APRIL, 1981

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V • 230 S. DEARBORN • CHICAGO, IL 60604 • WATER DIVISION

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
BOX 7921 • MADISON, WI 53707 • BUREAU OF ENVIRONMENTAL IMPACT

Environmental Impact Statement

Final

EIS80172F

Milwaukee Water Pollution Abatement Program

EPA-5-WI-MILWAUKEE-WWTP/INT

FINAL ENVIRONMENTAL IMPACT STATEMENT

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT
WATER POLLUTION ABATEMENT PROGRAM

Prepared by the

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

CHICAGO, ILLINOIS

and

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

MADISON, WISCONSIN

with the assistance of

ESEI - ECOLSCIENCES ENVIRONMENTAL GROUP

MILWAUKEE, WISCONSIN

APRIL 1981

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SUBMITTED BY:

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ABSTRACT

The Final Environmental Impact Statement (FEIS) addresses the Master Facilities Plan (MFP) proposed by the Milwaukee Metropolitan Sewerage District (MMSD) for upgrading and expanding the sewerage facilities within its planning area. The MFP concluded that the planning area should be regionalized with secondary wastewater treatment being achieved at the Jones Island and South Shore WWTPs. Combined Sewer Overflow (CSO) should also be abated by conveying and storing it in twenty-five foot diameter tunnels during peak flows and then treating it at either the Jones Island or the South Shore WWTP during low flow.

Concern about water quality, secondary growth, and groundwater impacts and public controversy led to the preparation of this EIS. The EPA generally concurs with the recommendations outlined in the MFP. Specific mitigative measures are also recommended by EPA to reduce impacts to water quality, secondary growth, groundwater and historical sites.

BEFORE THE
DEPARTMENT OF NATURAL RESOURCES

Public Hearing to Receive Comments on)
the Joint EPA/DNR Environmental Impact)
Statement on the Proposed Master)
Facilities Plan for the Milwaukee)
Metropolitan Sewerage District)

NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN that pursuant to Sections 1.11(2)(d) and 227.022, Wis. Stats., and Section NR 150.09(4), Wis. Adm. Code, the Department of Natural Resources will hold a public hearing for the purpose of receiving the views and comments of the public on the Final Environmental Impact Statement on the proposed Master Facilities Plan for the Milwaukee Metropolitan Sewerage District (MMSD). The service area of the MMSD includes parts of Milwaukee, Ozaukee, Washington, Waukesha and Racine Counties.

Time: A morning session starting at 9 a.m. followed by afternoon and evening sessions as deemed necessary, starting Monday, May 11, 1981 through Friday, May 15, 1981.

Place: Youth Building, State Fair Park, West Allis, Wisconsin. Enter the Fairgrounds from Greenfield Avenue at 81st Street or Gate 5 on 84th Street.

Following the completion of the Final EIS hearing and the close of the record by the hearing examiner, the Department will review the record including all testimony, evidence and written comments received during the hearing process and determine if it has complied with Section 1.11, Wis. Stats., and the Wisconsin Environmental Policy Act (WEPA). At that time the Department will also complete its review of the proposed Master Facilities Plan. The EIS may also be considered for compliance with the Wisconsin Environmental Policy Act, if compliance is necessary, for the other related permits and approvals needed for the proposed wastewater treatment facilities.

At the first portion of the hearing all interested persons or their representatives will be given an opportunity to present their views or comments concerning the proposed Master Facilities Plan and the Final Environmental Impact Statement. The hearing officer may limit oral presentation if he feels that the length of the hearing will be unduly increased by reason of repetition. Each interested person will also be given the opportunity to present facts, views or comments in writing. Persons appearing during this portion of the hearing will not be under oath or subject to cross-examination.

To provide the public an opportunity to more fully develop the informational record, any person may petition for an opportunity to either cross-examine a person who has been responsible for developing a specific portion of the EIS, or to present witnesses or evidence under oath, or both. No cross-examination on the proposed Master Facilities Plan shall be permitted. The petition shall include a statement of position on the proposed Master Facilities Plan and specific statements and issues that are desired to be cross-examined or presented with respect to the EIS. Petitions must be received by the Bureau of Environmental Impact, Department of Natural Resources, Box 7921, 101 South Webster Street, Madison, WI 53707, on or before April 30, 1981. Failure to submit a petition by April 30, 1981, shall preclude the opportunity to cross-examine and to present witnesses and evidence under oath.

In anticipation of the filing of petitions to cross-examine or to present witnesses or evidence under oath, a prehearing conference has been set for:

Time: Monday, May 4, 1981, 9:30 a.m.

Place: Room 027, GEF 2, 101 South Webster Street, Madison, WI.

Persons filing such petitions should be prepared to attend this prehearing conference to identify those portions of the EIS on which they desire to cross-examine someone and to clarify the intent of their proposed cross-examination with regard to the issues they wish to develop. Persons not attending the prehearing conference may have their petitions denied on the basis of lack of specificity. Petitioners shall bring to the prehearing conference ten (10) copies of their petitions. In the event that no timely petitions are filed, the prehearing conference will be cancelled.

If the Department finds that the proposed Master Facilities Plan may affect substantial interests of the petitioner and that the petition is clear on the issues to be addressed by cross-examination or presentation of witnesses or evidence, an order shall be issued stating what persons will be made available for such cross-examination and what information may be presented under oath. Denials of petitions shall be in writing. The opportunity to cross-examine persons responsible for developing portions of the EIS shall be given after the first portion of the hearing is completed. Although not a contested case proceeding, testimony given during this portion of the hearing will be given under oath.

Written comments on the Environmental Impact Statement will be accepted and considered if received by the Bureau of Environmental Impact, Department of Natural Resources, Box 7921, Madison, WI 53707, by 4:30 p.m., on Monday, May 18, 1981.

Copies of the EIS on the proposed MMSD Master Facilities Plan are available for public review at the following Department of Natural Resources offices:

Bureau of Environmental Impact, 101 South Webster Street, Third Floor, Box 7921, Madison, WI 53707

Southeast District Headquarters, 9722 West Watertown Plank Road, Box 13248, Milwaukee, WI 53213

Copies are also available at the offices of:

ESEI, EcolSciences, Inc., 735 North Water Street, Suite 715, Milwaukee, WI 53202

In addition, copies have been sent to the following libraries for public review:

Milwaukee Public Libraries:

Central and the following branches:

North Milwaukee, Center, Capitol, Oklahoma, Tippecanoe, Atkinson, East, Finney, Martin Luther King, Forest Home, Llewellyn, Mill Road.

Area Public Libraries:

Oak Creek, Shorewood, Wauwatosa, West Allis, Whitefish Bay, Brown Deer, Greendale, Hales Corners, Brookfield, Elm Grove, Maude Chunk, Muskego, New Berlin, Cudahy Memorial, South Milwaukee, Butler, Duerrwaechter Memorial, Germantown, Franklin.

Other Libraries:

MATC North and South Campuses, Marquette University, Milwaukee School of Engineering, Citizens Government Research Bureau, Legislative Reference Bureau.

Requests for personal copies should be directed to the Bureau of Environmental Impact, DNR, Box 7921, Madison, WI 53707.

Dated at Madison, Wisconsin, this 2nd day of April, 1981.

STATE OF WISCONSIN
Department of Natural Resources

By Andrew C. Damon
Andrew C. Damon, Hearing Examiner

TO ALL INTERESTED AGENCIES, PUBLIC
GROUPS AND CITIZENS

The Final EIS on the Milwaukee Metropolitan Sewerage District's (MMSD) Water Pollution Abatement Program is attached. Also included in this package are the Public Comment Appendix and addenda to the appendices published with the Draft EIS, in November, 1980. These appendices are on reserve at the public libraries listed on the following page.

North Milwaukee Library
3310 West Villard Avenue
Milwaukee, WI 53209

Oklahoma Library
3501 West Oklahoma Avenue
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1025 North Milwaukee Street
Milwaukee, WI 53201

Citizens Governmental Research Library
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Milwaukee, Wi 53202

Legislative Reference Bureau Library
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Brookfield Public Library
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CHAPTER 1

EXECUTIVE SUMMARY

CHAPTER 1 - EXECUTIVE SUMMARY

1.1 INTRODUCTION

This Final Environmental Impact Statement (FEIS) addresses the Master Facilities Plan (MFP) proposed by the Milwaukee Metropolitan Sewerage District (MMSD) for the sewerage facilities within its planning area (Figure 1.1). The MMSD must meet the effluent limits established by the United States Environmental Protection Agency (EPA) and the Wisconsin Department of Natural Resources (DNR), and must also comply with two court orders. The orders require the MMSD to implement the following:

- Discharges of raw or inadequately treated wastewater to area waters must be eliminated
- Wastewater treatment plants must be improved to meet effluent limits so that receiving waters meet water quality goals
- The solids removed from the wastewater must be disposed of in an acceptable way.

These goals must be achieved within a court established schedule.

To reduce the local costs of correcting its water pollution problems, the MMSD applied to the EPA for federal grant assistance under Section 201 of the Clean Water Act of 1977. The provisions of this Act require that facilities must be designed to incorporate the most economical means of meeting established water quality goals while recognizing environmental and social considerations. The National Environmental Policy Act of 1969 (NEPA) requires that an EIS must be prepared for major federal actions which could significantly affect the natural and man-made environments. Approval of the MFP has been determined to be such a major federal action.

The DNR must also approve many aspects of the MFP. The MMSD has requested state grant funding for parts of the MFP. Because of this state involvement, the Wisconsin Environmental Policy Act (WEPA) requires the preparation of an EIS.

An EIS analyzes the proposed action, reasonable alternatives, and their anticipated effects upon the environment. To minimize the duplication of efforts, this Final EIS was prepared as a joint EPA/DNR document.

The public is invited to comment on this Final EIS. Comments will be received from the date of its release through May 17, 1981. As required by state law, a public hearing on the Final EIS will be held in Milwaukee in May of 1981 to provide a forum for public comment. The comments and concerns expressed by citizens, EPA and DNR will be used to develop a Record of Decision for the MFP. The Record of Decision will set forth the EPA and DNR decision to approve, conditionally approve, or disapprove the MFP.

1.1.1 The Problem

For the most part, the sewers in the MMSD service area are adequate for conveying domestic and industrial wastewater. The problem is the entry of groundwater (infiltration) and storm runoff (inflow) through cracked or broken sewer pipes, leaking manhole covers, faulty sewer connections, illegal connections of sumps and tile drains, and other sources. Infiltration and inflow (I/I) can greatly increase the flows in the sewerage system resulting in bypasses and overflows to area rivers and Lake Michigan.

During wet weather, the volume of wastewater and its rate of entry into the sewerage system in the MMSD service area often exceeds the sewers' capacity to transport wastewater to the treatment plants. As a result, in a year of average rainfall, 6.4 billion gallons of storm water and untreated sewage overflow into area waters. In addition, wastewater flows to the area's treatment plants exceed their capacity, resulting in violations of DNR effluent limitations.

There are two types of sewer systems conveying wastewater in the MMSD planning area. About 6% of the sewers in Milwaukee County, serving approximately 47% of its population, are combined sewers. They were designed to transport the storm runoff entering the system through roof leaders, street drains, and other connections, as well as industrial and domestic wastes. To prevent sewer backups, the Metropolitan Interceptor Sewer (MIS) system is designed to allow untreated wastewater from the combined sewers to overflow into surface waters when the capacity of the MIS is exceeded.

Separated sewers serve other portions of the MMSD service area. With this type of system, storm water is collected in one set of pipes and conveyed directly to the waterways. Domestic and industrial wastewater is conveyed separately to treatment facilities. Ideally, the flows in the sanitary sewers should not be affected by rainfall and infiltration of groundwater. However, some parts of the sanitary sewer system have deteriorated, allowing storm water and groundwater to seep into the sewers and manholes. In many buildings,

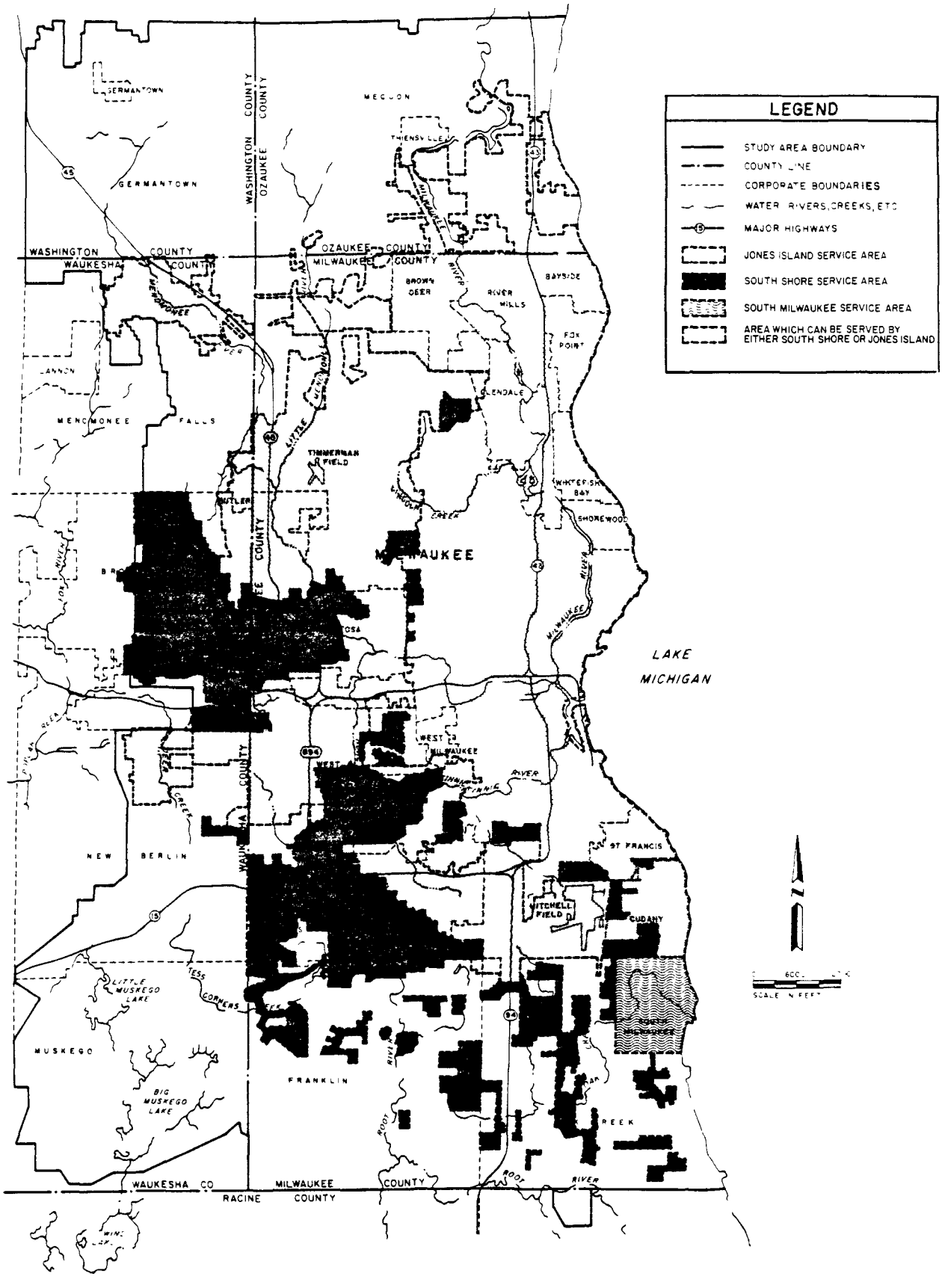


FIGURE 1-1

DATE APRIL 1981

MMSD SERVICE AREA AND PLANNING AREA

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

drains or sumps have been illegally connected to the sanitary sewer. As a result, I/I does enter the sanitary sewers. To prevent the backup of sewage into basements, sanitary sewers are also equipped with flow relief devices which discharge untreated sewage mixed with I/I into the area waterways.

In addition to causing combined sewer overflows and bypasses from the separated sewers, excessively high flows impair the operation of a wastewater treatment plant (WWTP). If the flow to the Jones Island and South Shore plants exceeds their capacity, wastewater must either be bypassed before treatment or after partial treatment. At Jones Island, the preliminary treatment and solids handling facilities are inadequate to handle flows greater than 140 million gallons per day (MGD) (6.1 m^3/sec.). The preliminary and primary treatment facilities at South Shore can handle peak capacities of 320 MGD (14 m^3/sec.). Secondary facilities bypass wastewater at flows over 240 MGD (10.5 m^3/sec.).

There are other sources of pollution to the waters of the area. Urban and rural runoff contains organic matter, pesticides and heavy metals. As part of their Water Quality Management (208) Plan, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) has recommended that pollutant loadings from non-point sources (urban and agricultural runoff) be reduced by a minimum of 25%. SEWRPC has designated each community within the MMSD planning area responsible for implementing the urban non-point source control measures to achieve this reduction of runoff pollution by 25%.

Combined sewer overflows, bypasses from the separated sewers, and non-point source loadings have resulted in the introduction and accumulation of pollutants and disease-producing organisms (pathogens) into area waters. Water quality in the MMSD service area is degraded by nutrients that stimulate plant growth and by organic pollutants which deplete the level of oxygen in the water. A potential health hazard is created by the pathogens and toxic substances including heavy metals.

1.1.2 Master Facilities Plan

The preparation of the Master Facilities Plan, which is also referred to in this EIS as the Milwaukee Water Pollution Abatement Program (MWPAP), has been required by state and federal legislation and by two court cases. The Federal Water Pollution Control Act Amendments of 1972 and the Clean Water Act of 1977 establish national water quality goals. Patterned after the federal legislation, Chapter 147 of the Wisconsin Statutes establishes the same goals. The Clean Water Act and Chapter 147 mandate the achievement by 1983 of fishable

and swimmable levels of water quality in the waters of the Nation and State. Chapter 144 of the Wisconsin Statutes requires the planning and approval of wastewater treatment facilities designed to achieve these water quality standards.

In addition to federal and state guidelines, preparation of the MFP has been governed by two court orders. In December 1974, the MMSD challenged DNR effluent limitations for the Jones Island and South Shore treatment plants. In response, the DNR initiated a counter suit. These actions resulted in a stipulation in the Dane County Circuit Court setting a schedule of compliance for the MMSD. The following deadlines were established:

1. Improvements to Jones Island and South Shore WWTPs must be completed by July 1, 1982

2. The solids management program at the two WWTPs must be in operation by July 1, 1982

3. All dry weather overflows and bypasses must be eliminated by July 1, 1982.

4. All wet weather bypasses from the separated sewers must be eliminated by July 1, 1986

5. The combined sewer overflow (CSO) problem must be corrected, and applicable water quality standards must be met by July 1, 1993.

In 1971, the States of Michigan and Illinois charged that the MMSD and the City of Milwaukee were endangering the public health by improper wastewater disposal. The case was heard in the United States District Court for the Northern District of Illinois, and that court's decision was appealed to the United States Seventh Circuit Court of Appeals. The result of these proceedings was the Court's reaffirmation of the EPA and DNR effluent limitations, and the requirements that all dry and wet weather bypasses from separated sewers be eliminated by July 1, 1986 and that combined sewer overflows cease by December 31, 1989. The MMSD and the City of Milwaukee have appealed the scope and schedule of the CSO abatement project to the United States Supreme Court. It is expected that a decision will be rendered by the middle of 1981.

The MFP is a complex set of programs devised to comply with federal and state legislation and the two court orders. The requirements applicable to the plan include the following:

1. Detailed evaluation of different approaches to wastewater treatment for the MMSD planning area shown in Figure 1.1

2. Reduction of infiltration and inflow (I/I) by the rehabilitation of the sewer system. A sewer system evaluation survey (SSES) is now being completed. The SSES provides detailed information about the sources of I/I and the costs of reducing these sources. The SSES is used to determine the level of I/I removal which will minimize the total cost of conveying and treating I/I

3. Evaluation of alignments of interceptor sewer extensions to serve the areas designated in the Regional Land Use Plan

4. Evaluation of methods to expand and rehabilitate the Jones Island and South Shore wastewater treatment plants

5. Development of a total solids management program to determine methods to process and dispose of the solids removed from the wastewater

6. Abatement of combined sewer overflows (CSO) by the date established by the U. S. Supreme Court.

Numerous alternatives were developed for each component project of the MFP. In this summary, only those alternatives found to be the most feasible will be discussed.

1.1.3 MMSD Recommended Plan and Feasible Alternatives

As part of the preparation and adoption of the Master Facilities Plan, the MMSD, as required by federal and state regulations, recommended alternatives for each major planning element. These major elements are as follows:

1. CSO Abatement and Peak Flow Attenuation

2. Wastewater Treatment

3. Solids Handling

4. Wastewater conveyance.

1.1.3.1 CSO Abatement and Peak Flow Attenuation

The I/I study estimated that a 50% reduction of I/I would be less expensive than expanding area wastewater treatment facilities to treat the peak volume of I/I and wastewater. However, even with this reduction, wet weather flows to the wastewater treatment plants (WWTPs) would exceed their capacity. Because the court orders require the elimination

of all separated sewer bypasses, all flows tributary to this system would require treatment. Since the peak flows would exceed the capacity of the WWTPs, some storage would be needed for wastewater volumes in excess of treatment plant capacity. The stored wastewater would be pumped to the WWTPs when treatment capacity became available.

It was apparent that the facilities for storing excess flows from the separated sewer service area could also be used to abate CSO. Therefore, the MMSD evaluated joint-use facilities. The alternatives considered to be the most feasible for this joint purpose are described in Table 1.1. The MMSD recommends the Inline Storage Alternative.

1.1.3.2 Wastewater Treatment

There are nine public wastewater treatment facilities in the MMSD planning area. Approximately 95% of the dry weather wastewater flow in the planning area is tributary to the Jones Island and South Shore WWTPs. The remaining dry weather flow is treated at public WWTPs in Thiensville, Germantown, New Berlin, Muskego (2 WWTPs), South Milwaukee, and the Caddy Vista subdivision in Caledonia.

Three organizational strategies were used to evaluate wastewater treatment for the MMSD planning area. These strategies, or system-levels, are described below:

1. The Local System-Level: The present localized approach to areawide wastewater treatment would continue. The Jones Island and South Shore WWTPs would serve Milwaukee County and some communities outside the County (contract communities). Other communities would operate their own wastewater treatment facilities.

2. The Subregional System-Level: The Milwaukee area would be divided into three smaller subregions. Each subregion would be responsible for operating its own wastewater treatment facilities. The Subregional System-Level Alternatives were eliminated from consideration because of cost and impacts on water quality.

3. The Regional System-Level: The MMSD would be responsible for treating all wastewater flows in the planning area. The flows would be treated at one or more WWTPs.

Strategies for CSO abatement were evaluated independently of the development of wastewater treatment strategies. The alternative considered to be the most feasible for each public wastewater treatment facility in the planning area is shown in Table 1.2.

TABLE 1.1

FACILITIES FOR CSO ABATEMENT AND PEAK FLOW ATTENUATION

Remote Storage	• Complete sewer separation in 11% of the CSSA. No work on private property. • Partial sewer separation* in 18% of the Combined Sewer Service Area (CSSA). 757 acre-feet of storage provided for excess flows at a cavern storage site near 58th and State Streets. • Complete separation in 48% of CSSA; excess flows tributary to 236 acre-feet of near-surface storage. • Excess flows from separated sewers stored at the storage cavern at 58th and State Streets.
Jones Island Storage	• Complete separation in 11% of the CSSA. No private property work required. • Complete separation in 48% of the CSSA with necessary private property work. • Partial sewer separation in 41% of the CSSA. Excess flow stored in 437 acre-feet of near-surface storage. • Excess flows from the separated sewers stored in a 550 acre-feet cavern near the Jones Island treatment plant.
CST Extension	• Complete sewer separation in 11% of the CSSA. No private property work. • Partial sewer separation in 21% of the CSSA. Excess flows tributary to 235 acre-feet of near-surface storage. • No sewer separation in 68% of the CSSA. Excess flows tributary to 30-foot tunnels in bedrock and 1,334 acre-feet of cavern storage near Jones Island. • Excess flow from separated sewers tributary to 30-foot diameter tunnels and cavern storage.
Inline Storage	• Complete separation in 11% of the CSSA. No private property work. • Partial separation in 68% of the CSSA. Excess flows tributary to 20-foot diameter tunnels in bedrock and 767 acre-feet of cavern storage near Milwaukee County stadium. • Partial separation in 21% of the CSSA with 235 acre-feet of near-surface storage. • Excess flow from the separated sewers tributary to 20-foot diameter tunnels and cavern storage facility.

*Partial Separation - New pipes would be constructed to convey storm water from street drains directly to a waterway. Sewage and storm water from drains on private property (e.g., roof leaders) would be combined and conveyed to a treatment facility.

TABLE 1.2

MMSD RECOMMENDATIONS FOR WASTEWATER TREATMENT PLANTS (LOCAL ALTERNATIVES)

Jones Island	. Expand treatment capacity to 300 million gallons per day. . Wastewater Treatment by Secondary Activated Sludge Process. . Disinfection by chlorination. . Site expansion by filling in 9.5 acres of Lake Michigan and using approximately 9 acres of Harbor Commission land.
South Shore	. Expansion of South Shore to 250 million gallons per day. . Wastewater Treatment by Secondary Activated Sludge Process. . Disinfection by chlorination. . Site expansion by enclosing 30 acres of Lake Michigan. At this time, 12 acres would be filled in. The remaining 18 acres would be filled as needed.
Caddy Vista Subdivision	. Existing facility would be demolished. . An advanced wastewater treatment plant would be constructed on the site. . Effluent would be discharged at the Root River.
Germantown	. Abandon existing facilities. . A new land application facility will be constructed on the site.
Muskego Northeast	. Abandon existing facility wastewater flows would be pumped to Vernon, Wisconsin, treated in aerated lagoons and discharged to infiltration-percolation ponds.
Muskego Northwest	. Facility would be abandoned. Wastewater flows would be combined with flows from Muskego Northeast and treated at the Vernon site.
New Berlin Regal Manors	. New aerated lagoon facility built at a site at Sunny Slope and Grange Streets. . Effluent transported to infiltration-percolation site in Vernon.
South Milwaukee	. No expansion. . Operation and maintenance procedures would be improved.
Thiensville	. Expand wastewater treatment capacity. . Treatment by existing processes. . Discharge of effluent to the Milwaukee River.

For the Local System-Level, all the WWTPs listed in the table would be in operation. For the Regional Alternative, only the Jones Island and South Shore facilities would continue operating. The No Action Alternative (continuing the present sewerage system with no improvements) was also considered for comparison.

The MMSD's Recommended Alternative (referred to as the Mosaic Alternative in this EIS) combines aspects of the Local and Regional System-Levels. With the Mosaic Alternative, the Jones Island and South Shore treatment facilities would serve the entire planning area, except for South Milwaukee which would operate its own facility. All other public WWTPs would be abandoned. The MMSD recommends that two private wastewater treatment plants, School Sisters of Notre Dame and Wisconsin Electric Power Company also continue operations, and that the Muskego Rendering Company operate its own facilities for pretreatment of effluent before discharge to the local sewer system.

1.1.3.3 Solids Handling

Closely related to the issue of expanding the Jones Island and South Shore WWTPs is the problem of disposing of the solids removed from the wastewater during treatment. Most of the solids from the Jones Island WWTP are now processed into the fertilizer Milorganite (about 70,000 tons per year). Any solids in excess of the capacity of the Milorganite process are landfilled (approximately 3,400 tons per year).

For most of the year, the solids from the South Shore WWTP (approximately 33,500 tons) are applied to agricultural land. However, after the growing season, when the ground is frozen, the sludge must be landfilled (about 10,500 tons per year).

The MMSD considered alternatives including landfill, land application, incineration, and composting for disposal of the solids from the two WWTPs. For the Jones Island WWTP, the MMSD proposes abandoning the production of Milorganite because it is energy intensive and contributes to air pollution in the Milwaukee area. (Milorganite production has been responsible for about 6% of Milwaukee County's annual input of particulates to the air.) Instead, landfilling of all solids was recommended. For the South Shore WWTP, land application was recommended. Solids from the South Shore plant would be stored during the winter for land application over the growing season.

The MMSD is currently preparing a facilities plan which will identify specific sites for solids disposal. A supplemental EIS on this facilities plan will be prepared by the EPA and DNR. The supplemental EIS will give special consideration to the impacts of site specific alternatives on the natural and man-made environments. It is currently anticipated that the Site Specific EIS supplement on agricultural spreading and landfill will be completed in mid-1984.

1.1.3.4 Wastewater Conveyance

The MFP evaluates alternatives for conveyance of wastewater to WWTPs from communities and areas served by MMSD. The particular facilities and their configurations vary under each system-level alternative, and they are listed in Table 1.3. The facilities are the following interceptors: Franklin Northeast, Underwood Creek, Root River, Hales Corners, Franklin-Muskego, Oak Creek North, and Menomonee Falls-Germantown.

1.2 THE DRAFT EIS

1.2.1 EIS Alternatives

1.2.1.1 CSO Abatement and Peak Flow Attenuation

There are many controversial aspects to the Inline Storage alternative for abating CSO and attenuating peak flows. The partial and complete separation of sewers in the entire combined sewer service area (CSSA) would disrupt traffic and business. With partial and complete separation, urban runoff which contains organic pollutants and heavy metals would still be discharged into the lower reaches of the Milwaukee, Menomonee and Kinnickinnic rivers, and instream water quality standards might not be achieved. Also, the public has expressed concern over the potential for temporary and long-term impacts to groundwater from cavern storage facilities. In response to those concerns, the EIS has evaluated three other alternatives for CSO abatement and peak flow attenuation. These alternatives are described in Table 1.4.

TABLE 1.4

EIS ALTERNATIVES FOR CSO ABATEMENT AND PEAK FLOW ATTENUATION

Complete Sewer Separation	• All combined sewers completed separated • Excess flow from the separated sewers would be stored in 20-foot diameter tunnels prior to transport to the WWTPs for treatment

TABLE 1.3

INTERCEPTORS ASSOCIATED WITH
DIFFERENT SYSTEM-LEVEL ALTERNATIVES

Local Alternative	. Northeast Side Relief System . Underwood Creek . Root River (Short Route) . Franklin Northeast . Oak Creek North . Franklin-Muskego (Franklin branch only)
Regional Alternative	. Northeast Side Relief System . Underwood Creek . Root River . Hales Corners . Franklin-Muskego . Franklin Northeast . Oak Creek North . Menomonee Falls-Germantown
Mosaic Alternative (MMSD's Preferred Alternative)	. Northeast Side Relief System . Underwood Creek . Root River . Hales Corners . Franklin-Muskego . Franklin Northeast . Oak Creek North . Menomonee Falls-Germantown

Modified CST/ Inline	• Complete sewer separation in 11% of the CSSA. Private property work required. • Partial sewer separation in 21% of the CSSA. Excess flows in the sanitary sewers stored in 235 acre-feet[1] of near-surface storage. • No sewer separation in 68% of the CSSA. Excess flow tributary to 30-foot diameter tunnels in bedrock and 1291 acre-feet of cavern storage at Milwaukee County Stadium. • 174 acre foot storage cavern at the Jones Island WWTP.
Modified Total Storage	• Complete separation in 11% of the CSSA. No private property work. • No sewer separation in the remaining portions of the CSSA. The flows from 68% of the CSSA would be tributary to 30-foot tunnels in bedrock and 1291 acre-feet of cavern storage at Jones Island. • Flows from the remaining 21% tributary to 715 acre-feet of near surface storage.

[1]Acre-foot - "The volume that would cover one acre to the depth of 1 foot." (Webster's New Collegiate Dictionary, Springfield, MA; G & C Merriam Company, 1977.)

The costs of the alternatives for the abatement of CSO and the attenuation of peak flows are shown in Table 1.5.

TABLE 1.5

COSTS (IN $ MILLIONS) OF CSO/PEAK FLOW ALTERNATIVES

Alternative	Capital Costs	Operation and Maintenance	Net* Present Worth
Inline Storage	$ 1658.53	$ 27.01	$ 1899.86
Complete Separation	1688.45	26.83	1968.22
Modified CST/Inline	1664.98	27.97	1931.50
Modified Total Storage	1682.56	28.48	1956.44

*Net Present Worth includes the construction and materials costs, financing costs and operating costs through the year 2005.

The cost estimates for these alternatives are within the margin of error for the methods used in their calculation and are therefore considered equivalent. Thus, the decision to implement one of the alternatives will be based on factors other than cost.

1.2.2 Environmental Consequences

1.2.2.1 No Action Alternative

The alternatives considered in the MFP and EIS are complex solutions for a number of problem areas which overlap to varying degrees. Several wastewater treatment plants in the MMSD planning area cannot treat the flows they receive adequately to meet the effluent limits imposed by their discharge permits. In many areas, these sewers and WWTPs are receiving volumes of wastewater in excess of their capacities. Deteriorating sewers and manholes, illegal connections of drains and sumps, and in the case of combined sewers, connection with the storm drainage system, all contribute to the problem of overloaded sewers and treatment plants.

The results of this overloading include bypassing at the WWTPs, bypassing from separated sewers, and overflows from combined sewers. These bypasses and overflows discharge raw or inadequately treated wastewater to area waterways. These inputs introduce disease-causing pathogens and toxic substances into the waters of the planning area, degrading water quality. These substances also impair plant and animal life, endanger the public health, and limit the potential uses of the area waters.

The failure of wastewater treatment systems to meet effluent limitations and court-ordered clean-up deadlines in the case of MMSD, could result in legal penalties including fines for the responsible organizations.

In addition, sewer extensions for new development in all areas served by the MMSD might be prohibited. The Dane County Court Stipulation establishes a wasteload allocation system to remain in effect until the Jones Island and South Shore WWTPs consistently comply with EPA and DNR effluent limitations. The wasteload allocation system restricts the increment by which annual flows and pollutant loadings to the Jones Island and South Shore WWTPs may increase. If violations of effluent limitations continue to occur, no new connections would be allowed after 1986.

If sewer extensions are prohibited because of violations of the Dane County Court stipulation, the demand for lots suitable for septic tank development might increase, possibly entailing the loss of prime agricultural land or wildlife habitat. In most cases, the scattered type of development that occurs when lots of one acre or more are developed for single-family residences would not be consistent with the Regional Land Use Plan.

With the No Action Alternative, the impacts outlined above could occur. The action alternatives described in Section 1.1.3 are designed to modify or eliminate the adverse impacts and maximize the beneficial environmental impacts at the smallest practicable monetary cost. The environmental impacts of the action alternatives are described below.

