0621-27	407	9
408	1323S	08	Highland View School	0621-35	407	10
409	1325S	08	Greendale Junior High School and Canterbury	0621-34	407	17
410	1326S	08	Greendale High School	0621-34	407	27
411	1327S	10	St. Alphonsus School	0621-34	407	12
412	1328	05	Lions Park	0621-34	407	2
413	1329	12	Village Club Grounds	0621-34	407	7
414	1330	04	Veterans Memorial Park	0621-03	417	1
415	1331S	08	S. 78th Street School	0621-16	410	12
416	1334S	08	Curtin School	0621-13	410	5
417	1335S	08	Kilmer School	0621-36	410	5
418	1336S	08	Fairview School	0621-10	410	10
419	1337S	08	S. 55th Street School	0621-11	410	4
420	1338S	08	Manitoba School	0621-12	410	6
421	1339S	08	Greenfield School	0621-01	410	1
422	1340S	08	Grant School	0621-01	410	2
423	1341S	08	Alcott School	0621-17	410	8
424	1342S	08	Bell Junior High School and 67th Street School	0621-15	410	7
425	1343S	08	Audubon Junior High School	0621-13	410	5
426	1344S	08	Walker Junior High School	0621-01	410	2
427	1345S	08	Hamilton High School	0621-15	410	13
428	1346S	10	St. Matthias School	0621-17	410	4
429	1348S	10	Blessed Sacrament School	0621-13	410	2
430	1349S	10	Alverno College Grade School	0621-13	410	1
431	1350S	10	Our Lady Queen of Peace School	0621-13	410	2
432	1353S	10	Church of the Holy Spirit School	0621-01	410	1
433	1355S	10	Gethsemane School	0621-12	410	1
434	1358S	10	Alverno College	0621-13	410	31
435	1359	04	Burnham Playfield	0621-01	410	9
436	1360S	10	St. John's Catholic School	0621-21	408	9
	1361	03	Manitoba Park	0621-11	410	5
	1362	03	Jackson Park	0621-12	410	117
	1363	03	Kinnickinnic River Parkway	0621-11	410	237
	1364	03	Lyons Park	0621-14	410	13
	1365	03	Wedgewood Park	0621-15	410	6
	1366	03	Zablocki Park	0621-24	408	47
	1367	03	Scout Lake Park	0621-35	407	72
	1368	03	Alcott Park	0621-17	410	17
	1370	03	Rainbow Park	0721-31	417	26
	1371	03	Armour Park	0621-22	408	16
437	1372	04	S. 30th and Fardale Playlot	0621-13	410	12
438	1373	04	38th and Branting	0621-01	410	1
439	1374	04	Rogers Playfield	0621-01	410	6
440	1375	04	S. 36th and Rogers Playlot	0621-01	410	3
441	1376	04	S. 63rd and Cleveland Playlot	0621-10	410	1
442	1377	04	S. 73rd and River Bend Playlot	0621-15	410	1
443	1379	04	S. 51st and Stack Totlot	0621-11	410	1
	1380	03	Euclid Park	0621-16	410	9
444	1381S	08	Whitman School	0621-23	410	8
445	1382S	08	Nathan Hale High School and Playfield	0621-07	417	40
446	1383	04	Franklin Field and Garfield Park	0621-04	417	11
447	1384	05	Canterbury Woodlands	0621-34	407	10
448	1385	05	Village Green Park	0621-35	407	6
449	1386	05	Parkland Grove Park	0621-27	407	3
450	1387	05	Village Green	0621-35	407	20
451	1388	05	Bentwood Hill Park	0621-34	407	1

Table B-1 (continued)

Map Reference Number	Site Number[a]	Ownership Code[b]	Site Name	Location[c]	Civil Division[d]	Acreage
452	1389	05	College Avenue Park	0621-35	407	42
453	1390S	08	Edgewood School	0621-26	408	5
454	1394	11	Parkway Stables, Inc.	0521-04	407	25
455	1397	11	Parkway Golf Range	0621-28	407	6
456	1398	10	Jaycee Park	0621-34	407	4
457	1399	11	Willows Golf Range	0621-24	408	9
458	1400S	08	Chapman School	0621-21	408	8
459	1401	04	Squire Park	0621-27	408	2
460	1402	05	Sherwood Heights Park	0621-34	407	10
461	1403S	08	S. 88th Street School	0621-16	410	6
462	1404S	10	St. John's Lutheran School	0621-22	408	5
463	1408S	10	St. Borromeo School	0621-36	410	2
464	1409	10	Little League Park	0521-05	409	12
465	1410S	08	Whitnall Junior High School	0621-30	408	8
466	1411S	08	Edgerton School	0621-30	409	4
	1412	03	Holt Park	0621-17	408	24
467	1413S	10	Martin Luther High School	0621-28	407	19
468	1414S	08	Greenfield Junior High School	0621-25	408	12
469	1415S	08	College Park School	0521-02	407	6
470	1416	04	Athletic Field	0621-03	417	5
471	1417S	08	Central High School	0621-04	417	2
472	1418S	10	Mary Queen of Heaven School	0621-08	417	5
473	1419S	10	St. Aloysius School	0621-05	417	1
474	1420S	10	Holy Trinity Lutheran School	0621-07	417	3
	1422	03	Barnard Park	0621-25	408	11
475	1423	04	Becher Fieldhouse and Playground	0622-06	410	1
	1425	03	Park Site 56	0621-26	408	17
	1427	03	Dale Creek Parkway	0621-34	407	45
476	1428	12	Edgerton Park	0621-27	407	15
477	1429	05	Cobb Park	0621-31	409	9
478	1430	04	Gra-Ram	0621-36	410	8
479	1431S	08	Wright Junior High School	0621-08	417	12
480	1501S	08	Country Dale Middle School	0521-07	405	6
481	1502S	08	Ben Franklin School	0521-15	405	4
482	1503S	08	Kilbourn School	0521-12	405	5
483	1505S	08	Pleasant View School	0521-11	405	11
484	1506S	08	Franklin High School	0521-14	405	63
485	1507S	10	Sacred Heart School	0521-18	405	7
486	1508S	10	St. Paul's Lutheran School	0521-02	405	4
487	1509S	10	St. James School	0521-12	405	5
488	1511	10	Herdas Field	0521-18	405	3
489	1512	10	Croatian Eagles Soccer Field	0521-22	405	18
490	1513	04	Fireman's League Ball Diamond	0521-28	405	2
	1514	03	Whitnall Park	0521-05	405	640
491	1515	10	Camp Arthur Davidson	0521-24	405	54
492	1516	04	Legend Park	0521-16	405	18
493	1517	11	Hales Corners Speedway	0521-06	405	45
	1518	03	Grobschmidt Park	0521-01	405	155
	1519	03	Franklin Nursery Site	0521-14	405	10
	1520	03	Franklin Park	0521-29	405	165
494	1522	04	City Park	0521-13	405	3
495	1523	04	Totlot	0521-12	405	1
496	1524	02	Wayside	0521-27	405	1
497	1525	04	City Park	0521-20	405	1
498	1526	04	City Park	0521-07	405	1
499	1528	11	Wildwood Inn	0521-28	405	7
500	1530S	08	Forest Hill School and Nature Center	0521-16	405	43
501	1531	04	City Park	0521-14	405	2
502	1532	11	Franklin Park	0521-12	405	10
503	1533	12	Tuckaway Country Club	0521-15	405	267
504	1534S	08	Robinwood School	0521-08	405	3
	1535	03	Oakwood Park	0521-25	405	278
	1753	03	Bender Park	0522-25	411	308
505	1755S	08	Cedar Hills School	0522-06	411	4
506	1756	12	Oak Park Subdivision Park	0522-21	411	2
507	1757S	08	Parkway School	0522-10	415	4
508	1758S	10	St. Sylvester School	0522-02	415	5
509	1759S	08	Lakeview School	0522-11	415	10
510	1760S	08	S. Milwaukee Junior High and Lutheran Schools	0522-02	415	5
511	1761S	08	S. Milwaukee High and Rawson Schools	0522-02	415	12
512	1762S	10	St. Adalbert School	0522-10	415	1
513	1763S	10	St. Mary School	0522-11	415	1
514	1764S	10	Zion Lutheran School	0522-11	415	1
515	1767	04	Little League Park	0522-11	415	6
	1768	03	Grant Park	0522-01	415	374
	1769	03	Rawson Park	0522-02	415	28
	1770	03	Oak Creek Parkway	0522-10	411	1,027
516	1771	12	South Milwaukee Yacht Club	0522-12	415	4
517	1774S	08	Meadow View School	0522-33	411	6
518	1776S	08	Scanlan School	0522-36	411	3
519	1777S	08	Oak Creek Junior High School	0522-21	411	22
520	1778S	08	Edgewood Elementary, Oak Creek High Schools	0522-16	411	36
521	1780	10	American Legion Park	0522-21	411	1
522	1781	04	Henry Miller Park	0522-16	411	6
523	1782	04	Subdivision Park	0522-19	411	1
524	1783	11	Woodland Golf Course	0522-34	411	18
525	1784	11	Oak Hills Golf Course	0522-33	411	34
526	1785	11	Kerbers Grounds	0522-23	411	2
527	1788	04	Subdivision Park	0522-23	411	2
528	1790S	10	St. Matthew School	0522-23	411	5
529	1792S	08	Shepard Hills School	0522-28	411	28
530	1793	04	Subdivision Park	0522-23	411	3
531	1794S	08	Carollton School	0522-23	411	9
	1795	03	Johnstone Park	0522-06	411	13
532	1798	04	Chapel Hills Park	0522-03	411	7
533	1799	04	Manor Marquette Park	0522-09	411	5
534	1800	04	Greenlawn Park	0522-09	411	9
535	1801	04	Willow Heights Park	0522-17	411	12
536	1802	04	Abendshein Park	0522-16	411	53
537	1803	04	Allen Playlot	0622-05	410	1
538	1804	04	Beulah Brinton	0622-09	410	6
539	1805S	08	8th Street Middle School	0722-29	410	1
540	1806S	08	Grandview School	0821-30	410	6
541	1807S	08	Granville School	0821-05	410	8
542	1808S	08	Kluge School	0821-27	410	4
543	1809S	08	Milwaukee Trade and Technical High School	0722-32	410	2
544	1810S	08	67th Street School	0621-15	410	3
545	1811S	08	Vincent High School	0821-17	410	48
546	1812S	08	Webster Middle School	0821-23	410	7
547	1813	04	5th and Randolph	0722-08	410	1
548	1814	04	1st and Hadley	0722-17	410	1
549	1815	04	1st and Lapham	0622-05	410	1

Table B-1 (continued)

Map Reference Number	Site Number[a]	Ownership Code[b]	Site Name	Location[c]	Civil Division[d]	Acreage
550	1816	04	40th and Douglas	0821-25	410	1
551	1817	04	4th and Mineral	0722-32	410	1
552	1818	04	Kaszube Park	0622-04	410	1
553	1819	04	Park East	0722-21	410	10
554	1820	04	Paliafito Park	0722-32	410	1
555	1821	04	Park West B	0721-13	410	1
556	1822	04	Park West C	0721-13	410	6
557	1823	04	Park West F	0722-19	410	7
558	1824	04	Reiske Park	0622-06	410	1
559	1825	04	17th and Vine	0722-19	410	1
560	1826	04	16th and Edgerton	0622-30	410	1
561	1827	04	16th and Hopkins	0722-18	410	1
562	1828	04	66th and Port	0821-15	410	6
563	1829	04	Teutonia and Fairmount	0821-36	410	1
564	1830	04	30th and Cawker	0721-13	410	1
565	1831	04	30th and Galena	0721-24	410	1
566	1832	04	35th and Lincoln	0621-01	410	1
567	1833	04	31st and Lloyd	0721-24	410	1
568	1834	04	34th and Mt. Vernon	0721-25	410	1
569	1835	04	21st and Keefe	0722-07	410	1
570	1836	04	29th and Brown	0721-24	410	1
571	1837	04	29th and Melvina	0721-12	410	1
572	1838	04	Urban Park	0722-28	410	10
573	1839S	10	Pius XI High School	0721-28	410	1
574	1841	04	Park Site A	0522-03	415	6
	1842	02	Havenwoods Environmental Center	0821-26	410	237
575	1843S	08	Glen Hills Middle School	0822-19	406	20
	1844	03	Hanson Park	0821-03	402	14
	1845	03	Parksite No. 71	0821-03	410	200
	1847	03	Moody Park	0722-07	410	4
	1849	03	Falk Park	0522-07	411	216
	1850	03	McKinley Park	0722-22	410	90
	1851	03	Juneau Park	0722-21	410	18
	1852	03	Johnson Park	0722-19	410	11
	1853	03	Metcalfe Park	0721-13	410	8
	1854	03	Maintenance (county parks)	0721-27	416	4
	1856	03	Riverfront Launch Site	0722-33	416	1
	1858	03	Cudahy Nature Preserve	0522-04	411	42
	1859	03	Trimborn Farm	0621-33	406	8
	1860	03	St. Martin's Park	0521-07	405	19
	1861	03	Parksite 64	0521-09	405	5
	1862	03	Froemming Park	0521-23	405	73
	1863	03	Parksite 65	0522-15	411	8
	1864	03	C&NW Railway Right-of-Way	0722-22	410	15
	1865	03	Meaux Park	0822-31	410	24
576	1866	04	MacArthur Square	0722-29	410	1
	1867	03	Parksite Square	0521-24	405	9
577	1868	04	Maier Festival Park	0722-28	410	30

NOTE: The locations of Milwaukee County parks and open space sites are shown on Map 20 in Chapter II.

[a]A site identification number was assigned to all sites included in the 1973 inventory of park and open space sites in the Region. This inventory is documented in Appendix D, SEWRPC Planning Report No. 27, A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000. Additional sites identified and included in the 1985 inventory are assigned a new site number. An "S" following the site number indicates that the site has been classified as a school outdoor recreation area.

[b]The ownership code numbers are divided into public and nonpublic as follows:

Public	Nonpublic
01 - Federal	10 - Organizational
02 - State	11 - Commercial
03 - County	12 - Private
04 - City	
05 - Village	
08 - School District	

[c]The location numbers represent the U. S. Public Land Survey township, range, and section numbers in which the site is located.

[d]The civil division code numbers refer to the location of the site within cities and villages in the County as follows:

401	Bayside Village (part)	411	Oak Creek City
402	Brown Deer Village	412	River Hills Village
403	Cudahy City	413	St. Francis City
404	Fox Point Village	414	Shorewood Village
405	Franklin City	415	South Milwaukee City
406	Glendale City	416	Wauwatosa City
406	Greendale Village	417	West Allis City
408	Greenfield City	418	West Milwaukee Village
409	Hales Corners Village	419	Whitefish Bay Village
410	Milwaukee City		

[e]Site is less than one-half acre in size.

Source: SEWRPC.

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Appendix C

MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN COMMERCIAL, INDUSTRIAL, MUNICIPAL, AND INSTITUTIONAL SURVEY QUESTIONNAIRES

H0109-U

MILWAUKEE COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY MILWAUKEE COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

COMMERCIAL SOLID WASTE SURVEY QUESTIONNAIRE
(January 1985)

To obtain information which can be used by local commercial establishments in Milwaukee County to consider alternative solid waste management systems, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all commercial establishments. If possible, please fill out a separate questionnaire for each major site, facility, or retail establishment at which solid waste is generated. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Establishment Name ______________________________
Address ______________________________ Phone ______________
Information prepared by: ______________________ Title ______________
Please provide the following information: SIC Code ______________

1. Type of Commercial Establishment ______________________________

2. Type of solid and liquid wastes produced ______________________________

3. Total solid waste produced per year*

   cubic yards ________ or tons ________

4. Total liquid waste produced per year*

   gallons ________ or pounds ________

5. Please describe the seasonal and/or annual variation in solid waste production for your establishment ______________________________
____
____

6. Type of solid waste disposal: (Please include all wastes, i.e., those hauled by owner, contractor, or both).

Landfill — Percent of solid waste _____ Percent of liquid waste _____
Owner/operator: Name ______________________________
Address ______________________________

Landfill — Percent of solid waste _____ Percent of liquid waste _____
Owner/operator: Name ______________________________
Address ______________________________

Incinerator — Percent of solid waste _____ Percent of liquid waste _____
Owner/operator: Name ______________________________
Address ______________________________

Recycle/reuse — Percent of solid waste _____ Percent of liquid waste _____
Other ______________________________

If wastes are salvaged or recycled either internally or through a commercial operator, please list the name and location of recycling operation, the waste types, and quantity. ______________________________

*Please fill out inventory sheets attached.

7. Please indicate your expected increase or decrease in solid waste production by the year 1990. ______________________________

8. Transfer stations or central collection point used for solid waste prior to hauling:

   Owner/operator ______________________________
   Location ______________________________
   Is compactor used? ______________________________
   Total capacity of transfer station(s) ______________________________
   Percent of waste generated which is processed at transfer station(s) __________
   Hours of operation ______________________________

9. Solid waste hauling   Collection Frequency: ____________

   By owner __________   Name: ______________________________
   By private collector   Address: ______________________________
   or municipality __________

10. Total solid waste disposal costs (dollars/year) including municipal collection programs and private contract solid waste hauling.