1.2.2.2 Action Alternatives

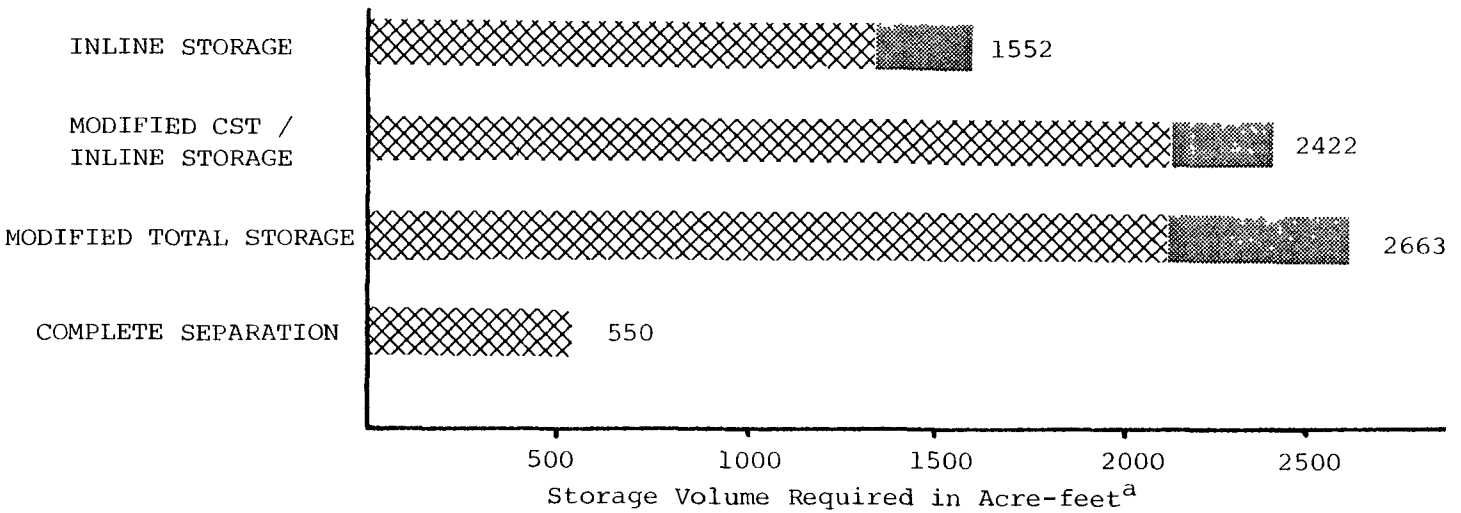
All of the action alternatives would share certain components. In all cases, the sewers in Milwaukee County would be reinforced and expanded based on the results of the sewer system evaluation survey. With any action alternative, the Jones Island WWTP would be expanded to treat 300 million gallons of wastewater each day and the South Shore WWTP 250 million gallons each day. Also, CSO and bypasses from the separated sewers would be eliminated.

Because these program components would be the same for any action alternative, some of the environmental impacts of the alternatives would be very similar. The elimination of bypasses of untreated wastewater into area waters would reduce the public health hazard from disease-producing organisms, making the waters more useful for recreation.

With any action alternative, all wastewater treatment facilities in the planning area would be capable of meeting effluent limitations in the discharge permits. As a result, all free-flowing portions of the rivers of the area should meet the water quality standards set for them by the DNR if SEWRPC's nonpoint source control program is implemented. Pollutant loadings to the Inner and Outer Harbors would be reduced, to varying degrees. However, water quality standards in the Inner Harbor might not be met because of pollutants accumulated in the sediments and pollution originating upstream of the MMSD service area.

1.2.2.3 CSO Abatement and Peak Flow Attenuation

The four alternatives for CSO abatement/peak flow attenuation which are considered in the EIS differ in the amount of construction that would be needed and in the amount of storm water that would receive treatment. Figure 1.2 compares the amount of storage required by these alternatives. Figure 1.3 compares the percentage of the combined sewer service area which would be affected by open-cut construction with the four alternatives. The alternatives that would treat the most urban runoff would achieve the most improvement in water quality because they would decrease total pollutant loads and cause less disturbance (via scouring) of sediments in the receiving waters.



Deep Rock Storage

Near Surface Storage

Additional Near Surface Storage (required if no work on private property is allowed. This is not reflected in the total volume shown)

a: 1.0 acre-feet = 1.23×10^3 m^3

FIGURE 1-2

DATE APRIL 1981

STORAGE VOLUMES REQUIRED UNDER THE FOUR FINAL CSO/PEAK FLOW ALTERNATIVES

SOURCE MMSD

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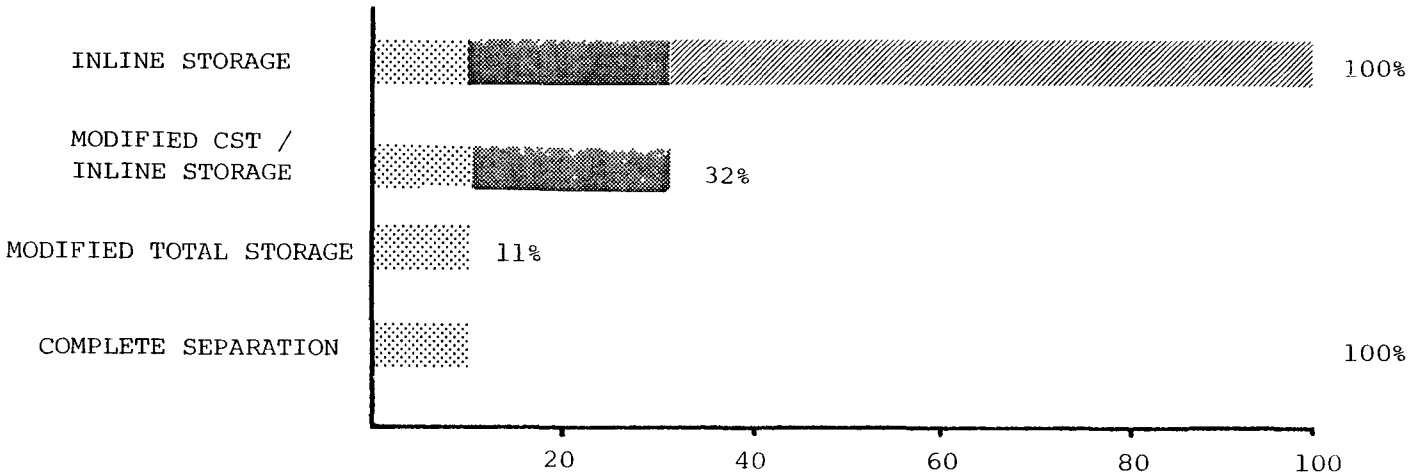

Complete Separation - No Private Property Work

Partial Separation with Overflows Tributary to Near Surface Storage

Partial Separation with Overflows Tributary to Central Storage Facilities

Complete Separation - Work on Private Property (These areas would be partially separated with near surface storage - if Private Property Work is not allowed)

FIGURE 1-3

DATE APRIL 1981

PERCENTAGE OF COMBINED SEWER SERVICE AREA AFFECTED BY OPEN CUT SEWER CONSTRUCTION

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

Any action alternative would improve sediment quality, but the sediments would remain highly polluted with organic matter and toxic substances. Disturbing the sediments (sediment scour) re-introduces these pollutants into the water. Levels of dissolved oxygen are lowered as the organic matter further decomposes. The Modified Total Storage Alternative would result in treatment of the greatest percentage of storm water and would eliminate CSO sediment scour, which is the mechanism whereby the highly polluted bottom sediments are resuspended by increased velocities in the vicinities of CSO outfalls. The Complete Separation Alternative would treat the least amount of storm water and increase the frequency of sediment scour near CSO outfalls.

The percentage of the CSSA that would be affected by each facility for CSO abatement and peak flow attenuation is shown in Figure 1.3. The Complete Separation and Inline Storage Alternatives would affect the greatest area and Modified Total Storage the least. Disruption of commercial areas would result in a loss of business during construction. This impact could be lessened by staging construction activities so that only a limited number of streets are disturbed at any one time. Local construction firms are equipped to construct new sanitary and storm sewers required under the alternatives relying on complete or partial separation. These approaches are more labor-intensive than the construction of large diameter tunnels in bedrock. As a result, the complete separation alternative creates the most potential employment opportunities for the local labor force. The Modified Total Storage Alternative creates the least local employment opportunities. The use of local construction firms for sewer separation alternatives would introduce more money into the local economy than a deep tunnel system that would rely on firms from outside the local economy.

Both EPA and DNR, as well as the public, have expressed concern that wastewater could seep out of large-diameter tunnels in the bedrock and contaminate deep groundwater; that groundwater could infiltrate the tunnels and lower local groundwater levels; or that both events could occur. These concerns have received detailed analysis, which is described further in Section 1.3.2.

1.2.2.4 Wastewater Treatment

With all action alternatives, the South Shore and Jones Island WWTPs would be expanded as described in Table 1.1. The improvements to the WWTPs would require about three years of construction. The construction would increase turbidity and resuspend sediments in Lake Michigan due to material washed from construction sites. However, the implementation of modern construction techniques would minimize construction-related turbidity.

The MMSD Recommended Alternatives for the expansion of these WWTPs include lakefills which would remove small portions of Lake Michigan habitat. This habitat is used for spawning and feeding by some species of fish. The construction would also increase air pollution in Milwaukee County. The yearly increases in emissions are expected to be less than one percent of the annual county-wide totals.

Some residents of the City of South Milwaukee have raised concerns about the expansion of the South Shore treatment plant. They have complained about odors from the South Shore WWTP and feel that the expansion of the facility would aggravate the problem. Also, they are concerned that the expansion would be unsightly and would disrupt the view of Lake Michigan. There is concern that, as a result of these factors, property values near the plant may be affected. Partially in response to these concerns, the Draft EIS also evaluates two new alternatives: one requiring only six acres of lakefill and another that would require no lakefill (see South Shore Appendix).

The South Shore WWTP might be more visible after its expansion and would slightly affect the view of Lake Michigan. Odors, however, should be less of a problem than at present. The odors are created by inadequately processed solids reaching the exposed sludge lagoons. With the rehabilitation and expansion of the facilities, the solids should be properly treated and all solids handling processes would be enclosed. As a result, odor problems should be reduced.

The issue of property value is more difficult to assess. Records show that, historically, property values near the WWTP have not been depressed in comparison to other property in South Milwaukee. Therefore, there is no evidence to indicate that property values would be affected by the expansion of South Shore.

The MMSD recommended alternatives for the other public treatment plants are listed in Table 1.2. Implementation of these alternatives could require the disruption of traffic and access and could cause a slight increase in air pollution. However, these impacts would be moderate and temporary.

The Local, Regional, and the MMSD Recommended System-Level Alternatives would result in the abandonment of some or all of the local WWTPs. The cessation of effluent discharges would change the character of some streams from permanent to intermittent. As a result, the biological communities present in the affected rivers could change.

Under the various System-Level Alternatives, at most, three local treatment plants would discharge effluent to waterways in the MMSD planning area: Thiensville to the Milwaukee River, Caddy Vista to the Root River, and South Milwaukee to Lake Michigan. Improved effluent from the Thiensville plant should allow quality standards for that part of the Milwaukee River to be met. Bypassing at the Caddy Vista Plant would be eliminated. Effluent from the South Milwaukee treatment plant should not have a large impact on Lake Michigan because of its presently acceptable quality and relatively small volume.

Under the various System-Level Alternatives, up to four of the existing local WWTPs would be converted to treatment of wastewater by some form of land application. With this type of treatment, there would be some chance of groundwater pollution. This potential would be minimized by the careful selection of sites with soils acceptable for wastewater application and by the monitoring of sites.

1.2.2.5 Solids Handling

The MMSD recommends abandoning Milorganite production at the Jones Island treatment plant because the Milorganite process is energy intensive and contributes to local air pollution. Instead, solids from Jones Island would be landfilled. During most of the year, the solids from the South Shore WWTP would be applied to agricultural land. During the winter months, the solids would be stored for later agricultural application.

Both of these alternatives would require large amounts of land. In a supplemental EIS to be prepared by EPA and DNR, Site Specific Analysis, the availability of sites and the environmental impacts of these solids alternatives will be studied in detail. If the necessary land is not available, the solids management alternatives may require further study.

Agricultural land would benefit from the organic matter and nutrients contained in WWTP solids. However, the solids also contain small quantities of toxic substances such as heavy metals and nitrate, and some public concern has been voiced about the environmental impacts of these toxic substances. The soils at solids application sites could retain the heavy metals in WWTP solids, possibly threatening their future use for agriculture. In addition, nitrate, if applied in amounts greater than can be removed by plant uptake, can contaminate groundwater and may cause human and animal health problems.

All farmers interested in receiving the solids from the South Shore WWTP would have to be informed of the proper management practices and potential hazards of solids application. This precaution and the adherence to DNR and EPA regulations would reduce the potential for soil and groundwater contamination. Abandoning the Milorganite process would reduce particulate emissions in Milwaukee County by 6% and energy consumption at the WWTP by 57%. However, abandoning the process would also cause the existing concentration of ammonia-nitrogen in the Jones Island WWTP to approximately triple (from 6 mg/l to 18 mg/l). Increased levels of ammonia-nitrogen in the Outer Harbor could be toxic to aquatic life.

Construction of an effluent outfall that would discharge treated effluent directly into Lake Michigan could alleviate this problem. However, pollutant loading to Lake Michigan would be increased by this action. The MMSD has performed a water quality study to determine how this increase in ammonia would affect the Outer Harbor. The MMSD also examined alternatives that would reduce the ammonia in the effluent. The results of this study are discussed further in Section 1.3.3.

1.2.2.6 Wastewater Conveyance

All the System-Level Alternatives were designed to serve the same area. The Local Alternative would include six interceptors, and the Regional and Mosaic Alternatives would include eight interceptors. The direct environmental impacts of these interceptors would be related to their construction. Traffic and access to businesses and residences might be disrupted. Air quality would be affected by vehicle fumes and dust. Also, groundwater levels could be lowered. The elimination of septic tanks and overloaded sewer systems should, in the long-term, reduce groundwater pollution.

All the action alternatives would provide enough sewer service to accomodate population up to the levels forecast by the Southeastern Wisconsin Regional Planning Commission. However, if the population does not grow to planned levels, the expanded sewer service could encourage a scattered pattern of development in some areas. With a scattered pattern of development, the costs of municipal services (schools, general administration, and public safety, for example) in Germantown, New Berlin and Oak Creek could exceed the revenues from the increased tax base.

1.2.2.7 Cost

The costs for the Final System-Level Alternatives are shown in Table 1.6. These costs assume the implementation of the MMSD's Recommended Alternatives for the rehabilitation and expansion of the Jones Island and South Shore WWTPs, and for solids handling.

TABLE 1.6

COSTS OF SYSTEM-LEVEL ALTERNATIVES
ASSUMING DIFFERENT CSO SOLUTIONS
(IN $ MILLIONS)

	CSO Component	Capital	O&M	Net Present Worth
Local				
	Inline Storage	$1692.39	$28.48	$ 1950.11
	Complete Separation	1722.31	28.30	2018.47
	Modified CST/Inline	1698.84	29.44	1981.75
	Mod. Total Storage	1716.42	29.95	2006.69
Regional				
	Inline Storage	1658.84	26.63	1896.06
	Complete Separation	1688.76	26.45	1964.42
	Modified CST/Inline	1665.29	27.59	1927.70
	Mod. Total Storage	1682.87	28.10	1952.64
Mosaic: MMSD Recommended	Inline Storage	1658.53	27.01	1899.86
	Complete Separation	1688.45	26.83	1968.22
	Modified CST/Inline	1664.98	27.97	1931.50
	Mod. Total Storage	1682.56	28.48	1956.44

Current projections of the availability of Federal and State funds for water pollution abatement projects indicate that a maximum of approximately thirty-six percent of the MFP costs would be funded by either the federal or state government. The remaining portion of the costs would have to be financed locally, probably by the issuance of municipal bonds. To finance the debt service on the bonds, Milwaukee County is empowered to increase taxes on property within its boundaries. Communities outside Milwaukee County would be charged annually according to the existing Contract Formula. Operation and maintenance costs would be distributed separately and proportionately by the User Charge System.

Table 1.7 outlines the estimated average annual property tax rates that would result from the implementation of the final system-level alternatives. These costs were determined assuming that the MMSD would construct all elements of the alternatives, including rehabilitation and relief work both inside and outside the County, except that Muskego, South Milwaukee, Germantown, New Berlin, Caddy Vista, and Thiensville would construct their own facilities with the Local Alternative. For the Local Alternative, no Federal funding is assumed for this construction.

Historically, local communities have financed their own sewer rehabilitation and connecting sewers to the Metropolitan Intercepting sewer system. The MMSD plans to include these costs and the costs for CSO abatement in the City of Milwaukee and Village of Shorewood with other MFP costs, and to distribute the debt service to all communities involved. The ultimate acceptability and implementability of district-wide financing will, in all likelihood, be resolved in the courts.

1.2.3 Public Hearing and Comments

The Draft EIS was released to the public and to government agencies on November 14, 1980. This date marked the start of the 45-day public comment period for the Draft EIS. The agencies held a public hearing on December 18, 1980 to provide a forum for public comment. Due to the requests of both federal agencies and the public, the comment period was extended from January 2, 1981 to January 12, 1981. Although the December 18, 1980 public hearing did not raise any significant new issues, it, as well as the written comments received, did highlight the areas of the MFP that concerned the public. The groundwater impacts of the deep tunnels and cavern storage facility was a major concern of both citizens as well as professional and agency commenters. A second significant issue concerned the economic impact on the Milwaukee area of the MMSD Recommended Plan. Aside from these two major points, the comments also focused on issues of concern in the Draft EIS such as effluent outfall relocation, increased ammonia discharge, effects of land application of sludge, and lakefill alternatives for plant expansion.

1.3 ADDITIONAL ANALYSES/ISSUES RESOLUTION

Since issuance of the Draft EIS, substantial new information has become available through further EIS analyses, further facilities planning work by MMSD, and the receipt of research results from the University of Wisconsin-Milwaukee. This new information and the conclusions reached with respect to major issues raised on the Draft EIS are outlined below.

TABLE 1.7

EQUALIZED AVERAGE ANNUAL (1985-2005) PROPERTY TAX RATES
BY SYSTEM LEVEL ALTERNATIVE (Assuming In-Line Storage)

Alternative	Milwaukee County (State Law Requires Debt Service Recovery By Property Tax Method)	Contract Communities (Assumes Property Tax As Method of Cost Recovery, For Comparison Purposes)	Communities with Local Alternatives (Assumes Property Tax Method, For Comparison Purposes)
No Action	$.63 per $1000 $31. on a $50,000 home	Average = $.34 per $1000 Range[1] = $.13 to $.56 $17. on a $50,000 home	Not Available
Local	$4.33 per $1000 $216. on a $50,000 home	Average = $1.82 per $1000 Range[1] = $.62 to $2.82 $91. on a $50,000 home	Average = $3.77 per $1000 Range[4] = $.59 to $10 $188 on a $50,000 home
Regional	$4.29 per $1000 $214. on a $50,000 home	Average = $1.81 per $1000 Range[2] = $.59 to $2.54 $90. on a $50,000 home	All Communities Connected
Mosaic	$4.37 per $1000 $218. on a $50,000 home	Average = $1.83 per $1000 Range[3] = $.59 to $2.57 $91. on a $50,000 home	$.59 per $1000 For South Milwaukee $29. on a $50,000 home[5]

[1] Bayside (Ozaukee County), Brookfield, Butler, Elm Grove, Menomonee Falls, Mequon
[2] Bayside (Ozaukee County), Brookfield, Butler, Elm Grove, Menomonee Falls, Mequon, Muskego, South Milwaukee, Germantown, New Berlin, Thiensville, Caddy Vista
[3] All Communities above except South Milwaukee
[4] Caddy Vista, Germantown, Muskego, New Berlin, South Milwaukee, Thiensville
[5] All other communities connected
[6] Tax rates assume District-wide financing of all MWPAP components, except local plants.

1.3.1 CSO Abatement and Peak Flow Attenuation

1.3.1.1 Groundwater Impacts

A significant issue associated with the CSO and Peak Flow Attenuation Alternatives is the impact of a deep tunnel system on groundwater. Converse, Ward, Davis Dixon (CWDD), a geotechnical consulting firm, was retained by the EIS consultant to assess the impacts of transporting and storing CSO and separated sewer bypasses in a tunnel and cavern storage system in the Niagaran Dolomite Aquifer. CWDD reviewed the existing data and tentatively concluded that no significant adverse impacts would occur from either construction or operation of the system provided the tunnel alignment is carefully planned, constructed and monitored. However, the following studies and mitigative measures should be undertaken to ensure adequate protection of the groundwater.

- Review the available data from the Tunnel and Reservoir Project (TARP) in Chicago, and determine if comparisons are possible between the Chicago and the Milwaukee environments. If so, a more accurate prediction of infiltration should be made using this information.

- Conduct site specific studies to determine the location of fault zones and cones of depression due to high rates of groundwater pumping before final tunnel alignment is established.

- Utilize design and construction procedures such as tunnel lining to minimize infiltration or exfiltration during operation of the system.

- Establish a monitoring system which includes inspection and maintenance of structures to assure that any infiltration or exfiltration will be detected in a timely manner and promptly corrected.

1.3.1.2 I/I Removal

Since the Draft EIS was issued, the MMSD has completed the draft SSES report and the preliminary results indicate that a cost-effective level for I/I removal may only be 13%. This figure will not be finalized until the final SSES report is adopted by the MMSD in May of 1981. Because the final SSES report was not available for incorporation into the Final EIS, the analysis of alternatives presented in the final EIS assumes that 48% of I/I would be removed. If the final I/I removal level is less than 48%, as is suggested by the draft SSES report, additional cavern storage will be required.

1.3.2 Ammonia Discharge/Outfall Relocation

Since the issuance of the Draft EIS, the EPA and DNR received the results of a study performed by the University of Wisconsin-Milwaukee which evaluates the impacts on the Outer Harbor of ammonia discharged in effluent from the Jones Island WWTP. This report concludes that the increased ammonia discharge would have no adverse effects on dissolved oxygen levels in the Outer Harbor. However, the toxic effects of the ammonia discharges would still be a serious issue. The discharge plume containing potentially toxic concentrations of un-ionized ammonia could extend up to 2600 feet from the Jones Island outfall. Therefore, EPA and DNR are recommending that the MMSD develop and analyze alternatives to mitigate the toxic effects of the ammonia discharge within the mixing zone. At a minimum, the following conditions must be achieved:

(1) The effluent mixing zone should be limited to a range of 900 to 1200 feet from the Jones Island outfall

(2) The passage between the Inner and Outer Harbor should be free from a toxic barrier which could be harmful to aquatic life

(3) The acute un-ionized ammonia nitrogen toxicity standard (0.4 mg/l) should be met within the limited mixing zone as well as at the point of discharge

(4) The chronic un-ionized ammonia nitrogen toxicity standard (0.4 mg/l) should be met at the boundary of the limited mixing zone.

Relocation of the Jones Island outfall from the Outer Harbor into the open lake was also considered in order to mitigate the ammonia impacts. This action is not recommended because it would merely transfer the water quality impacts to the open waters of the Lake. There are some estimates that approximately 40 percent of the pollutants in the effluent remain in the Outer Harbor and EPA and DNR believe this is preferable to transferring these materials to the high quality areas of the Lake.

1.3.3 Lakefills

The U.S. Fish and Wildlife Service has raised objections to the proposed Lake Michigan lakefills. Their concerns focus on the adverse impacts lakefills would have on spawning habitats in the near-shore areas of Lake Michigan. While this is a legitimate concern, the value of the affected areas must be weighed against the improved water quality resulting from the proposed project.

In the case of Jones Island, any lakefill recommended would replace a relatively unproductive area of Lake Michigan. There is, however, some concern regarding the lakefill's impact on navigation and operability of Slip Number 1 of the Milwaukee Harbor Commission. A recent wave analysis prepared by MMSD has demonstrated that the 5.7 acre lakefill could increase the wave energy input into Slip Number 1 by 56 to 60% over that entering under the existing configuration. However, the wave reflection and surging in Slip Number 1 could be mitigated for both the existing and proposed shore line configuration. The MMSD recommends, and the EPA and DNR concur, that a sophisticated mathematical model study or a hydraulic model study, or both, should be undertaken to refine the results in the preliminary report. The models should also evaluate the efficiencies of mitigation alternatives.

For the South Shore facility, the EPA and DNR concern for the aquatic habitat is greater, since the proposed fill is in the open water of Lake Michigan. In addition, many residents of South Milwaukee are concerned about potential operational impacts of the South Shore facility which has caused odor problems in the past. However, it is EPA's conclusion that the loss of approximately 400 feet of Lake Michigan shoreline is reasonable considering the potential water quality improvements that will result from an upgraded South Shore Facility. Although it would be technically feasible to expand the South Shore facility without using lakefill area, the resulting operational and reliability factors introduced by such an alternative make the lakefill alternative preferable from an environmental perspective.

1.3.4 Fiscal/Economic Impacts

Another significant issue raised in comments on the Draft EIS concerned the ability of the Milwaukee economy to finance a program as costly as that proposed. While the Final EIS presents an analysis of the fiscal impacts under varying assumptions, the actual implementability of the plan will hinge on the ability to finance it.

One aspect of the plan which could be affected in scope and cost through additional analyses is the CSO element. The water quality impact studies which are required to establish minimally acceptable water quality standards under the provisions of the Clean Water Act require an analysis considering environmental, technical, and economic impacts of attaining water quality standards. This analysis should be initiated as soon as possible.

The limitations of State funds and decreasing Federal construction grant funds will result in a financial impact on the Milwaukee area. The EPA will continue to assist the DNR and MMSD in evaluating funding options to the extent possible.

1.4 EPA PREFERRED ALTERNATIVE

1.4.1 CSO Abatement and Peak Flow Attenuation

While considerable analyses have been completed concerning CSO abatement and peak flow attenuation, the complexity of the system, difficulty in quantifying water quality impacts, and changing assumptions such as the level of I/I removal have made this the most difficult plan element to evaluate.

Based upon information available at this time, the EPA recommends the Modified Total Storage system to abate CSO and attenuate peak flows from the separated sewer area. The level of protection provided by the Modified Total Storage system could range from two to five years, to meet applicable water quality standards. The aspects of the Modified Total Storage System providing a 2-year level of protection are outlined below:

- Complete Separation in 11% of the CSSA with no private property work.
- No sewer separation in the remaining portion of the CSSA.
- 68% of the CSSA tributary to 20-foot diameter tunnels and offline cavern storage at County Stadium and Jones Island.
- 21% of the CSSA tributary to near surface storage.

The aspects of the Modified Total Storage system providing a 5-year level of protection are outlined below:

- Complete separation in 11% of the CSSA with no private property work.
- No sewer separation in the remaining portion of the CSSA.
- 88% of the CSSA tributary to 20-foot diameter tunnels and offline cavern storage at County Stadium and Jones Island.
- 1% of the CSSA tributary to near surface storage.

The total storage volumes necessary to meet applicable water quality standards range from 1,400 acre-feet (for the two-year level of protection) to 2,550 acre-feet (for the five-year level of protection), assuming a 13% I/I removal rate by implementation of SSES recommendations.

The volume of offline cavern storage is affected by several factors and cannot be finalized until the MMSD, EPA and DNR resolve issues including the actual storage requirements resulting from greater I/I flows, the specific level of protection necessary to meet applicable water quality standards, and the specific sequencing of flow through the Jones Island and South Shore WWTP.

Although EPA has an estimate of the level of protection necessary to meet existing water quality standards, it is recommended that additional water quality analysis be conducted to definitively establish the minimum level of CSO control required to meet the provisions of the Clean Water Act. This analysis would evaluate the environmental, technical, and economic impacts of attaining water quality standards. The analysis should use dynamic modeling techniques to address the effects of all point and non-poing pollutant loadings, as well as sediment oxygen demand.

The Modified Total Storage Alternative with a 2 to 5 year level of protection for CSO is assumed to meet applicable water quality standards but will not meet the more stringent requirements of the U.S. District Court Order to convey, store, and treat the storm of record for the past forty years. Therefore, EPA's Preferred Alternative to meet minimum water quality standards will not be implemented if the U.S. Supreme Court upholds the U.S. District Court Order. The U.S. District Court Order alternative for CSO Abatement and Peak Flow Attenuation would be a more costly, larger scale alternative than an alternative to meet water quality standards.

The differences between the alternatives to meet the U.S. District Court Order and applicable water quality standards are independent of I/I removal levels. EPA and DNR have decided not to quantify the costs or storage volume required for U.S. District Court decision due to uncertain reliability of some of the more crucial estimating assumptions.

Because of the large quantities of rock and overburden that would result from the construction of the alternative for CSO abatement and peak flow attenuation, the EPA recommends that the MMSD continue facilities planning to develop an environmentally sound, cost-effective method for spoil disposal. This planning output must be submitted to the EPA and DNR for approval prior to the start of construction.

1.4.2 Wastewater Treatment

The EPA concurs with MMSD Recommended Plan for wastewater treatment because the total present worth of the Local Alternative is $50 million more than the MMSD Recommended Plan. In addition, the MMSD Recommended Plan would use slightly less energy and resources and its annual operation and maintenance costs would be lower than other alternatives under consideration.

The Jones Island and South Shore WWTPs would serve the entire planning area except for South Milwaukee which would operate its own facility. All other public WWTPs would be abandoned. The two private wastewater treatment plants, School Sisters of Notre Dame and Wisconsin Electric Power Company should also continue operations, and the Muskego Rendering Company should operate its private facility for pretreatment of effluent before discharge to the local sewer system.

The EPA also concurs with the MMSD Recommended Plan with respect to liquids and solids treatment processes at the Jones Island and South Shore WWTPs. However, the MMSD recommendation for a 9.5 acre lakefill at the Jones Island WWTP and enclosing 30 acres and filling 12 acres at the South Shore WWTP are considered excessive by the EPA. EPA recommends limiting the Jones Island WWTP lakefill to 5.7 acres and the South Shore WWTP lakefill to 12 acres. The smaller lakefills would allow WWTP expansion to proceed without any major construction difficulties.

The EPA agrees with the MMSD recommendation to disinfect the final effluent from the Jones Island and South Shore WWTPs with chlorine gas. The MMSD's discharge permits require a chlorine residual of 0.5 mg/l in the final effluent. The MMSD recommends dechlorination with sulfur dioxide to achieve this effluent limit. However, the EPA recommends that dechlorination be used to reduce residual chlorine to at least 0.05 mg/l without causing excessive sulfur dioxide overdosing. Adequate system controls such as feed control should be used to minimize sulfur dioxide overdose and avoid the resultant unnecessary oxygen demand in the final effluent. This level of residual chlorine would also minimize the toxic effect of combined and free chlorine, while continuing to provide adequate pathogen removal.

EPA also recommends that the MMSD evaluate alternatives for ammonia-nitrogen control at the Jones Island WWTP and implement the most cost-effective alternative. Ammonia-nitrogen control is necessary due to the EPA's and DNR's interpretation of the effluent mixing zone and the existing DNR standard for un-ionized ammonia-nitrogen of 0.04 mg/l for the Outer Harbor.

1.4.3 Solids Handling

The EPA is basically in agreement with MMSD's recommendations to landfill Jones Island sludge and to apply sludge from South Shore to agricultural land. The concern about toxic substances and heavy metals and their potential effects on area farmland is valid, but the controls proposed by MMSD should be sufficient to avoid any adverse effects. It is important that MMSD rigorously implement its pretreatment program to minimize all toxic discharges to its system. If the pretreatment program is successful, reduced levels of toxic substances and heavy metals may, in the future, allow land application of Jones Island sludge.

1.4.4 Wastewater Conveyance

EPA is in agreement with MMSD's Recommended Plan for construction of intercepting and relief sewers. There are several cases however that are somewhat controversial, and one case where EPA cannot make a definite recommendation at this time.

EPA concurs with the MMSD that the Menomonee Falls-Germantown, Hales Corners and Oak Creek Interceptors should be constructed, but mitigating measures of institutional controls to limit development should be implemented through staging or with planned development in each sewer service areas. The Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the local governments will need to work closely to prevent scattered development not in conformance with the Regional Land Use Plan. EPA also concurs with the MMSD that the Northeast Side Relief System, Underwood Creek, Root River and Franklin-Muskego Interceptors should be constructed.

The Franklin Northeast Interceptor was also recommended in the 208 Plan, but MMSD, at least initially, found it to be more cost-effective to upgrade several pump stations. They later changed their recommendation after strong opposition at public hearings. EPA believes that additional information is necessary concerning the existing on-site systems in the area and the ability to serve additional development on such systems. The 208 Plan conclusion was based primarily on the fact that the soils in the area are classified by the Soil Conversation Service as severely limiting. While this

factor must be taken into consideration it alone cannot serve as the basis for supporting an interceptor recommendation. Until further information is available, the EPA and DNR will be precluded from approving this portion of the facilities plan.

1.4.5 Costs

The total system costs for EPA's Preferred Alternative assuming a 13% cost-effective I/I removal rate will range from $1.47 billion for a 2-year level of protection for CSO to $1.64 billion for a 5-year level of protection for CSO. The total system cost for U.S. District Court alternative would be higher because more storage is required for a greater level of protection.

1.5 ENVIRONMENTAL CONSEQUENCES

The environmental impacts of EPA's Preferred Alternative are very similar to the MMSD's Recommended Alternative. Section 1.2.2 describes the environmental impacts for all alternatives considered by the EIS including the MMSD Recommended Plan. Outlined below are the environmental impacts of EPA's Preferred Alternative which were not addressed in Section 1.2.2.

1.5.1 CSO Abatement and Peak Flow Attenuation

The Modified Storage Alternative with a 2 to 5 year level of protection for CSO would have the same environmental impacts which are outlined in Section 1.2.2.3. However, EPA's Preferred Alternative would overflow to the receiving streams on the average once every two to five years. These overflows would disturb the highly polluted sediments, re-introducing these pollutants into the waterways. Levels of dissolved oxygen would be temporarily diminished as this organic matter decomposed.

1.5.2 Wastewater Treatment

EPA's Preferred Alternative is identical to the MMSD's alternative except for the size of the proposed lakefills at both WWTPs. The South Shore WWTP lakefill preferred by EPA would enclose and fill only 12 acres compared to the MMSD alternative of enclosing 30 acres and filling 12 acres. EPA's Preferred Alternative would utilize approximately 400 ft. of Lake Michigan shoreline rather than 1000 feet.

The loss of 400 ft. is reasonable considering the potential water quality improvement that would result from the upgraded South Shore WWTP. The EPA also recommends limiting the Jones Island lakefill to 5.7 acre rather than the 9.5 acre as re-

commended by the MMSD. The limited lakefill would reduce the amount of aquatic habitat being permanently removed from the Outer Harbor by almost 50%.

1.5.3 Solids Handling

The environmental impacts of EPA's preferred solids handling alternative would be identical to those of the MMSD Recommended Plan, since EPA has also recommended landfilling of all solids from the Jones Island WWTP and agricultural application of solids from the South Shore WWTP. The environmental impacts are discussed in Section 1.2.2.5.

1.5.4 Wastewater Conveyance

The construction of interceptors would directly affect the natural environment of the MMSD planning. In addition, these interceptors would have a minimal secondary growth impacts in some areas. These impacts are outlined in Section 1.2.2.6.

1.6 SUMMARY

This Executive Summary only briefly outlines the EPA and MMSD Preferred Alternatives for water pollution abatement and the effects of these alternatives on the environment of the planning area. The Chapters 2 through 5 of the EIS describe in more detail the legislation guiding the MFP, the development of alternatives, the environment of the MMSD planning area, and the environmental impacts of the alternatives. In addition, the appendices to this document provide technical information about the component projects of the MFP.

CHAPTER 2

PURPOSE AND NEED

Chapter 2
PURPOSE AND NEED FOR THE MASTER FACILITY PLAN

As the City of Milwaukee expanded and industrialized, the quality of surface waters in the region declined. Even today, untreated sewage is discharged into these waters on occasion. Public concern about water pollution in the Milwaukee area has increased greatly over the past three decades, and in the 1950s, the city began to evaluate its sewage collection and disposal methods. In addition, recent Federal and State legislation and legal proceedings have established timetables and standards that Milwaukee must meet with a comprehensive sewerage program. The Milwaukee Water Pollution Abatement Program (MWPAP) was initiated for that purpose.

2.1 BACKGROUND

Milwaukee was founded as a trading post on Lake Michigan in 1795. From the City's beginning, the lake was its focal point, serving as means of transportation and supply of food and water. In the nineteenth century, with the arrival of the railroad, the City had a period of tremendous growth and change. The population quadrupled between 1850 and 1880, and industry became increasingly important to the local economy. The rapid growth and industrialization brought with them pollution, health, and transportation problems previously unknown. At this time, there was no public system for disposal of domestic and industrial waste and often the wastewater was merely deposited in the nearest body of water.

By the 1860s the leaders of Milwaukee were aware of a decline in the quality of their rivers caused by this method of sewage disposal. A well-known engineer, E.S. Chesborough, was hired to design the City's sewer system. Using the best technical knowledge of his day, Chesborough designed a system to collect domestic sewage and storm water and direct the flows away from the smaller watercourses to City's major rivers. This "combined" sewer system was constructed over the next fifty years.

Although these sewers alleviated pollution problems in smaller streams, untreated sewage was still being discharged to the Milwaukee, Menomonee, and Kinnickinnic Rivers, and ultimately to Lake Michigan. As the population continued to grow, the quality of these rivers declined. Odor problems became severe, particularly during warm weather. To reduce these problems, two flushing tunnels were built from Lake Michigan; first to the Milwaukee River and later the Kinnickinnic River. Water was pumped from the Lake through the tunnels into the lower reaches of the rivers to flush pollution out of the rivers and into the Lake. The flushing tunnels lessened the rivers' odor and nuisance problems, but did little to alleviate their continued pollution.

By the end of the nineteenth century, it was recognized that the presence of untreated sewage in surface waters posed a hazard to public health. In 1911, an Ad Hoc Committee report, "The Disposal of Sewage and Protection of the Water Supply of the City of Milwaukee," found that the flushing tunnels provided temporary relief from offensive conditions but that the public health hazards associated with Milwaukee's sewage disposal remained.

In 1913, the Sewerage Commission of the City of Milwaukee was formed to deal with the worsening problems caused by sewage disposal. This Sewerage Commission began pilot testing new sewage treatment processes in 1918 and, after study, the first full-scale activated sludge wastewater treatment plant in the country was built at Jones Island. The plant began operation in 1925 and the facilities were expanded over the course of the next 30 years.

The Metropolitan Sewerage Commission of the County of Milwaukee was formed in 1921 to have similar responsibility for the rest of Milwaukee County and additional areas within the County's general drainage basin. The County Commission redefined its ultimate service area in 1933. At that time, area limits were set to the south at the Milwaukee-Racine County line, to the north at the north line of Township 9 in Ozaukee County, and to the west close to the subcontinental divide which separates the Fox River watershed (which flows to the Mississippi River) from the Lake Michigan drainage basin. All planning after this date has been based on this description. The current jurisdictional boundaries are shown in Figure 1-1. They are similar to the limits suggested in 1933.

Over the next twenty years, these sewerage facilities were expanded. In 1951, both Sewerage Commissions initiated a joint study to develop a strategy for future sewerage facilities. The "Master Plan" (area-wide plan) was formally adopted by the Sewerage Commissions in November, 1959.

This plan recommended that the soundest approach to providing area-wide sewer service was to construct a new wastewater treatment facility and expand the intercepting sewer system. As a result, the South Shore Wastewater Treatment Plant was designed, and construction was completed in 1968. Additional interceptors were constructed to convey wastewater to the new facility.

In 1960, the Sewerage Commission of the City of Milwaukee and the Metropolitan Sewerage Commission for the County of Milwaukee combined to form the Milwaukee Metropolitan Sewerage District (MMSD) which exists today. The MMSD serves 18 of the 19 communities in Milwaukee County: Bayside, Brown Deer, Cudahy, Fox Point, Franklin, Glendale, Greendale, Greenfield, Hales Corners, Milwaukee, Oak Creek, River Hills, St. Francis, Shorewood, Wauwatosa, West Allis, West Milwaukee, and Whitefish Bay. Also, the MMSD is

empowered to deal with any city, town, village, sanitary district, or metropolitan sewerage district within the planning area (shown in Figure 1-1), including all or portions of the following communities: Brookfield, Butler, the Caddy Vista subdivision in the town of Caledonia, Elm Grove, Germantown, Menomonee Falls, Mequon, Muskego, New Berlin, South Milwaukee (the only community in Milwaukee County that is not part of the MMSD), and Thiensville.

In 1974, in accordance with federal legislation, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) requested that the Governor of Wisconsin designate the Southeastern Wisconsin Region as a water quality management planning area, and name their commission as the 208 planning agency. After a public hearing, the Governor granted that request which gave SEWRPC the primary responsibility for water quality planning in the Milwaukee area and the rest of the seven county area of Southeastern Wisconsin. In June, 1979 SEWRPC published their Regional Water quality Planning Report (208 Plan). This plan has been subsequently approved by DNR, the Governor of Wisconsin, and EPA.

As part of their planning effort, SEWRPC initially published Planning Report Number 16, "A Regional Sanitary Sewerage System Plan for Southeastern Wisconsin", in 1974. This report and the new Federal and State legislation prompted the MMSD to further study Milwaukee's Sewerage Facilities.

Today, the two MMSD wastewater treatment plants have been upgraded. Also, numerous independent facilities have been constructed. However, the pollution problems from sewage disposal have not disappeared. Milwaukee's sewerage facilities have been built over a seventy year time-span, and some of the techniques that were innovative at the time of their construction are now outdated.

Portions of the MMSD service area are presently served by both combined and separated sewers. The combined sewers are located in the older sections of Milwaukee and portions of Shorewood. They serve twenty-three square miles (59.6 km^2), about 6.5% of the planning area. These sewers, many of which are more than 70 years old, were built to carry both domestic wastewater and storm runoff. During wet weather, flows to these sewers increase tremendously. To prevent sewage backups, the sewers were designed to discharge excess sewage and storm water directly to the Milwaukee, Menomonee, and Kinnickinnic Rivers which carry the overflow to Lake Michigan. These discharges are referred to as combined sewer overflows (CSOs).

Other parts of the planning area are served by separated sewers. These sewers were designed to convey only sanitary flow. However, during wet weather, excess groundwater and runoff (clear water), known as infiltration and inflow (I/I), enter the system through cracks, manholes and roof drains. This I/I can increase the flow

beyond the sewer's capacity, causing sewage to backup into basements. To prevent the severe health hazards associated with these backups, separated sanitary sewers are also equipped to bypass excess flows to the rivers.

Overloading can also occur at the wastewater treatment plants. There are times when the amount of wastewater carried to a treatment plant exceeds the facility's capacity. At these times, the excess wastewater is inadequately treated or may bypass treatment altogether and be discharged directly into the Lake, Milwaukee Harbor, or a nearby river.

2.2 LEGISLATION AND COURT ACTIONS

The public's concern about the quality of their environment has grown tremendously over the past decade. With this increased concern have come stricter Federal and State legislation and a new awareness of the importance of evaluating existing techniques for waste disposal. In 1969, Congress passed the National Environmental Policy Act (NEPA) which recognizes each person's right to a healthful environment and directs the Federal Government to "promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man." NEPA requires that all federal agencies use a systematic, interdisciplinary approach for planning and decision-making. An environmental impact statement (EIS) is required for all federally funded actions that could significantly affect the quality of the human environment.

The State of Wisconsin created the Wisconsin Environmental Policy Act (WEPA) in 1972. Patterned after NEPA, WEPA sets a policy which encourages "productive and enjoyable harmony between man and his environment." It also states requirements for integrated planning and the preparation of environmental impact statements. The Wisconsin Administrative Code sets effluent limitations and design specifications for waste treatment and conveyance facilities.

The Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) sets national water quality goals of restoring and maintaining the chemical, physical and biological integrity of the Nation's waters. Section 201 of this Act establishes a three step funding procedure to encourage the construction of new wastewater treatment plants. Step one of the program provides funding for the planning of wastewater treatment systems, called "facilities planning." The second step provides funding for the actual design of the facilities, and the third step subsidizes their construction. Regional water quality planning is required by Section 208 of this Act, and National Pollution Discharge Elimination System (NPDES) is established in Section 402, requiring a permit for the discharge of any pollutant to surface or groundwater. The Wisconsin DNR has been authorized to administer this program by issuing Wisconsin Pollutant Discharge Elimination System (WPDES) permits.

The Clean Water Act of 1977 (P.L. 95-217) amends Public Law 92-500. It encourages the use of energy conservation measures and provides for more federal funding of facilities planned, designed or constructed for water pollution control.

Other federal legislation regulations and executive orders also have affected water quality planning in Milwaukee. Executive Orders 11990 and 11988 establish a federal policy of avoiding adverse impacts on wetlands and floodplains. The Endangered Species Act of 1973; the National Historic Preservation Act of 1966; Executive Order 11593, "Protection and Enhancement of the Cultural Environment"; the Wild and Scenic Rivers Act; and many other federal requirements influence planning in the Region.

At the same time, two legal events raised questions about the adequacy of the City of Milwaukee's sewerage facilities. In December 1974, a WPDES permit issued to the MMSD by the Wisconsin Department of Natural Resources (DNR) required that secondary treatment standards be met at the Jones Island Wastewater Treatment Plant by January 1, 1975. The MMSD challenged these requirements in the Dane County Circuit Court, arguing that the deadline set by federal legislation for secondary treatment standards was July 1, 1977.

The case resulted in a stipulation, between the parties that were entered as a judgment in the Dane County Circuit Court on May 25, 1977, which sets forth a pollution abatement program which the Sewerage Commission of the City and County of Milwaukee must undertake to meet DNR and Environmental Protection Agency (EPA) standards. The court stipulation (see Appendix I) set deadlines for the completion of treatment plant improvement and rehabilitation, relief sewer construction, interceptor construction, and the abatement of combined sewer overflows (CSOs). Compliance with secondary treatment standards for treatment plants during dry weather and completion of a Total Solids Management Program are required by July 1, 1982.

Secondly, in a Federal lawsuit filed in 1971, the States of Illinois and Michigan alleged that wastewater discharged by the City of Milwaukee and the MMSD into Lake Michigan endangered the health of their citizens and caused accelerated eutrophication of the Lake. An initial application for resolution by the U.S. Supreme Court was denied in April 1972, and the case was assigned to the U.S. District Court, Northern District of Illinois, Eastern Division. In a verbal opinion issued on July 29, 1977, Judge John F. Grady ruled that Milwaukee must eliminate its combined sewer overflow problem and meet wastewater treatment standards more stringent than the secondary treatment limitations imposed by federal legislation. A stipulation between the parties that was entered as a judgment on November 15, 1977, sets requirements and deadlines for a program for the abatement of pollution in the Milwaukee area. (Appendix 1).

On April 26, 1979, the Federal Court of Appeals in Chicago partly reversed the District Court ruling. The Court of Appeals rejected the stringent effluent limitations, substituting the EPA and DNR effluent standards, but it reaffirmed the District Court's stipulation and that all overflows and bypasses must be eliminated. Since that partial reversal of the U.S. District Court's decision, the MMSD has continued to petition the Supreme Court, in appeal of the original District Court Decision and the Federal Appeals Court ruling. On March 17, 1980, the Supreme Court agreed to hear the MMSD's case. This hearing is now pending and the proceedings could take at least one year.

2.3 WATER POLLUTION ABATEMENT PROGRAM

The Milwaukee Water Pollution Abatement Program (MWPAP) was the result of the outlined legislation and legal actions. With grant assistance (provided through Section 201 of PL 92-500) from the United States EPA and the Wisconsin DNR, the MMSD has prepared a "facilities plan" which is intended to determine the most cost effective and environmentally compatible methods for the conveyance, treatment, and disposal of sewage within their contract area.

The goal of the MWPAP is to end discharges of inadequately treated wastewater to the waters of the planning area in accordance with the Dane County Circuit and Federal District Court Orders. Also, the sewerage facilities must meet the federal and state effluent limitations and water quality standards. These actions, in the context of the SEWRPC Regional Water Quality Plan, seek to bring the Region's water quality closer to the national goal of fishable and swimmable waters by 1983. To achieve these goals, the MWPAP has the objective of maximizing water quality in the Menomonee, Milwaukee, and Kinnickinnic Rivers and Lake Michigan, while minimizing environmental and monetary costs.

The protection and enhancement of air quality is the national objective of the amended Clean Air Act. Another concern of the MWPAP project is compliance with the Clean Air Act through conformance with the State Air Quality Implementation Plan.

Other objectives of this project are conformance with the SEWRPC year 2000 recommended land use, sanitary sewerage, transportation, water quality, and park and open space plans. The policies which are the basis for the general SEWRPC land use plan are planned contiguous urban development at medium density, and preservation of prime agricultural lands and of areas designated as environmental corridors.

The MMSD Master Facilities Plan has five components: (1) Sewer System Evaluation Survey, (2) intercepting sewers for relief and extension of the MMSD service area, (3) treatment plant rehabilitation, (4) a solids management program and (5) abatement of combined sewer overflows.

1. Sewer System Evaluation Survey (SSES) for the sewer systems owned by each of the communities in the MMSD service area will require approximately three years (1978-1981) because of the size of the collection system. Ongoing rehabilitation of the locally owned systems to eliminate excessive flow will last up to five additional years (1982-1986). This program is currently underway and will locate sources of infiltration and inflow. Corrective action recommended by the SSES would result in a reduction of flow to the sewage treatment plants. It has been indicated in previous studies that these flow reductions will ensure reserve capacity during the design period (1985-2005) and avoid the more costly alternative of major treatment plant expansion.

2. Intercepting Sewer Program was originally conceived in 1973 to expand the MMSD's sewer service area. This plan, which recommends the construction of fourteen new interceptors, was used by SEWRPC in the development of their Regional Sanitary Sewerage System Plan. As part of the MWPAP program, the MMSD has studied the need for these proposed interceptors at this time and the impacts of their construction on the natural and manmade environments.

3. Rehabilitation and Expansion of the Two Existing Wastewater Treatment Plants is a program to study and implement methods to improve the operation of the Jones Island and South Shore WWTPs, including immediate measures to expand the facilities for the handling and disposal of solids removed from the wastewater. This rehabilitation and expansion must produce a high quality effluent, eliminate effluent violations and help to make the area's waters suitable for their designated purposes.

4. Solids Management Program goes beyond the short-term solids disposal practices presently being implemented by the MMSD. A long-term solids handling approach must be developed for the entire service area. This EIS addresses the solids handling at the treatment plant sites. The ultimate disposal site analysis will be given in a supplement to this EIS.

5. CSO Program was required by the Dane County and Federal District Court Orders. The purpose of the program is to determine the most effective, most environmentally compatible, and least costly method for modifying Milwaukee's combined sewer system to abate CSO.

2.4 PURPOSE AND NEED FOR THE ENVIRONMENTAL IMPACT STATEMENT

The EPA performed a preliminary review of the MMSD facilities planning studies, and determined that there was a possibility

of significant environmental impacts as a result of the MWPAP. Notices of Intent to prepare an environmental impact statement were published on February 19, 1976 and April 18, 1977. They were amended by supplemental Notices of Intent on October 21, 1977, February 8, 1978, and March 23, 1978 (Appendix I).

The Notices of Intent outlined the proposed interceptors and identified the potential significant environmental impacts associated with the project. They include impacts related to the location, construction, operation and maintenance of wastewater treatment and conveyance facilities in the planning area, the Total Solids Management Program, the abatement of CSOs, and certain interceptor programs. Table 2.1 summarizes the issues identified in the Notices of Intent and amendments.

Some interceptors identified in the original Notices of Intent subsequently received a Finding of No Significant Impact (formerly Negative Declaration). A Finding of No Significant Impact presents the reasons why an action would not have a significant effect on the human environment and indicates that an environmental impact statement will not be prepared. Table 3.14 shows the status in terms of an EIS or negative declaration of each interceptor and its tributary area.

On March 9, 1979, facilities planning for four of these interceptors was halted based on the determination by the MMSD that there was no demand for the proposed interceptors during the planning period (1985-2005). The analysis of the alignments and tributary areas for the Oak Creek south of Ryan Road, Ryan Creek, Oak Creek Southwest and Caddy Vista interceptors are, therefore, not included in this EIS.

Although the Caddy Vista Interceptor was eliminated from the MWPAP, the existing Caddy Vista WWTP, which serves a subdivision in the town of Caledonia in Racine County, was included in the Master Facilities Plan. This facility is in poor condition and numerous bypasses of untreated wastewater occur in the Caddy Vista sewer system. Because of the condition of the WWTP, and based upon the request of the Caddy Vista Sanitary District, the EPA and DNR evaluated the impacts of connecting the wastewater from the subdivision to the MIS by a force main. On September 10, 1980, based on the Facilities Plan and on the Environmental Assessment for the force main project proposed by the Caddy Vista Sanitary District, this connection was given a Finding of No Significant Impact. Since the Caddy Vista WWTP is considered in the MWPAP, it is also considered in this EIS.

This EIS was prepared simultaneously with the MWPAP planning process. It describes the alternatives considered by the MWPAP for reaching the objectives of State and Federal legislation and

TABLE 2.1

ISSUES IDENTIFIED IN THE
EIS NOTICES OF INTENT

Combined Sewer Overflows Alternatives:[1]

"• Potential impacts on groundwater quality;
• The primary and secondary impacts of rock disposal;
• Disposal of solids that will be captured by the system;
• Cost-effectiveness of wastewater treatment as it may be affected by the implementation of the recommended alternatives;
• Impacts on the achievement of water quality standards;
• Impacts from construction of the recommended alternative;
• Resource impacts resulting from implementation, including financial, labor market and energy resources."

Interceptors:

• Impacts on hydraulic capacities of conveyance facilities, pollutant loads to WWTPs, handling and disposal of sludge;
• Their effect on the ability of WWTPs in the planning area to meet WPDES standards and improvement to area-wide water quality;
• The relationship between the sizing, phasing and alignment of interceptors and future population estimates;
• Any potential of the interceptors construction to accelerate or induce growth in their tributary areas;
• Direct environmental impacts from interceptor construction;
• Impacts on financial, construction and energy resources.

Solids Management

Four possible alternatives were developed for solids handling: incineration, landfill, land application and various combinations. Concerns were identified for each type.

Incineration

• Air quality impacts;
• Availability of facilities and their capacities;
• Impacts of developing a new site on land use, public health and groundwater, construction impacts, effects of the operation of a new site, and its socio-political implications.

Land Application

• Energy requirements;
• Impacts on air quality (including odor and possible pathogens);
• Monitoring and controlling surface water runoff.

[1] Quoted from EPA, Notice of Intent to Prepare an Environmental Impact Statement, 18 April, 1977.

legal proceedings, and the effects that the most feasible of those alternatives would have on the natural and man-made environments in the Milwaukee area. This section of the EIS will explore why Milwaukee's sewerage system needs upgrading and will outline the environmental, technical, legislative and legal issues that must be addressed by such a plan.

In addition to the EPA and DNR, other government agencies were involved in the preparation of this EIS. Because some of the plans under consideration might require filling in a portion of Lake Michigan, the U.S. Army Corps of Engineers, the Office of Coastal Zone Management, and the U.S. Fish and Wildlife Service must be satisfied by the analysis of environmental issues included in this EIS. Also, the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) is involved because the application of treatment plant sludge to agricultural land is under consideration. The EIS Study Team has coordinated their efforts with these agencies to assure that the EIS responds to their concerns.

2.5 SUMMARY

The existing sewerage facilities in the MMSD planning area were constructed over the course of this century. Some of these facilities employ outdated techniques, others are too small or in need of repair. As a result, raw or inadequately treated sewage is periodically discharged to surface waters in the planning area, creating the risk of health hazards and impairing water quality.

As the public concern for environmental quality has grown, new Federal and State legislation has been enacted to improve national water quality. In response to this public concern, legislation, and recent court stipulations, the MMSD has initiated a program to develop a strategy for the disposal of sanitary waste within its planning area.

This EIS has been prepared concurrently with the facilities planning, conducted by MMSD. Preparation included auditing of the methods and results documented in the Master Facilities Plan and conducting independent analyses when necessary. This EIS considers the collective impacts of the complete wastewater conveyance and treatment system. The separate programs are integrated into one facilities plan which should define a cost-effective, environmentally sound solution to Milwaukee's wastewater treatment problem. The proposed action must eliminate discharge of untreated waste into the surface waters and allow adequate capacity for the increasing population and economic growth of the area. This EIS investigates the beneficial and adverse impacts of the proposed action, the committments of resources necessary to implement the action, and how the action will affect the short-term and long-term use and productivity of the environment.

CHAPTER 3

ALTERNATIVES

3.0 INTRODUCTION

The Master Facilities Plan (MFP) includes the MMSD Recommended Plan to abate the wastewater pollution problems experienced in the MMSD planning area. The MFP examines alternatives to convey and treat wastewater flows from the planning area through the year 2005 based on the recommendations of the regional water quality management plan (208 Plan) prepared by the Southeastern Wisconsin Regional Planning Commission (SEWRPC). The legislation and court orders discussed in Chapter 2 and the facilities planning requirements defined in Environmental Protection Agency (EPA) regulations and the Wisconsin Administrative Code were the two other major considerations in the development of the MFP.

The MFP developed and evaluated alternatives to comply with the two court orders: the U.S. District Court Order and the Dane County Court Stipulation. Both court orders require the MMSD to: 1) eliminate wet and dry weather bypassing from the separated sewer area; 2) control combined sewer overflow (CSO) from the combined sewer service area; 3) undertake a treatment plant and sewer improvement program; and 4) develop a wastewater solids management plan. The specific requirements and schedules are presented in Chapter 1.

This chapter describes the development and evaluation ("screening") of alternatives to meet the requirements listed above. The following elements were considered in the development of these alternatives.

1. Wastewater treatment plants and processes. This includes various combinations of the nine public and eight private wastewater treatment plants (WWTPs) currently in service and new configurations of treatment facilities.

2. Relief interceptor sewers for containment of flows for eliminating wet weather bypassing from both the separated sewer area and the combined sewer service area (CSSA). This element includes measures for abating CSO, such as complete sewer separation, partial sewer separation, and combinations of conveyance, storage, and treatment.

3. Expansion of interceptor sewers for extending sewer service in a manner consistent with the approved 208 Plan; both to eliminate existing problems and to serve planned growth.

Alternative development included the analysis of several approaches to eliminating sewage-related pollution in the MMSD planning area, including three possible strategies for organizing the components of wastewater treatment systems to

provide areawide wastewater treatment. It also involved the evaluation of the conditions of the existing facilities and their ability to meet the requirements cited above through the planning period. The strategies, referred to as system-levels, integrate reduction of wastewater quantities in excess of the capacity of the system, conveyance arrangements, and treatment facilities.

The Local System-Level Alternatives explore the viability of treating wastewater flows at the locally-operated WWTPs. These alternatives emphasize the rehabilitation and use of the 17 existing treatment facilities in the planning area, although new WWTPs were also considered.

Another approach to area-wide wastewater treatment would be to divide the planning area into medium-sized sewer service areas or subregions. Three potential subregions were delineated based on the existence, in the area, of a WWTP that could be expanded and the existence of, or proposal for, an interceptor sewer.

The Regional System-Level is the third possible strategy for wastewater treatment in the planning area. The entire area could be served by one, two, or three large WWTPs. All other public and private facilities would be abandoned.

Two other types of alternatives were also developed and evaluated. The No Action Alternative was carried through the entire environmental impact analysis as a control against which all other alternatives would be compared. Also, alternatives were considered that combined aspects of two or more of the systems levels; these were called Mosaic Alternatives. (The MMSD Recommended Plan is a Mosaic Alternative.) The components of the Local, Subregional, and Regional System-Level Alternatives are shown on Table 3.1. The alternatives that were considered are described in greater detail in section 3.5.

Water quality standards have been established by the DNR and approved by EPA. Wastewater discharge permits are issued and enforced to attain these standards. Any wastewater treatment system must be adequate to meet the enforceable requirements of the Clean Water Act and Chapter 147 of the Wisconsin Statutes. The EPA and DNR facilities planning regulations were developed to assist municipalities in meeting these requirements. The applicable water quality standards for waters of the MMSD planning area are listed in Table 4.1.

TABLE 3.1

Systems Level	Possible WWTPs	Possible MMSD Interceptors	Possible Local Connection Sewers	Actions Common to All Systems Levels
Local	Thiensville Germantown New Berlin Muskego Caddy Vista South Milwaukee MMSD	Northeast Side Relief Underwood Creek Root River Franklin-Muskego (Franklin only) Franklin Northeast Oak Creek North Oak Creek South Oak Creek Southwest Ryan Creek	New Berlin Sewer Muskego Sewer Mequon Sewer	CSO Solids Management I/I Removal
Subregional	Mequon-Thiensville-Germantown Mequon-Thiensville Germantown Muskego-New Berlin MMSD	Northeast Side Relief Underwood Creek Root River Franklin-Muskego Franklin Northeast Oak Creek North Hales Corners Oak Creek South Oak Creek Southwest Ryan Creek	Mequon-Thiensville Sewer Germantown Sewer Muskego-New Berlin Sewer Muskego Sewer Regal Manors Sewer Caddy Vista Sewer	CSO Solids Management I/I Removal
Regional	MMSD	Northeast Side Relief Underwood Creek Root River Franklin-Muskego Hales Corners Franklin Northeast Oak Creek Menomonee Falls-Germantown Oak Creek South Oak Creek Southwest Ryan Creek	Mequon-Thiensville Sewer Germantown Sewer Regal Manors Sewer Muskego Sewer Caddy Vista South Milwaukee Sewer	CSO Solids Management I/I Removal

Facilities plans must include an analysis of the alternative treatment configurations which take into account the infiltration/inflow in the existing system. The facilities plan must also include a cost-effectiveness analysis of the alternatives which identifies the least expensive, most environmentally sound alternative. This analysis includes determining the size of the treatment works needed to meet projected future needs, evaluating alternative flow and waste reduction methods, evaluating upgrading the existing facilities to meet water quality standards over the planning period, and determining the capability of proposed alternatives, including treatment of CSO,to meet water quality standards through the planning period. Facilities plans must also include an evaluation of the methods for ultimate disposal of treated wastewater and sewage sludge. The environmental effects of proposed facilities, alternative and innovative processes, energy requirements, and recreational opportunities must also be considered in a facilities plan.

The 208 Plan establishes objectives for land use, sanitary sewer service, water quality, and other considerations for the region which includes the MMSD planning area. The MMSD considered the 208 recommendations when developing the MFP.

3.1 AVAILABLE WASTEWATER POLLUTION CONTROL APPROACHES

In order to better understand how the components of a wastewater treatment system function to control wastewater pollution problems, it is useful to consider the four basic approaches that could be applied to manage wastewater in the MMSD service area. These basic approaches could be used, either singly or in various combinations, to meet the requirements outlined previously.

Wastewater can be controlled where it originates, the Source Control approach. Excessive wastewater flow can be managed within the conveyance system, mainly by increasing the conveyance capacity. This approach is the Conveyance and Storage Control method. Pollution from wastewater discharges can also be abated by End-of-Pipe Control measures, including the various combinations of treatment plants and treatment processes. Another approach to water pollution control is to increase the capacity of the receiving waters to assimilate wastes. This is the Instream Control approach. All of these approaches can be combined to restore and maintain water quality.

The alternative systems discussed in this chapter are various combinations of these approaches which have been assembled to meet the requirements imposed by the court orders, the Clean Water Act, and State legislation.

3.1.1 Source Controls

Most of the sewage-related pollution of surface waters in the MMSD planning area results from the periodic overloading of sewerage facilities. The bypassing of raw sewage from conveyance facilities, operating difficulties and bypassing of partially-treated sewage from WWTPs are usually related to the quantity rather than the quality of sewage flows. Pollution abatement projects which reduce the flow as well as the strength of the wastes utilize the Source Control approach.

3.1.1.1 Flow Reduction

There are both separated and combined sewers in the MMSD planning area (see page 2-3). Ideally, separated sewers convey domestic, commercial, and industrial wastewater only. However, infiltration and inflow (I/I) (see page 2-4) can enter the sanitary sewers from both intentional sources, such as connections from roof drains and sump pumps, and unintentional sources, such as surface runoff entering through flooded manholes and groundwater entering through cracked sewers.

This I/I greatly increases the flow in the sanitary sewers, especially during wet weather periods, requiring larger conveyance and treatment facilities. Eliminating some sources of I/I flows from the sewer system by repairing unintentional leaks and diverting intentional flows elsewhere is sometimes less costly than treating the entire flow. State and federal regulations require municipalities to determine the cost-effective levels of I/I reduction.

In a combined sewer system, storm water runoff and wastewater are contained in a single sewer, and drastic design changes are required to remove runoff flows from the system. These changes include separating wastewater flows from surface runoff or reducing the amount of runoff that enters the combined sewers.

Sewer separation is one method of source control. With this alternative, a new sewer system would be constructed. The new system, in conjunction with existing combined sewers, would be used to separate some or all of the storm water from the sewage. One method of sewer separation would be to disconnect all stormwater drains from the sanitary sewers (complete separation). This alternative would require modification of almost every building in the CSSA. Another method would involve disconnecting only those storm water sources in the public right-of-way (partial separation). The source control alternatives initially considered in the MFP planning process are described below.

1. Complete separation, installing new sewers for conveying storm water.

2. Complete separation, installing new sewers for conveying sanitary waste only.

3. Partial separation, installing new sewers for conveying wastewater from private property, including sewage and water from roof and yard drains.

4. Partial separation, connecting existing catch-basins to new storm sewers for conveying storm water from the streets.

5. Low pressure sanitary system, installing new small-diameter sewers inside existing pipe for either complete or partial separation.

3.1.1.2 Control of Toxic Substances

Toxic substances in the wastewater orginate from both domestic and industrial sources. Domestic source contributions are typically of very low concentration and difficult to regulate. Industrial sources produce greater concentrations that are relatively easier to regulate and treat. Industries can generally reduce the strength of their wastewater by changing plant operation or by treating their wastes before discharging them to the municipal sewer system. Industries can also disconnect from the municipal system and fully treat their own wastes. Industrial waste discharges into public sewers are regulated by 40 CFR 403, EPA regulations on pretreatment. The State of Wisconsin has proposed pretreatment regulations which parallel the requirements of the federal program.

Generally, the pretreatment regulations prohibit industrial wastes which would damage or threaten the operation of sewer systems or WWTPs. The regulations also require compliance with categorical standards for particular industries by three years from the issuance of the final rules. Pre-treatment standards have not yet been established for the 21 EPA industrial categories, so the MMSD's pretreatment program has not been fully implemented at this time.

3.1.2 Conveyance and Storage Controls

Water pollution due to bypassing from the separated sewer area and CSO can be abated by modifying the sewer system, or installing flow regulation devices and other components which convey wastewater from the source to treatment plants. This is the Conveyance and Storage Control approach.

Bypassing occurs because the sewage flow exceeds the capacity of wastewater conveyance and treatment systems. If dry weather bypassing occurs, it indicates that additional system capacity is needed. Wet weather bypassing occurs sporadically and can be controlled by increasing the existing conveyance capacity or optimizing the existing capacity by detaining peak flows in storage facilities until capacity is available to convey and treat the wastewater. The two wet weather approaches could also be combined.

The following types of storage facilities were considered by the MMSD, either singly or in combinations:

- Existing interceptors
- Shallow pits
- Deep shafts
- Mined caverns
- Oversized deep tunnels
- Artificial offshore islands
- Floating concrete tanks
- Inflatable tanks
- Quarries

To convey the overflows to storage or treatment sites and to convey normal wastewater flows to the appropriate WWTP, the following alternatives were considered:

- Gravity pipelines
- Pressure pipelines
- Shallow softground tunnels
- Deep rock tunnels
- River conduits
- Existing South Shore interceptor

3.1.3 End-of-Pipe Controls

End-of-pipe controls attempt to abate water pollution by treating the wastewater to reduce pollutants to levels which will not degrade the receiving waters below standards. Wastewater can be treated in major facilities which treat the entire quantity of the wastewater flows from the planning area, or in smaller facilities which treat the wastewater from a portion of the planning area.

One requirement of the MFP is to end dry and wet weather bypassing from the wastewater conveyance systems and at wastewater treatment facilities. Either the WWTPs serving the Milwaukee metropolitan area will have to be large enough to treat the maximum year 2005 flows or the flow volumes that exceed treatment capacity will have to be stored and

treated later during low flow periods. WWTPs would then be designed to treat the average year 2005 flow.

The number, location, and treatment processes of WWTPs needed to treat the flows from separated sewer areas and the CSSA are addressed by the three Local, Subregional and Regional System-Level Alternatives.

The treatment of CSO is addressed in the various out-of-basin and in-basin alternatives. The out-of-basin concept involves collecting some or all CSO, conveying that wastewater to a treatment plant, and discharging the treated wastewater to Lake Michigan (outside the river basin).

The in-basin alternatives were developed using three strategies. The first strategy would require the installation of treatment facilities such as swirl concentrators or clarifiers at each CSO outfall. The second approach was satellite treatment; new facilities would be constructed to treat CSO from several outfalls. The third type of alternative was local treatment (which is different than Local System-Level Alternative). New WWTPs would be constructed in the Milwaukee, Menomonee and Kinnickinnic River basins to treat all the CSO in those basins. These treatment strategies and various treatment method alternatives for controlling pollution from the CSSA are outlined below:

TREATMENT FACILITIES

- Expansion of South Shore WWTP
- Expansion of Jones Island WWTP
- New WWTP to Treat CSO
- Secondary Treatment and Land Application
- Treatment Facility at Each Overflow
- Treatment Facility for Multiple Overflow Points
- Treatment Facility for Each River Basin

TREATMENT PROCESSES

- Screening
- Swirl Concentrator
- Disinfection
- Sedimentation without Chemicals
- Dissolved Air Flotation
- Microscreens
- Macroscreens
- Deep Bed Filters
- Activated Sludge Process
- Rotating Biological Contactors
- Physical-Chemical Treatment

3.1.4 Instream Controls

Instream controls provide another mechanism for meeting water quality standards. Generally, instream measures increase the wasteload assimilation capacity of a lake or stream or involve the location and design of an outfall structure to take advantage of local variations in the existing wasteload assimilation capacities.

To improve wasteload assimilation capacity, three alternatives were considered: dredging, flow augmentation, and aeration. Dredging is the removal of bottom sediments which are rich in oxygen-depleting matter and other pollutants. Flow augmentation is a method of increasing stream flow and velocity to dilute pollutants and increase the stream's assimilative capacity. Aeration also increases the waste assimilative capacity by injecting air into the water, thereby providing adequate oxygen for the natural biological assimilation of the waste without creating odorous anaerobic conditions. To take advantage of variations in local wasteload assimilation capacities, the relocation of effluent discharges to other drainage basins was considered as an alternate instream measure.

The Clean Water Act does not allow instream measures to substitute for adequate conveyance and treatment practices. However, the restoration and maintenance of water quality in the MMSD planning area may require the implementation of selective instream measures in the lake influenced reaches of the Milwaukee, Menomonee, and Kinnickinnic Rivers (the Inner Harbor) and in the Outer Harbor.