		Solid Wastes	Liquid Wastes
Collection:	Municipal waste collection	$ ________	$________
	Private contract hauler	________	$________
Disposal:	Municipal landfill	________	________
	Private landfill	________	________
Administrative:		________	________
Other (please specify):		________	________
	Total annual cost	$ ________	$________

11. What year are cost estimates based on? ______

12. Basis of charges from private contractors or municipal haulers:

    $ __________ per ton
    $ __________ per cubic yard
    $ __________ other

13. Length of contract governing above charges __________ years.

14. Please indicate any concerns or thoughts you may want to express relating to solid waste disposal in the County or to the solid waste planning program.

____
____
____
____

Please return this questionnaire to:

Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53186

SOLID WASTE QUANTITY INVENTORY SHEET

Waste Types	Annual[b] Amount (yd^3 or (tons)	Annual[b] Volume (ft^3 or gallon)	Waste Quantities[a] Methods of Disposal			
			Sanitary Landfill	Incinerator	Recycle Reuse	Other (specify)
Solid Waste						
Paper and paper products						
Plastics						
Metals (specify type)...						
Rags and cloth materials						
Wood						
Rubber products						
Glass						
Toxic or hazardous wastes						
Foundry Sand						
Tires						
Air or waste treatment sludges						
Other (specify)						
Liquid Wastes (other than liquids disposed of as sewage)						
Oils and greases						
Chemical sludges						
Solvents						
Other (specify)						

[a]Please express units for each quantity entered on work sheet. Please use estimates if exact amounts are unknown.

[b]Please express waste amounts in appropriate category.

H0109-G

MILWAUKEE COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY MILWAUKEE COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

INDUSTRIAL SOLID WASTE SURVEY QUESTIONNAIRE
(January 1985)

To obtain information which can be used by local industries in Milwaukee County to consider alternative solid waste management systems, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all industries. If possible, please fill out a separate questionnaire for each major site, facility, or plant at which solid waste is generated. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Industry Name ______________________________
Address ______________________________ Phone ______________
Information prepared by: ______________________ Title ______________
Please provide the following information: SIC Code ______________

1. Type of Industry ______________________________

2. Type of solid and liquid wastes produced ______________________

3. Total solid waste produced per year* 4. Total liquid waste produced per year*

cubic yards ________ or tons ________ gallons ________ or pounds ________

5. Please describe the seasonal and/or annual variation in solid waste production for your industry ______________________________

____

____

6. Type of solid waste disposal: (Please include all wastes, i.e., those hauled by owner, contractor, or both).

Landfill Percent of solid waste _____ Percent of liquid waste ____
Owner/operator: Name ______________________________
Address ______________________________

Landfill Percent of solid waste _____ Percent of liquid waste ____
Owner/operator: Name ______________________________
Address ______________________________

Incinerator Percent of solid waste ____ Percent of liquid waste ____
Owner/operator: Name ______________________________
Address ______________________________

Recycle/reuse Percent of solid waste ____ Percent of liquid waste ____
Other ______________________________

If wastes are salvaged or recycled either internally or through a commercial operator, please list the name and location of recycling operation, the waste types, and quantity. ______________________________

*Please fill out inventory sheets attached.

7. Please indicate your expected increase or decrease in solid waste production by the year 1990. ____________________

8. Transfer stations or central collection point used for solid waste prior to hauling:

   Owner/operator ____________________
   Location ____________________
   Is compactor used? ____________________
   Total capacity of transfer station(s) ____________________
   Percent of waste generated which is processed at transfer station(s) ________
   Hours of operation ____________________

9. Solid waste hauling   Collection Frequency: ____________

   By owner ________   Name: ____________________
   By private collector   Address: ____________________
   or municipality ________

10. Total solid waste disposal costs (dollars/year) including municipal collection programs and private contract solid waste hauling.

		Solid Wastes	Liquid Wastes
Collection:	Municipal waste collection	$ ________	$ ________
	Private contract hauler	________	$ ________
Disposal:	Municipal landfill	________	________
	Private landfill	________	________
Administrative:		________	________
Other (please specify):		________	________
Total annual cost		$ ________	$ ________

11. What year are cost estimates based on? ______

12. Basis of charges from private contractors or municipal haulers:

   $ ________ per ton
   $ ________ per cubic yard
   $ ________ other

13. Length of contract governing above charges ________ years.

14. Please indicate any concerns or thoughts you may want to express relating to solid waste disposal in the County or to the solid waste planning program.

   ____
   ____
   ____
   ____

Please return this questionnaire to:

Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53186

SOLID WASTE QUANTITY INVENTORY SHEET

Waste Types	Annual[b] Amount (yd^3 or (tons)	Annual[b] Volume (ft^3 or gallon)	Waste Quantities[a] Methods of Disposal			
			Sanitary Landfill	Incinerator	Recycle Reuse	Other (specify)
Solid Waste						
Paper and paper products						
Plastics						
Metals (specify type)...						
Rags and cloth materials						
Wood						
Rubber products						
Glass						
Toxic or hazardous wastes						
Foundry Sand						
Tires						
Air or waste treatment sludges						
Other (specify)						
Liquid Wastes (other than liquids disposed of as sewage)						
Oils and greases						
Chemical sludges						
Solvents						
Other (specify)						

[a]Please express units for each quantity entered on work sheet. Please use estimates if exact amounts are unknown.

[b]Please express waste amounts in appropriate category.

H0109-0
1/21/85

MILWAUKEE COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY MILWAUKEE COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MUNICIPAL SOLID WASTE SURVEY
(January 1985)

City/Village of ______________________ Date ______________
Information Prepared By ______________________ Title ______________

To obtain information which can be used by local units of government in Milwaukee County to consider alternative solid waste management systems, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all communities. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Please provide the following information when known or when an estimate can be made:

1. How much solid waste is produced in your community?
   Residential ________ tons/year
   Commercial ________ tons/year
   Industrial ________ tons/year
   Total ________ tons/year

   Number of tires collected for disposal. ________ Number/year

2. Is source separation practiced? If so, check the type of materials separated and if known, the quantity of each material per year.

   __ Newspaper _____ tons/year
   __ Aluminum _____ tons/year
   __ White Goods _____ tons/year
   __ Tires _____ number/year
   __ Glass _____ tons/year
   __ Motor Oil _____ tons/year
   __ Other __________ _____ tons/year

3. List all recycle or salvage operations accepting waste materials from your community.
   Name and address: ______________________________________
   ____
   Types of Material Accepted: ______________________________
   ____

4. What type of collection service is used?

   Residential wastes: — Amount
   __ Municipal collection service (only) _____ tons/year
   __ Privately-owned collection service (only) _____ tons/year
   __ Combination of both _____ tons/year

   Multifamily residential wastes:
   __ Municipal collection service (only) _____ tons/year
   __ Privately-owned collection service (only) _____ tons/year
   __ Combination of both _____ tons/year

   Industrial wastes:
   __ Municipal collection service (only) _____ tons/year
   __ Privately-owned collection service (only) _____ tons/year
   __ Combination of both _____ tons/year

Commercial wastes:
__ Municipal collection service ______ tons/year
__ Privately-owned collection service ______ tons/year
__ Combination of both ______ tons/year

5. Frequency and method of collection (check all that apply):

Residential		Commercial		Industrial	
Frequency	Method	Frequency	Method	Frequency	Method
__ weekly	__ curbside	__ weekly	__ curbside	__ weekly	__ curbside
__ twice-weekly	__ backyard	__ twice-weekly	__ backyard	__ twice-weekly	__ backyard
__ monthly	__ cart	__ monthly	__ cart	__ monthly	__ cart
__ twice-monthly	__ dumpster	__ twice-monthly	__ dumpster	__ twice-monthly	__ dumpster
__ other	__ other	__ other	__ other	__ other	__ other

6. What type of collection vehicles and how many vehicles of each type are used in your community for municipal collection services?

Vehicle Type and Capacity Number

____
____
____

7. List all transfer stations or central collection stations utilized by your community.

Station Operator Address

____
____

8. List all licensed solid waste disposal sites utilized by your community.

Landfill Operator Location

____
____

9. If a private collection service is utilized for residential waste collection, how is the community charged? Indicate the annual cost where applicable below.
______ $/year per user charged to community
______ $/year per user charged to individual user
______ $/year per ton__ or yard__ charged to community
______ $/year lump sum charge to community
______ $/year other (please specify) ______________________
Comments: ______________________________
____

10. What is the length of and expiration date of the contract governing private collection service. ______________________

11. What is the total annual cost of solid waste disposal in your community? List as much cost information as possible below.
What year are cost estimates based on? ______________

List the cost of collection, transport, and disposal, and if applicable, transfer. Please list subtotal cost if components are unknown.

collection $________/yr
transport ________/yr
disposal ________/yr
transfer ________/yr
Subtotal ________/yr

List all administrative expenses ____________ \$/Year

Other expenses (please specify ____________________ ____________ \$/Year

Total Annual Cost ____________ \$/Year

12. Do the costs included in No. 9 include the cost for disposal of commercial solid wastes?
Yes__ No__. If not, list here if known. __________ \$/Year

13. Do the costs included in No. 9 include the cost for disposal of industrial solid wastes?
Yes__ No__. If not, list here if known. __________ \$/Year

14. Please give an indication of the seasonal variation and any other fluctuations over the course of the year in solid waste production for your community.

15. Please note any comments or particular concerns that you may want to express regarding solid waste disposal in your community or the County.

16. If available, please provide a map or written description of the areas collected and the end points for each collection route, as well as the location of the collection truck, starting and ending points. This information is intended to be used to assess the transportation costs of various alternatives.

Please return this questionnaire to:

Mr. Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53187

H0109-K

MILWAUKEE COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY MILWAUKEE COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

INSTITUTIONAL SOLID WASTE SURVEY QUESTIONNAIRE
(January 1985)

To obtain information which can be used to consider alternative solid waste management systems in Milwaukee County, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all institutions. If possible, please fill out a separate questionnaire for each major site, facility, or plant at which solid waste is generated. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Institution Name ______________________________
Address ______________________ Phone __________
Information prepared by: ______________ Title __________
Please provide the following information:

1. Type of Institution ______________________________

2. Type of solid and liquid wastes produced ______________________________

3. Total solid waste produced per year*
   cubic yards ________ or tons ________

4. Total liquid waste produced per year*
   gallons ________ pounds ________

5. Please describe the seasonal and/or annual variation in solid waste production for your institution ______________________________

6. Type of solid waste disposal: (Please include all wastes, i.e., those hauled by owner, contractor, or both).

   Landfill   Percent of solid waste _____   Percent of liquid waste ____
   Owner/operator: Name ______________________________
   Address ______________________________

   Landfill   Percent of solid waste _____   Percent of liquid waste ____
   Owner/operator: Name ______________________________
   Address ______________________________

   Incinerator   Percent of solid waste ____   Percent of liquid waste ____
   Owner/operator: Name ______________________________
   Address ______________________________

   Recycle/reuse   Percent of solid waste ____   Percent of liquid waste ____
   Other ______________________________

   If wastes are salvaged or recycled either internally or through a commercial operator, please list the name and location of recycling operation, the waste types, and quantity. ______________________________

*Please fill out inventory sheets attached.

7. Please indicate your expected increase or decrease in solid waste production by the year 1990..

____

8. Transfer stations or central collection point used for solid waste prior to hauling:

   Owner/operator ____________________
   Location ____________________
   Is compactor used? ____________________
   Total capacity of transfer station(s) ____________________
   Percent of waste generated which is processed at transfer station(s) __________
   Hours of operation ____________________

9. Solid waste hauling   Collection Frequency: ____________________

   By owner __________   Name: ____________________
   By private collector   Address: ____________________
   or municipality __________

10. Total solid waste disposal costs (dollars/year) including municipal collection programs and private contract solid waste hauling.

		Solid Wastes	Liquid Wastes
Collection:	Municipal waste collection	$ ________	$ ________
	Private contract hauler	________	$ ________
Disposal:	Municipal landfill	________	________
	Private landfill	________	________
Administrative:		________	________
Other (please specify):		________	________
	Total annual cost	$ ________	$ ________

11. What year are cost estimates based on? ______

12. Basis of charges from private contractors or municipal haulers:

   $ __________ per ton
   $ __________ per cubic yard
   $ __________ other

13. Length of contract governing above charges __________ years.

14. Please indicate any concerns or thoughts you may want to express relating to solid waste disposal in the County or to the solid waste planning program.

____
____
____
____

Please return this questionnaire to:

Robert P. Biebel, Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53186

SOLID WASTE QUANTITY INVENTORY SHEET

Waste Types	Annual[b] Amount (yd^3 or (tons)	Annual[b] Volume (ft^3 or gallon)	Waste Quantities[a] Methods of Disposal: Sanitary Landfill	Incinerator	Recycle Reuse	Other (specify)
Solid Waste						
Paper and paper products						
Plastics						
Metals (specify type)...						
Rags and cloth materials						
Wood						
Rubber products						
Glass						
Toxic or hazardous wastes						
Foundry Sand						
Tires						
Air or waste treatment sludges						
Other (specify)						
Liquid Wastes (other than liquids disposed of as sewage)						
Oils and greases						
Chemical sludges						
Solvents						
Other (specify)						

[a]Please express units for each quantity entered on work sheet. Please use estimates if exact amounts are unknown.

[b]Please express waste amounts in appropriate category.

Appendix D

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Appendix E

UNIT COSTS UTILIZED IN DEVELOPMENT OF COST ESTIMATES FOR SOLID WASTE MANAGEMENT ALTERNATIVES[a, b]

I. <u>Source Separation</u>	
A. Element 1: Recycling Centers	
<u>Large Recycling Facilities</u>	
1. Recycling Center Capital Costs	
a. Building, office supplies, telephone, heated; no water or sanitary sewer	$ 7,500 per site
b. Fence and gate	5,200 per site
c. Gravel surface	1,600 per site
d. Electric service and telephone	400 per site
e. Screening and signs	600 per site
2. Operation Equipment Capital Costs	
a. Containers	
1) Two 8-yard^3	1,400 each
2) Five 12-yard^3	1,800 each
Two semi-trailers	2,500 each
10 steel 55 gallon barrels	10 each
b. Miscellaneous equipment/Tools	600 per site
3. Operation and Maintenance (per year)	
a. Utilities	400 per site
b. Advertising	3,000 per site
c. Miscellaneous supplies and equipment	700 per site
d. Coordination and Operation	8,700 per site
e. Transportation	14,900 per site
<u>Small Recycling Facilities</u>	
1. Recycling Center Capital Costs	
a. Building: Small building for shelter, office supplies, telephone, heated; no water or sanitary sewer	4,500 per site
b. Fence and gate	4,000 per site

c. Gravel surface	1,200 per site
d. Electric service and telephone	400 per site
e. Screening and signs	500 per site

2. Operation Equipment Capital Costs

a. Containers	
1) Two 8-yard^3	1,400 each
2) Two 12-yard^3	1,800 each
Six 55-gallon steel barrels	10 each
One semi-trailer	2,500 each
b. Miscellaneous equipment and tools	500 per site

3. Operation and Maintenance Cost

a. Utilities	300 per site
b. Advertising	2,000 per site
c. Miscellaneous supplies and equipment	500 per site
d. Coordination and operation	6,800 per site
e. Transportation	7,700 per site

B. Element 2: Curbside Newsprint Collection

1. Capital Cost

a. Retrofit existing collection vehicles with racks	$ 400 per truck

C. Element 3: Composting

1. Capital Cost

a. Site development	$ 16,200 per site
b. Operation and Maintenance (equipment and labor costs for site operation)	25,000 per site

D. Element 4: Household Toxic and Hazardous Waste Collection

1. Operation and Maintenance Costs (costs based on 10 collections with a total of about 4,000 households participating)	$ 32,500 per collection

II and III. Collection and Transport

A. Trucking Operation Costs

1. 75 to 100 cubic yard trailer	$	60 per hour
2. 35 to 40 cubic yard compactor		55 per hour
3. 20 to 30 cubic yard compactor		55 per pour
4. 30 yard ash hauling tuck		60 per hour

IV. Transfer

A. Operation Costs

1. Small capacity transfer facilities	$	3.50 per ton of waste
2. Large capacity transfer facilities		3.00 per ton of waste

V. Processing

Waste to Energy Incineration

A. Phase I--900 Ton per Day Mass Burn Facility with Electric Power Generation

	Capital Costs	Operation and Maintenance Costs
1. Equipment	$47,940,000	$ --
2. Construction	15,258,000	--
3. Land acquisition	5,000,000	--
4. Electric lines	6,760,000	--
5. Facility operation and maintenance		4,029,000
6. Ash transport and disposal		1,938,000
7. Less average annual revenue		(4,355,000)
Subtotal	$74,958,000	$1,612,000

B. Phase II--900 Ton per Day Mass Burn Facility with Steam and Electric Power Generation

	Capital Costs	Operation and Maintenance Costs
1. Equipment	$47,940,000	$ --
2. Construction	14,470,000	--
3. Land acquisition	--	--
4. Electric lines	3,359,000	--
5. Facility operation and maintenance	--	3,716,000
6. Ash transport and disposal	--	1,884,000
7. Less average annual revenue	--	(9,945,000)
Subtotal	$65,769,000	$4,345,000

VI. Disposal

A. Capital, Operation and Maintenance (includes cost for landfill disposal and construction of additional capacity over the plan period which is assumed to be constructed incrementally over the plan period). — $ 21 per ton of waste

---

[a]Cost expressed in terms of first quarter 1986 dollars.