3.2 EXISTING WWTPS

The existing conditions of locally owned WWTPs are described below and summarized in Tables 3.2, 3.3, and 3.4. The location of the WWTPs are shown in Figure 3.1.

3.2.1 Publicly Owned WWTPs

3.2.1.1 Jones Island

3.2.1.1.1 Background: The Jones Island WWTP is located at the north end of the Jones Island peninsula. It is bounded by the Kinnickinnic River on the west, the harbor entrance on the north and Milwaukee's Outer Harbor on the east. The plant's location and service area are shown on Figure 3.2. The service area of the WWTP (also shown on Figure 3.2) contains about 98 miles (158 km) of intercepting sewers and 443 miles (890 km) of combined sewers. Jones Island was one of the first activated sludge plants in the world and its

TABLE 3.2
EXISTING CONDITIONS
JONES ISLAND WASTEWATER TREATMENT PLANT

ABILITY TO MEET WPDES EFFLUENT LIMITS:

Number of WPDES Violations

	1975	1976	1977	1978	1979	
BOD	4/8	1/1	0/0	0/0	0/0	(monthly/weekly)
SS	8/18	6/12	4/9	0/1	1/1	(monthly/weekly)
P	2	1	0	0	0	(monthly)
Fecal	10/16	2/6	2/7	0/2	0/4	(monthly/weekly)
pH	0	0	1	0	0	(daily)

TYPE OF TREATMENT

Treatment	Wastewater Treatment	Solids Handling
Preliminary:	Coarse Screens Grit Removal Fine Screens	Landfilled
Secondary:	Air Activated Sludge Phosphorus Removal Final Clarification	Gravity Thickened Chemical Conditioning Vacuum Filtration Heat Drying
Ultimate Disposal of Solids:		Milorganite Production with Excess to Landfill
Disinfection:		Chlorine
Location of Effluent Discharge:		Milwaukee Outer Harbor
Existing Conditions:		Outlived Service Life

BOD: Biochemical Oxygen Demand, WPDES monthly limit - 30 mg/l; weekly limit - 45 mg/l.
SS: Suspended Solids, WPDES monthly limit - 30 mg/l; weekly limit - 45 mg/l.
P: Phosphorus, WPDES monthly limit - 1 mg/l; permit limitations did not apply in 1975, 1976.
Fecal: Fecal Coliform, WPDES monthly limit - 200/100 ml; permit limitation did not apply in 1975, 1976.
pH: 6-9 range, daily.

TABLE 3.3
EXISTING CONDITIONS
SOUTH SHORE WASTEWATER TREATMENT PLANT

ABILITY TO MEET WPDES EFFLUENT LIMITS:

Number of WPDES Violations

	1975	1976	1977	1978	1979	
BOD	5/7	4/10	1/4	0/0	0/0	(monthly/weekly)
SS	11/32	0/17	2/2	0/2	0/0	(monthly/weekly)
P	*	*	8	4	0	(monthly)
Fecal	*	*	5	0	0	(monthly)
pH	0	0	0	0	0	(daily)

TYPE OF TREATMENT

Treatment	Wastewater Treatment	Solids Handling
Preliminary:	Coarse Screens Grit Removal	Landfill
Primary:	Primary Clarification	Anaerobic Digestion
Secondary:	Air Activated Sludge Phosphorus Removal Final Clarification	Flotation Thickened Anaerobic Digestion Storage in Sludge Lagoons
Ultimate Disposal of Solids:		Agricultural Application with Excess to Landfill
Disinfection:		Chlorine
Location of Effluent Discharge:		Milwaukee Outer Harbor
Existing Conditions:		Outlived Service Life

* Data not available. MMSD contested DNR limits for these dates.
BOD: Biochemical Oxygen Demand, WPDES monthly limit - 30 mg/l; weekly limit - 45 mg/l.
SS: Suspended Solids, WPDES monthly limit - 30 mg/l; weekly limit - 45 mg/l.
P: Phosphorus, WPDES monthly limit - 1 mg/l; permit limitations did not apply in 1975, 1976.
Fecal: Fecal Coliform, WPDES monthly limit - 200/100 ml; permit limitation did not apply in 1975, 1976.
pH: 6-9 range, daily.

TABLE 3.4

Public WWTPs	Ability to Meet WPDES Effluent Limits	Type of Treatment	Solids Disposal	Location of Discharge	Existing Conditions
Caddy Vista Sanitary District Plant	Isolated Violations occur for BOD, SS.	Primary Clarification; Low Rate Trickling Filter; Final Clarification	Single stage, anaerobic digestion to sludge drying beds. Then used as soil conditioner.	Root River	Poor
Village of Germantown	S.S. occasionally exceeded in 76 & 77.	Comminution; Phosphorus Removal; Aerated Contact Tank; Final Clarification Liquid Chlorine Disinfection; Polishing Lagoon.	WAS Aerobic Digestion; Digested sludge stored in tank. Hauled to Land Application Site or Sanitary Landfill	Menomonee River	Components are generally good to excellent. Hydraulically overloaded.
City of Muskego-Northeast District Plant	Phosphorus levels average above 1 mg/l.	Comminution; Phosphorus Removal; Activated Sludge; Polishing Lagoon; Chlorination	Aerobic Digestion; Sludge drying beds; Dried & digested sludge spread on agricultural land.	Unnamed Tributary of Root River	Generally Good
City of Muskego Northwest Plant	Frequent S.S.&P permit Violations	Aerated Lagoons; Phosphorus Removal; Chlorination	Removed from lagoons to agricultural land.	Tributary of Big Muskego Lake (part of Fox River Watershed)	Generally Good
City of New Berlin Regal Manors	Inadequate Data Due to Recent Extensive Plant Modifications	Comminution; Phosphorus Removal; Activated Sludge; Tertiary Filtration; Chlorination.	Aerobic Digestion; sludge drying beds; dried sludge used by city as soil conditioner	Deer Creek, Tributary of Fox River	Very Good
City of South Milwaukee	Consistently meets all parameters except P, which is occasionally exceeded.	Comminution; Grit Removal; Primary Clarification; Aeration Basins; Final Clarification; Chlorination.	Anaerobic Digestion; Oxidation of 90% of digested sludge; Remaining 10% dried and distributed as fertilizer.	Lake Michigan	Very Good
Village of Thiensville Plant	Some months where BOD, SS & P exceeded.	Comminution; Grit Removal; Primary Clarification; Activated Sludge; Phosphorus Removal; Chlorination.	Primary & Secondary Anaerobic digestion. Some digested sludge to sanitary landfill, some to drying beds then spread on land.	Pigeon Creek	Fair-Hydraullically Over-Loaded

BOD - Biochemical Oxygen Demand
SS - Suspended Solids
P - Phosphorus
WAS - Waste Activated Sludge
F - Fecal

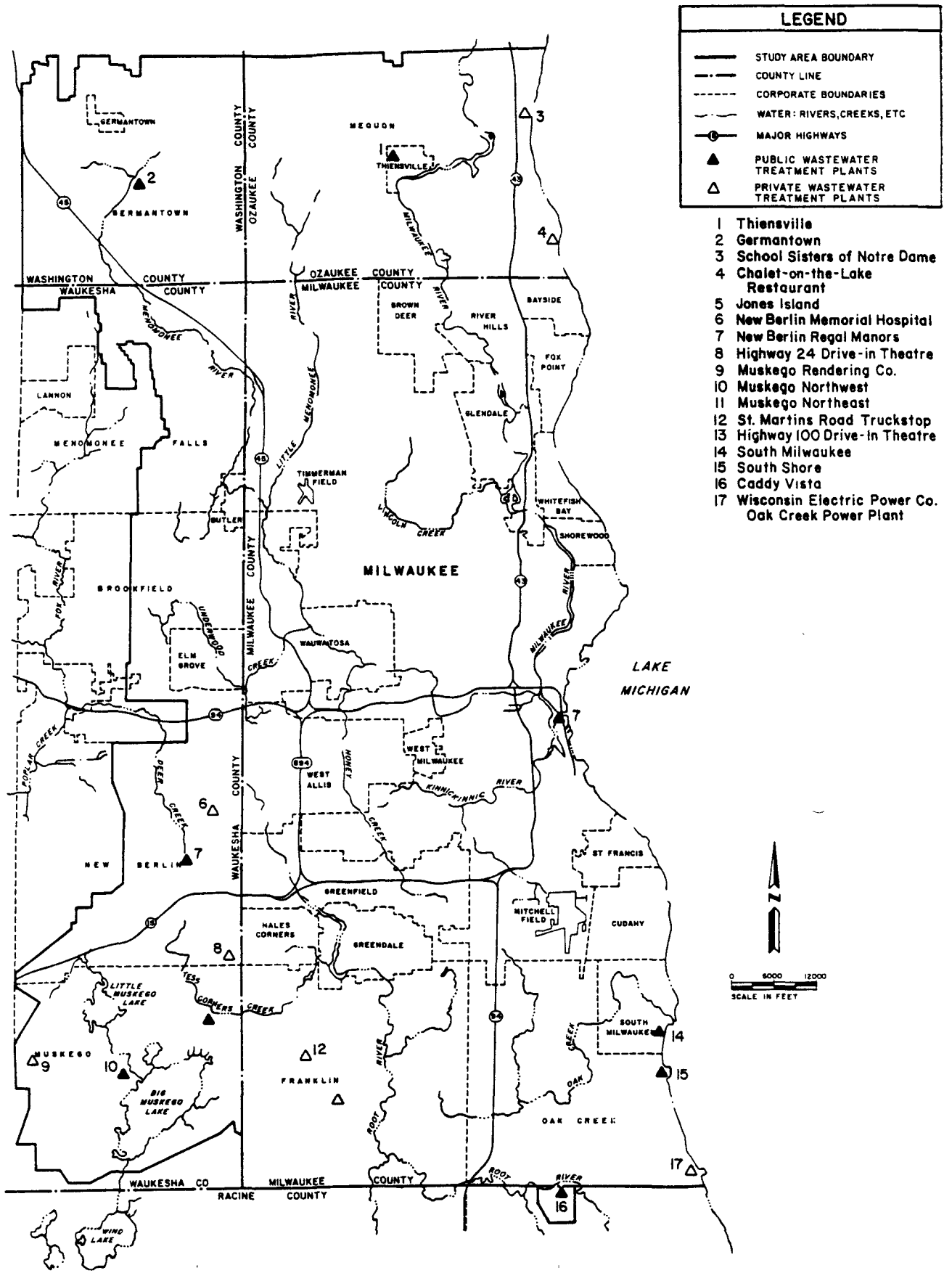

FIGURE 3-1

DATE APRIL 1981

WASTEWATER TREATMENT FACILITIES IN THE PLANNING AREA

SOURCE MMSD

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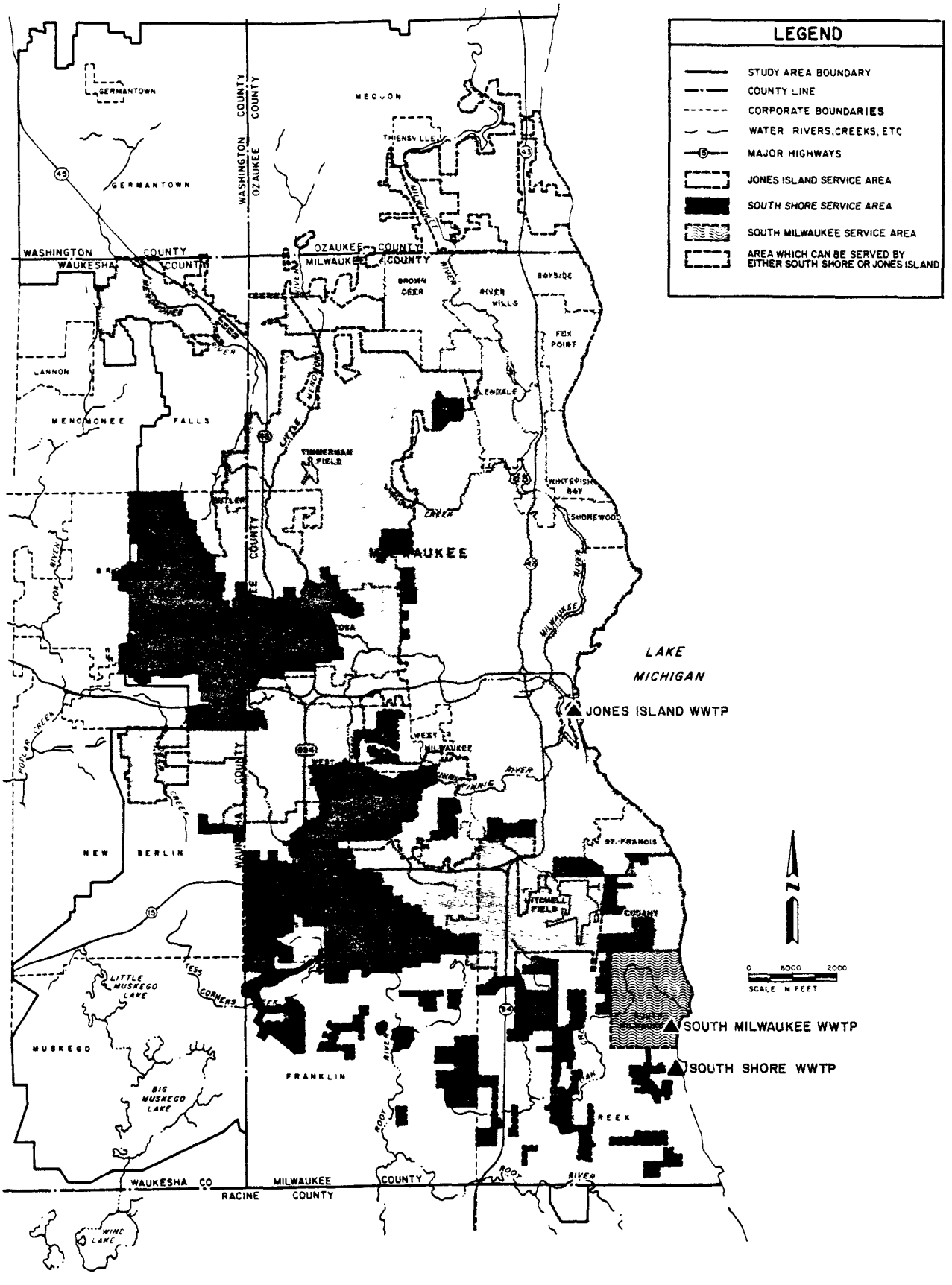

FIGURE 3-2

DATE APRIL 1981

MMSD SEWERAGE SYSTEM SERVICE AREA

SOURCE MMSD

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construction was preceded by the successful testing of a pilot scale wastewater treatment plant. In 1974, the American Society of Civil Engineers recognized the importance of the Jones Island WWTP by designating it a National Civil Engineering Historic Landmark. Also, in 1979 the WWTP was determined to be eligible for inclusion on the National Register of Historic Places.

The original facility is now known as the West Plant. It was designed to treat 85 MGD (3.7 m^3/sec) and was placed into operation in 1925. The East Plant was added in 1935 and was designed for 70 MGD (3.1 m^3/sec). In 1952, the East Plant was expanded to accommodate an additional 45 MGD (2.0 m^3/sec). Today the design capacity of the WWTP is 200 MGD (8.8 m^3/sec) of wastewater flow. However, due to insufficient capacity of the fine screens, the actual treatment capacity is only 140 MGD (6.1 m^3/sec). Wastewater flows to the Jones Island WWTP average 125 MGD (5.5 m^3/sec).

3.2.1.1.2 Processes: The Jones Island WWTP treats wastewater in a two stage process. Incoming flows pass through coarse screens to remove large material. Then they proceed to grit chambers where the velocity of the flow is controlled to allow sand, gravel, and some organic matter to settle. Finally, the wastewater passes through fine screens which catch even smaller solids, but allow most of the organic matter to continue to the secondary treatment process.

The second stage of treatment consists of the activated sludge process which is effective in removing 95% of the organic pollutants contained in the screened wastewater. This process combines the wastewater with highly active microorganisms (activated sludge) which feed on organic matter. This combination (mixed liquor) is then injected with air, to encourage the decomposition of the organic matter. Chemicals are added at this stage to aid in the removal of phosphorus.

After aeration, the mixed liquor flows to clarifiers. In these tanks, the microorganisms and any inert or non-biodegradable solids settle. The settled solids, or sludge, are removed before the wastewater is disinfected. The wastewater is then disinfected with chlorine and the final effluent is discharged to Milwaukee's Outer Harbor.

Some of the sludge is recycled and serves as the medium for introducing the activated microorganisms into the wastewater at the start of secondary treatment. The rest is either landfilled or dried and processed into Milorganite, a fertilizer and soil conditioner. The debris from the primary screening is collected and taken to a landfill.

3.2.1.1.3 Problems: Much of the equipment in the Jones Island WWTP is over 50 years old and has outlived its useful life. The coarse and fine screens are in poor condition and frequently become overloaded since there is no backup equipment available. Failure of this equipment leads to bypasses of partially screened, untreated wastewater into the final effluent channel, where it is mixed with treated effluent, chlorinated, and discharged.

The control of flows to the aeration tanks is not adjusted regularly. Uneven distribution of flows often occurs, reducing the system's efficiency. During periods of high flows, some tanks are not fully loaded, while others are overloaded and are unable to properly aerate the mixed liquor.

The Milorganite production facility is well operated but does not have adequate capacity to treat all solids from the WWTP. This process is energy intensive since the sludge must be heated to 1200°F (650°C) for drying. The volume of sludge entering the driers is controlled manually, and explosions have occurred due to rapid rises in temperature. Excess dewatered sludge is transported to a landfill site.

In the past, when flows to the Jones Island facility were larger, effluent violations frequently occurred. There were three causes of the violations: emphasis on Milorganite production rather than optimal process operation, lack of solids handling ability, and overloading.

Since 1978, careful operation of the facility has resulted in few effluent violations, but this has been due, in part, to the bypassing of untreated sewage into the Inner Harbor. The facility is equipped with several bypassing mechanisms and if the coarse screens clog, untreated influent can be bypassed directly into the Inner Harbor. At several other locations, partially treated effluent can be bypasssed to the effluent channel if equipment is overloaded or if the staff determines that bypassing is necessary. In-system bypasses receive disinfection before discharge and are sampled with the effluent for the WPDES permit. Unless the plant is rehabilitated and expanded, these bypasses will continue.

3.2.1.2 South Shore

3.2.1.2.1 Background: The South Shore WWTP plant is located on Lake Michigan in the City of Oak Creek. The treatment facilities were built on 40 acres (12 ha) of land reclaimed from the lake and the rest of the plant is located on top of a bluff on the 108-acre (44 ha) site. The reclaimed land is enclosed by a double wall steel breakwater.

The WWTP was designed to treat wastewater by solids removal only. It began operation in 1968 with a design capacity of 60 MGD (2.6 m^3/sec). However, in 1974, its capacity was expanded to 120 MGD (5.3 m^3/sec), and the plant was upgraded to include activated sludge treatment.

The South Shore WWTP serves approximately 113 square miles (293 km^2) in the southern and western portions of the MMSD service area. Included in this area are 82 square miles (212 km^2) of diversion area with wastewater flows that can be directed to Jones Island for treatment. The location of the South Shore WWTP and its service area, including the diversion area, is shown in Figure 3.2.

3.2.1.2.2 Processes: The South Shore WWTP presently utilizes the air activated sludge process which is similar to that used at the Jones Island WWTP. Secondary treatment can be bypassed at South Shore (while the entire treatment process can be bypassed at Jones Island).

Preliminary treatment at South Shore also consists of coarse screening and grit chambers. After the grit chambers, the wastewater passes to primary settling basins. These basins allow further settling of solids, and they are equipped to skim floating scum from the wastewater. After primary treatment, the wastewater continues to secondary treatment which consists of the same type of activated sludge process that is used at Jones Island. Highly active microorganisms are added to the wastewater to break down organic material. Then the sludge is thickened and removed, and the effluent is disinfected and discharged to Lake Michigan.

The sludge thickening process at the South Shore WWTP is slightly different from the Jones Island processes. Chemicals and air are added to the mixed liquor, which causes the solids to float to the surface, where they can be skimmed off.

Milorganite is not produced at the South Shore WWTP. Instead, the sludge is placed in an anaerobic (oxygen free) environment where, if the system is properly operated, the sludge decomposes to a stable form. A new heating system is being installed for these digestors to improve their performance. Methane gas, a by-product of this process, is used to power much of the facility's equipment. After digestion, the sludge is taken to lagoons where it is stored and thickened prior to land application.

3.2.1.2.3 Problems: Although the South Shore WWTP is a relatively new facility, a number of problems have affected its operation. Occasionally, during high flow conditions, the coarse screens and grit chambers malfunction and do not

remove solids adequately. The removal of scum and grease in the primary process is also inadequate. The wastewater can contain large amounts of solids when it reaches the secondary stage of treatment.

Under normal flow conditions, loadings to the secondary treatment system are below design capacity. However, when the flow from the primary treatment processes contains large amounts of scum, excessive amounts of sludge accumulate in the secondary clarifiers. As a result, the effluent leaving the WWTP is occasionally high in suspended solids.

Inefficient feeding, inadequate mixing, and poor temperature control of the anaerobic digesters have led to incompletely processed sludge reaching storage lagoons. Severe odor problems have resulted. The new heating system currently being installed should improve digester performance and alleviate the odor problems.

The South Shore WWTP has had numerous effluent violations since its expansion in 1974. However, as a result of modifications, improved operations, and increased solids handling, effluent quality has improved. There have been fewer WPDES violations since 1977. Appendix III, South Shore, lists effluent violations for this WWTP.

The operation of the Jones Island and South Shore WWTPs is the responsibility of the MMSD, which must ensure that the plants are able to meet future effluent limits. Thus, the expansion of these facilities is one of the major components of the MFP.

3.2.1.3 Muskego Northeast

The City of Muskego has two wastewater treatment plants; Northeast District and Woods Road (Muskego Northwest). The Muskego Northeast District plant is located in the northeast section of the city, and it serves a 2.1 square mile (5.4 km^2) area. The plant was built in 1971 and expanded in 1974 to include phosphorus removal equipment. It has an average design capacity of 0.39 MGD with peak capacity of 1.3 MGD (0.06 m^3/sec). The average daily flow to the plant is 0.6 to 0.7 MGD (0.03 m^3/sec).

The WWTP processes include secondary treatment with the activated sludge process, phosphorus removal, and chlorination. The plant and equipment are in good condition and can be expected to last until the end of the planning period. The effluent is discharged to Tess Corners Creek, a tributary of the Root River. The WWTP cannot presently meet the effluent limits necessary to achieve the water quality standards for Tess Corners Creek.

3.2.1.4 Muskego Northwest

The Woods Road Plant is located in the northwest portion of Muskego. It was built in 1966, expanded in 1971 and 1977, and serves approximately 2.4 square miles (6.2 km^2). The WWTP uses aerated lagoons for secondary treatment of wastewater. After removing some debris, wastewater is placed in a pond and injected with air, allowing organic matter to decompose. Effluent is disinfected by chlorination prior to discharge to Big Muskego Lake.

The facility is in generally good condition; however, much of the mechanical equipment will need replacement during the planning period. Its average design capacity is 0.7 MGD (0.03 m^3/sec), and the peak design capacity is 1.08 MGD (0.04 m^3/sec). Flows to the plant average 0.54 MGD (0.02 m^3/sec). Effluent from the Woods Road WWTP is discharged to Little Muskego Creek, a tributary of Big Muskego Lake. The effluent does not consistently meet WPDES limitations for suspended solids, phosphorus, and BOD, based on records from 1975-1980.

3.2.1.5 New Berlin Regal Manors

The Regal Manors Subdivision WWTP is the only public wastewater treatment plant in the City of New Berlin. The WWTP was built in 1969 and expanded in 1978. Processes used for wastewater treatment include the activated sludge process, tertiary filtration, phosphorus control, and chlorination.

The facility is generally in very good condition. It serves an area of one square mile (2.6 km^2) with a tributary population of 3,230. The peak design capacity is 0.65 MGD (0.03 m^3/sec), and the flows to the plant average 0.18 MGD (.007 m^3/sec). Effluent from this WWTP is discharged to Deer Creek, a tributary of the Fox River. The plant cannot meet effluent limits necessary to achieve the water quality standards for Deer Creek.

3.2.1.6 South Milwaukee

South Milwaukee is the only city in Milwaukee County to operate a WWTP independent of the MMSD. The South Milwaukee Plant is located in the southern part of the City. It serves an area of about 4.9 square miles (12.69 km^2) which includes almost the entire city. The plant was built in 1937 and expanded in 1952, 1962, and 1972.

Wastewater flows to the South Milwaukee WWTP receive secondary treatment by the activated sludge process, including phosphorus removal and disinfection. The plant and equipment are in

excellent condition and should last through the planning period. The South Milwaukee plant's peak design capacity is 12.0 MGD (0.53 m^3/sec) and average design capacity is 6.0 MGD (0.26 m^3/sec). Based on measurements taken from 1975-1977, the plant received average flows of 3.7 MGD (0.12 m^3/sec). Effluent from the South Milwaukee wastewater treatment plant is discharged to Lake Michigan. It generally meets all WPDES permit limitations, although standards for phosphorus are not met on occasion.

3.2.1.7 Germantown

The Village of Germantown maintains one public treatment facility which is located in the northern part of the Village. The WWTP was constructed in 1970, and it has not been expanded. The wastewater influent to the facility receives secondary treatment by the activated sludge process, with phosphorus control and chlorination.

The plant and equipment are generally in good to excellent condition, although some mechanical equipment will probably require replacement before the end of the planning period. The plant has an average capacity of 1.0 MGD (0.04 m^3/sec) with peak capacity of 2.0 MGD (0.09 m^3/sec). Effluent from the Germantown WWTP is discharged to the Menomonee River. The plant cannot meet effluent limits necessary to achieve the water quality standards for the Menomonee River.

3.2.1.8 Caddy Vista Subdivision

The Caddy Vista Sanitary District WWTP serves the Caddy Vista subdivision in the northern portion of the Town of Caledonia. The plant is located on the north side of the subdivision along the Root River and its service area consists of approximately 100 acres (40.5 ha). The Caddy Vista WWTP was built in 1955 and has not been extensively upgraded. Its average design capacity is 0.25 MGD (0.01 m^3/sec) with a peak capacity of 0.40 MGD (0.02 m^3/sec). The average flow to the plant is 0.084 MGD (0.004 m^3/sec), but its hydraulic capacity is sometimes exceeded during wet weather. Wastewater treatment includes a trickling filter, and the effluent receives disinfection by chlorination prior to discharge.

The WWTP is in very poor condition. Much of the mechanical equipment is corroded or inoperative. Effluent from this WWTP is discharged to the Root River. The effluent does not consistently meet WPDES permit limitations. Numerous bypasses of untreated sewage occur in this sewer system.

3.2.1.9 Thiensville

The Village of Thiensville has a single WWTP located in the northwestern portion of the Village. The plant was built in 1951 and extensively remodeled in 1963. New equipment was also added in 1970 and 1973. The average design capacity of the Thiensville plant is 0.24 MGD (0.01 m^3/sec) with a peak capacity of 0.36 MGD (0.02 m^3/sec). The average flow, measured during the period between 1975 and 1977, was 0.59 MGD (0.03 m^3/sec) which is substantially above the plant's design capacity. Wastewater is treated in an aeration chamber and clarifier. Phosphorus control and chlorination are also included.

The plant is in fair condition and some mechanical equipment will need replacement during the planning period. Effluent from the Thiensville WWTP is discharged to the Milwaukee River at the mouth of Pigeon Creek. The effluent generally meets WPDES permit limitations although BOD, suspended solids, and phosphorus limits have occasionally been exceeded. In addition, the Thiensville sewer system and WWTP bypass extensively during both dry and wet weather conditions.

3.2.2 Privately Owned WWTPs

In addition to the publicly-owned and operated WWTPs, there are eight small privately-owned facilities, shown in Figure 3.1. These WWTPs are described in Appendix VI, Local Alternatives, of this EIS.

In Planning Report 30, SEWRPC recommended abandoning all the private WWTPs in the planning area and connecting their flows to the nearest public sewer system. However, the report also suggested that a cost-effectiveness analysis be prepared for the Wisconsin Electric Power Company (WEPCO) WWTP in Oak Creek as part of the facilities planning process.

The MMSD analyzed all the private WWTPs in the planning area and determined that it would be very expensive to connect the flows from WEPCO to a local facility. Since the facility meets its WPDES permit limitations, the MMSD recommends that the facility continue to operate.

The MFP analysis further recommended that it would be environmentally acceptable and less costly to continue the operations of the wastewater treatment facility at the School Sisters of Notre Dame in Mequon. Also, it was recommended that the Muskego Rendering Company WWTP continue operations to pretreat the plant wastewater before discharge to the public sewer system.

The EIS examines the impacts of implementing the MFP, continuing the operations of the WEPCO and School Sisters of Notre Dame WWTPs, and using the Muskego Rendering Company facilities for pretreatment.

3.3 SOLIDS MANAGEMENT

In addition to the wastewater treatment studies being carried out for the Jones Island and South Shore WWTPs, the method of solids handling for these two WWTPs was also studied in the Solids Management Facility Plan Element (SMFPE) to evaluate solids handling for the two WWTPs. Appendix IV, Solids Management, to this EIS discusses the environmental impact analyses for the solids management alternatives.

3.3.1 Current Practices

Presently the solids handling method at the Jones Island WWTP is chemical conditioning, vacuum filtration, sludge drying, and processing into Milorganite. Approximately 200 tons (182 metric tons) of Milorganite are generated per day. Since 1977, the Jones Island WWTP has experienced problems with high wastewater flows and the operation of the Milorganite production equipment that have necessitated trucking excess sludge to a landfill. Approximately 3,400 tons per year (3,086 metric tons) of Jones Island sludge are landfilled.

The South Shore WWTP's current method of solids handling is dissolved air flotation thickening of waste activated sludge, mixing with primary sludge, anaerobic digestion, and storage in sludge lagoons prior to agricultural application of the sludge. In 1979, approximately 33,500 dry tons (30,500 dry metric tons) of solids were applied to agricultural land during the growing season and 10,500 dry tons (9,500 dry metric tons) of solids were landfilled during the winter months.

3.4 INFILTRATION AND INFLOW STUDY

In 1977, the MMSD initiated a program to study the effects of infiltration and inflow on the conveyance and treatment processes in the planning area. For the purposes of the study, the CSSA, shown on Figure 3.3,was evaluated independently of the separated sewer area. In compliance with the court orders, a separate analysis was performed to determine the least costly and most environmentally sound way to abate CSO. The I/I study of the combined sewers used a flow monitoring program to determine the average daily flows and assess the effects of dry weather infiltration on the system.

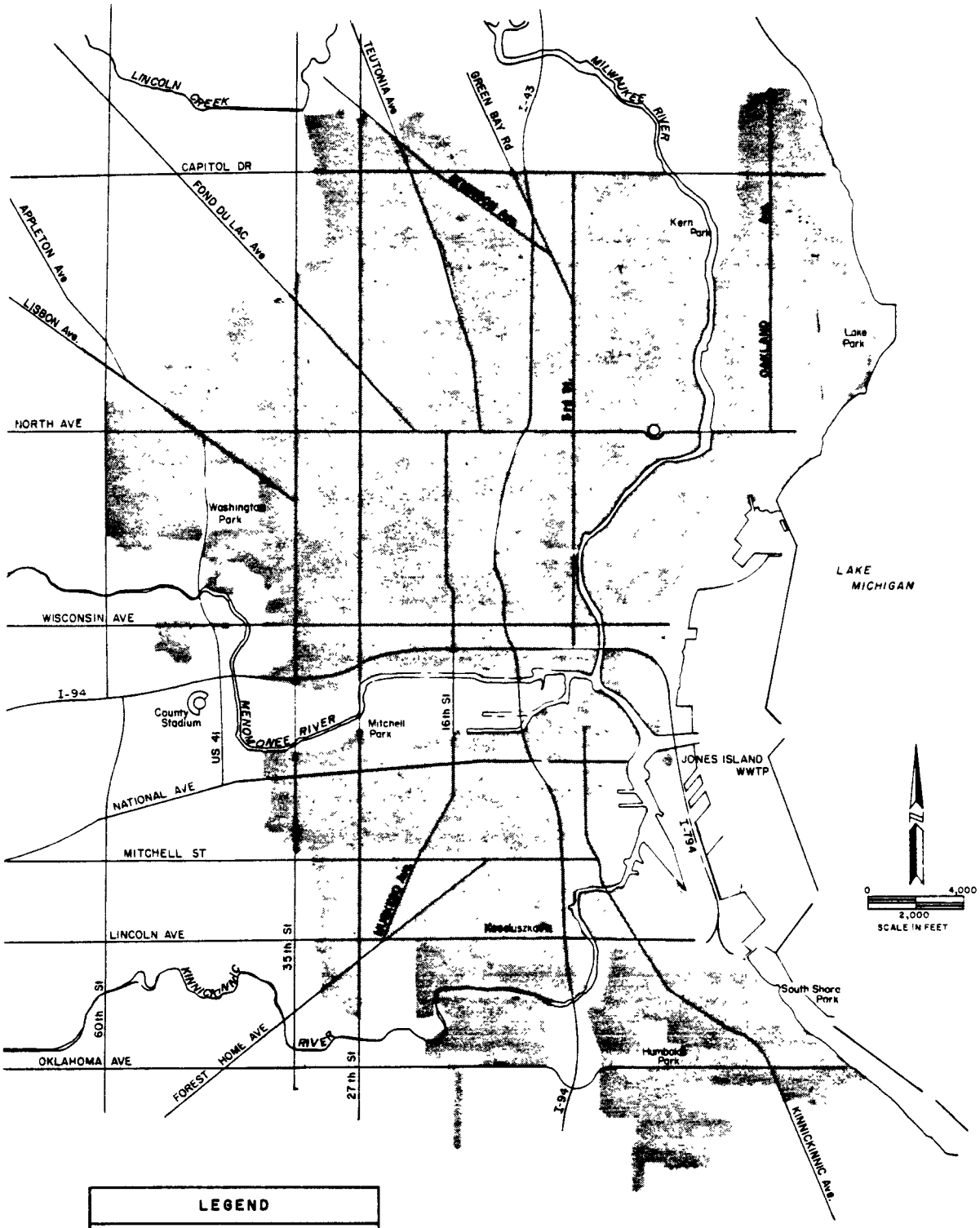

FIGURE 3-3

DATE APRIL 1981

COMBINED SEWER SERVICE AREA

SOURCE MMSD

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More detailed data was required for the separated sewer area because both inflow and infiltration had to be measured. Also, the separated sewer service area is much larger than the combined sewer area. For this portion of the I/I study, the separated sewer area was divided into 363 sub-basins, and each sub-basin was analyzed individually. The purpose of the evaluation was to determine the average flows in the sewers, the capacity of the Metropolitan Interceptor Sewer (MIS) system, and the amount of bypassing occurring during wet weather. By collecting these data, the effect of I/I on the operation of the MIS system and the WWTPs could be calculated.

To determine the maximum wastewater flow, WWTP records and flow gauging records were evaluated. Also inventories of existing and projected population growth and development were conducted to enable the MMSD staff to estimate the year 2005 maximum wastewater flow. The flow gauging records and previous I/I studies also indicated the capacity of the MIS system and approximate levels of bypassing. A flow monitoring study was performed for ten weeks in 1978. This analysis indicated that the flow in the sewer system was greatly affected by I/I. During one rainfall of 1.3 inches (3.3cm), ninety bypasses were recorded discharging over 100 million gallons (378.5 m^3) of sewage into the area's surface waters.

3.4.1 Results of I/I Study

From the data collected by this study, the MMSD determined that if there were no limits to the capacity of the MIS system and if no bypassing took place, a maximum of 840 million gallons per day (MGD) (36.8 m^3/sec) of wastewater would reach the treatment facilities from the MMSD service area. This figure includes the maximum sanitary sewage flow of 106 MGD (4.6 m^3/sec) from the separated sewer area, an estimated 114 MGD (5.0 m^3/sec) of combined sewage flow from the combined sewer area (not including CSO volume), and 620 MGD (27.2 m^3/sec) of I/I from the separated sewer area. With forecast levels of population and commercial growth, the peak daily flow would increase to 900 MGD (39.4 m^3/sec) by the year 2005.

Once the current and projected maximum flows had been determined, further information was required about the ability of the MIS system to convey those flows and the ability of the area WWTPs to treat those flows adequately. A computer model was used by the MMSD to determine which portions of the MIS would need expansion to convey current flows of wastewater and I/I. The computer simulated several levels of I/I reduction (27, 45, 52, and 81 percent) to identify future maximum flows without I/I, and those portions of the MIS and WWTPs that would not be large enough to handle the reduced

maximum flows. The costs of expanding sewerage facilities to enable them to operate successfully without bypassing were estimated and compared with the costs of rehabilitating the sewers to attain each level of I/I reduction. The analysis concluded that the cost-effective reduction of I/I would be 300 MGD (13.1 m^3/sec), which is approximately one-half of the estimated 620 MGD of I/I.

The study also determined that 328 of the 363 study areas in the separated sewer area required detailed sewer system evaluation surveys (SSES) to identify the improvements necessary to attain the cost-effective reduction in I/I.

The detailed alternative analysis presented in the Final EIS assumes that the cost-effective level of I/I removal would be 48%, based on the findings of the I/I study.

3.4.2 Sewer System Evaluation Survey (SSES)

The purpose of the SSES was to determine the specific sources of I/I in the 328 study areas contributing excessive I/I, determine the flow rate from each source, estimate the rehabilitation cost for each source, and reevaluate the cost-effectiveness analysis of removing each source of I/I. The program to determine the specific sources of I/I included inspection of thousands of manholes, millions of feet of sewer, and thousands of buildings in the planning area. Flow monitoring, smoke testing, and sewer cleaning were also undertaken. The results of these field investigations were used to determine the amount of I/I in the system and the cost to remove that I/I. A new cost-effectiveness analysis was undertaken with the new I/I and cost data.

The preliminary results of the SSES indicate that the cost-effective level for I/I removal may only be 13%. This figure is only preliminary at this time and will not be finalized until the Final SSES report is adopted by the MMSD and reviewed and approved by the EPA and the DNR. This report is expected to be adopted by the MMSD in May, 1981.

Because the Final SSES was not available for incorporation into the Final EIS, the analysis of alternatives presented in the Final EIS assumes 48% of I/I would be removed. If the final I/I removal level is less than 48%, as is suggested by the Draft SSES, additional cavern storage will be required in order to eliminate wet weather bypassing from the separated sewer system.

3.4.3 Rehabilitation Projects

Based on the results of the I/I study, the following portions

of the MIS would have to be expanded or constructed to enable the system to convey future maximum flows without bypassing.

South 81st Street and West Grant Branch
South 84th Street and West Becher Street Diversion
Hampton Avenue Branch
Kinnickinnic River Branch
South 6th Street Branch
Menomonee River - Burleigh Overflow
Menomonee River - Keefe Diversion
Milwaukee River Branch with Upper and Lower Lincoln Creek Segments
Crosstown Branch
West Bluemound and Honey Creek Branch

These sewers are shown on Figure 3.4. The rehabilitation, expansion, or replacement of these portions of the MIS is required regardless of any other actions in the MFP.

With a 48% reduction in I/I, maximum flows in the MIS system from the planning area could reach 600 MGD (26.3 m^3/sec) by the year 2005. One objective of the MFP is to end dry and wet weather bypassing from the wastewater conveyance systems and at sewage treatment facilities. Either the WWTPs serving the Milwaukee metropolitan area will have to be large enough to treat the maximum year 2005 flows, or the flow volumes that exceed treatment capacity will have to be stored and treated later during low flow periods. These issues were considered in formulating alternatives for area-wide wastewater treatment.

3.5 DEVELOPMENT OF ALTERNATIVES

When evaluating alternatives for this EIS, only the specific MMSD actions identified in the Notices of Intent were analyzed in detail. Detailed analyses were conducted on alternatives for the abatement of CSO, the construction of interceptors within Milwaukee County, interceptor service areas outside the county, and the upgrading and expansion of the Jones Island and South Shore WWTPs. The other components, including alternatives for treatment plants in the planning area, but outside Milwaukee County, local connector sewers, and certain alternatives for CSO abatement were evaluated on a conceptual level only. This EIS identifies only the major impacts of these components. Further facilities planning and environmental review would be required for these components if it is determined that their construction is feasible.

3.5.1 Local System-Level Alternatives

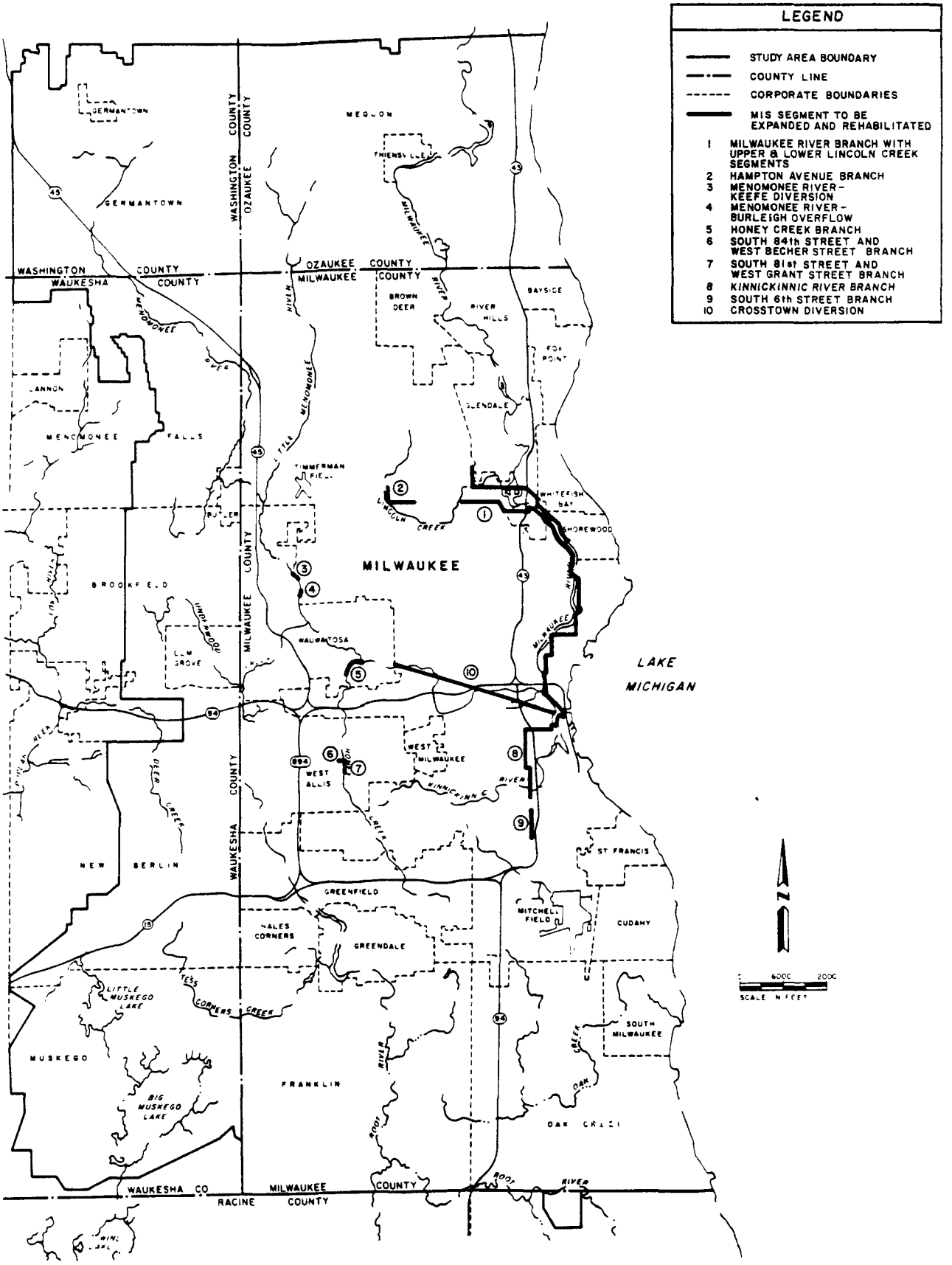

FIGURE 3-4

DATE APRIL 1981

MILWAUKEE INTERCEPTOR SEWER REHABILITATION

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

Local System-Level Alternatives (Local A Alternatives) were developed with the assumption that the existing WWTPs in the planning area would continue to operate through the planning period. Communities not presently served, or only partially served, by the MMSD would continue to operate their own wastewater treatment facilities (see Figure 3.5). Alternatives were developed to upgrade or replace each public and private WWTP in the planning area. The alternatives considered for each WWTP are described below and summarized in Table 3.5.

1. No Action - The EIS has assessed each public and private WWTP in the planning area to determine its ability, using existing processes and equipment, to adequately treat wastewater flows through the planning period without bypassing. This alternative served as the system-wide No Action Alternative, and it was carried through the entire screening process as basis for comparison.

2. Upgrade Operations and Maintenance - Each WWTP was evaluated to determine whether it could meet WPDES standards (without bypassing) through the year 2005, assuming that operation and maintenance procedures were optimized. No new procedures or equipment would be added with this alternative.

3. Expansion - The EIS determined the costs and environmental impacts of adding new equipment to the facility, without changing its processes, to enable it to operate adequately to meet permit levels without bypassing through the planning period. This alternative assumes the optimization of operation and maintenance procedures.

In addition to assessing treatment processes, the effluent discharge location of each WWTP was evaluated. The alternative discharge locations that were considered are described below.

4. Upgrade treatment and discharge to the Fox River Basin - This alternative was considered for all WWTPs that discharge to the Lake Michigan Basin. Consideration was given to the possibility of improving the level of treatment to that required for discharge of the effluent to the Fox River watershed.

5. Upgrade treatment and discharge to the Lake Michigan Basin - For those WWTPs that do discharge effluent to the Fox River Basin, the alternative of upgrading treatment to the level required for discharge into the nearest water body in the Lake Michigan Basin was considered.

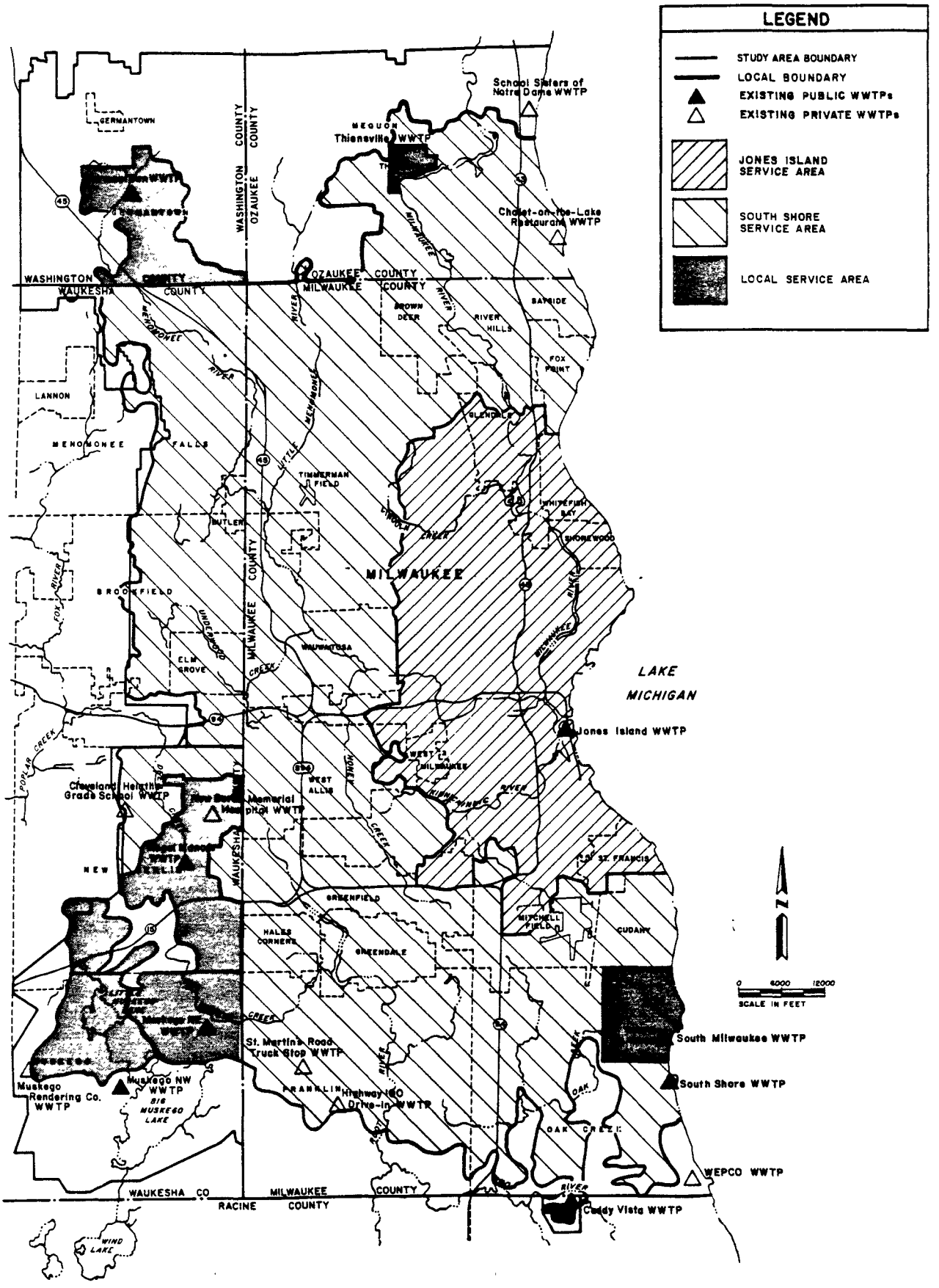

FIGURE 3-5

DATE APRIL 1981

LOCAL SERVICE AREAS (A)

SOURCE MMSD

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TABLE 3.5

PRELIMINARY LOCAL ALTERNATIVES

Local A[1] Alternatives	No Action	Improve O&M	Expand in Kind	Discharge:	Land Application**				Recycle and	Upgrade Treatment Discharge to:	
			Lake Michigan	Fox River	1.	2.	3.	4.	Reuse	Lake Michigan	Fox River
Jones Island*											
South Shore*					X	X	X	X	X	Milwaukee River	
Thiensville	X	X	Milwaukee River		X	X	X	X	X	Menomonee River	Fox River
Germantown	X	X	Menomonee River	Deer Creek	X	X	X	X	X	Root River	Deer Creek
N.B. Regal Manors	X	X		Tess Corners Creek	X	X	X	X	X	Tess Corners Creek	Little Muskego Creek
Muskego NW	X	X			X	X	X	X	X	Tess Corners Creek	Big Muskego Creek
Muskego NE	X	X	Tess Corners Creek		X	X	X	X	X	Root River	
Caddy Vista	X	X	Root River						X	Lake Michigan	
South Milwaukee	X	X	Lake Michigan		X	X	X	X	X	Lake Michigan	
Sisters of Notre Dame	X	X	Lake Michigan		X	X	X	X	X	Lake Michigan	
Chalet-on-the-Lake Restaurant	X	X	Lake Michigan		X	X	X	X	X	Root River	
New Berlin Memorial Hospital	X	X	Root River	Poplar Creek	X	X	X	X	X	Poplar Creek	
Cleveland Hghts. Grade School	X	X		Fox River or Big Muskego Lake	X	X	X	X	X		Fox River or Big Muskego Lake
Muskego Rendering Company	X	X			X	X	X	X	X	Root River	
St. Martins Road Truck Stop	X	X	Root River	Ryan Creek	X	X	X	X	X		Ryan Creek
Highway 100 Drive-In	X	X			X	X	X	X	X	Lake Michigan	
Wisconsin Electric	X	X	Lake Michigan								
Local B[2] Alternatives											
New Berlin NE					X	X	X	X	X	Root River	Deer Creek
New Berlin SE					X	X	X	X	X	Tess Corners Creek	Deer Creek
Muskego NE					X	X	X	X	X	Tess Corners Creek	Big Muskego Lake

*See Regional Alternative Matrix for alternatives considered for these WWTPs.

**Land Application Alternatives: (1) Normal Rate Irrigation, (2) High Rate Irrigation, (3) Infiltration-percolation, and (4) March application

[1]Local A - Alternatives for all public and private WWTPs in planning area

[2]Local B - All private WWTPs would be abandoned "Local A" alternatives were considered for all public WWTPs except Muskego Northwest, Muskego Northeast and New Berlin Regal Manors. These WWTPs would be abandoned. Instead the New Berlin Northeast, New Berlin Southeast, and Muskego Northeast WWTPs (described in text) were considered.

X: Alternative was considered for this WWTP. If a body of water is indicated, it means the alternative was considered and this watercourse would receive the effluent.

Finally for all WWTPs, consideration was given to changing the type of treatment process or abandoning the facility. Two processes were considered:

6. Land Application of Effluent - This method consists of two steps. First of all, the effluent receives pre-treatment by a secondary type treatment process. Then the effluent is spread or sprayed on agricultural land, or discharged to percolation ponds or to wetlands. The MMSD proposed eight wetlands as possible effluent application locations: Wayne Marsh, Jackson Marsh, Cedarburg Bog, Germantown Marsh, Menomonee Falls Tamarack Marsh, Vernon Marsh, Wind Lake Marsh, and Forrest Hill Marsh.

7. Recycle and Reuse of Effluent - Very highly treated effluent can be used for a variety of industrial and recreational purposes or for groundwater recharge. Consideration was given to the possibility of upgrading the treatment processes to such an extent that the effluent would be suitable for these purposes. In most cases, this alternative would include the addition of treatment processes beyond the secondary level, such as further chemical treatment, filtration, or carbon absorption.

8. Connect to MIS - The facility could be abandoned and flows connected to the MIS or to a local system tributary to the MIS.

These eight possible Local Alternatives were considered for each WWTP in the planning area. The MMSD, EPA, DNR, and EIS consultant independently analyzed the feasibility of each of these alternatives. A detailed discussion of this EIS analysis is included in Appendix VI, Local Alternatives.

Preliminary analysis of the private WWTPs in the planning area indicated that many of the facilities are poorly operated and maintained. Therefore, another group of Local Alternatives (Local B Alternatives) were developed assuming the abandonment of all the private wastewater treatment facilities (see Figure 3.6). The local private WWTPs treat a relatively very small volume of wastewater. Abandoning the private facilities would not greatly affect the flows to the local public facilities.

For New Berlin, two new Local Alternative WWTP sites were developed at the request of the City. Both alternatives would include abandoning the Regal Manors WWTP and constructing a new facility. The first alternative would locate a new WWTP near the New Berlin-West Allis border. The other

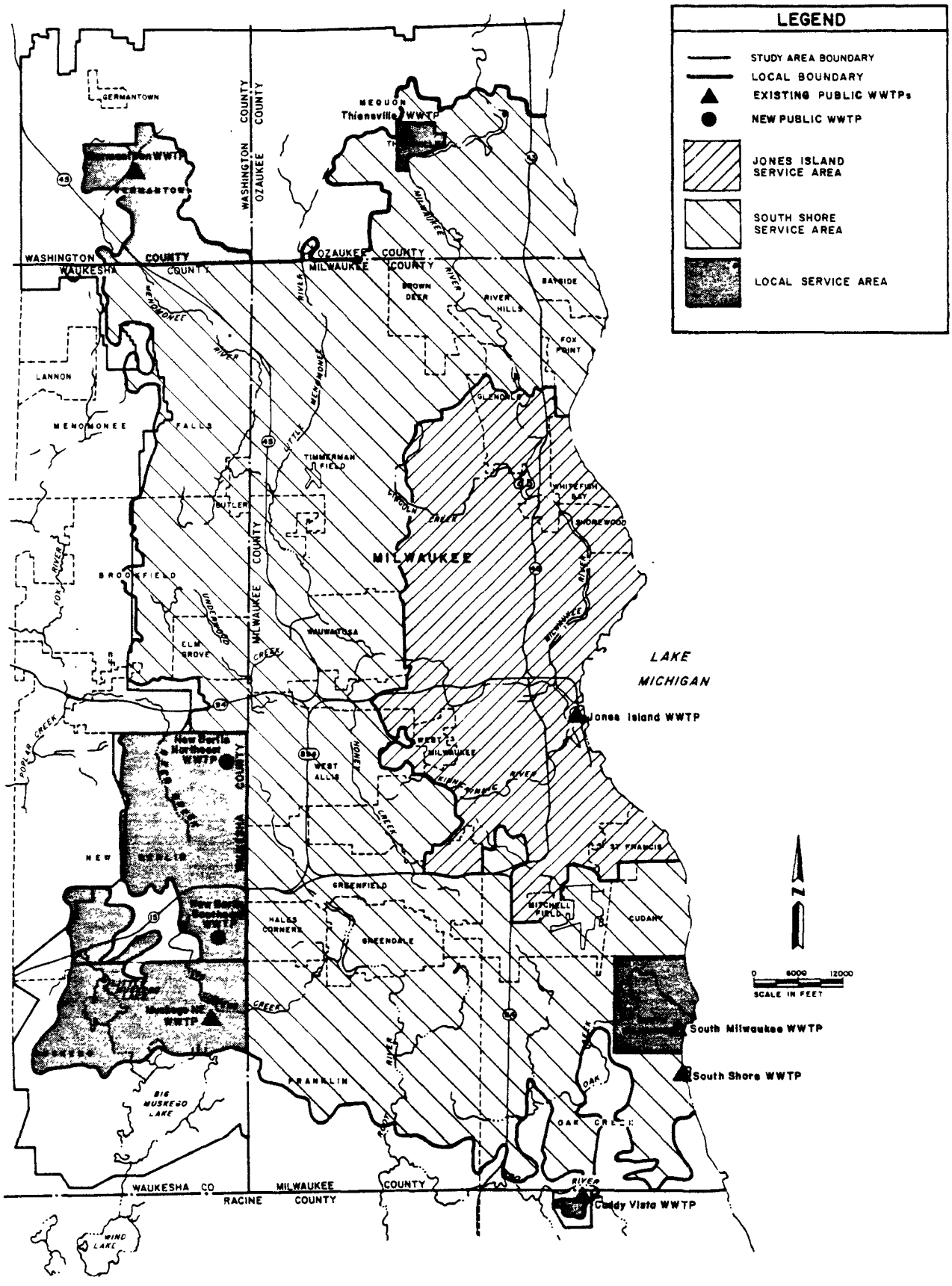

FIGURE 3-6

DATE APRIL 1981

LOCAL SERVICE AREAS (B)

SOURCE MMSD

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alternative WWTP would be constructed in southeast New Berlin.

For Muskego, an additional configuration was included in the study at the request of the City's consulting engineers. The alternative would include abandoning the Muskego Woods Road WWTP and possibly the Muskego Rendering Company's treatment processes. All the wastewater flows in the area would be conveyed to the Muskego Northeast WWTP, which would be expanded or upgraded.

3.5.2 Subregional System-Level Alternatives

For an analysis of the Subregional System-Level, the planning area was divided into three subareas based on the location of existing treatment plants and conveyance systems, the availability of land for the construction of new facilities, and the political boundaries in the planning area. Three subregions were identified: the Northern Subregion consisting of Germantown, Thiensville, and Mequon; the Southwestern Subregion consisting of New Berlin, Muskego, Franklin, Greendale, Hales Corners, and portions of West Allis and Greenfield; and the Central Subregion consisting of the remainder of the planning area. The subregions are shown in Figure 3.7. The subregional alternatives are outlined in Table 3.6.

3.5.2.1 Northern Subregion

For the Northern Subregion, both one and two WWTP configurations were considered. The one WWTP configuration would include a treatment facility located either in Mequon on the Milwaukee River south of Donges Bay Road or in Germantown near Highways 41-45 and Division Road. Either WWTP would serve the entire subregion.

For the two WWTP approach, one wastewater treatment facility would be built at the same Milwaukee River site to serve Mequon and Thiensville and the second facility would be built at the same Germantown site to serve only Germantown. The School Sisters of Notre Dame and Chalet-on-the-Lake treatment plants would be abandoned and connected to the local sewers tributary to these proposed WWTPs.

The following alternatives were considered for each WWTP in the Northern Subregion:

1. Secondary treatment and land application of effluent

2. Advanced treatment and recycling or reuse of effluent

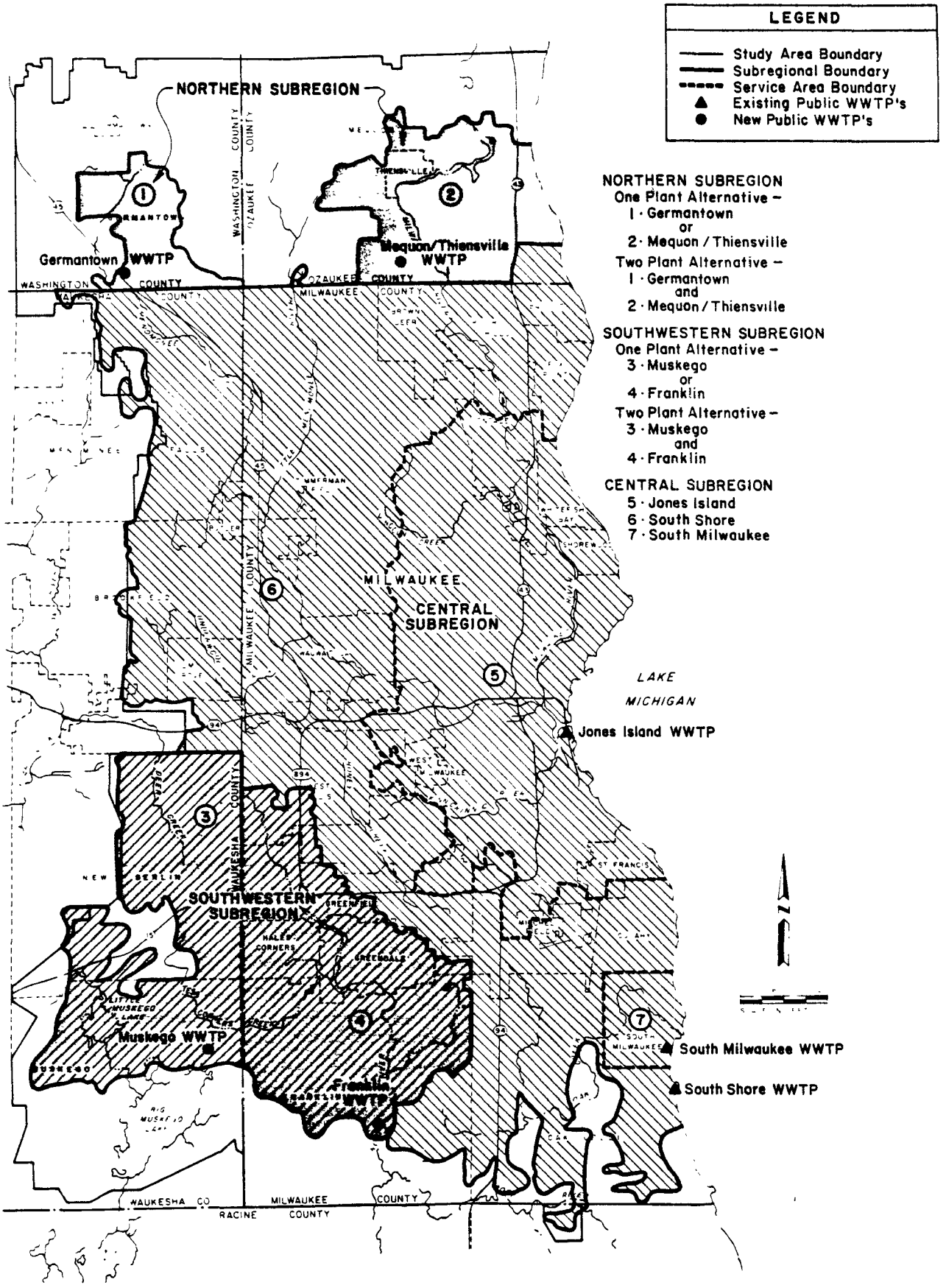

FIGURE 3-7

DATE APRIL 1981

SUBREGIONAL SERVICE AREAS

SOURCE MMSD

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TABLE 3.6

PRELIMINARY SUBREGIONAL ALTERNATIVES

WWTPs	Land Application** Alternatives 1.	2.	3.	4.	Recycle and Reuse	Treatment and Discharge to: Lake Michigan Basin	Fox River Basin
Jones Island* South Shore*							
Mequon 1-plant	X	X	X	X	X	Milwaukee River	
Germantown 1-plant	X	X	X	X	X	Menomonee	Fox River
Mequon 2-plant	X	X	X	X	X	Milwaukee River	
Germantown 2-plant	X	X	X	X	X	Menomonee River	Fox River
Franklin 1-plant	X	X	X	X	X	Root River	Wind Lake
Franklin 2-plant	X	X	X	X	X	Root River	
Muskego 2-plant	X	X	X	X	X	Tess Corners Creek	Big Muskego Lake

* See Regional Alternatives Matrix for alternatives considered for these WWTPs.
** Land Application Alternatives: (1) Normal Rate Irrigation, (2) High Rate Irrigation, (3) Infiltration-Percolation, and (4) Marsh Application

X: Alternative was considered for this WWTP. If a body of water is indicated, it means the alternative was considered for the WWTO and that watercourse would receive the effluent.

3. Advanced treatment and discharge to the Lake Michigan Basin.

In addition, for the WWTP located in Germantown, an alternative for advanced treatment and discharge to the Fox River Basin was considered. The WWTP in Mequon was evaluated for secondary treatment and discharge directly to Lake Michigan.

3.5.2.2 Southwestern Subregion

In the Southwestern Subregion, both one and two WWTP configurations were evaluated. The single plant alternative was developed to serve the entire subregion. A facility would be built on the Root River north of Ryan Road. The two plant system would include the construction of a smaller plant at the Root River site serving only the Milwaukee County portion of the subregion and a second plant located at the existing Muskego Northeast site to serve those portions of New Berlin and Muskego in the planning area.

The following alternatives were considered for each WWTP in the Southwestern subregion:

1. Secondary treatment and land application of effluent

2. Advanced treatment and recycling or reuse of effluent

3. Advanced treatment with discharge to the Fox River Basin

4. Advanced treatment with discharge to the Lake Michigan Basin.

In addition, the existing Muskego Northeast WWTP was evaluated for upgrading.

3.5.2.3 Central Subregion

The central subregion would be served by the Jones Island, South Shore, and South Milwaukee WWTPs. For each of these WWTPs, all the alternatives identified for the Local and Regional System-Levels were studied.

3.5.3 Regional System-Level Alternatives

Regional Alternatives were developed using the strategy of treating all wastewater flows in the planning area at one, two, or three large WWTPs. The development of this type of alternative took place in conjunction with the creation of possible means for storing and treating peak flows to avoid bypassing and overflows.

In order to consider the feasibility of a one WWTP Regional Alternative, the initial study was conducted using the South Shore WWTP as an example of a single regional WWTP. All the facility alternatives identified for Local Alternatives (except abandonment) were considered for expanding South Shore to treat all the wastewater flows from the planning area.

The two facility alternative evaluated the feasibility of using Jones Island and South Shore for regional wastewater treatment. Again, all possible methods for expanding or upgrading the facilities were considered.

The three facility alternative included operation of the Jones Island and South Shore WWTPs and the construction of a new WWTP. The MFP analysis of the area's sewers indicated that a likely location for the new facility would be at Ryan Road and the Root River in Franklin (see Figure 3.8). The alternatives studied for the new facility are listed below and summarized in Table 3.7:

1. Advanced wastewater treatment with discharge of effluent to Lake Michigan Basin

2. Advanced wastewater treatment with discharge of effluent to the Fox River Basin

3. Secondary treatment and land application of effluent

4. Advanced wastewater treatment and recycle or reuse of effluent.

All the alternatives described in section 3.5.1 were considered for the Jones Island and South Shore WWTPs.

Unlike the MMSD staff, the EPA, DNR, and EIS consultant did not include the South Milwaukee facility as a regional WWTP, since its service area would not be expanded. Also, the EPA, DNR, and EIS consultant evaluated the system-levels separately from the other components of the MFP.

3.6 THE SCREENING PROCESS

After the development of a comprehensive list of alternatives for water pollution abatement, the EPA, DNR and EIS consultant determined the environmental consequences, cost, and engineering feasibility of each alternative.