[b]Sources used to develop unit cost include the following:

1. Robert Snow Means Company, Inc., Means Building Construction Cost Data 1985, 43rd Annual Edition.
2. Dodge Building Cost Services, 1985 Dodge Guide to Public Works and Heavy Construction.
3. Cost estimates based upon consultations with communities sponsoring clean sweep programs in Wisconsin and in other states in the Midwest.
4. Cost estimates based upon consultation with municipalities operating residential collection systems in Milwaukee County and private solid waste disposal contractors serving Milwaukee County.
5. Cost estimates based upon consultation with municipalities and private contractors operating transfer facilities in southeastern Wisconsin.
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7. Velzy Associates, Incinerator-Boiler Study, Milwaukee County Institutions, 1982.
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10. Black and Veatch Engineers and Architects, A Feasibility Study for Solid Waste Resource Recovery in LaCrosse County, Wisconsin, 1984.
11. Anderson-Ritchie Engineering & Survey Company, Barron County Refuse Incineration Facility Project Report, 1984.
12. Cost estimates based upon consultation with private solid waste contractors operating landfill facilities in southeastern Wisconsin.

Source: SEWRPC.

Appendix F

DETAILED COST ESTIMATES UTILIZED FOR EVALUATION OF SOLID WASTE MANAGEMENT ALTERNATIVES

Appendix F-1

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 1: CONTINUED USE OF EXISTING
SOLID WASTE MANAGEMENT SYSTEMS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010
I. Residential Solid Waste Recycling		
15 at 19,800 = $297,000 Subtotal $562,600	$563,000	
Capital - 8 @ 33,200 = $265,600 15 @ 19,800 = 297,000 Subtotal $562,600	563,000	
O&M - 8 @ 27,700 = $221,600 15 @ 16,500 = 247,500 Subtotal $469,100		$ 469,000[a]
II. Solid Waste Transportation	--	7,677,000
III. Solid Waste Transfer	--	1,346,000
IV. Solid Waste Landfill Disposal	--	21,222,000[b]
Total Cost	$563,000	$30,714,000

Unit Cost = $29.72 per ton of solid waste.

[a]Does not include annual amortized capital cost of $49,000.

[b]Cost assumes increases over present charges in order to fully comply with all regulations and environmental controls. If present charge cost is used, this cost is reduced to $20,323,000. Costs include a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for further detail.

Source: SEWRPC.

Appendix F-2

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 2: DISPOSAL OF SOLID WASTES AT A SINGLE EXISTING COMMERCIAL GENERAL USE LANDFILL AND AT SEVEN EXISTING PRIVATE SPECIAL USE LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010
I. Residential Solid Waste Recycling 15 at 19,800 = $297,000 Subtotal $562,600	$563,000 $563,000	$ 469,000[a]
Capital - 8 @ 33,200 = $265,600 15 @ 19,800 = 297,000 Subtotal $562,600	$563,000	
O&M - 8 @ 27,700 = $221,600 15 @ 16,500 = 247,500 Subtotal $469,100		$ 469,000[a]
II. Solid Waste Transportation	--	8,592,000
III. Solid Waste Transfer	--	1,321,000
IV. Solid Waste Landfill Disposal	--	21,222,000[b]
Total Cost	$563,000	$31,604,000

Unit Cost = $30.58 per ton of solid waste.

[a]Does not include annual amortized capital cost of $49,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility to be included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-3

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 3: DISPOSAL OF SOLID WASTES
AT TWO EXISTING COMMERCIAL GENERAL USE LANDFILLS
AND AT SEVEN EXISTING PRIVATE SPECIAL USE LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010
I. Residential Solid Waste Recycling	$563,000	$ 469,000[a]
15 at 19,800 = $297,000 Subtotal $562,600	$563,000	
Capital - 8 @ 33,200 = $265,600 15 @ 19,800 = 297,000 Subtotal $562,600	$563,000	
O&M - 8 @ 27,700 = $221,600 15 @ 16,500 = 247,500 Subtotal $469,100		$ 469,000[a]
II. Solid Waste Transportation	--	7,509,000
III. Solid Waste Transfer	--	1,321,000
IV. Solid Waste Landfill Disposal	--	21,222,000[b]
Total Cost	$563,000	$30,521,000

Unit Cost = $29.54 per ton of solid waste.

[a]Does not include annual amortized capital cost of $49,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility to be included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-4

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 4: PROCESSING OF A PORTION OF THE SOLID WASTES AT ONE NEW INCINERATOR DESIGNED FOR STEAM PRODUCTION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,488,000
III. Solid Waste Transfer	--	1,080,000
IV. Solid Waste Incineration		
A. Equipment	33,400,000	--
B. Construction	11,200,000	--
C. Land Acquisition	4,000,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	37,299,000	
E. Facility Operation and Maintenance	--	5,016,000
F. Ash Transport and Landfill Disposal	--	2,692,000
G. Less Average Annual Revenue	--	(10,225,000)
Subtotal	$85,899,000	-2,517,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$86,462,000	$19,811,000

Unit Cost = $26.43 per ton of solid waste.

[a]Does not include annual amortized capital cost of $7,539,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-5

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 5: PROCESSING OF A PORTION OF THE SOLID WASTES AT ONE NEW INCINERATOR DESIGNED FOR ELECTRIC POWER GENERATION WITH DISPOSAL OF UNRECYCLED AND UNINCINERATED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,488,000
III. Solid Waste Transfer	--	1,080,000
IV. Solid Waste Incineration		
A. Equipment	42,900,000	--
B. Construction	12,900,000	--
C. Land Acquisition	4,000,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	40,530,000	
E. Facility Operation and Maintenance	--	5,280,000
F. Ash Transport and Landfill Disposal	--	2,692,000
G. Less Average Annual Revenue	--	(6,610,000)
Subtotal	$100,330,000	1,362,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$100,893,000	$23,690,000

Unit Cost = $31.39 per ton of solid waste.

[a]Does not include annual amortized capital cost of $8,798,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-6

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 6: PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO NEW INCINERATORS DESIGNED FOR STEAM PRODUCTION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,173,000
III. Solid Waste Transfer	--	833,000
IV. Solid Waste Incineration		
A. Equipment	39,426,000	--
B. Construction	13,152,000	--
C. Land Acquisition	4,200,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	40,516,000	--
E. Facility Operation and Maintenance	--	5,662,000
F. Ash Transport and Landfill Disposal	--	2,656,000
G. Less Average Annual Revenue	--	(10,098,000)
Subtotal	$ 97,294,000	$ -1,780,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$ 97,857,000	$19,986,000

Unit Cost = $27.53 per ton of solid waste.

[a]Does not include annual amortized capital cost of $8,510,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-7

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 6A: PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO NEW INCINERATORS DESIGNED FOR STEAM PRODUCTION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS[a]

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[b]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	5,842,000
III. Solid Waste Transfer	--	653,000
IV. Solid Waste Incineration		
A. Equipment	47,416,000	--
B. Construction	15,873,000	--
C. Land Acquisition	4,200,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	46,808,000	--
E. Facility Operation and Maintenance	--	6,802,000
F. Ash Transport and Landfill Disposal	--	2,934,000
G. Less Average Annual Revenue	--	(11,841,000)
Subtotal	$114,297,000	$ -2,105,000
V. Solid Waste Landfill Disposal	--	13,136,000[c]
Total Cost[b]	$114,860,000	$17,995,000

Unit Cost = $27.06 per ton of solid waste.

[a]This alternative is the same as Alternative Plan 6 except that the incinerator located at the Americology Transfer Station site would have a capacity of 1,000 tons of solid waste per day as opposed to 800 tons of solid waste per day as provided for under Alternative Plan 6.

[b]Does not include annual amortized capital cost of $10,016,000.

[c]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-8

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 7: PROCESSING OF A PORTION OF THE SOLID WASTES AT THREE NEW INCINERATORS DESIGNED FOR STEAM PRODUCTION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,031,000
III. Solid Waste Transfer	--	913,000
IV. Solid Waste Incineration		
A. Equipment	36,288,000	--
B. Construction	11,700,000	--
C. Land Acquisition	4,400,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	40,449,000	--
E. Facility Operation and Maintenance	--	6,151,000
F. Ash Transport and Landfill Disposal	--	2,666,000
G. Average Annual Revenue	--	(9,964,000)
Subtotal	$ 92,837,000	$ -1,147,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$ 93,400,000	$20,557,000

Unit Cost = $27.73 per ton of solid waste.

[a]Does not include annual amortized capital cost of $8,144,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-9

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 7A: PROCESSING OF A PORTION OF THE SOLID WASTES AT THREE NEW INCINERATORS DESIGNED FOR STEAM PRODUCTION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS[a]

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[b]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	5,759,000
III. Solid Waste Transfer	--	748,000
IV. Solid Waste Incineration		
A. Equipment	41,688,000	--
B. Construction	13,500,000	--
C. Land Acquisition	4,400,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	45,749,000	--
E. Facility Operation and Maintenance	--	7,181,000
F. Ash Transport and Landfill Disposal	--	2,895,000
G. Less Average Annual Revenue	--	(11,707,000)
Subtotal	$105,337,000	$ -1,631,000
V. Solid Waste Landfill Disposal	--	13,136,000[c]
Total Cost[b]	$105,900,000	$18,481,000

Unit Cost = $26.78 per ton of solid waste.

[a]This alternative is the same as Alternative Plan 7 except that the incinerator located at the Americology Transfer Station site would have a capacity of 800 tons of solid waste per day as opposed to 600 tons of solid waste per day as provided for under Alternative Plan 7.

[b]Does not include annual amortized capital cost of $9,234,000.

[c]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-10

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 8: PROCESSING OF A PORTION OF THE SOLID WASTES AT FIVE NEW INCINERATORS DESIGNED FOR STEAM PRODUCTION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,163,000
III. Solid Waste Transfer	--	801,000
IV. Solid Waste Incineration		
A. Equipment	41,880,000	--
B. Construction	13,200,000	--
C. Land Acquisition	4,500,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	39,444,000	--
E. Facility Operation and Maintenance	--	7,055,000
F. Ash Transport and Landfill Disposal	--	2,740,000
G. Less Average Annual Revenue	--	(9,828,000)
Subtotal	$ 99,024,000	$ - 33,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$ 99,587,000	$21,691,000

Unit Cost = $29.35 per ton of solid waste.

[a]Does not include annual amortized capital cost of $8,684,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-11

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 8A: PROCESSING OF A PORTION OF THE SOLID WASTES AT FIVE NEW INCINERATORS DESIGNED FOR STEAM PRODUCTION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS[a]

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[b]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	5,877,000
III. Solid Waste Transfer	--	636,000
IV. Solid Waste Incineration		
A. Equipment	48,080,000	--
B. Construction	15,290,000	--
C. Land Acquisition	4,500,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	46,767,000	--
E. Facility Operation and Maintenance	--	7,965,000
F. Ash Transport and Landfill Disposal	--	3,032,000
G. Less Average Annual Revenue	--	(11,572,000)
Subtotal	$114,637,000	$ -575,000
V. Solid Waste Landfill Disposal	--	13,136,000[c]
Total Cost	$115,200,000	$19,543,000

Unit Cost = $28.59 per ton of solid waste.

[a]This alternative is the same as Alternative Plan 8 except that the incinerator located at the Americology Transfer Station site would have a capacity of 800 tons of solid waste per day as opposed to 600 tons of solid waste per day as provided for under Alternative Plan 8.

[b]Does not include annual amortized capital cost of $10,045,000.

[c]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-12

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 9: PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO NEW INCINERATORS DESIGNED FOR ELECTRIC POWER GENERATION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,173,000
III. Solid Waste Transfer	--	833,000
IV. Solid Waste Incineration		
A. Equipment	43,862,000	--
B. Construction	13,250,000	--
C. Land Acquisition	4,200,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	46,995,000	--
E. Facility Operation and Maintenance	--	5,928,000
F. Ash Transport and Landfill Disposal	--	2,656,000
G. Less Average Annual Revenue	--	(5,878,000)
Subtotal	$108,307,000	$ 2,706,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$108,870,000	$24,472,000

Unit Cost = $32.82 per ton of solid waste.

[a]Does not include annual amortized capital cost of $9,493,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-13

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 10: PROCESSING OF A PORTION OF THE SOLID WASTES AT THREE NEW INCINERATORS DESIGNED FOR ELECTRIC POWER GENERATION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,031,000
III. Solid Waste Transfer	--	913,000
IV. Solid Waste Incineration		
A. Equipment	41,409,000	--
B. Construction	12,900,000	--
C. Land Acquisition	4,400,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	45,488,000	--
E. Facility Operation and Maintenance	--	6,351,000
F. Ash Transport and Landfill Disposal	--	2,666,000
G. Less Average Annual Revenue	--	(5,857,000)
Subtotal	$104,197,000	$ 3,160,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$104,760,000	$24,864,000

Unit Cost = $32.85 per ton of solid waste.

[a]Does not include annual amortized capital cost of $9,135,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-14

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 11: PROCESSING OF A PORTION OF THE SOLID WASTES AT FIVE NEW INCINERATORS DESIGNED FOR ELECTRIC POWER GENERATION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,163,000
III. Solid Waste Transfer	--	801,000
IV. Solid Waste Incineration		
A. Equipment	48,209,000	--
B. Construction	15,600,000	--
C. Land Acquisition	4,500,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	47,968,000	--
E. Facility Operation and Maintenance	--	7,415,000
F. Ash Transport and Landfill Disposal	--	2,740,000
G. Less Average Annual Revenue	--	(5,148,000)
Subtotal	$116,277,000	$ 5,007,000
V. Solid Waste Landfill Disposal	--	14,291,000[b]
Total Cost[a]	$116,840,000	$26,731,000

Unit Cost = $35.67 per ton of solid waste.

[a]Does not include annual amortized capital cost of $10,188,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-15

DETAILED COST ESTIMATE
ALTERNATIVE PLAN 12: PROCESSING OF A PORTION OF THE SOLID WASTES INTO REFUSE-DERIVED FUEL, INCINERATION AT ONE NEW INCINERATOR DESIGNED FOR ELECTRIC POWER GENERATION WITH THE DISPOSAL OF UNRECYCLED AND UNINCINERATED SOLID WASTES, REFUSE-DERIVED FUEL RESIDUE, AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	6,728,000
III. Solid Waste Transfer	--	1,080,000
IV. Solid Waste Conversion to Refuse-Derived Fuel	9,348,000	500,000
V. Solid Waste Incineration		
A. Equipment	37,800,000	--
B. Construction	10,500,000	--
C. Land Acquisition	4,000,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	28,389,000	--
E. Facility Operation and Maintenance	--	4,831,000
F. Ash Transport and Landfill Disposal	--	770,000
G. Less Average Annual Revenue	--	(5,491,000)
Subtotal	$ 80,689,000	$ 110,000
VI. Solid Waste Landfill Disposal	--	15,677,000[b]
Total Cost[a]	$ 90,600,000	$24,564,000

Unit Cost = $31.37 per ton of solid waste.

[a]Does not include annual amortized capital cost of $7,900,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-16

DETAILED COST ESTIMATE
REFINED ALTERNATIVE A: PROCESSING OF A PORTION OF THE SOLID WASTES AT THREE NEW INCINERATORS--LOCATED AT THE AMERICOLOGY SITE AND TWO OTHER SITES IN THE COUNTY WITH A COMBINED CAPACITY OF 1,600 TO 1,800 TONS PER DAY--DESIGNED FOR STEAM AND ELECTRIC POWER GENERATION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	3,202,000
III. Solid Waste Transfer	--	520,000
IV. Solid Waste Incineration		
A. Equipment	60,892,000	--
B. Construction	19,118,000	--
C. Land Acquisition	4,400,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	65,000,000	--
E. Facility Operation and Maintenance	--	8,028,000
F. Ash Transport and Landfill Disposal	--	3,832,000
G. Less Average Annual Revenue	--	(7,480,000)
Subtotal	$149,410,000	$ 4,380,000
V. Solid Waste Landfill Disposal	--	12,495,000[b]
Total Cost[a]	$149,973,000	$21,066,000

Unit Cost = $32.99 per ton of solid waste.

[a]Does not include annual amortized capital cost of $13,078,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-17

DETAILED COST ESTIMATE
REFINED ALTERNATIVE B: PROCESSING OF A PORTION OF THE SOLID WASTES AT THREE NEW INCINERATORS--LOCATED AT THE COUNTY INSTITUTIONS SITE AND TWO OTHER SITES IN THE COUNTY WITH A COMBINED CAPACITY OF 1,600 TO 1,800 TONS PER DAY--DESIGNED FOR STEAM AND ELECTRIC POWER GENERATION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	3,591,000
III. Solid Waste Transfer	--	710,000
IV. Solid Waste Incineration		
A. Equipment	59,156,000	--
B. Construction	19,118,000	--
C. Land Acquisition	1,400,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	65,000,000	--
E. Facility Operation and Maintenance	--	8,028,000
F. Ash Transport and Landfill Disposal	--	3,819,000
G. Less Average Annual Revenue	--	(13,960,000)
Subtotal	$144,674,000	$-2,113,000
V. Solid Waste Landfill Disposal	--	12,495,000[b]
Total Cost[a]	$145,237,000	$15,152,000

Unit Cost = $26.88 per ton of solid waste.