These alternatives were then evaluated in two phases. In the first phase obviously unacceptable alternatives were eliminated. In the second phase the remaining alternatives

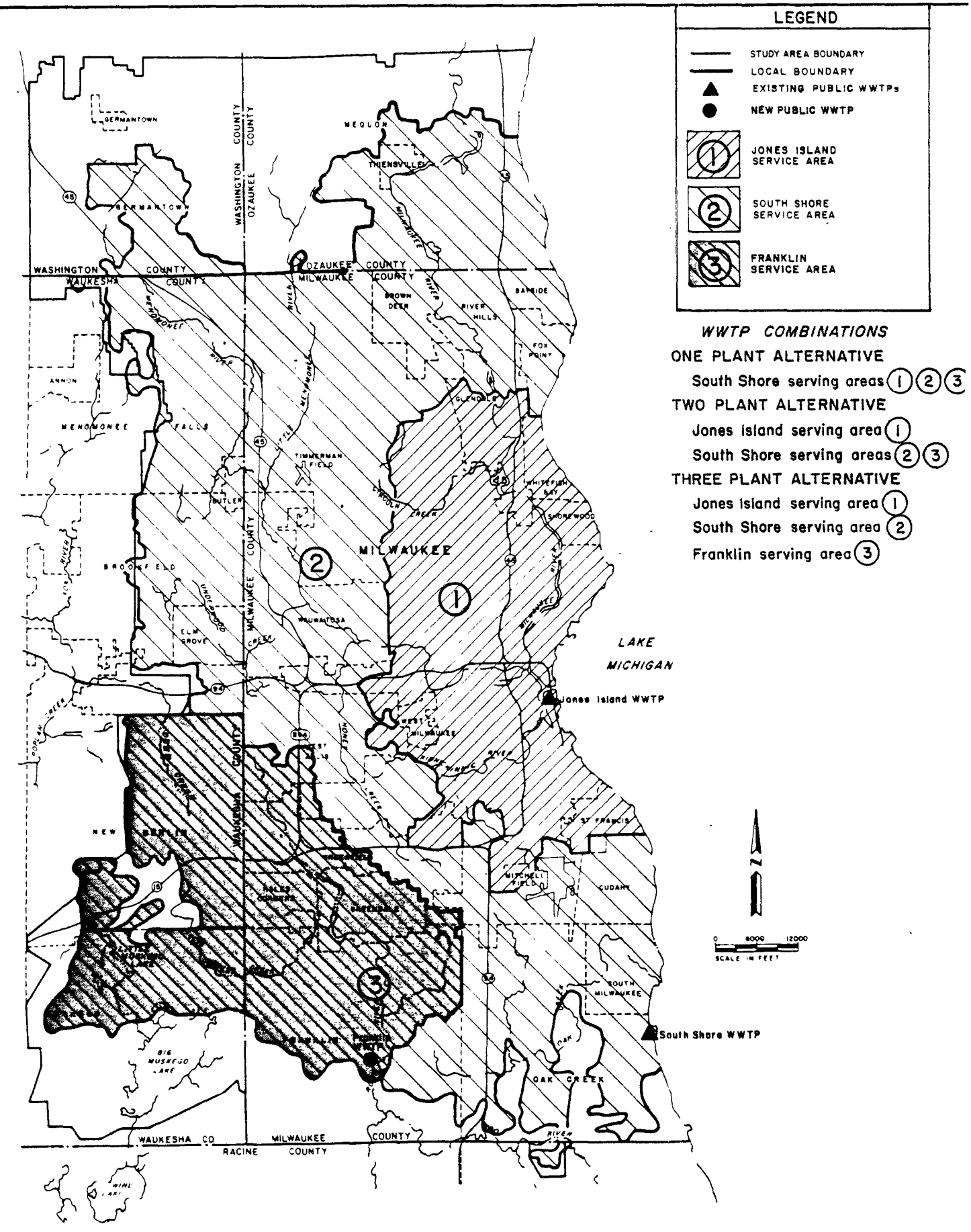

FIGURE 3-8

DATE APRIL 1981

REGIONAL SERVICE AREAS

SOURCE MMSD

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TABLE 3.7
PRELIMINARY REGIONAL ALTERNATIVES

CNE WWTP ALTERNATIVE	No Action	Improve O&M	Upgrade and Discharge to Lake Michigan	Upgrade and Discharge to Fox River	Recycle and Reuse	Land Application	Expand to 700 MGD Maximum	Expand to 125 MGD Plus Storage
South Shore WWTP	X	X	Lake Michigan	Wind Lake	X	X	X	X

TWO WWTP ALTERNATIVE +	No Action	Improve O&M	Upgrade and Discharge to Lake Michigan Basin	Upgrade and Discharge to Fox River Basin	Recycle and Reuse	Expansion* Alternative 1	Expansion** Alternative 2	Expansion*** Alternative 3
South Shore WWTP	X	X	Lake Michigan	Wind Lake	X	X	X	X
Jones Island WWTP	X	X	Lake Michigan	Wind Lake	X	X	X	X

THREE WWTP ALTERNATIVE ++	Treatment and Discharge to Lake Michigan #1	Treatment and Discharge to Lake Michigan #2	Treatment and Discharge to Fox River Basin	Recycle and Reuse
Franklin	Root River	Root River	Wind Lake	X

X - Alternative considered for this WWTP. If a body of water is indicated, it means the alternative was considered and that body of water would be the effluent discharge point.

\+ These alternatives were also considered as part of the Local and Subregional Systems-levels.

*1 South Shore - maximum 400 MGD, No Storage
Jones Island - maximum 300 MGD, No Storage

**2 South Shore - maximum 200 MGD, No Storage
Jones Island - maximum 500 MGD, No Storage

***3 South Shore - maximum 125-200 MGD, with Storage
Jones Island - maximum 200-300 MGD, with Storage

++ When it was determined that the Franklin WWTP was not viable, no further analysis of the South Shore and Jones Island WWTPs was conducted.

were examined in greater detail to determine the most environmentally sound and least costly alternatives. This two phase process is called "screening".

3.6.1 Screening Considerations

In order to screen the possible alternatives, it was necessary for the EPA, DNR and EIS consultant to develop a list of sensitive aspects of the natural and man-made environments which might be affected by the alternatives. These considerations are outlined below.

NATURAL ENVIRONMENT

1. Water Quality: Would the alternative allow the waters of the planning area to meet existing DNR standards and 208 recommended water quality standards?

2. Aquatic Biota: Would the aquatic biota in the region benefit or be degraded?

3. Threatened or Endangered Species: Would the alternative threaten or harm any species on the State or Federal Endangered or Threatened Species lists or would it remove the habitat of any such species?

4. Air Quality: Would the construction or operation of the alternative increase the annual loadings of any air pollutants for which the Milwaukee area is a non-attainment area? Would air quality be affected?

5. Odors: Would the alternative increase the perceived odors from sewerage facilities? Would construction or operation of the alternative create odors?

6. Groundwater: Would the construction or operation of the alternative greatly reduce groundwater supplies or degrade groundwater quality?

7. Floodplains: Does the alternative include the construction of facilities in areas where there is a 1% or greater chance of flooding each year? Would there be unavoidable alteration of the upstream or downstream flooding and channel patterns?

8. Wetlands: Would the alternative require construction on or disruption of any wetlands?

9. Prime Agricultural Land: Would the alternative require the use of any lands identified by the Soil Conservation Service as having special importance for farming?

10. Scientific Study Areas: Would any lands reserved for educational use or research be severely affected?

11. Wildlife Habitat: Would the alternative damage or require construction on land that supports populations of wild animals?

MANMADE ENVIRONMENT

12. Future Growth: Would the alternative cause population growth to deviate from the 208 Plan or would it divert construction to areas not designated for development?

13. Land Use: Would the alternative encourage development in conflict with local zoning regulations or area-wide land use planning?

14. Cost: Is the alternative greater than 15% more costly in comparison with other alternatives without offering compensating improvements in environmental quality? For example, land application of effluent was considered for local plants, in spite of the fact that it would be more expensive than other alternatives, because it offered improvement of water quality.

15. Fiscal Impacts: What would be the fiscal burden to communities and households to implement the alternative? Would its implementation affect growth in such a way to alter community costs or revenues?

16. Economic Impacts: How would the implementation or operation of the alternative affect regional employment, income, and production?

17. Recreation: As a result of the implementation of the alternative, would beach closings increase or decrease? Would parks and recreational facilities be otherwise impaired or improved?

18. Aesthetics: Does the alternative require the construction of unsightly facilities? Would it reduce or increase the attractiveness of surface waters?

19. Noise: How would the alternative affect the ambient noise levels in the vicinity of sewerage facilities? Would the construction cause an extreme amount of noise?

20. Public Health: Would the alternative pose a hazard to the public health? Would it relieve existing health hazards?

21. Safety: Would the implementation or operation of the alternative endanger workers or the public?

22. Access to Businesses, Residences, Industry, Police and Fire Services: Would the construction or operation of the alternative severely disrupt traffic and access?

23. Archaeological and Historic Sites: Would the alternative unavoidably effect any archaeological site or any property, eligible for inclusion on the National Register of Historic Places by introducing "visual, audible or atmospheric elements that are out of character with or alter its setting?" (36 CFR Part 800.3b)

24. Energy: Would the implementation or operation require the purchasing and consumption of excessively more energy than other alternatives, without offering other compensating benefits to the environment?

25. Resources: Would the construction or operation of the alternative require a disproportionately greater committment of resources (materials, labor, chemicals) than other alternatives under consideration? Would it require the committment of any non-renewable resources?

26. Engineering Feasibility: Would the alternative be infeasible or much less feasible than other alternatives under consideration? The judgment of feasibility was based on many factors: the use of proven construction and operation techniques (not excluding "innovative and alternative" technologies, but requiring that these techniques have been used successfully in conditions similar to those in the MMSD planning area); appropriate sizing of the facilities for proposed use; and the practicality of the alternative, whether it would present functional or operational problems.

27. Legality: Would the alternative meet all the legal requirements of the Court Orders, Clean Water Act, and Wisconsin Statutes outlined in Section 4.2.1? If an alternative did not meet all these requirements, it was eliminated from consideration.

3.6.2 The Primary Screening Process

The purpose of primary screening was to eliminate the least acceptable alternatives from the list of possible alternatives. An alternative was eliminated if it would result in the violation of effluent limits, if it would be obviously infeasible, or if its cost was much higher than other alternatives, without environmental advantages.

The primary screening results are shown in Tables 3.8, 3.9, and 3.10.

3.6.3 The Secondary Screening Process

The alternatives that survived primary screening were then analyzed in greater detail. As part of this process, the MMSD identified specific routes for interceptors and sites for wastewater storage and treatment. Pipe sizes and process equipment requirements were also determined. Based on this information and using EPA guidelines, the MMSD estimated costs for all alternatives.

The EPA, DNR and EIS consultant reviewed the MMSD data including an analysis of the reliability of alternatives. Independent EIS analyses were also performed using EPA cost-effectiveness guidelines to estimate water quality impacts, and energy and resource use. To mitigate severe environmental impacts, the EIS also identified and evaluated new alternatives, and these are described throughout the document.

Because obviously infeasible alternatives had been eliminated in primary screening, secondary screening was a comparison process. For each alternative, impacts were assessed using the twenty-seven considerations described above. Each alternative's adverse and beneficial impacts to the natural environment were evaluated in relation to its cost, potential disruption to the community, and ability to support the goals of the 208 Plan.

Alternatives were not eliminated on the basis of a single criterion, unless the detailed analysis showed that it would not meet water quality standards or legal requirements, or that it would be excessively more costly than other alternatives without offering compensating environmental benefits. Rather, an alternative was eliminated as it became apparent to the EPA, DNR and EIS consultant that other alternatives better met Federal, State, regional and local regulations and requirements.

The purpose of secondary screening was to compare alternatives for each system-level and to select the alternative for that system-level that would be the most environmentally sound and the least costly. These became the final alternatives. The screening process is summarized in Tables 3.11, 3.12, and 3.13, and the final alternatives are described in section 3.13.

3.7 THE REHABILITATION AND EXPANSION OF THE JONES ISLAND AND SOUTH SHORE WWTPS

The alternatives for the rehabilitation and expansion of the

TABLE 3.8

PRELIMINARY SCREENING OF LOCAL ALTERNATIVES

Local A* Alternatives	No Action	Improve O&M	Expand in Kind: Lake Michigan	Expand in Kind: Fox River	Land Application+ 1.	2.	3.	4.	Recycle and Reuse	Upgrade Treatment Discharge to: Lake Michigan	Fox River
Thiensville	L	L	IN	F	C	C	C	C	F,C	C,U	F
Germantown	L	L	L	F	C	C	IN	C	F,C	IN	C,L
New Berlin Regal Manors	L	L	C	L	C	C	IN	C	C	C	IN
Muskego, NW	L	L	F	L	C	C	IN	C	C	IN	IN
Muskego, NE	L	L	L	F	C	C	C	C	C	IN	IN
Caddy Vista	L	L	L	F	C	C	C	C	C	IN	F
South Milwaukee	L	IN	C	F	F	F	F	F	C	C	F
Sisters of Notre Dame	L	IN	C	F	F	F	F	F	C	C	F
Chalet-on-the-Lake Rest.	L	L	L	F	F	F	F	F	C	C	F
New Berlin Mem. Hospital	L	L	L	F	F	F	F	F	C	C	F
Cleveland Hgts. Grade School	L	L	F	L	F	F	F	F	C	C	C
Muskego Rend.	L	L	F	L	C	C	IN	C	C		C
St. Martin's	L	L	L	F	F	F	F	F	C	C	F
Hwy. 100 Drive-in	L	L	L	F	F	F	F	F	C		C,F
Wis. Elec.	L	IN	C	F	F	F	F	F	C	C	F
Local B Alternatives**											
New Berlin, NE	F	F	F	F	L	C	C	C	C	C	L,C
New Berlin, SE	F	F	F	F	C	C	IN	C	C	IN	C
Muskego, NE	L	L	L	F	C	C	IN	C	C	IN	W

*Local A - Alternatives for all public and private WWTPs in the planning area.
**Local B - All private WWTPs would be abandoned. "Local A" alternatives were considered for all WWTPs except Muskego Northwest, Muskego Northeast and New Berlin Regal Manors. These WWTPs would be abandoned and instead the New Berlin Northeast, New Berlin Southeast and Muskego Northeast WWTPs, described in text, were considered.

+Land Application Alternatives - 1. Normal Rate Irrigation 2. High Rate Irrigation 3. Infiltration-percolation 4. Marsh application

L: Legality. See section 3.5.1
F: Feasibility. See section 3.5.1
C: Cost. See section 3.5.1
IN: The alternative was included for further evaluation

TABLE 3.9

PRELIMINARY SCREENING OF SUBREGIONAL ALTERNATIVES

WWTPs	LAND APPLICATION ALTERNATIVES* 1.	2.	3.	4.	RECYCLE AND REUSE	UPGRADE TREATMENT DISCHARGE TO: LAKE MICHIGAN	FOX RIVER BASIN
Mequon 1-plant	L	C	C	C	C	C	F
Germantown 1-plant	C	C	C	C	C	C	C
Mequon 2-plant	C	C	IN	C	C	IN	F
Germantown 2-plant	C	C	IN	C	C	IN	F
Franklin 1-plant	C	C	C	C	C	IN	F
Franklin 2-plant	C	C	C	C	C	IN	F
Muskego 2-plant	C	C	IN	C	C	IN	IN

L: Legality. See section 3.5.1.
C: Cost. See section 3.5.1.
F: Feasibility. See section 3.5.1.
IN: The alternative was included for further evaluation
* Land application alternatives
1. High Rate Irrigation
2. Normal Rate Irrigation
3. Infiltration/Percolation
4. Marsh Application

TABLE 3.10

PRELIMINARY SCREENING OF REGIONAL ALTERNATIVES

ONE WWTP ALTERNATIVE	No Action	Improve O&M	Upgrade and Discharge to Lake Michigan	Upgrade and Discharge to Fox River	Recycle and Reuse	Land Application	Expand to 700 MGD Maximum	Expand to 125 MGD Plus Storage
South Shore WWTP	L	L	F	L	F	F	F,E	C,F,E

TWO WWTP ALTERNATIVE +	No Action	Improve O&M	Upgrade and Discharge to Lake Michigan	Upgrade and Discharge to Fox River	Recycle and Reuse	Expansion* Alternative 1	Expansion** Alternative 2	Expansion*** Alternative 3
South Shore	L	L	F	L	F	F,E	IN	IN
Jones Island	L	L	F	L	F	F,E	IN	IN

THREE WWTP ALTERNATIVE ++	Treatment and Discharge to Lake Michigan #1	Treatment and Discharge to Lake Michigan #2	Treatment and Discharge to Fox River Basin	Recycle and Reuse
Franklin	C	C	L	F

\+ These alternatives considered as part of the Local and Subregional Systems-levels.

++ When it was determined that the Franklin WWTP was not viable, no further analysis of the South Shore and Jones Island WWTPs was conducted.

L Legality. See section 3.5.1.

F Feasibility. See section 3.5.1.

C Cost. See section 3.5.1.

IN Alternative was included for further analysis

*1 South Shore - maximum 400 MGD, No Storage
Jones Island - maximum 300 MGD, No Storage

**2 South Shore - maximum 200 MGD, No Storage
Jones Island - maximum 500 MGD, No Storage

***3 South Shore - maximum 125-200 MGD, with Storage
Jones Island - maximum 200-300 MDG, with Storage

TABLE 3.11
SECONDARY SCREENING OF LOCAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternatives	Impacts	Selection of Final Alternative
Thiensville	Expand In Kind-Discharge to Milwaukee River	• Short-term construction impacts. • Plant would be expanded into open land to North. • Plant would meet WPDES effluent limits. • All existing DNR water quality standards would be met in the Milwaukee River. • All 208 recommended water quality standards would be met except for the phosphorus standard which would be violated due to discharge from upstream WWTPs. • Present Worth = $\$5.17 \times 10^6$.	Expand In Kind-Discharge to Milwaukee River • Total cost is lower than all land application alternatives. • No DNR or 208 recommended water quality standards would be violated due to the discharge.
Germantown	Upgrade Treatment-Discharge to Menomonee River	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • Both the existing DNR and 208 recommend water quality standards for chlorine would be violated. All other standards are met. • Present worth = $\$17.03 \times 10^6$.	
	Land Application	• Short-term construction impacts. • Groundwater pollution potential exists. • All existing DNR and 208 recommended water quality standards would be met in the Menomonee River. • 110 acres of agricultural land would be lost in the Village. • Abandonment of existing plant in residential area. • Alternative technology. • Present Worth = $\$13.17 \times 10^6$.	Land Application-Infiltration/Percolation • Least cost feasible alternative. • All DNR and 208 recommended water quality standards would be met. • As alternative technology, system would be eligible for 85% funding.
New Berlin Alternative A Regal Manors Plant	Upgrade Treatment-Discharge to Deer Creek	• Short-term construction impacts would be significant due to close proximity of plant to residential area. • Plant would meet WPDES effluent limits. • The existing DNR chlorine water quality standards would be violated in Deer Creek. All other DNR standards would be met. • The 208 recommended water quality standards for phosphorus, chlorine, and un-ionized ammonia nitrogen would not be met in Deer Creek. • New Berlin would be served by both Regal Manors WWTP and the MMSD. • Malfunctioning septic systems would be eliminated. • Present Worth = $\$20.85 \times 10^6$.	

TABLE 3.11 (Continued)
SECONDARY SCREENING OF LOCAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
	Land Application-Infiltration/Percolation	• Short-term construction impacts. • Groundwater pollution potential exists. • All existing DNR and 208 recommended water quality standards would be met in Deer Creek. • 80 acres of agricultural land would be lost. It would have to be secured from the Town of Vernon. • Abandonment of existing plant. • New Berlin would be served by both the land application plant and the MMSD. • Malfunctioning septic systems would be eliminated. • Present Worth = $\$19.27 \times 10^6$.	
Alternative B Southeast Plant	Construct Plant-Discharge to Deer Creek	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • Existing DNR chlorine water quality standard would be violated in Deer Creek. All other DNR standards would be met. • The 208 recommended water quality standards for chlorine and phosphorus would be violated. All other 208 standards would be met. • New Berlin would own and operate its own plant. • 11.5 acres of residentially zoned land would be needed for the new plant. • Regal Manors Plant would be abandoned. • Malfunctioning septic systems would be eliminated. • Present Worth = $\$40.01 \times 10^6$.	
	Construct Plant-Discharge to Tess Corners Creek	• Existing DNR chlorine standard would be violated in Tess Corners Creek. All other DNR standards would be met. • The 208 recommended water quality standards for chlorine and phosphorus would be violated. All other 208 standards would be met. • All existing DNR and 208 recommended water quality standards would be met in Deer Creek. • All other impacts identical to Deer Creek discharge alternative. • Present Worth = $\$38.53 \times 10^6$.	

TABLE 3.11 (Continued)
SECONDARY SCREENING OF LOCAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternatives
	Land Application-Infiltration/Percolation	• Short-term construction impacts. • Groundwater pollution potential exists. • All existing DNR and 208 recommended water quality standards would be met in Deer Creek and in Tess Corners Creek, if the Muskego WWTPs also did not discharge to Tess Corners Creek. • Approximately 211 acres of residentially zoned land would be needed in New Berlin. • A 12.1 acre storage pond and 21-8.2 acre infiltration/percolation ponds would be located on 230 acres of agricultural land in Vernon. • Regal Manor Plant would be abandoned. • Malfunctioning septic systems would be eliminated. • Alternative technology. • New Berlin would own and operate its own plant. • Present Worth = $39.43x10^6$.	
New Berlin (Comparison of A &B Alternatives)	Alternative A Regal Manors: Land Application-Infiltration/Percolation (Portion of New Berlin served by MMSD)	• Groundwater pollution potential. • All existing DNR and 208 recommended water quality standards would be met in Deer Creek. • Abandon existing plant, acquire 80 acres of agricultural land in Vernon. • New Berlin served by local plant and MMSD. • Total of Regal Manors Yearly Present Worth[1] = $14.77x10^6$. Total of MMSD Charges Yearly Present Worth[1] = $17.84x10^6$. Total of New Berlin Yearly Present Worth[1] = $32.61x10^6$.	
	Alternative B New Berlin Southeast: Land Application-Infiltration/Percolation	• Groundwater pollution potential. • All existing DNR and 208 recommended water quality standards would be met in Deer Creek. • Abandon Regal Manors, acquire 211 acres of of residentially zoned land in New Berlin and 230 acres of agricultural land in Vernon. • New Berlin would own and operate its own plant. • Total of New Berlin Yearly Present Worth[1] = $30.12x10^6$. [1]Total of the present worth of yearly expenditures as computed by the MWPAP Financial Planning Model	B. New Berlin Southeast Land Application by Infiltration/Percolation: • New Berlin would control its entire local sewage treatment. • Most cost-effective alternative because it is alternative technology. • As alternative technology, system would be eligible for 85% funding. • All DNR and 208 recommended water quality standards would be met in Deer Creek and Tess Corners unless Muskego discharges to either creek.

TABLE 3.11 (Continued)
SECONDARY SCREENING OF LOCAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
Muskego Alternative A Northeast Plant	Upgrade Treatment-Discharge to Tess Corners Creek	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • The existing DNR water quality standard for chlorine would be violated in Tess Corners Creek. All other DNR standards would be met. • The 208 recommended water quality standards for chlorine, phosphorus, and un-ionized ammonia nitrogen would not be met. All other 208 standards would be met. • Long-term eutrophication of Whitnall Park Pond would continue. • Plant would be expanded on city-owned land currently zoned residential and in sight of new residential development. • Present Worth - $\$11.00 \times 10^6$.	
	Upgrade Treatment-Discharge to Big Muskego Lake	• Short-term construction impacts. • Plant would meet WPDES permit. • All existing DNR and 208 recommended water quality standards would be met in Tess Corners Creek. • Increased loads of phosphorus and nitrogen would aid in the accelerated eutrophication of Big Muskego Lake. • Plant would be expanded on city-owned land currently zoned residential. • Present Worth - $\$11.13 \times 10^6$.	
Northwest Plant	Upgrade Treatment-Discharge to Tess Corners Creek	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • The existing DNR water quality standard for chlorine would be violated in Tess Corners Creek. All other DNR standards would be met. • Long-term eutrophication of Whitnall Park Pond would continue. • The 208 recommended standards for chlorine, phosphorus, and un-ionized ammonia nitrogen would not be met. • Long-term eutrophication of Whitnall Park Pond would continue. • Existing plant in area zoned wetland/floodplain would be partially abandoned. Plant expansion would occur in area zoned suburban residential. • Nutrient loads to Big Muskego Lake would be decreased, slowing the eutrophication process. • Present Worth = $\$13.10 \times 10^6$.	

TABLE 3.11 (Continued)
SECONDARY SCREENING OF LOCAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
	Upgrade Treatment-Discharge to Big Muskego Lake	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • Existing plant in area zoned wetlands/flood-plain would be partially abandoned. Plant expansion would occur in area zoned suburban residential. • Increased phosphorus and nitrogen loads would aid in the continued eutrophication of Big Muskego Lake. • All existing DNR and 208 recommended water quality standards would be met in Tess Corners Creek. • Present Worth = $\$10.29 \times 10^6$.	
	Land Application-Infiltration/ Percolation	• Short-term construction impacts. • Groundwater pollution potential exists. • Existing nutrient loads to Big Muskego Lake would be reduced, slowing the eutrophication process. • All existing DNR and 208 recommended water quality standards would be met in Tess Corners Creek. • Existing plant would be converted to new aerated lagoons. • A 2.4 acre storage pond and 7 4.5 acre infiltration/percolation ponds would be located on 74 acres of agricultural land in Vernon. • Alternative technology. • Present Worth = $\$10.25 \times 10^6$.	
Alternative B Northeast Plant (to serve all Muskego)	Upgrade Treatment-Discharge to Tess Corners Creek	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • The existing DNR water quality standard for chlorine would be violated in Tess Corners Creek. All other DNR standards would be met. • The 208 recommended standards for chlorine, phosphorus, and un-ionized ammonia nitrogen would not be met. • Muskego Northwest Plant would be abandoned, eliminating significant nutrient loads to Big Muskego Lake. • Existing plant would be abandoned. New plant would be built on city-owned land currently zoned residential and within sight of new residential development. • Long-term eutrophication of Whitnall Park Pond would continue. • Present Worth = $\$16.72 \times 10^6$.	

TABLE 3.11 (Continued)
SECONDARY SCREENING OF LOCAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
	Land Application-Infiltration/Percolation (Aerated Lagoons at Vernon)	• Short-term construction impacts. • Groundwater pollution potential exists. • Existing Northeast Plant would be abandoned, eliminating discharges to Tess Corners Creek. All existing DNR and 208 recommended water quality standards would be met in Tess Corners Creek. • Existing Northwest Plant would be abandoned and its phosphorus and nitrogen loads to Big Muskego Lake would be eliminated. • A 22 acre aerated lagoon and 7 9.1 acre infiltration/percolation ponds would be located on 115 acres of agricultural land in Vernon. • Alternative technology. • Present Worth = $\$14.57 \times 10^6$.	
	Land Application-Infiltration/Percolation (Aerated Lagoons at Northwest Site) (EIS alternative not considered in MFP)	• Short-term construction impacts. • High groundwater elevation at Northwest Plant site increased potential for groundwater pollution. • Expansion at Northwest Plant site would further disrupt wetlands and floodplains. • Impacts on Tess Corners Creek and Big Muskego Lake would be the same as for lagoons in Vernon alternative. • 17 less acres of agricultural land would be required in Vernon for the 7 9.1 acre infiltration/percolation ponds. • Alternative technology. • Present Worth = $\$15.49 \times 10^6$.	
Muskego (Comparison of A & B Alternatives)	Alternative A Northeast Plant: Upgrade Treatment-Discharge to Tess Corners Creek Northwest Plant: Land Application-Infiltration/Percolation	• The existing DNR chlorine standard would be violated in Tess Corners Creek. All other DNR standards would be met. • The 208 recommended standards for chlorine, phosphorus, and un-ionized ammonia nitrogen would be violated in Tess Corners Creek. • Nutrient loads to Big Muskego Lake from the existing Northwest Plant would be eliminated. • Nutrient loads to Whitnall Park Pond would continue contributing to its long-term eutrophication. • Northwest Plant site would continue to be used. • Approximately 74 acres of agricultural land would be needed in Vernon. • Present Worth = $\$21.26 \times 10^6$	

TABLE 3.11 (Continued)
SECONDARY SCREENING OF LOCAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
	Alternative B Northeast Plant: Land Application- Infiltration/ Percolation (Aerated Lagoons in Vernon)	• All existing DNR and 208 recommended water quality standards would be met in Tess Corners Creek. • Nutrient loads to Big Muskego Lake from the existing Northwest Plant would be eliminated. • Nutrient loads to Whitnall Park Pond would be decreased, slowing its long-term eutrophication. • Northwest Plant would be abandoned. • Approximately 115 acres of agricultural land would be needed in Vernon. • Present Worth = $\$14.57 \times 10^6$.	Alternative B Northeast Plant: Land Application- Infiltration/Percolation (Aerated Lagoons in Vernon) • Least cost feasible alternative. • All DNR and 208 recommended water quality standards would be met in Tess Corners Creek. • Nutrient loads to Big Muskego Lake from Northwest Plant would be eliminated. • Unpopular Northwest Plant would be abandoned. • As alternative technology, system would be eligible for 85% funding.
Caddy Vista	Upgrade Treatment- Discharge to Root River	• Short-term construction impacts. • Existing plant would be abandoned. • New plant would be built on existing property along an area currently zoned as a recreational park. • The water quality of the Root River at Caddy Vista is greatly affected by discharges from upstream WWTPs. If the Caddy Vista Plant was the only plant in the planning area which discharged to the Root River or its tributaries, the existing DNR chlorine standard would be violated. The 208 recommended standards for chlorine and phosphorus would also be violated. Phosphorus concentrations would exceed the 208 recommended standard due to discharges from upstream WWTPs outside the MMSD planning area. • Bypassing of untreated or poorly treated sewage would be eliminated. • Present Worth = $\$2.64 \times 10^6$.	Upgrade Treatment- Discharge to Root River • Most DNR water quality standards would be met. • All recommended 208 water quality standards would be met except chlorine. Phosphorus standards would be violated because of upstream sources.
South Milwaukee	Upgrade O & M Discharge to Lake Michigan	• Only solids handling will be upgraded. • Plant would meet WPDES effluent limits. • All DNR water quality standards would be met except possibly toxicity levels for un-ionized ammonia nitrogen.	Upgrade O & M- Discharge to Lake Michigan • Total cost is lower than all land application alternatives. • All DNR water quality standards would be met except possibly toxicity levels for un-ionized ammonia nitrogen.
MMSD		See Regional System-Level Alternative Screening-Table 3.13	

TABLE 3.12
SECONDARY SCREENING OF SUBREGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternatives	Impacts	Selection of Final Alternative
Northern Subregion Mequon- Thiensville	Construct Plant- Discharge to Milwaukee River	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • The existing DNR water quality standard for chlorine would be violated in the Milwaukee River. All other standards would would be met. • The 208 recommended standards for chlorine and phosphorus would violated, in part, due to discharge from upstream WWTPs. • Mequon and Thiensville would operate plant. Portion of Mequon would still be tributary to MMSD. • Approximately 7.5 acres of industrially zoned land would be needed for the new plant. • Thiensville plant would be abandoned. • Malfunctioning septic systems would be eliminated. • Present Worth = $\$26.80 \times 10^6$.	Construct Plant- Discharge to Milwaukee River • Cost is comparable to Discharge to Lake Michigan Alternative and a new plant discharge would not be introduced into Lake Michigan. • Long outfall to Lake Michigan would not be needed. • Violations of DNR water quality standards for chlorine could be mitigated at a lower cost than the additional cost of the land application-infiltration/percolation system. • 160 acres of agricultural land in Germantown would not be needed.
	Construct Plant- Discharge to Lake Michigan	• Short-term construction impacts at plant site and outfall. • Construction of outfall through lake bluff could cause major bluff stability problems. • Plant would meet WPDES effluent limits. • Additional point source with phosphorus loads would be added to Lake Michigan. Thiensville loads to Milwaukee River would cease. Milwaukee River would meet existing DNR water quality standards. The 208 recommended phosphorus standard would continue to be violated in the Milwaukee River due to discharges from upstream WWTPs. o Mequon and Thiensville would operate plant. Portion of Mequon would still be tributary to MMSD. o Approximately 7.5 acres of industrially zoned land would be needed for the new plant. o 26,000 feet of force main outfall would be needed. 1000 feet of outfall would be under Lake Michigan. o Thiensville plant would be abandoned. o Malfunctioning septic systems would be eliminated. o Present Worth = $\$26.76 \times 10^6$.	

TABLE 3.12 (Continued)
SECONDARY SCREENING OF SUBREGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
Germantown	Land Application-Infiltration/Percolation	• Short-term construction impacts. • Groundwater pollution potential exists. • Thiensville loads to Milwaukee River would cease. • Approximately 160 acres of agriculturally and conservancy zoned land in Germantown would be required for the aerated lagoons and ponds. No land would be required in Mequon. • Malfunctioning septic systems would be eliminated. • Alternative technology. • Mequon and Thiensville would operate plant. Portion of Mequon would still be tributary to MMSD. • Present Worth = $32.05x10^6$.	
	Construct Plant-Discharge to Menomonee River	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • Both the existing DNR and 208 recommended chlorine standards would be violated in the Menomonee River. All other water quality standards would be met. • Existing Germantown plant would be abandoned. • Approximately 4.5 acres of agricultural land would be needed for the new plant. • Present Worth = $17.65x10^6$.	
	Land Application-Infiltration/Percolation	• Short-term construction impacts. • Groundwater pollution potential exists. • Germantown plant would be abandoned. • All existing DNR and 208 recommended water quality standards would be met in the Menomonee River. • Approximately 28 acres of agricultural land would be needed for the aerated lagoons. o Approximately 110 acres of agricultural land would be needed for the ponds. o Malfunctioning septic systems would be eliminated. o Alternative technology o Present Worth = $16.58x10^6$.	Land application by Infiltration/Percolation: • Least cost feasible alternative. • All DNR and recommended 208 water quality standards would be met. • As alternative technology, system would be eligible for 85% funding.

TABLE 3.12 (Continued)
SECONDARY SCREENING OF SUBREGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
Southwest Subregion Alternative A Plant at Franklin only	Construct Plant-Discharge to Root River	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • The existing DNR chlorine standard would be violated in the Root River. All other standards would be met. • The 208 recommended chlorine and phosphorus standards would be violated in the Root River. • Existing Regal Manors, Muskego Northeast and Northwest plants would be abandoned. • Nutrient loads to Big Muskego Lake and Whitnall Park Pond would be decreased. • Approximately 16.5 acres of agricultural land owned by Milwaukee County as part of the House of Correction Work Farm would be needed for the new plant. • Plant would be operated by the MMSD. New Berlin and Muskego would become Contract Communities to the MMSD. • Malfunctioning septic systems would be eliminated. • Present Worth = $\$100.79 \times 10^6$.	
Alternative B Plant at Franklin	Construct Plant-Discharge to Root River	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • The existing DNR chlorine standard would be violated in the Root River. All other standards would be met. • The 208 recommended chlorine and phosphorus standards would be violated in the Root River. • Approximately 11.3 acres of agricultural land owned by Milwaukee County as part of the House of Correction Work Farm would be needed for the new plant. • Plant would be operated by the MMSD. • Present Worth = $\$58.31 \times 10^6$.	
Plant at Muskego	Construct Plant-Discharge to Tess Corners Creek	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • The existing DNR chlorine standard would be violated in Tess Corners Creek. All other standards would be met. • The 208 recommended standards for chlorine and phosphorus would be violated.	

TABLE 3.12
SECONDARY SCREENING OF SUBREGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
		• All existing DNR and 208 recommended water quality standards would be met in Deer Creek. • Existing Regal Manors, Muskego Northeast and Northwest plants would be abandoned. • Nutrient loads to Big Muskego Lake would be decreased. Nutrient loads to Whitnall Park Pond would increase, contributing to its continued eutrophication. • New plant would be built on Muskego-owned land currently zoned residential and within sight of new residential development. • Plant would be operated by New Berlin and Muskego. • Malfunctioning septic systems in New Berlin and Muskego would be eliminated. • Present Worth = $\$50.71 \times 10^6$.	
	Construct Plant-Discharge to Big Muskego Lake	• Short-term construction impacts. • Plant would meet WPDES effluent limits. • Major increases in nutrient loads to Big Muskego Lake. • Existing Regal Manors, Muskego Northeast and Northwest plants would be abandoned. • All existing DNR and 208 recommended water quality standards would be met in Tess Corners Creek and Deer Creek. • Remaining impacts identical to Tess Corners Creek alternative. • Present Worth = $\$51.08 \times 10^6$.	
	Land Application-Infiltration/ Percolation	• Short-term construction impacts. • Groundwater pollution potential exists. • Existing Regal Manors, Muskego Northeast and Northwest plants would be abandoned. • All existing DNR and 208 recommended water quality standards would be met in Tess Corners Creek and Deer Creek. • Nutrient loads to Big Muskego Lake and Whitnall Park Pond would be decreased. • Secondary plant would be built on Muskego-owned land. • Approximately 340 acres of agricultural land would be needed in Vernon for the ponds and buffer areas. • Plant would be operated by New Berlin and Muskego.	