[a]Does not include annual amortized capital cost of $12,665,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix F-18

DETAILED COST ESTIMATE
REFINED ALTERNATIVE C: PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO NEW INCINERATORS--LOCATED AT THE AMERICOLOGY SITE AND THE COUNTY INSTITUTIONS SITE WITH A COMBINED CAPACITY OF 1,600 TO 1,800 TONS PER DAY--DESIGNED FOR STEAM AND ELECTRIC POWER GENERATION WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

Plan Subelement	Initial Capital Costs	Average Annual Operation and Maintenance 1990-2010[a]
I. Residential Solid Waste Recycling	$ 563,000	$ 469,000
15 at 19,800 = $297,000		
Subtotal $562,600	$ 563,000	
Capital - 8 @ 33,200 = $265,600		
15 @ 19,800 = 297,000		
Subtotal $562,600	$ 563,000	
O&M - 8 @ 27,700 = $221,600		
15 @ 16,500 = 247,500		
Subtotal $469,100		$ 469,000
II. Solid Waste Transportation	--	4,173,000
III. Solid Waste Transfer	--	832,000
IV. Solid Waste Incineration		
A. Equipment	57,752,000	--
B. Construction	17,701,000	--
C. Land Acquisition	4,000,000	--
D. Engineering, Environmental, and Legal Costs; Contingency, and Interest During Construction	60,711,000	--
E. Facility Operation and Maintenance	--	7,656,000
F. Ash Transport and Landfill Disposal	--	3,822,000
G. Less Average Annual Revenue	--	(14,240,000)
Subtotal	$140,164,000	$ -2,762,000
V. Solid Waste Landfill Disposal	--	12,495,000[b]
Total Cost[a]	$140,727,000	$ 15,207,000

Unit Cost = $26.60 per ton of solid waste.

[a]Does not include annual amortized capital cost of $12,320,000.

[b]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

See Appendix E for more detail.

Source: SEWRPC.

Appendix G

NEWSPAPER ARTICLES AND NEWS RELEASE PERTAINING TO MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN

Garbage: Trouble that can't be tossed aside

THE MILWAUKEE JOURNAL
March 3, 1985

By Lawrence C. Lohmann
of The Journal Staff

Take an ellipse the size of Milwaukee County Stadium. Fill it with garbage to a line 17 feet below the upper grandstand roof, just above the top row of seats.

What you would have is a cylinder of garbage 770 to 780 feet in diameter and 95 feet high, the equivalent of all the residential solid waste generated each year in Milwaukee County.

Put another way, that is 420,000 tons or 45 million cubic feet of garbage.

Add to that an estimated 700,000 tons of industrial and commercial waste that is collected in Milwaukee County each year. That would fill up a second stadium and much of a third.

Of course, nobody is planning to dump garbage in the Stadium, especially not if the Brewers have a winning season this year. The vision of the ballpark brimming with solid waste is merely a way of illustrating that the Milwaukee area generates large amounts of solid waste each year.

And while the volume is increasing, the sanitary landfills in which the refuse can be dumped safely and economically are dwindling. The cost to Milwaukee County communities, meanwhile, was $57 million in 1983 for collection, transportation and disposal.

At their current rate of use, the major landfills in southeastern Wisconsin have an estimated seven years of capacity left, according to the State Department of Natural Resources.

That diminishing landfill life, plus the rising costs of disposal and an increasing awareness of environmental dangers have generated great concern in nearly every community in the Milwaukee area. Officials like David Kuemmel, Milwaukee's commissioner of public works, say there is no more serious problem facing local governments.

"It is very critical," Kuemmel said. "All our landfills are ticking time bombs, in my opinion, and we don't know when they will go off. We're anxious to get out of landfilling and into some other mode of disposal."

He added that the solution probably would be incineration. Throughout the United States there has been a proliferation of solid waste incineration systems that produce some form of salable energy.

"We can bury the waste underground or dump it in the water or put it in the air, and all three are becoming polluted," he said. "What this means is that it it going to cost us a lot of money to protect the environment, so that no matter where we put our solid waste it is environmentally safe."

Countywide task force

Others also are worried. Indeed, the waste disposal problem has become so pervasive that officials of Milwaukee County, the City of Milwaukee and suburb-dominated Intergovernmental Cooperation Council have put aside their differences to create a countywide task force to study the problem.

It has caused ordinarily fractious communities to unite.

"Everybody is cooperating," said Brian Bowser, the city's resource recovery manager.

Armed with a $100,000 grant from the state, the task force has put the Southeastern Wisconsin Regional Planning Commission to work on a study to determine what choices Milwaukee County communities have.

It could lead to a recommendation to build one or more incinerators to burn residential solid waste, if customers can be found to buy the energy byproduct. Finding uses for energy is the key, officials say.

The concern over waste disposal also has spurred satellite efforts toward solution of solid-waste problems. They include:

Studies by a consortium on the possibility of using household wastes to generate high-yield methane to operate municipal vehicles. The consortium, made up of Rexnord, Wisconsin Gas Co., the City of Milwaukee, Milwaukee County and American Can Co., also has begun studying the possibility of producing methane from garden wastes and grass clippings.

A study by the city and the Metropolitan Sewerage District to determine whether energy from an incinerator could be used to provide electrical power for district plants and facilities.

An application by the city for a grant from the federal Environmental Protection Agency to study possible expansion of the central business district's steam distribution system to use steam or hot water generated by waste incineration.

Talks between the city and Wisconsin Electric Power Co. that could lead to use of power produced by incineration for the city water system and city street lights.

Negotiations leading to the possible purchase by Waukesha County of the Waukesha city incinerator — the only one in the Milwaukee area still operating. The county would expand the incinerator's capacity.

Discussions in Port Washington on the reactivation of the city incinerator to burn garbage from Port Washington and neighboring communities.

Solid waste from every community in the Milwaukee area winds up in a sanitary landfill. The dump is the end of a costly process that starts at the curbside where residents place their garbage for collection.

In addition to collection, the process includes the transportation of wastes to transfer sites or landfills, and finally disposal. Combined, the three components make the process the third most expensive municipal service, behind police and fire protection.

$70 a ton

In 1983, Milwaukee County communities spent an average of about $70 a ton, or about $29 million, to collect their garbage, according to the regional planning commission. The cost of transporting and disposing it was $25 a ton, or about $28 million a year.

Most communities in Milwaukee County use their own trucks to make collections. In most communities outside the county, collections are made by waste contractors who are hired either by the municipality or by the

— *Journal Photo by John A. Ehlers*

Bulldozers worked to move huge piles of garbage at the Omega Hills landfill in Germantown

Incineration may be alternative to building mounds of garbage

individual homeowner.

Milwaukee alone spends almost $20 million a year to collect residential garbage and $7 million to dispose of it a under contract with Waste Management of Wisconsin, according to William Kappel, superintendent of the Bureau of Sanitation.

Waste Management operates the area's main landfills: Omega Hills in Germantown, Metro in Franklin and Muskego in Muskego, which serve up to 75% of the area's communities.

A fourth major landfill is operated by Land Reclamation, in the town of Mount Pleasant. It is used primarily for the City of Racine and Racine County communities.

650 tons a day

In Waukesha County, about 650 tons of refuse is collected daily and most is taken to the Waste Management landfills or to Mayville, according to Richard Mace, assistant county planning director.

But the City of Waukesha still operates its own incinerator, burning about 120 tons of garbage waste picked up in Waukesha and neighboring communities daily. Steam produced by the plant is sold to the city and to an industrial firm.

At Omega Hills, in Germantown, the state's largest landfill, two years of space is available in the northern part and five years in the unopened Omega Hills South, according to Arthur H. Glor, chief of solid waste management for the DNR's Southeastern District.

Waste Management still has not obtained final approval from the DNR to operate the southern section of the site, across the border in Menomonee Falls.

At Waste Management's Metro landfill in Franklin, about five years of space is left and there is only one year's space left at the Muskego site, according to Glor.

The Land Reclamation site has about 15 years of life, he estimated.

"We will always need landfills, but obviously something else could be done to reduce the need," Glor said. "I see the things the City of Milwaukee is looking at as being the trend of the future."

Bowser, the city's resource manager, says that trend is toward construction of incinerators that produce energy that can be sold.

"There are about 120 such systems in the US so far, an explosion of waste-to-energy," Bowser said. "Every major city has something going."

He said he was optimistic that a waste-to-energy system could be developed here, but that the key would be to find customers for the energy. Without them the project would be too expensive, he said.

Study may be done

If the EPA approves the city's request for a $40,000 grant, a team will study whether steam or hot water produced from the process of incinerating garbage could be piped underground to industries, businesses and city public housing projects in an area bounded by the northern edge of the Downtown, the lake, the North-South Freeway and North Ave.

Solid waste has been the subject of many studies made for city, county and suburbs over the last 20 years. One of them resulted in construction of a resource recovery system for the city by the Americology Division of American Can Co.

Burn it or bury it: the garbage choice

THE MILWAUKEE JOURNAL
March 15, 1985

By DAVE HENDRICKSON
of The Journal staff

The City of Milwaukee is flirting with the idea of beginning the most expensive public works project in its history, but it has a question to answer first:

Is it necessary?

The question is not as simple as it seems.

The project is a waste-to-energy plant — a huge incinerator that could burn 1,000 tons of garbage a day and generate electricity with steam.

Public Works Commissioner David Kuemmel estimates the cost of building the incinerator at $120 million. Others say the price easily could hit $150 million.

Optimistically, Kuemmel says, construction could begin in April 1989 and be completed in June 1992 — just as the city's landfill contract with Waste Management expires.

Kuemmel warns that delays could cost the city $1 million a month in 1992 — what the city would pay Waste Management to continue hauling garbage.

Until a few weeks ago, it seemed the Common Council had given its blessing to the project, or at least had condoned the work being done.

Last year, Kuemmel asked for $1.5 million for engineering and environmental studies. That amount, he says, would have given the city the information it needed to make a thumbs up or thumbs down decision.

The council gave him $350,000 and tentatively agreed to a bond issue this year for the remaining $1.15 million.

But in January, the $350,000 was rescinded for accounting purposes, and when it came back for reapproval in February, the council hit the brakes.

It agreed to spend $50,000 for a financial feasibility study, but decided to hold off on spending the remaining $300,000 on engineering and environmental studies.

As Ald. Steven Cullen put it: "We decided that we shouldn't study this until we study what we're going to study."

Was the change caused by skittishness over spending $120 million? Or was it a display of clout by

Kuemmel and Katzman both have convincing arguments. Kuemmel has support from another public engineer — Kurt Bauer, director of the Southeastern Wisconsin Regional Planning Commission. The commission is wrapping up a countywide plan for garbage disposal. Bauer said it would recommend building two incinerators.

The city now pays about $28 a ton to Waste Management. Kuemmel says the cost of sending garbage to a landfill has increased about 11% a year since 1971, when the city was paying about $6 a ton.

By national standards, that is still relatively cheap, Kuemmel says. "On the East Coast [where the prices are the highest], prices of $50 to $100 a ton are not uncommon."

As important as the argument over the costs is the argument over the damage to the environment: Which hurts more, a landfill or an incinerator?

Kuemmel says incinerator technology has improved so much that the effect is negligible. Standing outside of one would have about the same effect as smoking two cigarets a year, he says.

Bauer adds: "There are worse horror stories with landfills than with incinerators. Every one of the damn things leaks, and once it gets into the ground water, what are you going to do about it?"

Katzman, not surprisingly, disagrees with everything Kuemmel and Bauer have to say. But that is not a mere reflection of his business interest, he says.

"If the city wants an incinerator and the city wants to pay $50 a ton instead of $15, I'm going to be the first guy in line," Katzman says.

He dismisses environmental arguments against landfills and Bauer's comment as "ignorance of how the new sites are engineered."

And he doesn't believe the city will run out of landfill space in the foreseeable future or that a 1,000-ton-a-day incinerator would cover the city's waste disposal needs.

No matter what the Common Council ultimately decides to do, some people will be dissatisfied, Katzman says.

"What we tell people is, 'Look, there's only three places on this Earth where we can put your garbage. We can dump it in the water — that's not acceptable. We can bury it in the ground, or we can dump it in the air.'

" 'Now where do you want us to dump it? It's not our garbage, it's your garbage. Where do you want us to dump it?' "

William Katzman, president of Waste Management of Wisconsin? His name can be found next to large numbers on most campaign finance statements in City Hall.

Katzman acknowledges calling several aldermen and receiving calls from others. He told them, quite frankly, that the city doesn't need an incinerator.

"We don't think there is a waste disposal crisis," he says.

Katzman does have the aldermen's collective ear, but he doesn't think that can be traced to campaign contributions.

"More than influence, it's respect for our company," he says. "We've provided the city with waste disposal services for more than 17 years now and have never missed a day.

"I resent very much the implication that we're stealing $9 million a year out of the city. That's what got my back up. I felt that we were unfairly being put in the middle of things and that's when I went and talked to some people."

Council President John R. Kalwitz says Katzman "has what I consider to be a good relationship with members of the Common Council. . . . [He] can offer the city advice that it's not obliged to take."

Kalwitz adds: "There's nobody that I know of, including Bill Katzman, that's going to dictate what the council is going to do."

Your trash and its travels

Where does your garbage go today?

If you live in West Allis or West Milwaukee, it goes to the Browning & Ferris landfill in Lake County, Illinois.

If you live in Bayside, it's Hechimovich's landfill in Dodge County.

If you live in Brown Deer, it's the Magnus landfill in Fond du Lac County.

If you live in Shorewood, Whitefish Bay or certain neighborhoods of Milwaukee, your garbage is trucked off to Omega Hills in Germantown.

And if you live in the majority of Milwaukee neighborhoods or Oak Creek, it's to the Metro landfill in Franklin.

Most of the City of Milwaukee's household trash — which weighs in at about 300,000 tons each year — goes to Metro, which is owned by Waste Management of Wisconsin. The company, part of an international waste disposal corporation, also owns Omega Hills.

What about Wauwatosa? The garbage carried out the back door of Wauwatosa households is trucked south to the Land Reclamation landfill in Mount Pleasant, southwest of Racine.

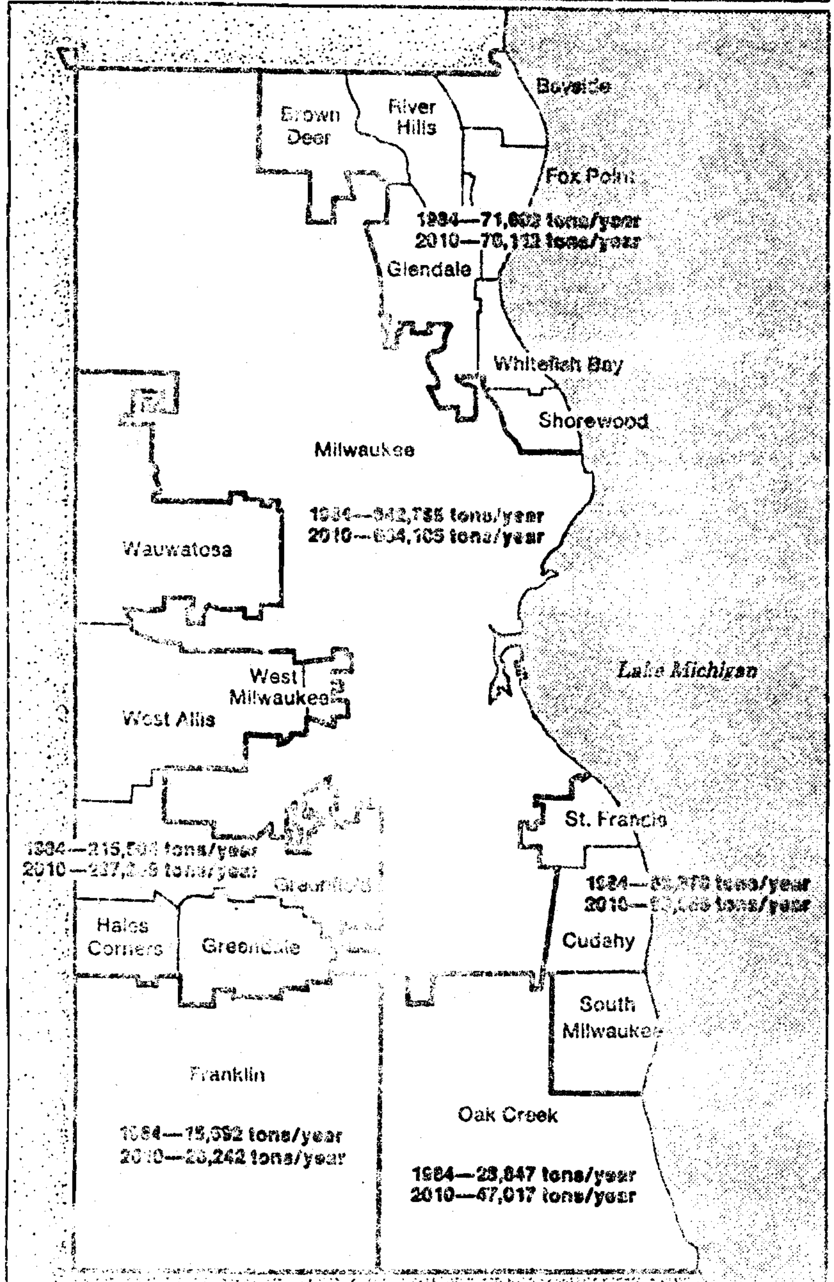
Greenfield residents send their garbage to Waste Management's landfill in Muskego.

The county's household garbage travels many miles across state and county highways before it is dumped onto one of seven fast-growing trash heaps somewhere. Only one of the seven — the Metro landfill in the far southwestern corner of Franklin — is in Milwaukee County.

The traffic pattern of garbage trucks carrying refuse away from metropolitan communities would form a criss-crossed web on a map. One year ago, the State Department of Natural Resources counted 150 garbage hauling companies driving through the alleys of southeastern Wisconsin communities.

THE MILWAUKEE JOURNAL
March 24, 1987

Milwaukee County waste: now and in the future



Source: Southeastern Wisconsin Regional Planning Commission

Burn or recycle but don't bury, waste plan urges

By DON BEHM
Journal environment reporter

The garbage disposal habits of Milwaukee County communities would be dramatically altered after 1991 under preliminary waste management recommendations prepared by the Southeastern Wisconsin Regional Planning Commission.

The 10 cities and 9 villages of Milwaukee County send a total of 447,500 tons of household garbage each year to one of seven landfills, six of them in southeastern Wisconsin and one in northern Illinois. The waste load from county households is expected to increase to about 515,560 tons a year by 2010.

To reduce the total flow of waste trucked to landfills and reduce future dumping costs, a countywide disposal plan calls for building two garbage incinerators and establishing 23 recycling centers. The plan also envisions 21 composting centers for tree limbs, leaves and brush.

The disposal plan's basic theme is simple: burn or recycle most household garbage, and bury as little of it as possible.

The costs are high: an estimated $141.7 million. Construction of two incinerators would cost approximately $140,727,000. That estimate does not include financing costs and some engineering design costs, Biebel said.

In addition, the cost of building 23 recycling centers would be $563,000. The price tag for setting up 21 composting sites would be about $340,000. The equipment for a newsprint recycling system would cost about $40,000.

The two incinerators could easily burn up to 420,000 tons of household garbage each year, or 85% of the total residential waste that could not be recycled, according to the plan.

All of the regional planning commission's incineration ideas assume that the burning could be accomplished within existing clean-air rules. The plan also has the potential for reducing ground water pollution caused by the dumps.

The recommendation to shift from dumping to burning is based on the regional planners' conclusion that landfill disposal costs will steadily increase. Dumping garbage into landfills will cost about $47 per ton by 2010, more than double today's cost of $21 per ton, the planning commission said. Burning it would cost $42 per ton in 2010, or $5 per ton less, if incinerator operators were able to sell steam produced by the incinerators, it said.

The cost savings would be more substantial if the value of the steam sold to a utility or public institution increased by an inflation rate of 8% each year, the commission said. By 2005, for example, the revenue from steam sales would be greater than total incinerator disposal costs. The net cost of incineration, at that time, would be zero. Landfill disposal costs, on the other hand, would have increased to about $38 per ton by 2005.

The first incinerator would be built in the Menomonee Valley by 1991, according to the plan.

Richard Keyes, an environmental engineer with the Milwaukee County Public Works Department, said Monday that the first incinerator would be built with a capacity to burn 800 to 1,200 tons of garbage each day.

Asked for his opinion on the need for building incinerators and reducing the county's future reliance on landfills, Keyes said: "I think that's the way we're going to have to go."

A second incinerator should be built about 15 years later at the Milwaukee County Regional Medical Center in Wauwatosa, solid waste researchers with the commission recommended. If the medical center site is not approved, the draft plan recommends building two smaller incinerators to replace it. One of the smaller-scale incinerators would be built on Milwaukee's Northwest Side and the second would be built in Oak Creek, near the South Shore sewage treatment plant.

Milwaukee Public Works Commissioner David Kuemmel also wants to build a garbage incinerator, one capable of burning up to 1,000 tons of garbage each day. But Common Council members are balking at spending $120 million or more for constructing and financing the project.

If the city builds an incinerator for itself in the next decade, a county waste authority should be established to purchase the incinerator from the city and operate it as part of a countywide disposal program, according to Robert Biebel, chief environmental planner for the planning commission.

The 23 recycling centers recommended in the plan, to be scattered around the county, could easily remove up to 25,000 tons of newsprint, glass, aluminum and plastic from the total flow of household wastes, the researchers concluded. The number of future recycling centers in Milwaukee County is mandated by recent amendments to state solid waste laws.

In addition, the plan encourages county communities to sponsor special collections of hazardous household wastes at a total of 10 sites each year. To date, no Milwaukee County community has sponsored a special collection for toxic and other hazardous household wastes.

The plan's preliminary recommendations will be reviewed next month by a task force of public officials representing most of the communities in Milwaukee County. At least one public hearing will be held to review the recommendations, Biebel said.

Under the plan, Milwaukee County communities would continue to use two large commerical landfills for disposal of incinerator ash and other household wastes that could not be burned or recycled.

THE MILWAUKEE JOURNAL
March 24, 1987

Daniel Cupertino, Jr.
Supervisor
17th Supervisory District
Milwaukee County
Courthouse Room 201
901 N. 9th Street
Milwaukee, Wisconsin 53233

DATE: May 6, 1987

TO: Milwaukee County Newspapers

With the process of preparing a solid waste management study for Milwaukee County nearing completion, public review and comment on the findings and recommendations of the study are being sought. The Milwaukee County Solid Waste Management Planning Task Force guiding the planning work has directed the staff to prepare informational materials on this subject for public dissemination prior to a public hearing on the plan. Attached is a brief description of the preliminary recommended plan produced by the study and an announcement of the public hearing date.

The public hearing for the Milwaukee County Solid Waste Management Plan is a crucial step in the planning process. Your assistance in informing the public would be greatly appreciated and would constitute an important service to your readers.

The Committee members and technical staff listed on Attachment B are available for any questions you may have.

Sincerely,

Daniel Cupertino, Co-Chairman
Milwaukee County Solid Waste
Management Planning Task Force

DC/ib
Enclosures

Member: Energy, Environment & Extension Education • Housing and Community Development • Transportation & Public Works

Attachment A

Milwaukee County Solid Waste Management Plan Informational Release

PUBLIC HEARING SET FOR COUNTY SOLID WASTE PLAN

A public hearing on a preliminary Milwaukee County Solid Waste Management Plan has been scheduled for Thursday, May 14, 1987, at 1:30 p.m., in the Milwaukee County Courthouse Annex Assembly Room, 907 N. 10th Street.

The hearing was announced by the Milwaukee County Solid Waste Management Planning Task Force--a committee created jointly by Milwaukee County, the Intergovernmental Coordinating Council, and the City of Milwaukee to guide the solid waste planning in the County. A technical subcommittee of that Task Force has guided a two-year study of solid waste management needs in Milwaukee County and has recommended a preliminary plan to meet those needs through the year 2010. The preliminary plan, which will be presented at the public hearing, consists of seven components:

1. The use of proper storage practices for solid wastes, including use by residents of galvanized metal cans, heavy-duty plastic trash cans, heavy-duty plastic bags, or where applicable, specialized larger capacity carts designed for mechanized collection.

2. Source separation of solid wastes and a recycling program in which residents would take paper, glass, and metals to recycling centers located at 23 sites and composting operations at 21 sites throughout the County;

3. A countywide household toxic and hazardous waste management program of 10 annual "special collections" for household products containing toxic and hazardous substances and a special information and education program regarding proper use and disposal of such materials.

4. The continued use of existing municipal and private garbage collection and transportion operations;

5. A system for transfering solid wastes from one type of vehicle to another prior to disposal, including the continued use of the eight existing transfer stations.

6. The construction of incinerator facilities in two phases to burn a portion of the solid wastes in order to produce steam or electricity.

7. The continued use of existing landfills located within and near Milwaukee County and the siting of new special use landfills for the disposal of the materials which are not incinerated or recycled and incinerator ash.

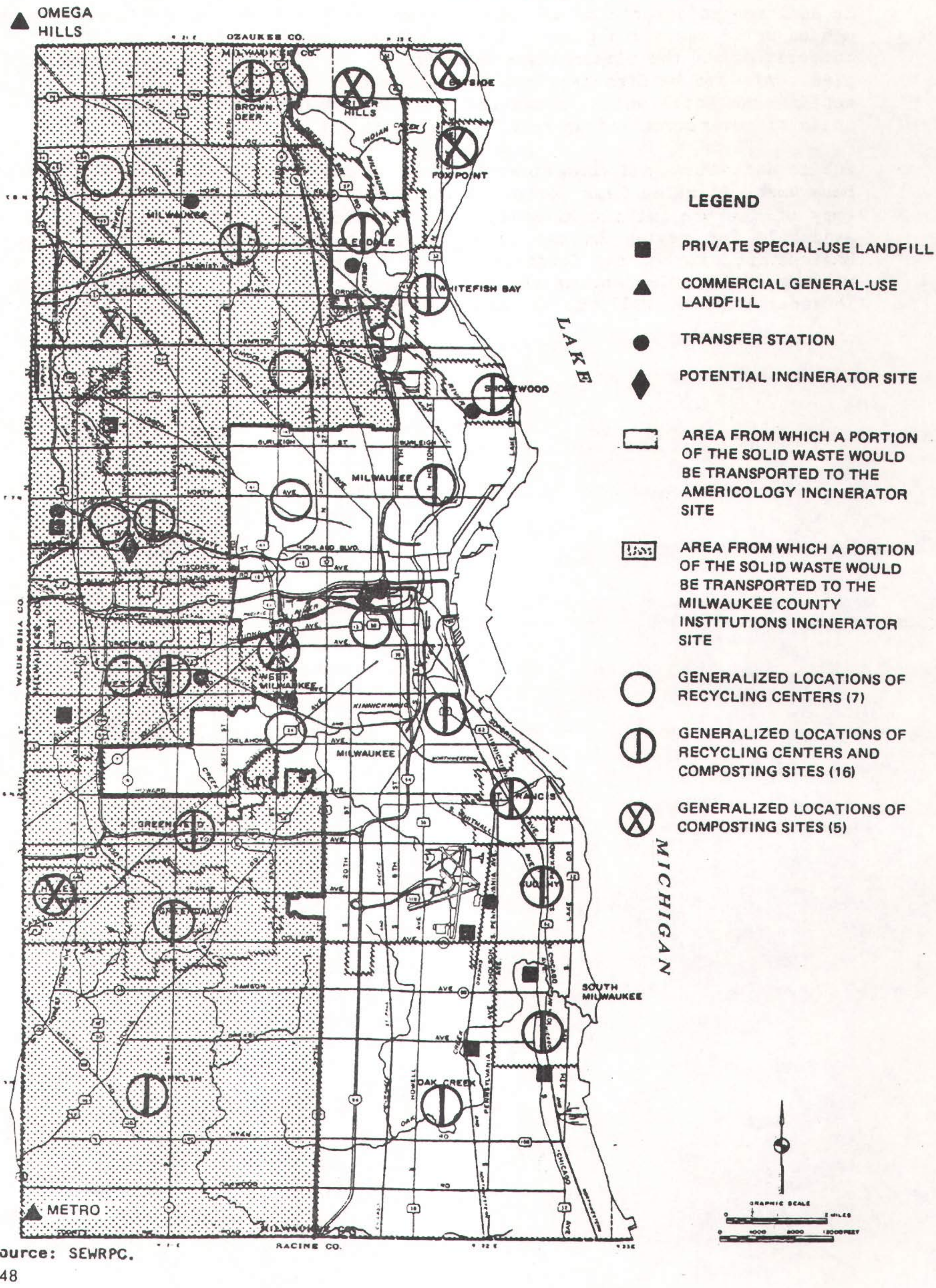
The accompanying map shows the location of the various solid waste management facilities proposed for use under the preliminary recommended plan and an alternative recommended plan. (EDITORS NOTE: STRIKE PRECEDING SENTENCE IF MAP IS NOT PRINTED).

In addition to describing the seven major components of the preliminary recommended solid waste management plan, the May 14 hearing will be used to present information on the alternatives considered, and the costs of implementing the plan. Also to be discussed are the recommended means and schedule for implementing the solid waste management plan and the responsibilities of various units of government and agencies in carrying out the plan.

Public attendance and comment at the hearing are encouraged by the Solid Waste Management Planning Task Force. For persons unable to attend the hearing, a copy of the preliminary Milwaukee County Solid Waste Management Plan will be available for review at the Milwaukee County Public Works, Department of Engineering, Energy and Environment, 907 N. 10th Street. Written coments are welcome at any time during the review period, and may be submitted through Thursday, May 28, 1987, to the above address.

Map 1

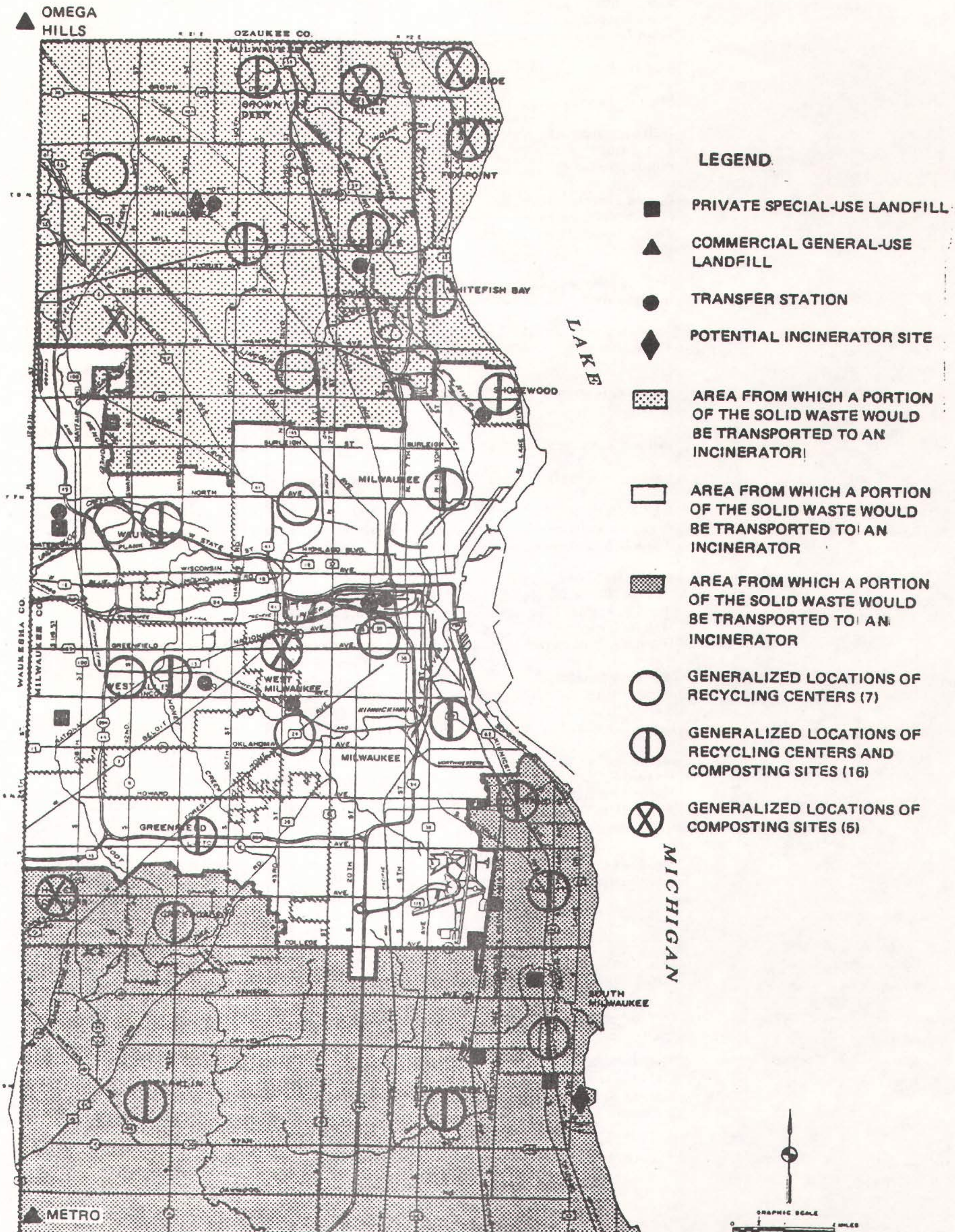
PRELIMINARY RECOMMENDED SOLID WASTE MANAGEMENT PLAN



Source: SEWRPC.

Map 2

ALTERNATIVE RECOMMENDED SOLID WASTE MANAGEMENT PLAN TO
BE USED IF THE COUNTY INSTITUTIONS INCINERATOR SITE PROVES NOT VIABLE



Source: SEWPRC.