TABLE 3.12 (Continued)
SECONDARY SCREENING OF SUBREGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
		• Malfunctioning septic systems in New Berlin and Muskego would be eliminated. • Alternative technology. • Present Worth = $\$64.07 \times 10^6$.	
Southwest Subregion (Comparison of A & B Alternatives)	Alternative A Franklin Plant Only: Construct Plant-Discharge to Root River	• The existing DNR chlorine standard would be violated in the Root River. All other standards would be met. • The 208 recommended chlorine and phosphorus standard would be violated in the Root River. • Nutrient loads to Big Muskego Lake and Whitnall Park Pond would be decreased. • Regal Manors, Muskego Northeast and Northwest plants would be abandoned. • Present Worth = $\$100.79 \times 10^6$.	Alternative A Franklin Plant Only: Construct Plant- Discharge to Root River • Least cost feasible alternative. • All DNR and recommended 208 water quality standards would be met in Deer Creek, Tess Corners Creek, Big Muskego Lake, and the Root River above the proposed WWTP. • Would not be necessary to construct large WWTP in developing residential area of Muskego. • Nutrient load to Whitnall Park Pond would be reduced instead of increased.
	Alternative B Franklin Plant: Construct Plant-Discharge to Root River Muskego Plant: Construct Plant-Discharge to Tess Corners Creek	• The existing DNR chlorine standard would be violated in Tess Corners Creek and the Root River. • The 208 recommended water quality standards for chlorine, phosphorus, and un-ionized ammonia nitrogen would be violated in Tess Corners Creek. The chlorine and phosphorus standards would also be violated in the Root River. • Nutrient loads to Big Muskego Lake would be decreased. Nutrient loads to Whitnall Park Pond would increase, aiding in its continued eutrophication. • Regal Manors, Muskego Northeast and Northwest Plants would be abandoned. • Present Worth = $\$109.02 \times 10^6$.	
Central Subregion MMSD		See Regional Alternative Secondary Screening - Table 3.13.	

TABLE 3.13
SECONDARY SCREENING OF REGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
MMSD	Remote Storage Jones Island-300 MGD South Shore-250 MGD	CSO Abatement/Peak Wastewater Flow Control[1] • Cavern storage of 757 acre-feet would be constructed at an abandoned gravel pit between South Hawley Road and U. S. 41 south of the Menomonee River or at the Hawthorne Glen Nature Reserve Center near 60th Street and State Street. 6-10 acres of land needed for construction. • Near surface storage totaling 236 acre-feet would be constructed for 23% of CSSA. • Private property work would be required in 48% of CSSA. • Major disruption due to construction of storm and sanitary sewers would occur in 89% of CSSA. • Construction impacts would be reduced since only the west branch of the Crosstown Diversion would be constructed. Milwaukee River Branch would be constructed at a shallow depth. • Both construction and operation of storage and conveyance facilities could cause groundwater pollution. • CSOs and sanitary sewage bypasses would be eliminated for storms up to the storm of record. • Existing DNR water quality standards would be achieved in the Inner Harbor areas of the Milwaukee, Menomonee, and Kinnickinnic Rivers if instream measures were also implemented. Jones Island[2] • Lakefill expansion of 9.5 or 5.7 acres would occur east of existing plant. • Reduction in Harbor Commission land as a result of further plant expansion would be necessary. • Plant would meet WPDES effluent limits. Loads of un-ionized ammonia would increase significantly if ammonia removal is not implemented. • DNR water quality standards for the Outer Harbor would be violated for un-ionized ammonia nitrogen, unless ammonia removal is implemented. All other standards would be met. South Shore[3] • Lakefill north of existing lakefill would remove 30 acres of unpolluted nearshore area of Lake Michigan.	

TABLE 3.13 (Continued)
SECONDARY SCREENING OF REGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
		• Plant would meet WPDES effluent limits. • DNR water quality standards for Lake Michigan would be violated for un-ionized ammonia nitrogen during critical summer pH and temperature conditions. Interceptor Expansion • The existing MIS system would be rehabilitated where necessary. • The MMSD service area would be expanded with construction of the following interceptors: Franklin-Muskego Interceptor[5] Franklin Northeast Pump Stations Hales Corners Interceptor[5] Menomonee Falls-Germantown Interceptor (East-West alignment) Mitchell Field South Interceptor Northeast Side Relief Sewer Northridge Interceptor Oak Creek North Branch Interceptor[5] Root River Interceptor[5] Underwood Creek Interceptor Caddy Vista Connection[5] Muskego Connection[5] New Berlin Connection[5] Mequon/Thiensville Connection[5] Germantown Connection[5] South Milwaukee Connection[5] • Local sewer systems would be rehabilitated. Cost[6] • Present Worth = $1814.20x10^6$ ($1913.20x10^6$ if surface storage is used with partial sewer separation to eliminate private property work.)	
	Jones Island Storage Jones Island-300 MGD South Shore-250 MGD	CSO Abatement/Peak Wastewater Flow Control[1] • Cavern storage of 550 acre-feet would be constructed in bedrock at a site immediately south of the Kinnickinnic Mooring Basin. Area is presently used by railroads and industry. • Near surface storage totaling 437 acre-feet would be constructed for 41% of CSSA.	

TABLE 3.13 (Continued)
SECONDARY SCREENING OF REGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternatives	Impacts	Selection of Final Alternative
		• Private property work would be required in 48% of CSSA. • Major disruption due to construction of storm and sanitary sewers in 89% of CSSA. • Both the Crosstown Diversion and the Milwaukee River Branch would be constructed at shallow depths. • Remaining impacts would be identical to the Remote Storage Alternative.	
		Jones Island[2] • Impacts would be identical to the Remote Storage Alternative.	
		South Shore[3] • Impacts would be identical to the Remote Storage Alternative.	
		Interceptor Expansion[4] • Impacts would be identical to the Remote Storage Alternative.	
		Cost[6] • Present Worth = $\$1871.20 \times 10^6$ ($\$1970.20 \times 10^6$ if near surface storage is used with partial sewer separation to eliminate private property work.)	
	CST Extension Jones Island-300 MGD South Shore-250 MGD	CSO Abatement/Peak Wastewater Flow Control[1] • Cavern storage at 1,334 acre-feet would be constructed in bedrock at a site immediately south of the Kinnickinnic Mooring Basin. Area is presently used by railroads and industry. • Near surface storage totaling 235 acre-feet would be constructed for 21% of CSSA. • No private property work would be required in CSSA. • Major disruption due to construction of storm sewers in 21% of CSSA • Urban runoff would be captured and treated in 68% of CSSA.	

TABLE 3.13 (Continued)
SECONDARY SCREENING OF REGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
		• Both the Crosstown Diversion and the Milwaukee River Branch would be constructed as 30-foot tunnels in bedrock. • Remaining impacts would be identical to the Remote Storage Alternative. Jones Island[2] • Impacts would be identical to the Remote Storage Alternative. South Shore[3] • Impacts would be identical to the Remote Storage Alternative. Interceptor Expansion[4] • Impacts would be identical to the Remote Storage Alternative. Cost[6] • Present Worth = $1894.20x10^6$.	
	Flow-Through Treatment Jones Island-450 MGD South Shore-250 MGD	CSO Abatement/Peak Wastewater Flow Control[1] • No cavern storage would be necessary. • Near surface storage of 437 acre-feet for 41% of CSSA. • Private property work required in 48% of CSSA. • Major disruption due to construction of storm and sanitary sewers in 89% of CSSA. • Both Crosstown Diversion and the Milwaukee River Branch would be constructed at shallow depths. • Remaining impacts would be identical to the Remote Storage Alternative.	

TABLE 3.13 (Continued)
SECONDARY SCREENING OF REGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
		Jones Island[2] • An additional 31-45 acres of land would be required for expansion. This land would come from the Harbor Commission or lakefill or both. • Greater shock loads to Outer Harbor due to higher peak loads. • Difficult operation of plant due to high peak flows. • Remaining impacts would be identical to the Remote Storage Alternative.	
		South Shore[3] • Impacts would be identical to the Remote Storage Alternative.	
		Interceptor Expansion[4] • Impacts would be identical to the Remote Storage Alternative.	
		Cost[6] • Present Worth = $1898.94x10^6$ ($1997.94 if near surface storage is used with partial sewer separation to eliminate private property work.)	
	CST/Inline Storage Jones Island-300 MGD South Shore-250 MGD	CSO Abatement/Peak Wastewater Flow Control[1] • Cavern storage of 1,291 acre-feet would be constructed in bedrock near Milwaukee County Stadium. No solids removal equipment would be required since the cavern would drain by gravity. • Cavern storage of 174 acre-feet near Jones Island with solids removal equipment would be required. • Near surface storage totaling 235 acre-feet would be constructed to serve 21% of the CSSA. • No private property work would be required in the CSSA. • Major disruption would occur due to construction of storm sewers in 21% of the CSSA. • Urban runoff would be captured and treated in 68% of the CSSA.	

TABLE 3.13 (Continued)
SECONDARY SCREENING OF REGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
		• Both the Crosstown Diversion and the Milwaukee River Branch would be constructed as 30-foot diameter tunnels in bedrock. • Remaining impacts are identical to the Remote Storage Alternative. Jones Island[2] • Impacts are identical to the Remote Storage Alternative. South Shore[3] • Impacts are identical to the Remote Storage Alternative. Interceptor Expansion[4] • Impacts would be identical to the Remote Storage Alternative. Cost[6] • Present Worth = $1879.00x10^6$.	
	Inline Storage Jones Island-300 MGD South Shore-250 MGD	CSO Abatement/Peak Wastewater Flow Control[1] • Cavern storage of 767 acre-feet would be constructed in bedrock near Milwaukee County Stadium. No solids removal equipment would be required since the cavern would drain by gravity. • Near surface storage totaling 235 acre-feet would be constructed for 21% of CSSA. • No private property work would be required in CSSA. • Major disruption due to construction of storm sewers in 89% of CSSA. • Both the Crosstown Diversion and the Milwaukee River Branch would be constructed as 20-foot tunnels in bedrock. • Remaining impacts would be identical to the Remote Storage Alternative.	Inline Storage Jones Island-300 MGD South Shore-250 MGD Inline Storage Alternative is the MMSD's preferred CSO abatement/peak wastewater storage alternative. Because of the potentially severe impacts of the alternative, additional CSO abatement/peak wastewater storage alternatives (Complete Sewer Separation, Modified CST/Inline, Modified Total Storage) have been further analyzed in this EIS compared to the Inline Storage Alternative. See Section 3.9 as well as the Draft Combined Sewer Overflow Appendix and the Combined Sewer Overflow Appendix Addendum for details of this EIS analysis.

TABLE 3.13 (Continued)
SECONDARY SCREENING OF REGIONAL SYSTEM-LEVEL ALTERNATIVES

Plant/Community	Feasible Alternative	Impacts	Selection of Final Alternative
		Jones Island[2] • Impacts would be identical to the Remote Storage Alternative. South Shore[3] • Impacts would be identical to the Remote Storage Alternative. Interceptor Expansion[4] • Impacts would be identical to the Remote Storage Alternative. Cost[6] • Present Worth = $1845.20x10^6$.	

[1]See Draft Appendix V, Combined Sewer Overflow, for details of CSO and peak wastewater storage alternative analysis.

[2]See Draft Appendix II, Jones Island, for details of Jones Island alternative analysis.

[3]See Draft Appendix III, South Shore, for details of South Shore alternative analysis.

[4]See Draft Appendix VIII, Interceptor Alignment, for details of the alternative analysis of those interceptors evaluated in the EIS. See Draft Appendix VI, Local Alternatives, for details of the connector sewer alternative analysis.

[5]These interceptors and connections would either not be built or would be modified under the Local and Subregional System-Levels.

[6]Regional System-Level costs developed from costs in Wastewater System Plan Chapter 10.

Source: ESEI, 1981.

Jones Island and South Shore WWTPs were studied independently of the analysis of system-level alternatives. The purpose of expanding and rehabilitating the WWTPs is to enable the WWTPs to operate at maximum treatment efficiency and to meet the limitations in their WPDES discharge permits. Environmental consequences and cost were also considered. The evaluation of system-level alternatives does not depend on the evaluation of WWTP alternatives, since the flows to the WWTPs under the Local, Regional, Subregional, or Mosaic Alternatives would vary by less than seven percent. The one-plant Regional Alternative would greatly alter the flows to the South Shore WWTP, but this alternative was determined infeasible in Primary Screening. See Table 3.10.

3.7.1 Jones Island WWTP

For the Jones Island WWTP, consideration was given to possible treatment and disinfection processes, the possible location for siting the additional equipment, and the methods used for processing and disposing of the solids removed by wastewater treatment. The process and location evaluations are summarized here and described in detail in Appendix II, Jones Island and Appendix IV, Solids Management. Solids Management is addressed briefly in section 3.8 of this chapter.

Numerous alternatives were considered by the MMSD for the processes and disinfection methods at the WWTP. However, only the alternatives considered feasible are described here. Six process alternatives were included:

- Alternative 1 - Upgrade and expand the existing air activated sludge system.
- Alternative 2 - Air activated sludge system with primary treatment.
- Alternative 3 - Single air activated sludge system.
- Alternative 4 - Two parallel air activated sludge systems.
- Alternative 5 - High purity oxygen (HPO) activated sludge system.
- Alternative 6 - Activated biofilter (ABF) followed by an activated sludge system.

Disinfection alternatives included the following:

- chlorine
- ozone
- chlorine dioxide

Three feasible location alternatives were identified:

- new site
- existing site
- expansion of existing site

After evaluating numerous different alternatives for these expansion options (see Figure IV-7 of Appendix II), retaining the existing site with adjacent expansion for new facilities was found to be the most cost-effective. Therefore, the MMSD evaluated various locations for siting disinfection facilities and providing land for future expansion. The feasible alternatives are listed below:

- A 9.5 acre lakefill for new disinfection facilities, construction staging, and future expansion. In addition, the MMSD would require up to 10 additional acres located south of the plant.

- A 5.7 acre lakefill for new disinfection facilities plus 10 acres south of the plant.

- A 4.8 acre lakefill for new disinfection facilities plus 10 acres south of the plant.

- A cofferdam which would enclose a 4.8 acre area of the Outer Harbor during the construction of the new disinfection facilities, but would be partially removed following completion of construction. The 10 acre expansion south of the plant would also be necessary.

- A dual-use facility involving construction of underground disinfection facilities at a site presently occupied by a cargo warehouse. After construction, the site would be used for sewage treatment and Port of Milwaukee operations. The 10 acre expansion site would also be needed.

Throughout the analysis of the Jones Island WWTP, the No Action Alternative was also included. In this case, the No Action Alternative assumed that all other elements of the MFP would be implementd, but that no improvements would take place at the Jones Island WWTP.

3.7.1.1 Feasible Alternative for Jones Island WWTP

The development and screening of alternatives for the Jones Island WWTP is described in Appendix II. The most feasible alternative for the Jones Island WWTP would be expansion to 300 MGD (13.1 m^3/sec). The hydraulic capacity of the aeration

basins at the facility is now 300 MGD (although the treatment capacity is 140 MGD). Expanding only the primary treatment and secondary clarification capacities would enable the WWTP to treat 300 MGD adequately to meet WPDES limitations. Expanding the facility to a greater capacity would be far more costly. The average dry weather flow to the WWTP is expected to be 95 MGD (5.0 m^3/sec) in 2005. The capacity of the facility would not change under the Local, Subregional, or Regional System-Levels. Some type of plant site expansion would be necessary. This expansion could occur on Harbor Commission land or by lakefill.

The most feasible process alternative for the WWTP is Alternative 2-Air activated sludge system with primary treatment. The treatment process would include primary treatment, secondary treatment with air-activated sludge, and disinfection by chlorine gas.

This alternative was retained through the screening process for the following reasons.

- The alternative had the lowest net present worth of any feasible alternatives.
- The projected annual energy requirements of the alternative would be approximately 20% of present requirements.
- The net present worth of chlorine disinfection would be 40% less than ozone disinfection.

3.7.2 South Shore WWTP

South Shore WWTP (as did Jones Island WWTP) received consideration for possible treatment and disinfection processes, possible locations for siting additional equipment, and methods for processing and disposing of solids removed during wastewater treatment. A detailed description of these evaluations is included in Appendix III, South Shore, and Appendix IV, Solids Management. Solids Management is addressed briefly in Section 3.8 of this Chapter.

The air activated sludge process, which is currently used at the treatment plant, was retained for secondary treatment. Chlorination and ozonation were considered as possible disinfection alternatives. Additional land would be required to site additional facilities at the WWTP. Alternatives developed for expansion at the South Shore WWTP are described below.

Alternative 1 - Expansion in the Lake to the North
a) Enclosing 30 acres (12 ha) and filling 12 acres (5 ha).
b) Filling only 12 acres (5 ha).

Alternative 2 - Expansion on the shoreline by cutting 14 acres (6 ha) of bluff.

Alternative 3 - Expansion by filling 9 acres (4 ha) of lake and cutting 3 acres (1 ha) of bluff.

Alternative 4 - Expansion on the top of the bluff.

Three additional MMSD alternatives were considered in response to requests from nearby residents. They are:

Alternative 5 - East expansion - filling in 9 acres (4 ha) to the east of the present lakefill.

Alternative 6 - South expansion - filling in 6 acres (2 ha) to the south of the present lakefill.

Alternative 7 - West expansion - cutting 9 acres (4 ha) of bluff to the west of the present lakefill.

The EIS also evaluated two additional alternatives.

Alternative 8 - A 6-acre (2 ha) lakefill to the north of the present lakefill.

Alternative 9 - Expansion at lake level without any bluff cut or lakefill. The proposed chlorine contact chambers would be located at the northern end of the existing lakefill, while the secondary clarifiers would be at the southern end.

The No Action Alternative was also considered for purposes of comparison and to allow a baseline for evaluation. The No Action Alternative assumes that the MMSD's Master Facilities Plan would be implemented without improvements at the South Shore WWTP.

3.7.2.1 Feasible Alternative for South Shore WWTP

The development and evaluation of expansion alternatives for the South Shore WWTP is described in Appendix III. The most feasible alternative for the WWTP involves expanding the existing wastewater treatment process to a capacity of 250 MGD. The most feasible location for expansion would be at lake level (cutting into the bluff or lakefill). Aeration capacity would be expanded by 16% and secondary clarification capacity would be expanded by 50%. Preliminary and primary

treatment facilities would remain unchanged while new chlorination/dechlorination facilities would be constructed. The reasons for the selection of this alternative are outlined below:

- The plan's cost would be within 5% of the lowest cost alternative.

- The alternative would have the lowest annual energy requirements. Electrical requirements would be 40% lower than the electrical requirements for expansion on the top of the bluff.

- The chlorination and dechlorination disinfection system would have a present worth which is 12% of the present worth of an alternative ozonation system.

3.8 SOLIDS MANAGEMENT

In addition to the wastewater treatment studies being carried out for the Jones Island and South Shore WWTPs, the method of solids handing for these two WWTPs was also studied in the MMSD's Solids Management Facility Plan Element (SMFPE). Appendix IV, Solids Management, to this EIS discusses the environmental impacts of the solids management alternatives.

The feasible solids management alternatives for the Jones Island facility include agricultural application, landfill, incineration, and co-combustion processes. The Milorganite process was evaluated, but it was not considered feasible because of its high energy requirements. Feasible alternatives for South Shore include agricultural application and landfill options. Composting sludge was also considered.

3.8.1 Feasible Solids Management Alternative

The most feasible solids management alternatives are listed below.

- For Jones Island - Dissolved air flotation thickening of waste activated sludge, anaerobic digestion of the thickened waste activated sludge and the primary sludge, filter press dewatering of the digested solids and landfilling of the dewatered solids. (This alternative is identified in the SMFPE as J31.)

- For South Shore - Dissolved air flotation thickening of waste activated sludge, anaerobic digestion of the thickened waste activated sludge and the primary sludge, belt filter dewatering of the digested solids and application to agricultural land of dewatered solids. (This alternative is identified in the SMFPE as S12.)

3.9 INTERCEPTORS

In conjunction with the analysis of wastewater treatment facilities in the planning area, conveyance systems had to be evaluated for each system-level. Certain interceptors within the County of Milwaukee and some service areas outside Milwaukee County were included in the Notices of Intent. These sewers had been under consideration since 1956, when a consulting engineering firm recommended the construction of the South Shore WWTP and new interceptors to extend sewer service to unsewered areas.

The service areas of the interceptors included in the EIS are shown on Figure 3.9.

The original notices of intent included the following interceptors:

Franklin-Muskego
Mitchell Field
Northridge
Menomonee Falls-Germantown
Hales Corners
Underwood Creek
Ryan Creek
Franklin Northeast
Root River
Oak Creek (south of Ryan Road)
Oak Creek (north of Ryan Road)
Oak Creek Southwest
Caddy Vista
Northeast Side Relief System

Prior to 1978, Environmental Assessments had been prepared for the Northeast Side Relief System, the Root River Interceptor, and for portions of the Menomonee Falls-Germantown and Hales Corners Interceptors. The EPA examined these assessments and issued a Finding of No Significant Impact (FNSI) for portions of the Menomonee Falls-Germantown and Hales Corners Interceptors within Milwaukee County. The FNSI for the Menomonee Falls-Germantown Interceptor included the southern segment of the interceptor (Contract 813). This segment is currently under construction and will provide for the connection of the Village of Menomonee Falls sewer service area to the MMSD. Two WWTPs in Menomonee Falls will be abandoned. The FNSI for the Hales Corners Interceptor will permit the southern segment of that interceptor to be built (Contract 237). This portion of the Hales Corners Interceptor is also currently under construction and will permit the abandonment of the Hales Corners WWTP. A FNSI was also issued for the Northridge and Mitchell Field Interceptors.

Based on the environmental impact analysis presented in the Draft EIS, the EPA issued a FNSI on the Underwood Creek Interceptor on October 17, 1980, and the Root River Interceptor on January 13, 1981. Facility Plan approvals by EPA and DNR

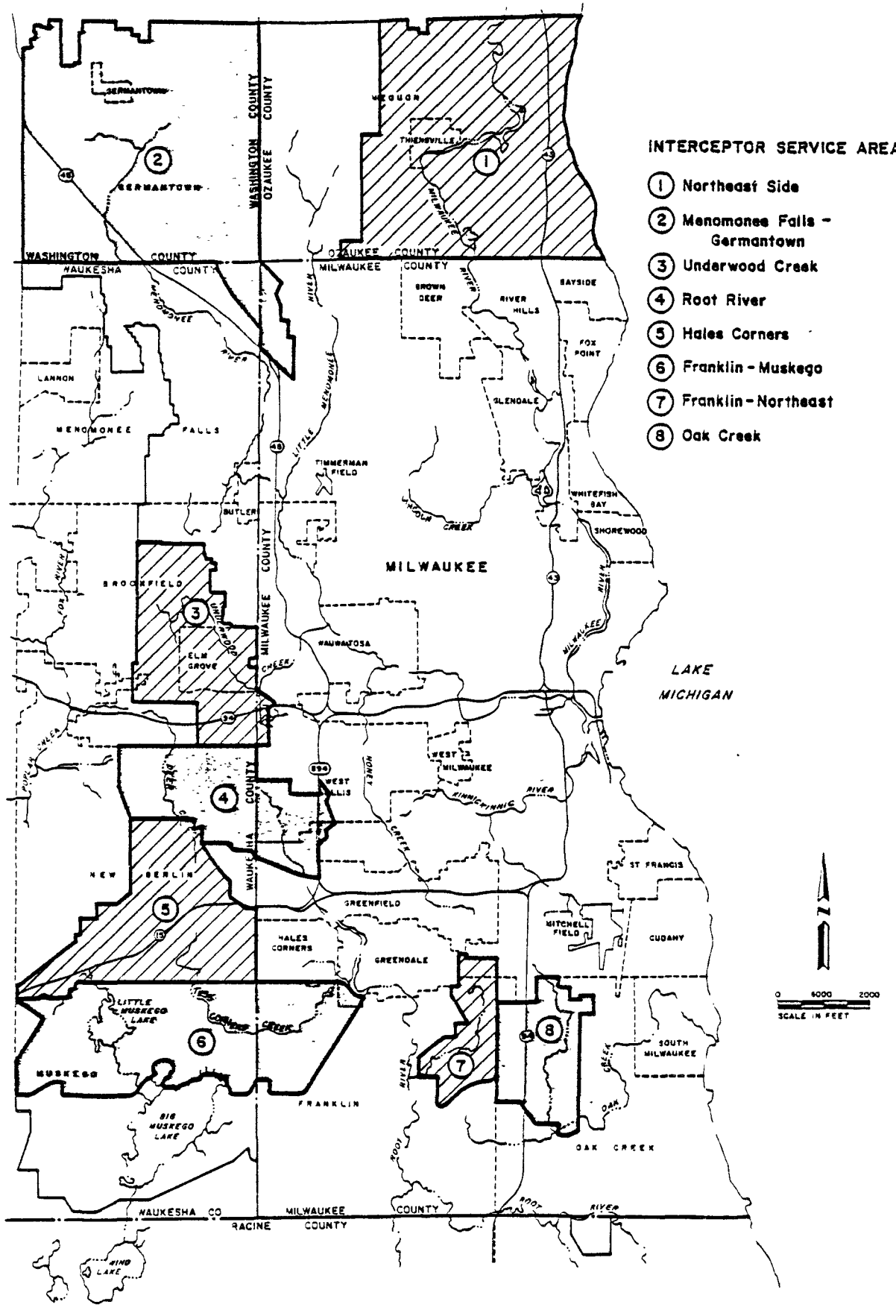

FIGURE 3-9

DATE APRIL 1981

INTERCEPTOR SERVICE AREAS

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

were received on the Underwood Creek Interceptor on November 19, 1980, and on the Root River Interceptor on February 16, 1981. Both interceptors are currently under design. The documentation of these decisions is contained in the Addendum to Appendix VIII, Interceptor Alignment.

On March 9, 1979, facilities planning was halted for four other interceptors: the Ryan Creek, Oak Creek Southwest, Oak Creek (south of Ryan Road), and Caddy Vista Interceptors. It was determined that these interceptors would not be needed during the twenty-year planning period and thus should not be included in the facilities planning process.

For the remaining interceptors, the EPA specified whether an EIS had to be prepared on the alternative routes to assess construction impacts, impacts to the service area, or both. Table 3.14 indicates which aspects were studied as part of the EIS analysis.

3.9.1 Purposes of the Interceptors (see Figure 3.9)

3.9.1.1 Franklin-Muskego Interceptor

The Franklin-Muskego Interceptor would convey Muskego's wastewater to the Metropolitan Interceptor Sewer (MIS) System and eventually to the South Shore treatment plant. It would also provide service to areas of Franklin currently served by the St. Martin's pump station as well as areas currently not provided with sewer service. Sewage transport would begin at the existing Muskego Northeast Treatment Plant and run to the MIS located in College Avenue in Milwaukee County.

3.9.1.2 Franklin Northeast Interceptor

The Franklin Northeast Interceptor would serve the northeast section of Franklin, including small parts of Greendale and Greenfield. Construction of the interceptor would eliminate sewage bypassing into the Root River and the possibility of septic tank failure in its service area. It would also provide sewer service to presently undeveloped areas.

3.9.1.3 Oak Creek North Branch Interceptor

The Oak Creek North Branch Interceptor would connect 3,200 acres (1,295 ha) in the northwest section of the City of Oak Creek and a small portion of the City of Franklin to the MMSD collection and treatment system. The Oak Creek Interceptor is intended to relieve septic system problems and bypasses from Wildwood Drive lift station into the North Branch of Oak Creek, as well as to provide sewer service for future development.

TABLE 3.14

EIS ANALYSIS OF INTERCEPTORS

Interceptor	Status of Evaluation
Oak Creek (North of Ryan Road)	EIS on construction impacts EIS on service area impacts EA presented in MFP.
Franklin Northeast	EIS on construction impacts EIS on service area impacts EA presented in MFP.
Franklin-Muskego	EIS on construction impacts EIS on service area impacts EA presented in MFP.
Underwood Creek	FNSI on construction impacts. FNSI on service area impacts EA presented in MFP.
Hales Corners	EIS on construction impacts of portion from treatment plant to County Line. EIS on service area impacts. EA previously prepared by MMSD.
Root River	FNSI on construction impacts. FNSI on service area impacts EA previously prepared by MMSD, but updated in MFP.
Menomonee Falls-Germantown	EIS on construction impacts of northern 2/3 of interceptor. EIS on service area impacts. EA previously prepared by MMSD.
Northeast Side Relief System	FNSI on construction impacts. EIS on service area impacts. EA previously prepared by MMSD.

FNSI: Finding of No Significant Impact. A FNSI presents the reasons why an action (e.g., construction) will not have a significant effect on the human environmental and indicates that an EIS will not be prepared.

3.9.1.4 Menomonee Falls-Germantown Interceptor (above Contract 813)

The original Menomonee Falls-Germantown Interceptor was to be extended north from its intersection with Contract 813 along the Waukesha-Milwaukee County Line to the Village of Germantown. This interceptor would have served portions of Menomonee Falls and Milwaukee and all of the Village of Germantown in the planning area. Later analysis showed that additional sewer service to Menomonee Falls and Milwaukee was not needed at this time and that the wastewater flows from Germantown could be served through an existing MIS in N. 107th Street. Accordingly, the alignment of the Menomonee Falls-Germantown Interceptor was changed to an east-west route. The new interceptor would allow the abandonment of the Germantown wastewater treatment plant and would extend sewer service to areas in Germantown currently using septic systems.

3.9.1.5 Underwood Creek Interceptor

The Underwood Creek Interceptor would alleviate overloading to the MIS system in western Wauwatosa and a portion of West Allis. The existing interceptors in this area do not have adequate capacity to handle wet weather flows, and several bypasses have been installed to prevent local collecting sewers from backing up into basements. In addition, the Underwood Creek Interceptor would allow for the hook-up of areas now using septic tank systems, eliminating the impacts of potential system failures. The interceptor would not extend service to any undeveloped areas.

3.9.1.6 Root River Interceptor

The Root River Interceptor would relieve the sewerage system in portions of New Berlin, West Allis, and Greenfield. Local collector systems would be constructed in the City of Greenfield, thus eliminating 75 septic systems. Also, the interceptor would relieve frequent surcharge and flooding problems that have occurred due to inadequate sewerage capacity. In addition, it would allow some new development.

3.9.1.7 Hales Corners Interceptor (above Contract 237)

The Hales Corners Interceptor would serve the southern portion of New Berlin within the planning area. It would allow the abandonment of the Regal Manors WWTP and a number of septic systems in the area. The interceptor would also allow the development of some presently unsewered land.

3.9.1.8 Northeast Side Relief System

The Northeast Side Relief System would augment the existing sewer system which has insufficient capacity to transport wet weather flows. The relief system would eliminate both the bypassing of sewage and the flooding of basements in the northeast portion of Milwaukee County.

3.9.1.9 Construction Methods

These intercepting sewers could be constructed by the open-trench method or tunneling. The open-trench method requires the digging of shallow trenches, typically less than 20 feet (6.2 m) below grade. Pipe is laid in the trench and covered. Construction by the tunnel method allows deeper construction, usually 20 feet (6.2 m) or more below grade. Manholes and dropshafts are the only exposed work areas. Historically, the MMSD has used the tunnel methods because it involves less soil moving and fewer temporary facilities during construction.

The specific routes and construction impacts of the interceptors identified in the final alternatives were analyzed independently by the EIS. This analysis and its results are discussed in Appendix VIII, Interceptor Alignment.

3.9.1.10 EIS Analysis

The Mequon/Thiensville, Germantown, New Berlin, Muskego Northeast and Northwest, Caddy Vista, and South Milwaukee connector sewers were also identified as system-level alternatives. The EIS evaluated these sewers for obvious, serious environmental impacts. All of the identified connector sewers were found to be feasible and could be constructed in a cost-effective and environmentally sound manner.

On September 10, 1980, the EPA issued a FNSI on the Caddy Vista Connection. Facility Plan approval was given by EPA and DNR on October 17, 1980. It is expected that construction on the connector will begin in September, 1981, with hook-up to the MMSD sewerage system by the end of the year.

Further facilities planning and environmental assessments could be necessary in order to determine the specific routes, construction methods, and impacts prior to the construction of the other five connector sewers.

3.10 CSO ABATEMENT

The CSSA is shown in Figure 3.3. Prior to the development of the MFP, CSO which includes storm water and wastewater

was recognized as a major contributor to water quality degradation and as a potential health hazard. In 1971, SEWRPC published A Comprehensive Plan For The Milwaukee River Watershed, which identified CSO as a problem, and recommended a strategy for alleviating the problem to meet Federal and State water quality standards.

The SEWRPC recommendations served as a starting point for this aspect of the MFP. Because planning for CSO abatement began prior to planning to meet the other requirements of the MFP, the two planning processes developed separately for a considerable time.

The U.S. District Court Order required the MMSD to design and construct a system that would be able to contain CSO from the greatest storm of record. The central requirement of the Court Order was the elimination of all discharges of human waste from combined sewers. A system to achieve this goal would have to be constructed by December 31, 1989, regardless of the availability of Federal or State funding assistance. Because MMSD filed a petition with the United States Supreme Court to appeal the U.S. District Court decision, there was reason to include, in the planning process, alternatives that would abate CSO to comply with the Dane County Stipulation, in case the District Court decision were to be reversed or modified. In order to meet the requirements of the Dane County Court Stipulation and the Wisconsin Statutes, the DNR has determined that a CSO abatement alternative must result in the achievement of applicable water quality standards.

Because the requirements of the two court orders differ in some respects, the MMSD's CSO abatement planning proceeded on two parallel paths. The first path developed alternatives that would meet both the U.S. District Court Order and the Dane County Stipulation by: 1) eliminating the discharge of human waste into area waters; 2) meeting applicable effluent limitations and water quality standards; 3) meeting all other State and Federal facilities planning requirements; and 4) constructing an abatement alternative in accordance with the U.S. District Court Order schedule.

The second path developed alternatives to meet only the Dane County Stipulation by: 1) meeting applicable effluent limits and water quality standards; 2) meeting all state and federal facility planning requirements; and 3) constructing an abatement alternative in accordance with the schedule set by the Dane County Stipulation.

3.10.1 Development of Alternatives

Taking all these concerns into consideration, the MMSD used the available wastewater pollution control approaches described in section 3.1 to develop general strategies for CSO abatement. Initially, four alternative strategies were identified: sewer separation, out-of-basin methods, in-basin methods, and instream measures. A detailed discussion of the development of these alternatives is located in Appendix V, Combined Sewer Overflow.

3.10.2 Screening of CSO Alternatives

The initial screening determined the practicality of the alternatives, their approximate cost based on previous experience and the expected performance of the system. In addition, a preliminary assessment of environmental impacts was made. After comparing these criteria for each alternative, the least effective strategies were eliminated. Next, a secondary evaluation was conducted to analyze the improvements to surface water quality, to prepare more precise cost estimates, and to make a more comprehensive assessment of the effects on the environment of the alternatives. The screening process is described in detail in Appendix V.

As these alternatives were being analyzed, additional water quality impact data became available. It appeared, based on this new information, that any plan to abate combined sewer overflows might not in itself enable the waters of the Milwaukee, Menomonee, and Kinnickinnic Rivers to meet EPA and DNR water quality standards. Although instream measures would be beneficial in improving water quality, they would not reduce the discharges of untreated CSO. Accordingly, both to abate overflows and to improve water quality, the instream measures were combined with the sewer separation, inbasin and out-of-basin alternatives for abating CSO.