Milwaukee County Solid Waste Management Planning Task Force

Attachment B

Daniel Cupertino, Jr. . . . . Supervisor, Milwaukee County Board
Co-Chairman
Robert A. Anderson . . . . Alderman, City of Milwaukee
Co-Chairman
Jack Barlich. . . . . Mayor, City of West Allis
Co-Chairman
Susan L. Baldwin. . . . . Supervisor, 21st District, Milwaukee County
Kurt W. Bauer* . . . . Executive Director, Southeastern Wisconsin Regional Planning Commission
Brian Bowser* . . . . Resource Recovery Coordinator, City of Milwaukee
James A. Brundahl . . . . Mayor, City of Wauwatosa
F. R. Dengel . . . . President, Village of Fox Point
Paul R. Erickson* . . . . Director, Enviro Energy Technology Center, Rexnord, Inc.
Donald Fieldstad, Jr. . . . . Manager, Village of Greendale
Chester M. Grobschmidt . . . . Mayor, City of South Milwaukee
Paul A. Henningson. . . . . Alderman, City of Milwaukee
Robert H. Holder* . . . . Vice-President and Chief Engineer, Wisconsin Gas Company
Norbert J. Hynek . . . . Mayor, City of Glendale
Ronald Jurvis . . . . General Electric Medical Systems Business Group
David A. Kaczynski. . . . . Mayor, City of Greenfield
William Kappel* . . . . Superintendent, Sanitation Services, City of Milwaukee
Robert W. Kasten . . . . President, Village of River Hills
Lawrence P. Kelly . . . . Mayor, City of Cudahy
Lawrence J. Kenny . . . . Supervisor, 8th District, Milwaukee County
Richard A. Keyes* . . . . Environmental Engineer, Milwaukee County
David A. Kuemmel* . . . . Commissioner of Public Works, City of Milwaukee
John J. Mann. . . . . President, Village of Shorewood
F. Patrick Matthews . . . . President, Village of Whitefish Bay
Gloria L. McCutcheon. . . . . Director, Southeast District, Wisconsin Department of Natural Resources
Earl W. McGovern . . . . President, Village of Brown Deer
Mark E. Miazga . . . . Mayor, City of Franklin
Henry J. Poehler . . . . President, Village of Hales Corners
Fred R. Rehm* . . . . Environmental Consultant
Thomas J. Rutkowski* . . . . Corporate Energy Manager, Briggs & Stratton Corporation
Milo G. Schocker. . . . . Mayor, City of Oak Creek
Jenny Schuler . . . . President, Village of West Milwaukee
Fred C. Schulz*. . . . . President, EnerVation, Inc.
Gerald Schwerm* . . . . Director of Transportation, Milwaukee County
Joseph A. Tanski. . . . . Manager, Village of Bayside
Howard R. Tietz . . . . Alderman, City of Milwaukee
Milton Vretener. . . . . Mayor, City of St. Francis
Alphonse E. Zanoni*. Professor, Department of Civil Engineering, Marquette University

*Member of Countywide Technical Coordinating and Advisory Committee, a subcommittee of the full Task Force.

Additional Countywide Technical Coordinating and Advisory Subcommittee Members not Included on the Full Task Force

Shirl C. Abbey. . . . . Manager, Village of Shorewood
Christine B. Bastian. . . . . Representative, City of Oak Creek
John M. Bennett . . . . City Engineer, City of Franklin
Joseph P. Heil, Jr. . . . . Representative, Village of River Hills
LeRoy Krafcheck . . . . Director of Public Works, City of West Allis
Fred J. Patrie. . . . . Administrator, Village of West Milwaukee
Gerald J. Seeber . . . . Manager, Village of Brown Deer
Norbert S. Theine . . . . Administrator, City of South Milwaukee
S. Howard Young . . . . Engineering and Operations Administrator, City of Wauwatosa

Milwaukee County Department of Public Works Staff:

Gerald Schwerm - 278-4835
Carl W. Birks - 278-4874
Richard A. Keyes - 278-4936

SEWRPC Staff:

Kurt W. Bauer - 547-6721
Robert P. Biebel - 547-6721

New pickup urged for home wastes

By DON BEHM
Journal environment reporter

A separate collection system for hazardous household wastes is needed in Milwaukee to ensure that chemical and petroleum wastes are not dumped into landfills along with regular household trash, according to a city health official.

The hazardous wastes eventually leak out of garbage dumps and contaminate ground water, according to George Kupfer, director of the Health Department's Bureau of Consumer Protection and Environmental Health. And liquid hazardous wastes dumped down storm sewers are flushed into the Milwaukee River and Lake Michigan.

While Kupfer and others wait for a separate collection system, he said city residents should call state environmental officials for information on proper disposal methods.

Spring cleaning of basements and garages, for example, may uncover a forgotten and certainly unwanted cache of hazardous chemical and petroleum wastes.

Waste oil, old gasoline, pesticides, lead-based paints, cleaning solvents, caustic drain cleaners, mouse poisons, wood preservatives and used car batteries often are rediscovered on storage shelves at this time of year.

Although you may have put the containers in an old box, you should not throw the box into a garbage collection cart or can, state health and environmental officials say. And don't dump liquid wastes down storm sewers or the sink in your basement, they say.

So what can you do?

For residents of Milwaukee County, there are no easy answers to the question.

Milwaukee County households toss out up to 250 tons of hazardous wastes each year, according to the Southeastern Wisconsin Regional Planning Commission. Those wastes are dumped into landfills along with the rest of the county's municipal trash.

To date, no Milwaukee County community has sponsored a special collection for accumulated toxic and hazardous wastes. Kupfer estimates that a one-day special collection for city of Milwaukee residents would cost more than $100,000 and perhaps as much as $250,000, depending on the volume of wastes turned in.

"For a one-shot pickup, the amount of money it would cost the city is tremendous," he said. "And the experience of other cities indicates that only about 2% of all households participate in the one-day collections."

For those two reasons, Kupfer is pushing the idea of an ongoing separate collection system for hazardous household wastes.

In addition, a minor incentive for communities considering one-day special collections — a state grant program that would have paid each community up to $15,000 — has been eliminated, Kupfer said.

Around the state, special collections of hazardous household wastes have been offered in only 13 counties since 1984, according to the University of Wisconsin Extension in Madison.

Waukesha County sponsored a one-day collection of hazardous household wastes in May 1986. It took in 1,052 gallons of hazardous liquid wastes and 953 pounds of solid hazardous wastes from 228 households in the county. The wastes included 280 pounds of DDT and 75 pounds of lead-arsenate, both of which are banned from use. Waukesha County plans another one-day collection in October.

In Milwaukee County, the Southeastern Wisconsin Regional Planning Commission has recommended special collection days for the wastes at a total of 10 county sites each year. The once-a-year collections would cost about $325,000, the planning commission said.

The planning commission, in a draft report of a solid waste management plan for Milwaukee County, acknowledged that the limited, 10-site program would collect only 10 tons of toxic and hazardous wastes, or 4% of the estimated total of those wastes now discarded along with household trash.

However, the proposed hazardous household waste collection program should be considered a temporary program until a regional or statewide hazardous waste collection system is available, the planning commission said.

AT A GLANCE

How to get information

For information on proper methods of disposing of hazardous household wastes, contact state or local health and environment officials.

- **Poison information centers:** Madison — (608) 262-3702; Milwaukee — (414) 931-4114; Green Bay — (414) 433-8100; Eau Claire — (715) 835-1515; La Crosse — (608) 784-3971
- **Department of Natural Resources:** Southern District, Madison — (608) 275-3266; Southeast District, Milwaukee — (414) 562-9500; Lake Michigan District, Green Bay — (414) 497-4040; West Central District, Eau Claire — (715) 839-3700; North Central District, Rhinelander — (715) 362-7616; Northwest District, Spooner — (715) 635-2101
- **County offices:** Contact your county courthouse for the telephone numbers of public health departments, extension offices or county solid waste departments.

THE MILWAUKEE JOURNAL
May 11 1987

Cities may burn garbage

Countywide incineration plan costs $141 million

Garbage from Milwaukee and the 16 suburbs surrounding the area will be disposed of by incineration within the next 10 years if all of these units of government agree.

Plans for the countywide incineration plan will be presented to the Milwaukee County Board of Supervisors at its meeting this week and later this year to all of the cities expected to join the plan.

The new method of disposing of the county's mounting pile of daily garbage was proposed by the two-year-old Solid Waste Management Task Force. It is headed by Milwaukee County Supervisor Daniel Cupertino of the 17th District on the South Side.

Of seven alternatives for solid-waste disposal by the year 2000, the committee narrowed down the seven possible choices to one--incineration. Cost of the massive 20-year project is $141 million. The plan calls for construction of two incinerators; a city of Milwaukee-built one at the former Americology plant in the Menomonee Valley at a cost of $74.96 milion, and a second county-financed one costing $65.77 million on the county institution grounds in Wauwatosa.

Milwaukee and all of the suburbs will haul the bulk of their refuse to these locations after first separating metals, glass, wastepaper and hazardous materials. Cudahy, St. Francis and South Milwaukee would haul their trash to a solid-waste transfer station in Cudahy on Pennsylvania Avenue. The trash, free of foreign materials, would then be trucked to the Milwaukee incinerator.

Trash from these cities now is disposed of at a landfill in Franklin operated by Waste Management Inc.

Estimated cost of the incineration process is $27 per ton, about what it now costss these same cities to dispose of refuse. However, these costs are escalating each year as landfill space is disappearing.

Cities will sell the recycled materials they separate from the trash to recoup some of their costs.

"It is important to recycle some materials in trash because the incinerator just won't handle it," Cupertino said of metals, glass and some hazardous materials. He said it was failure to do this that caused the Americology plant to have problems and, eventually, close.

Milwaukee and Milwaukee County will recover some of their costs by selling steam generated at the two incinerators to both commercial customers and both the city and county. Wisconsin Electric Power Co. has a number of commercial steam customers in downtown Milwaukee.

Still to be evaluated is the environmental effect of burning refuse. Cupertino said it is inevitable some hazardous materials will get into the garbage and be burned.

Between this and pollution from previous incinerators used in Milwaukee County, including the city of South Milwaukee, this method of refuse disposal disappeared 20 years ago.

"Today there is new technology and there is more technology in this field all of the time," Cupertino said. "The $141 million price tag on this package is using the technology we have today. By the time it begins and the 20 years it will take to complete the entire program, things could change dramatically."

Cities across the United States are studying a variety of garbage-disposal methods because they face the same problem—lack of available landfill space.

"To adopt this plan will cost money intially," Cupertino said about the increased cost of garbage disposal. "The city of Milwaukee does not see any return for 20 years. But, we have to do something. Our collective pile of garbage is getting bigger each year."

As an example, Cupertino said a Japanese family of four doesn't throw away as much garbage in one month as a single person does in this country in one week. "People in that country are taught to recycle," he said.

The incineration plan does not put private landfills out of business. They will continue to serve cities and commercial customers, as they do now.

"But, we are running out of space to hide our garbage," Cupertino said of the traditional method of burying. Besides that, this adds a lot of hazards to the soil. In Caledonia, for example, people are complaining about materials from landfills polluting their well water."

THE SOUTH MILWAUKEE VOICE JOURNAL
May 21, 1987

Task force wants incinerators built by city, county

THE MILWAUKEE JOURNAL
May 15, 1987

A countywide task force has endorsed a long-term garbage disposal plan that would cost an estimated $141 million and would involve building two incinerators.

The County Solid Waste Management Task Force on Thursday recommended that the county build a $65.8 million incinerator on the Milwaukee County Grounds in Wauwatosa and that the city build a $74.9 million incinerator at the site of the former Americology plant in the Menomonee River Valley.

Solid waste in the county would go to one of the two incinerators for disposal, under the recommended plan. The Menomonee River Valley incinerator could be built by 1993 and the county incinerator by 1998.

Milwaukee County operates a coal-fired incinerator at the County Grounds that should run for another 10 to 15 years, the task force said.

Both the city and county could finance building the incinerators or seek a private partner to help finance the long-term garbage disposal plans, according to the task force recommendation.

A technical subcommittee of the task force met for two years to determine long-range solid waste management needs for Milwaukee County through the year 2010.

The task force report will be forwarded to the County Board, which in turn will distribute it to the 19 municipalities in the county, said Robert Biebel, chief environmental engineer for the Southeastern Wisconsin Regional Planning Commission.

However, Biebel said that none of the municipalities was obligated to adopt the report, and that if the county and the city ultimately rejected the task force's recommendations, the incinerators would not be built.

City officials already have expressed concern about the long-range garbage disposal plan.

Earlier Thursday, Milwaukee City Comptroller James A. McCann said in a report that there were too many uncertainties surrounding the garbage incinerator to proceed with plans.

Areawide approach

Lately, there has been growing discussion of Milwaukee's long-range waste disposal needs.

Somewhat coincidentally, a countywide task force has endorsed a long-range garbage disposal plan that would include incinerators on county grounds in Wauwatosa and in the Menomonee River Valley.

Although nothing definite is in the offing, the prospect of a broader approach to waste management is a development worth watching, for the disposal of tons of wastes is not a local but rather a metropolitan — and even regional — problem.

In Milwaukee, uncertainties about the financial feasibility of an energy conversion disposal system to replace landfill operations have put a hold on initial enthusiasm.

But along comes a report from the County Solid Waste Management Task Force that should be cause for constructive cooperation at all levels of metropolitan government.

The report urges, among other things, the construction of two incinerators that would convert garbage into energy. There are differing opinions on the cost. But the suggestion by City Comptroller James A. McCann should be the guiding light in discussions on where we go from here.

The city, he said, should "explore the feasibility of attempting to coordinate its efforts with those of surrounding communities."

As long as there is doubt in City Hall about tens of millions for the city's own waste disposal plant, there should be no reluctance to opening discussions on a metropolitan or regional basis to spread costs, while developing economies at the same time.

THE MILWAUKEE SENTINEL
May 22, 1987

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Appendix H

MINUTES OF PUBLIC HEARING ON THE MILWAUKEE COUNTY SOLID WASTE MANAGEMENT PLAN

Chairperson: Supervisor Cupertino
Clerk: Ms. Maribeth Welchman

COUNTY-WIDE SOLID WASTE MANAGEMENT PLANNING TASK FORCE

Thursday, May 14, 1987 - 1:30 P.M.

Milwaukee County Courthouse Annex Assembly Room
907 North Tenth Street, Milwaukee, Wisconsin

M I N U T E S

TASK FORCE MEMBERS PRESENT:

Daniel Cupertino, Jr., Supervisor, 17th District, Milwaukee County (Co-Chairman)
Gerald Schwerm, Director of Transportation, Milwaukee County
Richard A. Keyes, Environmental Engineer, Milwaukee County
David A. Kuemmel, Commissioner of Public Works, City of Milwaukee
Brian Bowser, Resource Recovery Coordinator, City of Milwaukee
Fred R. Rehm, P.E., Environmental Consultant
Thomas J. Rutkowski, Corporate Energy Manager, Briggs & Stratton
Alphonse E. Zanoni, Dept. of Civil Engineering, Marquette University
Milo Shocker, Mayor, City of Oak Creek
James A. Brundahl, Mayor, City of Wauwatosa
Joseph Tanski, Village Manager, Bayside for Marshall Loewi, President, Village of Bayside
Gerald Seeber, Manager, Village of Brown Deer, for Earl W. McGovern, President, Village of Brown Deer
Donald Fieldstad, Jr., Village Manager for Bernard G. Schroedl, President, Village of Greendale
Kurt W. Bauer, Executive Dir., Southeast Wisconsin Regional Planning Commission (SEWRPC)
John Bennett, Engineer, City of Franklin
LeRoy Krafcheck, City of West Allis
Elizabeth Duchelle, for Gloria McCutcheon, S.E. Dir., Wisconsin Department of Natural Resources (DNR)

ALSO PRESENT:

Carl W. Birks, Milwaukee County
Mr. Beibel, S.E. Wis. Regional Planning Commission (SEWRPC)

MEMBERS NOT PRESENT:

Lawrence J. Kenny, Supervisor, 9th District, Milwaukee County
Susan L. Baldwin, Supervisor, 21st District, Milwaukee County
Robert A. Anderson, Alderman, 13th District, City of Milwaukee
Paul A. Henningsen, Alderman, 4th District, City of Milwaukee
Howard R. Tietz, Alderman, 9th District, City of Milwaukee
William Kappel, Superintendent of Sanitation Services, City of Milwaukee
Paul Erickson, Dir., Enviro Energy Technology Center
Robert H. Holder, Vice Pres. & Chief Engineer, Wisconsin Gas Company
Fred C. Schulz, President, EverVation, Inc.
Lawrence P. Kelly, Mayor, City of Cudahy
James Besson, City of Glendale
David A. Kaczynski, Mayor, City of Greenfield
Milton Vretenar, Mayor, City of St. Francis
Chester W. Grobschmidt, Mayor, City of South Milwaukee
Jack Barlich, Mayor, City of West Allis
Jenny Schuler, President, Village of West Milwaukee
Phyllis Ernest, Trustee, Village of Whitefish Bay
Norbert S. Theme, Administrator, City of South Milwaukee
James C. Hurm, Commissioner, Vilalge of Hales Corners
John M. Fredrickson, Manager, Village of River Hills
Shirl C. Abbey, Manager, Village of Shorewood
Frederick J. Petrie, Administrator, Village of West Milwaukee

Tape #1; Side 1; Track 1
#1 - 561

SCHEDULED ITEMS:

1. Roll Call.

   Supervisor Cupertino in the chair. (Roll call indicated above.)

2. Review and approval of the Minutes of the Meeting of April 14, 1987. (Minutes mailed prior to the meeting.)

   Supervisor Cupertino asked if all members had received copies of the April 14, 1987 minutes. There being no questions or corrections, the minutes stood approved as written and distributed.

NOTE: ITEM NUMBERS 3, 4 & 5 TAKEN TOGETHER. ACTION NOTED BELOW UNDER ITEM NUMBER 5.

3. Summary of Plan report Chapter IX, "Recommended Plan" as reviewed by the Technical Coordinating and Advisory Committee on May 8, 1987.

4. Partial Summary of Plan Report Chapter X, "Public Participation", exclusive of the Public Hearing documentation, as reviewed by the Technical Coordinating and Advisory Committee on May 8, 1987.

5. Summary of Plan Report Chapter XI, "Summary" as reviewed by the Technical Coordinating and Advisory Committee on May 8, 1987.

Mr. Beibel, SEWRPC, stated that the summary distributed on Plan Report Chapters IX, X and XI also includes background and inventory materials previously reviewed by the Task Force. He outlined the report and provided the following additional comments:

A. Household Toxic and Hazardous Waste Management
The recommended plan to handle toxic waste is an interim plan only, dealing with household toxic waste. Further, there is a need for a comprehensive county-, state-, or region-wide program to be developed which includes materials from industries and commercial establishments. As the broader plan is developed, it is recommended that the individual household plan be incorporated so that there is one program to handle all of these materials. The development of a toxic waste plan would have to look at the broader geographic area rather than just the municipalities or counties, and should be done on a regional or statewide basis.

B. Processing
In the case of both proposed facilities for processing solid waste, there would have to be a more detailed feasibility and environmental impact study to go into air quality implications, traffic conditions, etc. This report has looked at these areas in some detail and concluded that it is likely that the sites are both viable and the incineration system is workable. In the case of the county grounds, a detailed study needs to be done concerning the hospital in the area. The next best alternative for the county site would be two smaller facilities: one located in Oak Creek near the South Shore treatment plant; and the other in the northwest part of the County, near the transfer station operated by the city. These alternative plans have been included should the more detailed studies indicate that the county site is not feasible.

In terms of timing, the recommendation is that these facilities be phased in. The first at the Americology site and the second at the county grounds, with construction at the county site to be started in another ten to fifteen years. The reason for this is that the county presently has a coal-fired boiler system at the county grounds that is workable and will be viable for at least another ten years.

SCHEDULED ITEMS (CONTINUED):

C. Costs
The costs over the planning period of $28 per ton compared to pure landfill costs would be somewhat higher (landfill is $21 or $22 per ton); however, with the analyses conducted, it is likely that over time these costs will come closer together, particularly when the capital expenditures become fixed and won't rise in terms of inflation as much as other costs.

In summary, Mr. Beibel explained that the plan has been reviewed by the Task Force, and should be sent to the Milwaukee County Board of Supervisors and local municipalities. He further explained that the Task Force meetings (of which there were six) involved most of the communities in Milwaukee County, and that the materials that went into the making of the plan have been reviewed. He stated that there were also eight meetings of the Advisory Committee which reviewed each section of the report. The one final element of the plan which remains is a public participation program to receive public input.

Mr. Joseph Tanski queried the $31 cost per household, and if this cost included the recommendation that local communities continue their own transportation, collection, disposal, etc. Mr. Beibel responded that this figure does not include those costs incurred by local communities

9. Conduct of a Public Hearing on Southeastern Wisconsin Regional Planning Commission Planning Report No. 120, <u>A Solid Waste Management Plan for Milwaukee County, Wisconsin.</u>

Tape #184 Supervisor Cupertino announced the public hearing would commence. Speakers were as follows:

Mary Thomas, 12120 Woodcrest, Franklin, WI
supporting incinerators and against landfills
Thomas Theys, 10509- 8 Mile Rd., Franksville, WI
supporting incinerators
Neil Palmer, 201 W. Michigan St., Milwaukee, WI
representing Wis. Electric Power Co. and submitting a written report entitled "A Solid Waste Management Plan for Milwaukee County, Comments by Wisconsin Electric Power Company", dated May 14, 1987
Peter I. Slaby, 805 N. 28th St., Milwaukee, WI
supporting mandatory recycling efforts for apartment building owners, residents, etc. and education of the public relative to recycling
Cristina Herrera, 3044-A N. Fratney, Milwaukee, WI
supporting mandatory recycling and public education sites
Mark Hansen, Racine/Kenosha Sierra Club
supporting tougher regulations for landfill owners
Marc Brody, Box 245, Mount Horeb, WI
representing Environmental Alliance and stating protest against problems with incinerators relative to lead, fly ash, dioxins; toxicity problems at current incinerator sites; and that new DNR restrictions being developed in response to incinerators are not being addressed at this time
Chris Bastian, 3752 E. Oakwood, Oak Creek, WI
supporting recycling education

Tape #396 Supervisor Cupertino called for a ten-minute question/answer period, and the following persons were heard:
Susan Carlson, Wauwatosa, WI
B. Sanders, Wisconsin Environmental Services
Marc Brody, Environmental Alliance

Tape #521 Supervisor Cupertino concluded the public hearing portion of the meeting.

SCHEDULED ITEMS (CONTINUED):

Tape #521

ACTION BY: (KUEMMEL) Approve report as recommended and forward, along with minutes of this meeting, to appropriate governmental bodies.

AYES: Schwerm, Keyes, Kuemmel, Bowser, Rutkowski, Zanoni, Schocker, Tanski, Seeber, Fieldstad, Bauer, Bennett, Rehm, Brundahl, Krafcheck, Cupertino (Chm.) - 16
NOES: None

6. Old Business: None

7. New Business: None

This meeting was recorded on tape, which is available for audit upon prior request of the Committee Clerk. The foregoing matters were not necessarily considered in agenda order. The official copy of these minutes is available in the County Board office.

******

Length of Meeting: 1:30 P.M. to 3:15 P.M.

Adjourned,

Maribeth Welchman
Assistant Committee Clerk

mw:051587
SWMPm051487

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Appendix I

CORRESPONDENCE PERTAINING TO PUBLIC HEARING

Appendix I-1

A SOLID WASTE MANAGEMENT PLAN FOR MILWAUKEE COUNTY

Comments by Wisconsin Electric Power Company

Neil H. Palmer

May 14, 1987

Wisconsin Electric welcomes this opportunity to offer its comments on the Solid Waste Management Plan for Milwaukee County.

Wisconsin Electric has had a supportive policy regarding refuse-to-energy conversion for a number of years. During the 1970s, Wisconsin Electric worked closely with the City of Milwaukee and the Americology Division of the American Can Company to test the economic and technical feasibility of cofiring refuse-derived fuel with coal in units 7 and 8 at the Oak Creek Power Plant. This development was unfortunately not successful, but it demonstrated an early cooperative effort to address this issue.

It is our policy to cooperate with state, county and municipal agencies in the review of concepts, to assist in the review of technical and economic feasibility, and to assist in determining environmental impacts of such systems. If requested by an authorized public agency, we will consider acting as an agent for the agency in the design and construction of waste-to-energy facilities and will also consider providing operation and maintenance services for public agency owners. However, it is not Wisconsin Electric's intent to become involved in refuse collection systems or in the financing or ownership of refuse-to-energy facilities.

As our policy indicates, we will certainly cooperate with the County in the development of a waste-to-energy facility. However, we note with some concern that the County is basing the economic feasibility of its study on the assumption of the sale of electrical energy at Wisconsin Electric's retail industrial rates. We understand that the study assumes that the City of Milwaukee would utilize the energy from a downtown plant and that a second plant located on the County Institution grounds would provide energy directly to facilities located at the County Institution site. The alternative to the use of either of these sites is to develop smaller waste-to-energy facilities which would sell energy to customers. The study apparently concludes that Wisconsin Electric's buyback rates are not adequate to justify the building of a waste-to-energy facility. In other words, it appears that these projects cannot be sustained on their own economics but require subsidies from retail electricity charges to support refuse incineration.

There are several points which the County should consider if it is intending to provide energy directly to an industrial customer. This would also apply to energy supplied to facilities owned by the City of Milwaukee. Such customers would expect to be provided with the same reliability that Wisconsin Electric is capable of providing. This requires redundancy on the part of the waste-to-energy facility to assure the desired level of reliability, increasing the cost of the waste-to-energy facility. An alternative to this would be for the customer to contract with Wisconsin Electric to provide backup power. If the industrial user has to pay for this backup service in addition to the rate to the County or City, the user will then be paying more than Wisconsin Electric's industrial rate for equivalent service reliability.

The economics of waste-to-energy plants are dependent upon high utilization of the facility so that the waste stream can be incinerated in the smallest and, hence, least costly plant possible. Finding customers with loads to match the size of plants being considered may be a problem. It is conceivable that the County will need to sell energy to Wisconsin Electric when it is not required for its connected customers. The time this would most likely occur is during off-peak periods when our buyback rates are low. This may reduce the average price per kWh that the County will receive below the assumed Wisconsin Electric industrial rate. If the County does not sell to Wisconsin Electric, it would need to reduce the plant output thus increasing the cost of generation for each kWh actually sold. Further, the inability to incinerate all the waste would increase the need for additional refuse storage.

We understand that during the developmental stages of a project such as this one, the possibility of having Wisconsin Electric transport, or wheel, electrical energy from a waste-to-energy facility to a user at another location has been considered. Wheeling energy from a generating source to a specific user over Wisconsin Electric's transmission and distribution system is not allowed by the rules and regulations under which we operate. The County's alternative would be to construct its own system to be able to distribute the energy produced at a waste-to-energy facility. Of course, this approach would result in an added cost for the waste-to-energy facility thereby reducing the net value of the energy sales.

Another facet of the County plan is the possibility of providing steam to industrial customers. Our studies have indicated that this is a desirable option for a waste-to-energy facility. The Americology location is at the boundary of our district steam heating utility in downtown Milwaukee. The district heating utility could have a possible use for the steam. However, in previous discussions with the City of Milwaukee we have determined that the rate we could pay for steam, based on our costs at the Valley Power Plant, is considered inadequate to support this concept. Regardless, we are willing to continue discussion if it can be of some benefit. As the study has pointed out, new steam loads of a continuous and substantial amount are difficult to locate. Our steam heating load is primarily limited to the winter season of the year making it necessary for the waste-to-energy facility to be able to generate electricity as well as steam. Similar to the electrical situation, the wheeling of steam through our distribution system to an exclusive customer of the waste-to-energy facility would not be permissible.

The use of refuse-derived fuel is discussed in Alternative 12 and again in Alternative 12A. Specifically, Alternative 12A references "refuse-derived fuel for use at the Wisconsin Electric Power Company Oak Creek Power Plant." The uncertainty surrounding the feasibility and technology of co-firing coal and refuse-derived fuel in fluidized bed electric power generating boilers is also mentioned. Even though this is not the recommended course of action, we would like to express our concerns with this alternative. We conducted a thorough study in early 1986 in response to a similar proposal which had been put forward by the City of Milwaukee.Wisconsin Electric considers the co-firing of coal and refuse-derived fuel to be technically unacceptable for commercial utility units of the type planned for installation at the North Oak Creek Power Plant. The lack of data and experience from pilot and demonstration test facilities, the lack of a homogeneous fuel, the potential for increased operating and maintenance costs, the potential for severe corrosion attack of boiler components, and the service requirements of utility power boilers in general preclude use of refuse-derived fuel in the fluidized bed boilers of the type planned for the Oak Creek Power Plant. Wisconsin Electric's previous experience with co-firing of refuse in its units 7 and 8 at the Oak Creek Power Plant was poor and demonstrated the problems with burning such fuels in boilers not designed for such purposes.

In conclusion, Wisconsin Electric supports waste-to-energy systems and will continue to cooperate with various agencies in their review concepts, feasibility and environmental impacts of such systems. Issues such as energy buyback rates, service reliability, wheeling of energy and matching load to facility size must be closely examined. Above all, waste-to-energy systems should stand on their own economic merits and not be justified by a subsidy from other energy suppliers or their customers.

Citizens For A Better Environment

RECEIVED

JUN 0 2 1987

SEWRPC

150 E. Juneau Ave #206 • Milwaukee, WI 53202 • (414) 271-7280

Gerald Schwerm, Director
Milwaukee County Public Works Dept.
Courthouse Annex
907 N. 10 St.
Milwaukee WI 53233

May 27, 1987

Re: Proposed Milwaukee County Solid Waste Management Plan

Dear Mr. Schwerm,

After review and discussion of the proposed solid waste management plan for Milwaukee County, we feel it is necessary to express our concerns over adoption of the current form of the plan.

We are troubled by the general focus, direction, and assumptions of the document. The proposed plan is based upon the use of incinerators, rather than using them as a step in a well thought out and well coordinated solid waste management program. While we concur that the current imbalance in solid waste disposal, in which there is total reliance on landfilling, needs to be changed, we are concerned by the almost total reliance on mass burn incinerators in the proposed plan.

As recognized in the plan, there are state regulations concerning priorities for solid waste disposal. The priorities for solid waste management set down by the State in Wisconsin stat. 144.792 are a)reduction of the amount of solid waste generated, b) reuse of solid waste, c) recycling of solid waste, d) composting of solid waste, e) recovery of energy from solid waste, f)land disposal of solid waste.

The proposed plan, although recognizing the responsibility to abide by the law, fails to comply with these priorities. We feel that there should be a reevaluation of the focus of the county plan using our state's priorities which are designed to promote cost efficient and environmentally safe waste disposal methods.

Also, the plan makes recycling a difficult task for the citizens since only newsprint will be recycled using curbside pickup. Finally, the focus on two central facilities means heavy traffic low, added noise, and air pollution which will have a tremendous impact not only on the surrounding neighborhoods, but also may hinder plans to develop the valley.

A second concern pertaining to the proposed plan deals with the many environmental questions that arise when considering incineration as a solid waste management alternative. Incineration may be the only feasible process to reduce the volume of some of the solid waste, after all recyclable materials are removed. However, the plan fails to address the environmental side effects that incineration may produce. The proposal does not adequately address final disposal of the waste fly and bottom ash. It states that the ash would be disposed of in two current landfill sites. Problems arise when the metal in the waste becomes condensed, leaving the bottom ash in a highly leachable form. Will already leaking landfills become even greater sources of groundwater contamination? What steps would have to be taken, and what additional costs would be incurred if, as elsewhere, the ash is classified as hazardous waste? What kind of anti-pollution devices would these incinerators include? Would it be feasible to implement an incinerator with maximum anti-pollution capability? When examining the possibility of the ash being classified as hazardous waste, the financing of the proposed incinerators may become exorbitant. With a price tag already over $141 million, large quantities of garbage will have to be burned in order to justify the huge capital investment. This may explain the modest commitment to recycling in the plan. Recycling could take care of a large fraction of the solid waste generated, especially if made easier for residents through curbside pickup.The proposed plan, relying on centers run by volunteers that residents would have to take their materials to,reduces the likelihood of good citizen participation in recycling.

Finally, and probably most importantly, we would like to express our dissatisfaction with the method by which this plan was adopted. There was almost no notice or advertisement of the single public hearing held on the proposal (in contrast with Walworth county.) We ask that more public hearings be held, well advertised in advance, so that citizens from all over the county may be made aware of this long term plan affecting their future. We urge that public comment periods be longer so that those who were or are not aware of the plan and its long term implications may have an opportunity to comment. We urge you to open this issue up to the public, because as you know, in order for this solid waste management plan to be truly effective, strong public support and knowledge will be needed.

Thank you for your consideration of these comments.

Sincerely,

Citizens For A Better Environment

Susan Mudd

Milwaukee Audubon

[illegible signature]

West End Community Association

[illegible signature]

The Environmental Alliance Box 245, Mt. Horeb, Wisconsin 53572-0245
(608-767-3888)

May 27, 1987

Mr. Kurt W. Bauer
Executive Director
SEWRPC
916 N. East Ave.
Waukesha, WI 53186

RE: COMMENTS ON SOLID WASTE PLAN

Dear Mr. Bauer:

The Environmental Alliance would like to thank SEWRPC for their efforts in compiling a comprehensive solid waste plan.

However, we believe there are four problems with the plan.

Misplaced Priorities: Recycling before Incineration

1. The plan disportionately relies upon incineration to manage the region's solid waste. Incineration will not solve problems of toxicity, but rather incineration will actually create hazardous waste and generate unacceptable air emissions. To address fundamental problems of solid waste management, we request that higher priority be given to source separation and recycling. Specifically, recycling should be a higher priority on the plan of action as outlined on the table on page 18 of the plan.

Problems Specific to Incineration Analysis

2. Air emissions. The plan does not adequately address questions of air emissions. At the public hearing on May 14, we were pleased to hear that either staff or the Board acknowledged inadequacies with their incineration air quality review.

3. Ash Disposal. There are not adequate plans to dispose of the enormous volume of hazardous ash that will be generated by incineration. The plan to use already leaking and dangerous landfills, Metro and Omega, must re-evaluated.

The Environmental Alliance

4. Cost. We have two general questions: A. Why is the cost for first the incinerator less than the previously cited $120.8 million project? B. How was the cost to process a ton of waste by incineration determined to be only $27.58? By our estimates, the cost per ton will be much closer to $100.00, even before considering the costs of proper disposal.

We thank SEWRPC for this opportunity to comment upon their plan. We look forward to working with you to develop a solid waste plan that best serves the interests of the greater Milwaukee area.

Respectfully submitted,

Marc Brody

THE ENVIRONMENTAL ALLIANCE
Marc Brody, Director

MB:lh

COPY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

916 N. EAST AVENUE • P.O. BOX 1607 • WAUKESHA, WISCONSIN 53187-1607 • TELEPHONE (414) 547-6721

Serving the Counties of: KENOSHA MILWAUKEE OZAUKEE RACINE WALWORTH WASHINGTON WAUKESHA

June 10, 1987

Mr. Marc Brody, Director
The Environmental Alliance
P.O. Box 245
Mt. Horeb, Wisconsin 53572-0245

Dear Mr. Brody:

This is to acknowledge receipt of your letter of May 27, 1987, in which you provided comments regarding the Milwaukee County Solid Waste Management Plan which was the subject of a public hearing held on May 14, 1987. In your letter you cite, in a positive manner, the comprehensive nature of the solid waste management plan, but raise four concerns about which you request further information. Each of these four concerns raised is addressed in the following comments and are offered for your consideration:

1. Recycling and Incineration Priority. You indicate that the plan relies too heavily on incineration and not heavily enough on source separation and recycling. You state that the incineration system will actually create hazardous waste and generate unacceptable air emissions and suggest that a higher priority be given to source separation and recycling. You cite Figure 1 on page 18 of the summary document which was distributed at the May 14 meeting and suggest that that be modified to give higher priority to recycling.

   As you are aware, the plan recommendations do provide for recycling and source separation. More specifically, the plan includes four recycling and source separation subelements including installation and operation of 23 recycling centers; the installation and operation of 21 composting operations; the separate collection of newsprint; and a household toxic and hazardous waste collection program. The plan subelements are set forth on pages 9 through 11 of the summary document reviewed at the public hearing and on pages 5 through 10 of Chapter IX, "Recommended Solid Waste Management Plan and Implementation Actions", a copy of which is attached hereto for your information. This recycling program, if implemented, would represent a substantial increase in the recycling and source separation programs presently being carried out in the County. Based upon the deliberations of the Milwaukee County Solid Waste Management Task Force and its Technical Coordinating and Advisory Subcommittee concerning this issue, it would appear that implementation of the level of recycling recommended may be ambitious. Should this level of recycling, as recommended in the plan, be substantially achieved, there would be no reason why a higher level of recycling could not be considered as the plan is periodically updated. At such time as the first plan update, which may be expected to be conducted in about five years, the record of implementation of this element could be considered. If a higher level of recycling is considered achievable at that time, it could be incorporated in the plan refinement. The other plan elements, including the incineration systems design, would not be sensitive to incorporation of a higher level of recycling and source separation.

It should be noted that the implementation schedule shown in Figure 1 on page 18 of the public hearing summary lists the plan elements with a recommended implementation schedule. The location of the elements in the list is not intended to indicate the conceptual desirability of the element as opposed to the other elements. The time schedule could be considered more appropriately as some measure of priority. That schedule provides for implementation of the source separation-recycling component ahead of the incineration system component.

2. Air Emissions. You indicate in your letter that the plan does not adequately address the issue of air pollutant emissions. You also indicate that the staff acknowledged inadequacies with the analysis of air quality impacts considered in the plan preparation.

   You are referred to pages 31 through 38 of the draft of Chapter IX of the plan which contains an extensive discussion of the air quality concerns related to the proposed incinerators. The Commission staff considers this discussion adequate for a system level plan such as the Milwaukee County Solid Waste Management Plan. As you will note on page 38, the plan specifically includes recommendations for a more exhaustive and systems-specific evaluation of the air quality impacts associated with each of the proposed incineration systems. Such evaluation would require the collection of about one year of baseline air quality monitoring at each site and extensive air quality modeling, and would be appropriately conducted as a part of the facilities planning and engineering which should follow systems planning and should precede final design. Discussions at the May 8, 1987, Technical Coordinating and Advisory Committee meeting concluded in a recommendation that this lanquage be strengthened to indicate that further environmental impact statement studies will be needed to fully evaluate the air quality implications. This section is presently being strengthened to address those concerns. However, it is the conclusion of the Commission staff and the Task Force that with proper control technology, it is likely that the proposed facilities will be able to meet all air pollution control requirements.

3. Ash Disposal. You indicate that the plan, upon implementation, will result in the generation of large volumes of hazardous ash as a by-product of the incineration systems. You further indicate that the plan recommends that the ash be disposed of in existing landfills.

You are correct that upon full implementation of the plan there will be a substantial amount of ash generated by the incinerations systems --approximately 170,000 tons per year. On the average during the plan period, about 100,000 tons per year may be expected to be generated. This ash represents about 32 percent by weight of the total solid wastes expected to be incinerated--530,000 tons upon full implementation of the plan and 310,000 tons on an average basis over the plan design period. However, your letter specifically mentions volumes of solid wastes. In terms of volume, it is expected that the reductions will be far more substantial than on a weight basis—on the order of about 85 percent reduction. Furthermore, the Commission staff and the Task Force carefully considered the matter of incinerator ash disposal. It was concluded, and it is specifically noted in the plan, that the ash should not be disposed of in existing landfills as you indicated is recommended, but rather that a new specially-designed landfill be constructed for the disposal of the ash, or alternatively, that new cells in a previously unused portion of an existing landfill be segregated and designed specifically for ash disposal only. This will prevent the mixing of conventional solid waste and incinerator ash which has been reported to result in the leaching of potential contaminants from the ash. We refer you to page 15 of the summary document distributed at the hearing and to page 16 of the draft recommended plan of Chapter IX, "Recommended Solid Waste Management Plan and Implementation Actions", which specifically sets forth the recommendations regarding the disposal of incinerator ash.

4. Cost for Incineration. You specifically ask, a) why the cost of the incinerator is less than the previously "cited", $120.8 million project; and b) you ask how the cost for incinerating a ton of waste will be only $27.58 in that you estimate the cost per ton would be closer to $100 per ton.

The answer to the first question is that the incinerator costs provided have been developed on the basis of a careful review of the literature, and of data on some of the most recent incinerator projects in the country. A partial listing of those references is attached hereto. The costs are based on 1986 costs and include engineering and contingencies; however, the costs do not include inflation or certain bonding-related costs. The procedures utilized in the analysis were standard present worth and equivalent annual cost analyses that are used in all major public facility cost evaluations done in this area at the system level planning stages. The costs are not directly comparable to the costs which you refer to--$120.8 million--which we presume is the cost presently estimated by the City of Milwaukee as the cost of their facility. The cost analysis provided for the City included other factors that would not typically be included in an analysis such as that included in the Milwaukee County Solid Waste Management Plan. Those costs include inflation and certain bond-related costs which may be prepaid in certain instances, rather than being paid over time as part of the bond amortization costs. In addition, the sizes of the incinerator the City has based its estimates on is somewhat larger than that included in the County plan—1,150 tons per day versus 900 tons per day. It is expected that final sizing of that facility will be completed as part of the next level of plan development--the detailed facility planning. The Commission staff believes the costs presented in the County plan are a good representative estimate of the actual costs which may be expected.

With regard to the second question, the costs presented in the plan are the entire costs of solid waste management, including not only the incineration costs, but also the costs of transportation, landfilling, ash disposal, and recycling of all of the solid wastes generated in Milwaukee County. The costs of incineration only are estimated to be about $18 per ton. However, these costs should not be looked at in isolation but rather in combination with the costs of recycling, transportation, transfer, processing, and disposal. Inclusion of two incinerator facilities in the plan may be expected to reduce the transportation costs due to the closer proximity of transportation end points to the incinerator facilities. The capital cost of the two incinerator systems is estimated to be about $141.0 million. This results in an annual capital cost of about $12.3 million per year, or $23 per ton, assuming a 20-year ammortiziation period and a 6 percent interest rate, and assuming about 530,000 tons of solid waste are incinerated per year. The operation and maintenance cost of these facilities, including ash disposal, is estimated to be about $11.6 million per year, or $22 per ton. Revenues from the sale of steam and electricity are estimated at about $14.3 million per year, or $27 per ton, for a total incineration cost of about $9.5 million, or $18 per ton. The cost of transportation and transfer may be expected to add about $5 per ton to the cost. The un-incinerated portion of the total solid waste stream within the County would continue to be disposed of at landfills at a slightly higher cost; other portions of the total solid waste stream would be recycled; and the portion consisting of household toxic and hazardous wastes would be managed separately. Thus, the average unit cost of the recommended solid waste management system may be expected to approximate $28 per ton. The cost for the initial system with incineration at the Americology facility may be expected to approximate $32 per ton since the energy revenues were assumed to be based upon electricity sales to the Wisconsin Electric Power Company rather than the sale of steam. Accordingly, the unit cost per ton for incineration of solid waste cannot approach $100 per ton.

We trust this is responsive to the concerns raised in your letter. We appreciate your comments on the plan, which will be incorporated into the record of the hearing.

Sincerely,

Kurt W. Bauer
Executive Director

KWB/ib
Enclosure
cc: Mr. Gerald Schwerm, Milwaukee County
Mr. David A. Kuemmel, City of Milwaukee

DEPARTMENT OF PUBLIC WORKS
GERALD SCHWERM • Director
ERNEST VOGEL • Deputy
Milwaukee County
PROFESSIONAL SERVICES DIVISION

July 30, 1987

Ms. Susan R. Mudd
Citizens For A Better Environment
150 East Juneau - #206
Milwaukee, Wisconsin 53202

Dear Ms. Mudd:

Re: Proposed Milwaukee Solid Waste Management Plan

Your organization has expressed concern over the adoption of the current form of the Solid Waste Management Plan and are troubled by the form of the plan, general focus, direction and assumption of the document. In your letter you cite, in a positive manner, the comprehensive nature of the plan but raise concerns about which you request further information. Those concerns raised are addressed in the following comments and are offered for your consideration.

Solid Waste Management Program

You indicated the proposed plan is based upon the use of incinerators rather than using them as a step in a well thoughtout and well coordinated solid waste management program and concern by the almost total reliance on mass burn incinerators in the proposed plan.

Based upon the deliberation of the Milwaukee County Solid Waste Management Task Force and its Technical Coordinating and Advisory Subcommittee concerning this issue, various solid waste management techniques considerations applicable to Milwaukee County were developed on a cost effective impact. As set forth in Chapter V "Inventory and General Evaluation of Solid Waste Management Techniques", the techniques were evaluated as to ten solid waste management functions: source reduction, source separation, storage, collection, transfer, transportation, processing, treatment, resource recovery, and disposal. Further, other alternative plans (12) were developed under the program by combining techniques in various ways to meet the needs of the evaluation plan. For more specific steps and taken criteria, Chapter V is referenced of the plan report of those alternatives solid waste management systems considered worthy of further consideration by the Task Force.

It is noteworthy to point out that prior to the final plan draft, chapters were submitted to Wisconsin Department of Natural Resources for review and comments on compliance with state regulations and priorities for solid waste disposal. Chapters were accordingly updated to reflect state comments and recommendations.

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Citizen Recycling

You indicated that the plan makes recycling a difficult task for the citizens since only newsprint will be recycled using curbside pickup. You further state that the plan fails to address the environmental side effects that incineration may produce after all recyclable materials are removed.

As you are aware, the plan recommendations do provide for recycling and source separation. More specifically, the plan includes four recycling and source separation subelements including and operation of 21 composting operations; the separate collection of newsprint; and a household toxic and hazardous waste collection program. Chapter IX, "Recommended Solid Waste Management Plan and Implementation Action" are suggested for detail information on this matter. This recycling program(s), if implemented, would represent a substantial increase in the recycling and source separation programs presently being carried out or made available to the citizens of the County.

Further, should this level of recycling, as recommended in the plan, be substantially achieved, there would be no reason why a higher level of recycling could not be considered as the plan is periodically updated. At such time as the first plan update, which may be expected to be conducted in about five years, the record of implementation of this element could be considered. If a higher level of recycling is considered achievable at that time, it could be incorporated in the plan refinement. The other plan elements, including the incineration system design, would not be sensitive to incorporation of a higher level of recycling and source separation.

Facility Criteria and Location

You indicated in your letter that the plan focus on two central facilities means heavy traffic flow, added noise and air pollution which will have a tremendous impact not only on the surrounding neighborhoods, but also may hinder plans to develop the valley.

You are referred to Chapter IV "Landfill and Incineration Siting Analysis" of the plan. The criteria formulated and applied in the incineration siting analyses was categorized as to existing urban land uses, location of transportation, transportation route, potential energy users, historical sites and environmental air quality. After applying each category of criteria for siting, an incinerator composite map was prepared pinpointing site locations. Map 2 of the cited chapter is referenced for your consideration.

Waste Fly and Bottom Ash Disposal

You indicate that the plan does not adequately address final disposal of the waste fly and bottom ash. You further indicate that the plan recommends that the ash would be disposed of in existing landfills.

The Commission staff and the Task Force, in this instance, carefully considered the matter of incinerator ash disposal. It was concluded, and is specifically noted in the plan, that the ash should not be disposed of in existing landfills as you indicated is recommended, but rather that a new specially-designed landfill be constructed for the disposal of the ash, or alternatively that new cells in a previously unused portion of an existing landfill be segregated and designed specifically for ash disposal only. This will prevent the mixing of conventional solid waste and incinerator ash which has been reported to result in the leaching of potential containments from the ash.

For your consideration, page 15 of the summary document is referenced. This information was distributed at the public hearing held on May 14, 1987, and to page 16 of the draft recommended plan of Chapter IX, "Recommended Solid Waste Management Plan and Implementation Actions," which specifically sets forth the recommendations regarding the disposal of incinerator ash.

Incineration Quantities

You indicate the price tag already over $140 million, will require large quantities of garbage will have to be burned in order to justify the huge capital investment. You are correct that upon full implementation of the plan it is expected that 530,000 tons will be incinerated and 310,000 tons on an average basis over the plan design period. With regard to your question on cost presented in the plan, these are the entire costs of solid waste management, including not only the incineration costs but also the cost of transportation, landfilling, ash disposal, and recycling of all the solid waste generated in Milwaukee County.

Incinerator costs, noted at $141.0 million is capital cost of the two incinerator systems. This results in an annual capital cost of about $12.3 million per year or $23 per ton, assuming a 20-year ammoritization period and a 6 percent interest rate, and assuming the base incineration tonnage previously cited above.

Environmental Questions

You indicated a concern pertaining to the proposed plan deals with the many environmental questions that arise when considering incineration as a solid waste management alternative. You further indicate the plan fails to address the environmental side effects that incineration may produce. A concern is additionally raised whether it would be feasible to implement an incinerator with maximum anti-pollution capacity.

The Commission staff and the Task Force has documented and suggested a format and thorough Environmental Impact Statement (EIS) process be completed before any approval or construction permits be issued for this type project. Possibilities for (1) ash residue and disposal, and (2) anti-pollution capabilities would be explored during the EIS process. More specifically, moving forward with the EIS and with the procurement activities at the same time will help insure that both reasonable costs and acceptable environmental performance levels are built into the structure of the project early on.

In closing, as pointed out by the Commission staff and the Task Force, the next step in the plan implementation process, is the formal adoption of the recommended solid waste management plan by the designated management agencies and others affected, both public and private.

We trust this letter is responsive to the concerns raised in your letter. We appreciate your comments on the plan and will forward them to the Commission staff and Task Force for consideration in finalizing the Solid Waste Management Plan.

Sincerely,

DEPARTMENT OF PUBLIC WORKS

Gerald Schwerm
Director of Transportation

GS:CWB:gp

cc: Kurt W. Bauer, SEWRPC
David A. Kuemmel, City of Milwaukee

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION STAFF

Kurt W. Bauer, PE, AICP, RLS. . . . . Executive Director

Philip C. Evenson, AICP .Assistant Director

Kenneth R. Yunker, PE .Assistant Director

Robert P. Biebel, PE . . . . Chief Environmental Engineer

John W. Ernst. . . . . .Information Systems Manager

Gordon M. Kacala . . . . Chief Economic Development Planner

Leland H. Kreblin . . . . .Chief Planning Illustrator

Donald R. Martinson . . . . Chief Transportation Engineer

Bruce P. Rubin . . . . .Chief Land Use Planner

Roland O. Tonn, AICP. . . . . . . .Chief Community Assistance Planner

Joan A. Zenk . . . . .Administrative Officer

Special acknowledgement is due James R. D'Antuono, SEWRPC Senior Planner, for his contribution to this report.

MILWAUKEE COUNTY STAFF

DEPARTMENT OF PUBLIC WORKS

Gerald Schwerm . . . . Director

Ernest R. Vogel. . . . . .Deputy Director

Carl W. Birks . . . . Engineering, Energy and Environmental Director

Richard A. Keyes . . . . Environmental Engineer

Special acknowledgement is due the staff of the Milwaukee County Department of Health and Social Services, including Mr. James W. Wahner, Director; Mr. Jerry Stephaniak, Deputy Director; and Mr. Dierk Losinger, P. E., Power Plant Superintendent, for their comment on and review of this report.