Completion of this initial screening process resulted in the six alternatives described below. Alternatives 1 through 4 were developed to meet only the requirements of the Dane County Court Stipulation. Alternatives 5 and 6 were developed in order to meet both court requirements.

1. Out-of-Basin system using large diameter tunnels in the Niagaran rock stratum for the storage of CSO as well as for the conveyance to a new facility for treating CSO near the existing Jones Island WWTP. This alternative would provide a "two-year level of protection," meaning that on a statistical average, only one storm in a two-year period would cause an overflow. This alternative

would include instream measures.*

2. In-Basin system using large tunnels in the Niagaran rock stratum for CSO storage and conveyance to three new WWTPs (one for each river basin) for treating CSO before discharging it to the river basin from which it came. The system would provide a two-year level of protection and instream measures would be included.*

3. Complete sewer separation with instream measures. Sanitary sewage in the CSSA would be completely separated from storm water. All sanitary sewage would be treated at the existing Jones Island WWTP. Instream measures would be undertaken in order to meet water quality standards.*

4. Out-of-Basin system using large tunnels in the Niagaran rock stratum for storage of CSO as well as for conveyance to a new CSO WWTP near the existing Jones Island WWTP. This system would serve 56% of the CSSA. In the remaining 44% of the CSSA, sewers would be completely separated. This alternative would include instream measures.*

5. Out-of-Basin system to meet both the U.S. District Court and the Dane County Stipulations. All CSO (storm water and sewage) would be conveyed to a new advanced waste treatment WWTP for treatment. (Advanced waste treatment requirements have since been repealed.) Enough storage would be provided by the conveyance and storage system to store all overflow from the worst storm of record. Instream measures would be implemented to meet water quality standards as required by the Dane County Stipulation.*

6. Complete separation and instream measures adequate to meet both court requirements.* All storm water would be separated from domestic sewage. The Jones Island WWTP would be upgraded to advanced waste treatment. (Advanced waste treatment has subsequently been repealed. Consequently, Alternatives 3 and 6 have become identical.)

After reviewing the six feasible alternatives, the MMSD selected the alternatives they believed would meet the

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*MMSD maintains that it does not have the authority to undertake instream measures. Therefore, instream measures are not a part of the final alternatives in the MFP. At this time, the MMSD, EPA, DNR, and SEWRPC are investigating alternative instream measures and means for their implementation.

requirements of the Dane County Court Stipulation and the U.S. District Court Order. The MMSD recommended that, to meet the District Court Order, CSO be eliminated by sewer separation in the public right-of-way. Properties outside of the public right-of-way would be required to abate CSO in accordance with cost-effective findings. Each of the 176 individual basins in the CSSA could then be evaluated to determine whether sewer separation or some other alternative would be the most cost-effective means of abating CSO.

In order to meet the Dane County Stipulation, the MMSD proposed sewer separation in a portion of the CSSA. The remainder of the CSSA would be served by a deep tunnel system with facilities being developed to capture infiltration and inflow from the separated sewer area.

3.10.3 Refinement of CSO Abatement Alternatives

The analysis of each of the 176 CSSA basins was undertaken by the MMSD as a means of minimizing the need for construction work on private property. The results of these analyses was the following CSO abatement plan to meet the U.S. District Court Order.

- Complete separation in 11% of the CSSA with no private work.
- Partial sewer separation of the public right-of-way with local, near-surface storage of CSO for 41% of the CSSA.
- In the remaining 48% of the CSSA complete sewer separation with private property work was cost-effective.

This "Modified U.S. District Court Order CSO Abatement Plan" was adopted awaiting the results of the peak wastewater flow attenuation alternative analysis. Analysis of a CSO abatement plan to meet the requirements of the Dane County Court Stipulation was also halted pending the development of the peak wastewater flow attenuation alternatives.

3.11 PEAK FLOW ATTENUATION

In addition to eliminating CSO, the MFP must eliminate or treat to secondary standards all dry and wet weather bypassing from separated sewers and treatment facilities. Without these bypasses, the maximum flows in the sewerage system would be much greater than the present capacity of the Jones Island and South Shore WWTPs. In developing possible treatment configurations, consideration had to be given to either expanding the existing facilities so that they could treat

the maximum flow, or providing storage facilities. Different combinations of treatment capacity expansion and CSO and peak flow storage were developed in conjunction with the Regional System-Level Alternatives, since this type of alternative would result in the greatest total flow to the one, two, or three regional WWTPs.

3.11.1 Development of Alternatives

The MMSD originally considered nine combinations of treatment and storage facilities to contain and to treat future maximum flows. These nine combinations were formulated using the one, two, and three WWTP Regional Alternatives, but the South Milwaukee WWTP was also assumed to continue operations. This list included all reasonably feasible alternatives developed to meet the requirements of the court orders, legislation, and the 208 Plan.

The EPA and DNR, in conjunction with the EIS consultant, independently evaluated the MFP storage alternatives and concluded that the list was comprehensive. Next, these treatment and storage concepts were screened separately as part of the EIS analysis. Because Regional System-Level Alternatives had been created assuming the abandonment of the South Milwaukee WWTP, storage concepts were developed with the same assumption. Since the peak capacity of the South Milwaukee WWTP is only 12 MGD, the results of the EIS and the MFP analyses can be compared.

The nine storage alternatives originally considered by the EIS are listed below.

1. One WWTP with adequate capacity to treat the maximum year 2005 flow (No Storage).

2. One WWTP, with on-site storage for peak wastewater flows.

3. Two WWTPs with adequate combined capacity to treat the maximum year 2005 flow (No Storage).

4. Two WWTPs with on-site storage for peak wastewater flow attenuation at two sites (Jones Island and South Shore).

5. Two WWTPs with storage at a remote site (a location at the intersection of 58th and State Streets was identified by the MMSD in a computer modeling study).

6. Two WWTPs with storage included as part of the conveyance system. Tunnels would be constructed along the routes of the Milwaukee Interceptor, the Kinnickinnic Interceptor and the Crosstown Diversion Sewer.

7. Three WWTPs (Jones Island, South Shore, and a new WWTP located west of the Root River and north of Ryan Road in Franklin) with adequate capacity to treat year 2005 maximum flow with no storage.

8. Three WWTPs with storage sites at the Jones Island, South Shore, and Franklin sites.

9. Three WWTPs with another location for storage at the intersection of 58th and State Streets.

3.11.2 Screening the Alternatives

Since the alternatives for peak flow attenuation were developed in conjunction with the Regional System-Level Alternatives, the screening described in section 3.6.2 and Table 3.10 eliminated all but three of the nine alternatives described above. (The one and three WWTP alternatives and Alternative 4, were all screened out.) The following three alternatives remained.

1. Remote Storage - The Jones Island and South Shore WWTPs would continue operations. Jones Island would be expanded to a capacity of 300 MGD (13.1 m^3/sec), and South Shore to 250 MGD (11.0 m^3/sec). Storage facilities would be provided at a third location (near the intersection of 58th and State Streets) for flows exceeding those capacities.

2. CST Extension - The South Shore and Jones Island WWTPs would be expanded. Excess flow would be stored in 30-foot (9.1 m) diameter tunnels extending north along the Milwaukee River and west along the Menomonee River. These tunnels would convey and store peak wastewater flows as well as CSO from the CSSA.

3. Flow-Through Treatment - Jones Island and South Shore WWTPs would be expanded to such a capacity that they could treat the maximum flows with no storage.

These three alternatives were studied in detail. Also, the MMSD developed two new alternatives using favorable aspects of the alternatives that had been eliminated. The two new alternatives are described below.

4. Jones Island Storage - The Jones Island and South Shore WWTPs would be expanded and excess flows would be stored at the Jones Island Site.

5. Inline Storage - The Jones Island and South Shore WWTPs would be expanded. Large diameter sewers (20-foot, 6.1

m) along the Milwaukee and Menomonee Rivers would convey and store peak wastewater flows.

Alternatives 1, 3, 4 and 5 were developed solely for the storage and treatment of bypasses from the separated sewer area without any consideration of methods for the abatement of CSO. However, Alternative 2 included facilities to control both CSO and peak wastewater flows.

Because it might be cost-effective to construct facilities for storing and treating both CSO and bypasses from the separated sewer area, Alternatives 1, 3, 4 and 5 were also studied for their flexibility for dual-use. Accordingly, the screening process was expanded to determine the most effective method for storage and treatment of bypasses from the separated sewers, the most effective alternative for CSO abatement, and the most effective method for combining those two alternatives.

3.12 JOINT FACILITIES FOR PEAK FLOW ATTENUATION AND CSO STORAGE

3.12.1 Alternatives

The MMSD developed three alternatives for the joint storage of bypasses from the separated sewer area and CSO by integrating the Modified U.S. District Court Order CSO Abatement Plan (described in section 3.10.3) with the Remote Storage, Jones Island Storage, and Inline Storage Alternatives. These alternatives were then evaluated along with the CST Extension Alternative.

At the request of the DNR, the MMSD evaluated a fifth joint CSO abatement/peak wastewater attenuation alternative. This alternative, the Modified CST/Inline Storage Alternative (also called the CST/Inline Storage Alternative) combines features of the Inline Storage and CST Extension Alternatives.

The MMSD did not further analyze the Flow-Through Alternative because they concluded that it would not be technically feasible to treat the high peak flows at the Jones Island WWTP that would result from this alternative. For the EIS process, the Flow-Through Alternative was evaluated further because it was the only remaining alternative that did not require the construction of deep tunnels or storage caverns. The Flow-Through Alternative was also integrated with the Modified U.S. District Court Order CSO Abatement Plan.

Each of the five joint alternatives included varying degrees of cavern storage, near-surface storage, and complete and partial sewer separation. They also involved different

levels of construction work on private property.

The differences in alternatives were due to the facilities required by each flow attenuation alternative, and how easily and cost-effectively portions of the CSSA could be made tributary to the peak wastewater attenuation storage and conveyance facilities. Based on the analysis of various combinations, the six following joint alternatives were developed.

1. Remote Storage

- Complete sewer separation in 11% of CSSA. No private property construction work.
- Partial separation with 757 acre-feet (0.93 million m^3) of cavern storage near 58th and State Streets for 18% of CSSA.
- Complete sewer separation in 48% of CSSA. Private property construction work would be required.
- Partial sewer separation with 236 acre-feet (0.29 million m^3) of near-surface storage in 23% of the CSSA.
- Excess flows from separated sewers also tributary to cavern storage at 58th and State Streets.

2. Jones Island Storage

- Complete sewer separation in 11% of CSSA. No private property construction work.
- Complete sewer separation in 48% of CSSA with private property work.
- Partial sewer separation with 437 acre-feet (0.54 million m^3) of near-surface storage in 41% of the CSSA.
- 550 acre-feet (0.68 million m^3) of cavern storage near Jones Island for storage of excess flows from separated sewers.

3. CST Extension

- Complete sewer separations in 11% of the CSSA. No private property work.
- No sewer separation in 68% of CSSA. All CSO tributary to 30-foot (9.1 m) tunnels in bedrock and 1,334 acre-feet (1.6 million m^3) of cavern storage near Jones Island.

- Partial sewer separation with 235 acre-feet (0.29 million m^3) of near-surface storage in 21% of the CSSA.

- Excess flows from separated sewers also tributary to 30-foot (9.1 m) tunnels and cavern storage.

4. Inline Storage

- Complete sewer separation in 11% of CSSA. No private property work.

- Partial sewer separation in 68% of CSSA. Remaining CSO tributary to 20-foot (6.1 m) tunnels in bedrock and a 767 acre-feet (0.95 million m^3) storage cavern near Milwaukee County Stadium.

- Partial sewer separation with 235 acre-feet (0.29 million m^3) of near-surface storage in 21% of the CSSA.

- Excess flows from separated sewers tributary to 20-foot (6.1 m) tunnels and cavern storage.

5. Modified CST/Inline Storage

- Complete sewer separations in 11% of the CSSA. No private property work.

- No sewer separation in 68% of CSSA. All CSO tributary to 30-foot (9.1 m) tunnels in bedrock and 1,291 acre-feet (1.6 million m^3) of cavern storage near Milwaukee County Stadium. A 174 acre-feet (0.21 million m^3) storage cavern would be built at Jones Island for grit removal.

- Partial sewer separation with 235 acre-feet (0.29 million m^3) of near-surface storage in 21% of the CSSA.

- Excess flows from separated sewers also tributary to 30-foot (9.1 m) tunnels and cavern storage.

6. Flow-Through Treatment (Evaluated in EIS only)

- Complete sewer separation in 11% of the CSSA. No private property work.

- Complete sewer separation in 48% of CSSA with private property work.

- Partial sewer separation with 437 acre-feet (0.54 million m^3) of near-surface storage in 41% of the CSSA.

- Excess clear water would be treated at an expanded Jones Island with a peak flow capacity of 450 MGD (19.7 m^3/sec).

The Remote Storage, Jones Island Storage, and Flow-Through Treatment Alternatives were initially developed with some private property construction involved. Because of implementation difficulties that could arise due to this private property work, these alternatives were reevaluated using near-surface storage facilities in 48% of the CSSA instead of complete sewer separation.

3.12.2 Costs

A comparison of the costs for each alternative with and without private property work is shown in Table 3.15.

TABLE 3.15

CSO ABATEMENT/PEAK WASTEWATER FLOW ATTENUATION COST

Alternative	Net Present Worth With Private Property Construction	Net Present Worth Without Private Property Construction
Remote Storage	$ 1818.00 X 10^6	$ 1917.00 X 10^6
Jones Island Storage	1875.00 X 10^6	1974.00 X 10^6
Inline Storage	1832.00 X 10^6	1849.00 X 10^6
CST Extension	1880.00 X 10^6	1898.00 X 10^6
Modified CST/ Inline Storage	1859.00 X 10^6	1979.00 X 10^6
Flow-Through Treatment	1899.00 X 10^6	1998.00 X 10^6

Source: MMSD

The differences in costs between each alternative are less than 10%, well within the level of accuracy of the cost estimates. The environmental impact evaluation of these alternatives as part of the Regional System-Level secondary screening analysis is summarized in Table 3.13.

3.12.3 EIS Alternatives for the Attenuation of Peak Flows and Abatement of CSO

With the Inline Storage Alternative (recommended in the MFP and shown on Figure 3.10) 11% of the CSSA would be completely separated without private property work. Another 68% of the CSSA would be partially separated (separation in the public right-of-way only). Excess wastewater from this area would flow through 20-foot diameter tunnels to a storage cavern near Milwaukee County Stadium. The remaining 21% of the CSSA would be partially separated, and overflows would be stored in 235 acre-feet of near surface storage. Excess sanitary wastewater from the separated sewer area would flow through 20-foot diameter tunnels to the cavern storage at Milwaukee County Stadium.

The Inline Storage Alternative for abating CSO could significantly affect both the man-made and natural environments. Partial separation of sewers in most of the streets of the CSSA would require extensive construction, disrupting traffic and business. In addition, with partial separation, storm sewers would continue to discharge urban runoff containing organic pollutants as well as heavy metals into the lower portions of the Milwaukee, Menomonee, and Kinnickinnic Rivers. Instream water quality standards might not be achieved. Also, without proper precautions, the construction of cavern storage facilities could have both short-term and long-term impacts on groundwater. For these reasons the EIS detailed impact analysis included the evaluation of three other alternatives for CSO abatement and peak flow attenuation in order to more further investigate alternatives which could avoid potential, adverse environmental consequences of the Inline Storage Alternative.

1. Complete Sewer Separation (see Figure 3.11) This alternative was developed by combining complete sewer separation of combined sewers in the CSSA with the 20-foot tunnels necessary to eliminate bypassing in the separated sewer area.

   - Complete sewer separation in 11% of CSSA. No private property work.
   - Complete sewer separation in 89% of CSSA with private property work.
   - Excess flow from the separated area tributary to 20-foot (6.1 m) diameter tunnels.

2. Modified CST/Inline (see Figure 3.12) This alternative was also evaluated by the MMSD. It was further evaluated

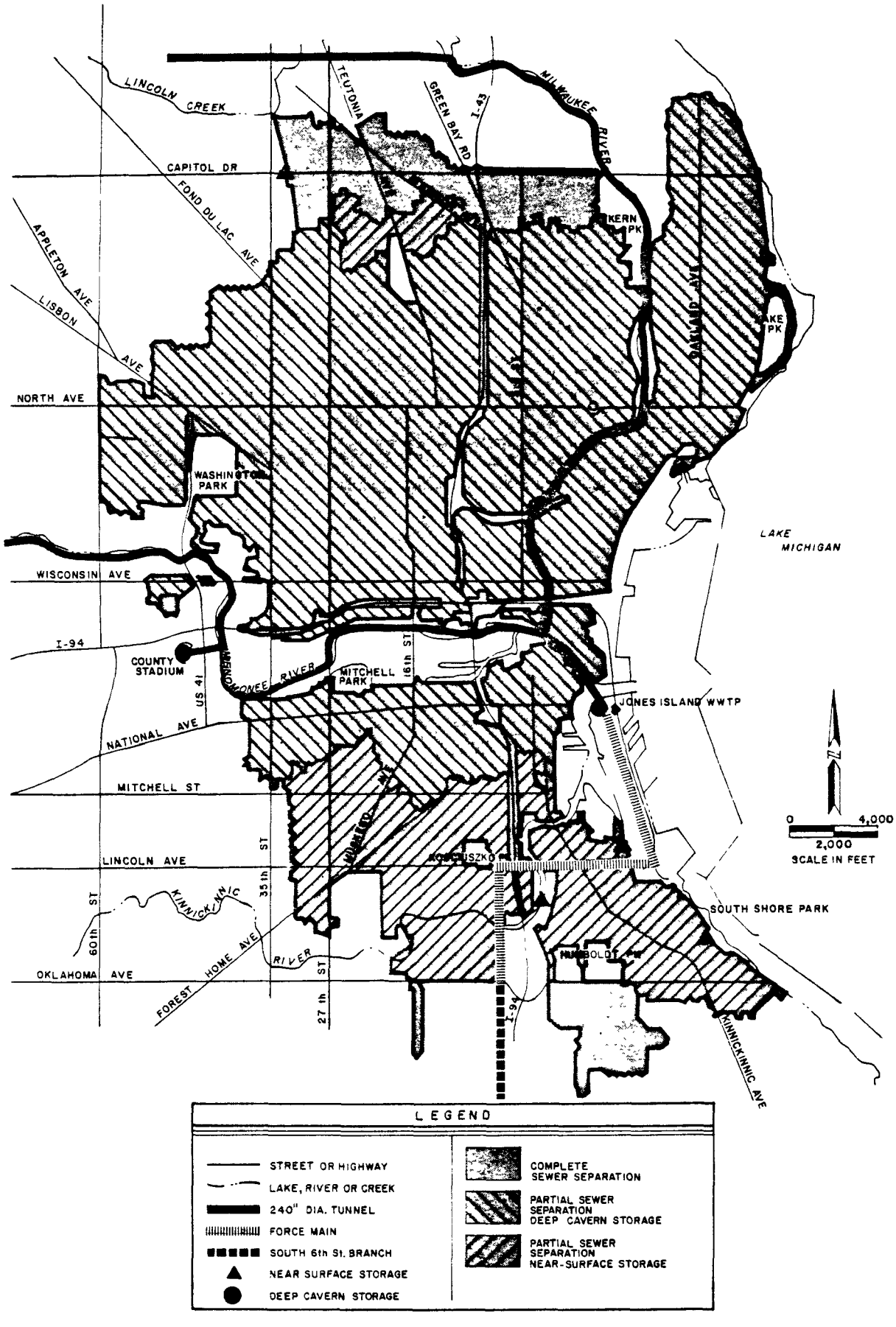


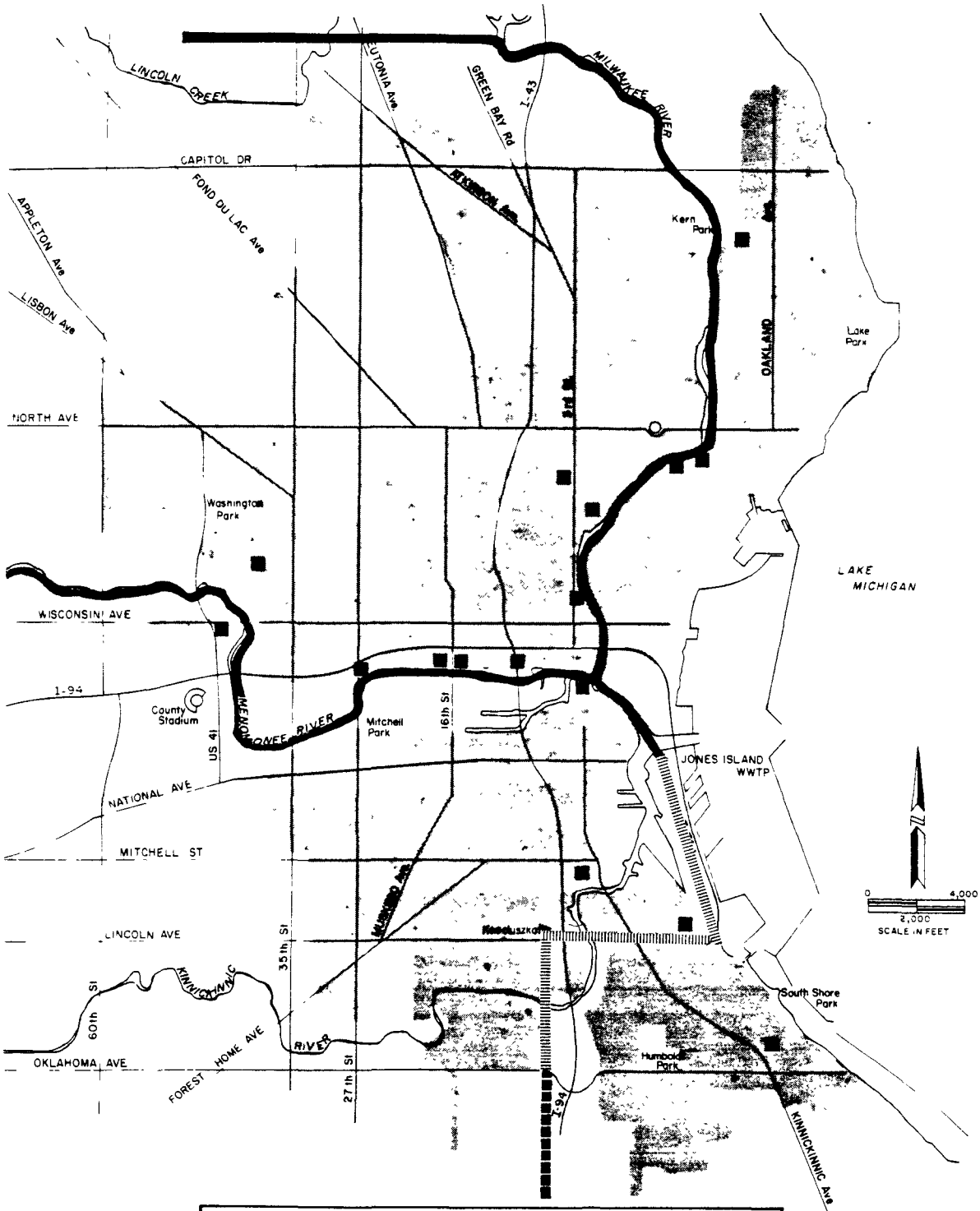
FIGURE 3-10

DATE APRIL 1981

INLINE STORAGE ALTERNATIVE

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP



LEGEND

- STREET OR HIGHWAY
- LAKE, RIVER OR CREEK
- 240" DIA. TUNNEL
- FORCE MAIN
- SOUTH 6th St. BRANCH
- PUMP STATION
- COMPLETE SEWER SEPARATION

FIGURE 3-11

DATE APRIL 1981

COMPLETE SEWER SEPERATION ALTERNATIVE

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

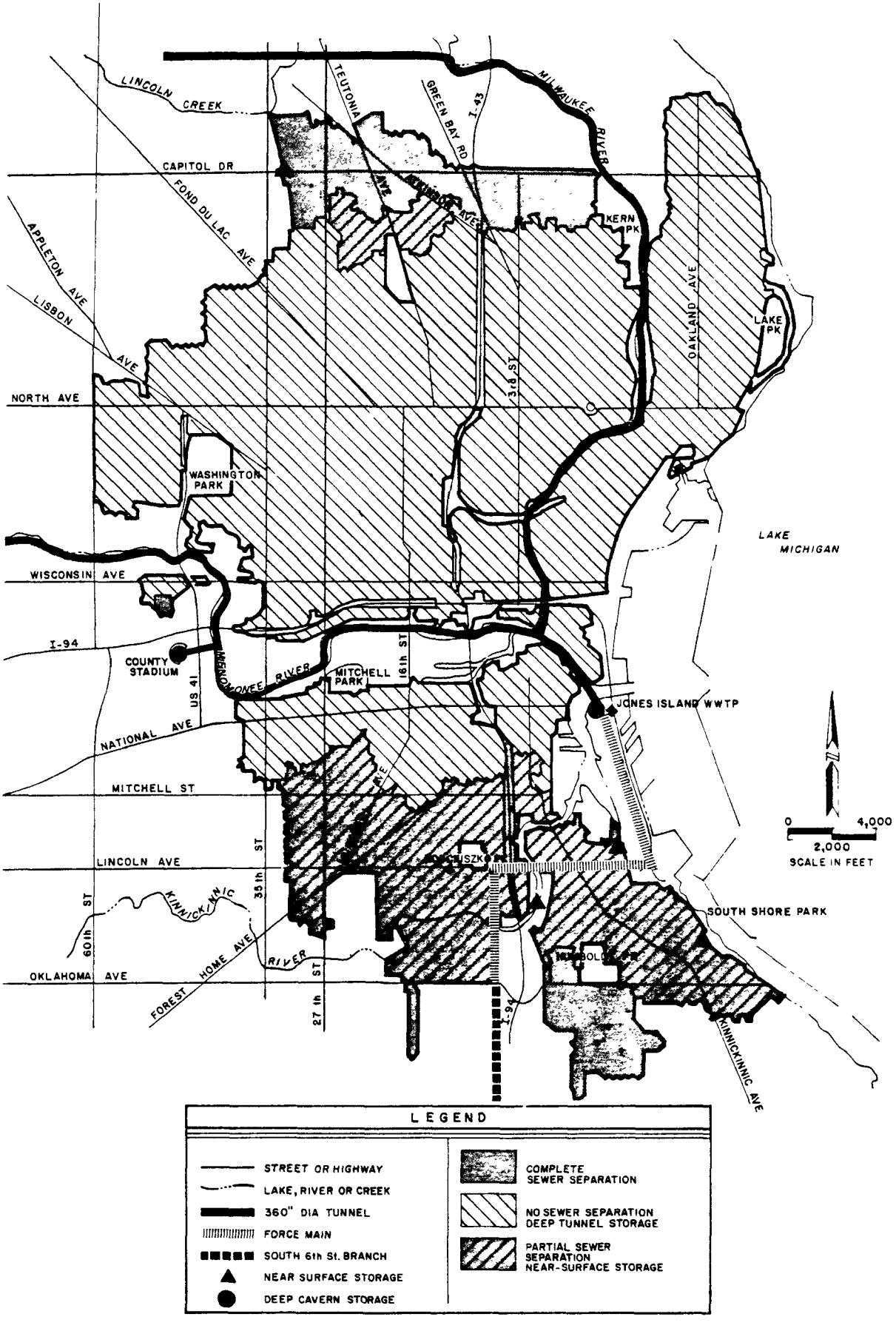


FIGURE 3-12

DATE APRIL 1981

MODIFIED CST/INLINE STORAGE ALTERNATIVE

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

in the EIS because it involved less disruption due to sewer construction, appeared to be beneficial to water quality, and had a cost comparable to the Inline Storage Alternative. See Section 3.12.1 for the description of the alternative.

3. Modified Total Storage (see Figure 3.13) This alternative is a modified version of the Modified CST/Inline Alternative. It was evaluated in order to eliminate most sewer construction disruption and end most urban runoff from the CSSA into the local rivers and the Outer Harbor.

- Complete sewer separation in 11% of CSSA. No private property work.

- No sewer separation in 68% of CSSA. All CSO tributary to 30-foot (9.1 m) diameter tunnels in bedrock and 1291 acre-feet (1.6 million m^3) of cavern storage at Milwaukee County Stadium. A 174 acre-feet (0.21 million m^3) storage cavern would be built at Jones Island for grit removal.

- No sewer separation in 21% of CSSA. All CSO tributary to 715 acre-feet (0.88 million m^3) of near-surface storage.

- Excess flow from the separated sewers would be stored in the 30-foot (9.1 m) diameter tunnel system.

These three alternatives and the Inline Storage Alternative are evaluated in Chapter V, Environmental Consequences. A detailed evaluation of the impacts of these four CSO abatement/peak wastewater attenuation alternatives is presented in Appendix V, Combined Sewer Overflow.

3.12.4 Alternatives to Comply with Water Quality Standards

The purpose of this section is two fold: to provide background information concerning the development and evaluation of CSO abatement alternatives for meeting applicable water quality standards and to provide the results of additional analyses which have been conducted since release of the Draft EIS and which take into account the preliminary findings of the SSES conducted by MMSD.

After the MMSD completed the original CSO abatement analysis, the MMSD recommended a system providing a 2-year level of protection as the preferred CSO alternative for meeting the requirements of the Dane County Court Stipulation. This analysis was subsequently expanded to evaluate the potential for joint use of facilities for elimination of separated

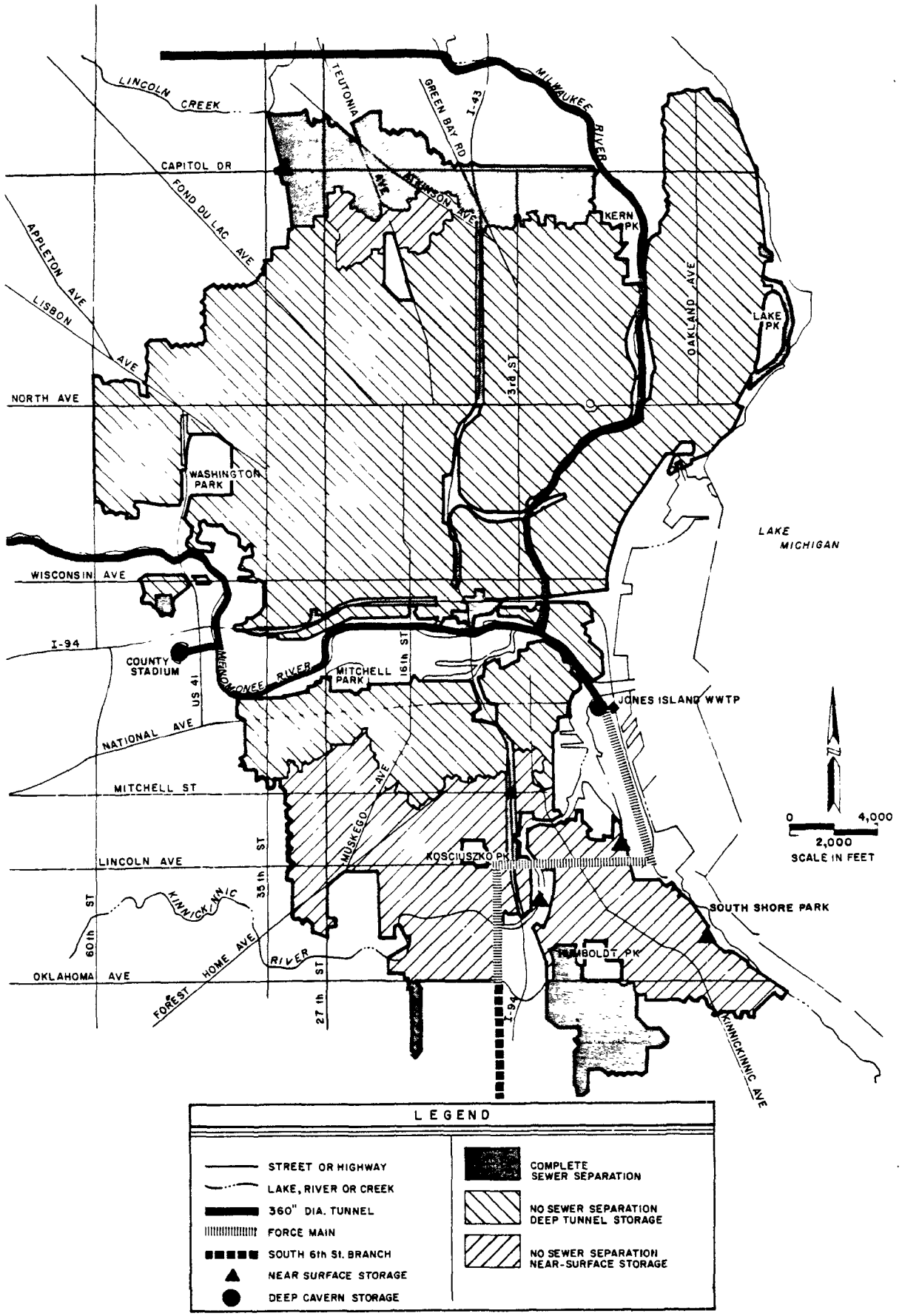


FIGURE 3-13

DATE APRIL 1981

MODIFIED TOTAL STORAGE ALTERNATIVE

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

sewer bypassing and CSO abatement. Based on this additional analysis, the MMSD recommended the Inline/Near-Surface Storage Alternative with a 1/2-year level of protection for meeting the requirements of the Dane County Stipulation. This alternative is shown in Figure 3.14. Neither the DNR nor the EPA approved this CSO abatement alternative.

In the first half of 1980 the DNR requested that the MMSD evaluate additional levels of protection and determine the associated costs and overall impacts on water quality. This additional information was requested so that it would be available and could be used for selecting a CSO abatement alternative for achieving applicable water quality standards, if the U.S. District Court Order is overturned by the U.S. Supreme Court.

When the Draft EIS was distributed, the MMSD had generated some of the requested information. It consisted of additional level of protection data to compare different CSO and peak flow storage volumes with the frequency, amount, and duration of overflows from the CSSA. Wet weather bypasses from the separated sewer area are prohibited by both the U.S. District Court Order and the Dane County Stipulation. Based on the MMSD's I/I study and MIS modeling, it had been determined at the time the Draft EIS was distributed that 550 acre-feet of storage would be necessary to eliminate wet weather bypassing in the separated area. This value assumes a daily maximum capacity at Jones Island of 300 MGD, a daily maximum capacity at South Shore of 250 MGD and removal of 48% of the existing I/I.

By assuming various storage volumes, corresponding levels of protection for CSO were developed by the MMSD. These data are summarized in Table 3.16. These values represent the volume of CSO from the CSSA that could be expected for different levels of protection. The analysis assumes that all wet weather bypasses from the separated sewer area would be captured and subsequently treated. The remaining storage was used for CSO. After the total storage capacity of the system is reached, the system would close and all remaining CSO would be discharged to the surface waters.

This MMSD analysis was preliminary. It did not optimize the treatment capacities of the Jones Island and South Shore WWTPs, nor did it identify the costs or water quality impacts of each level of protection. At the time the Draft EIS was released, it was recognized that it would be necessary to develop additional information prior to the selection of a CSO abatement alternative to meet applicable water quality standards.

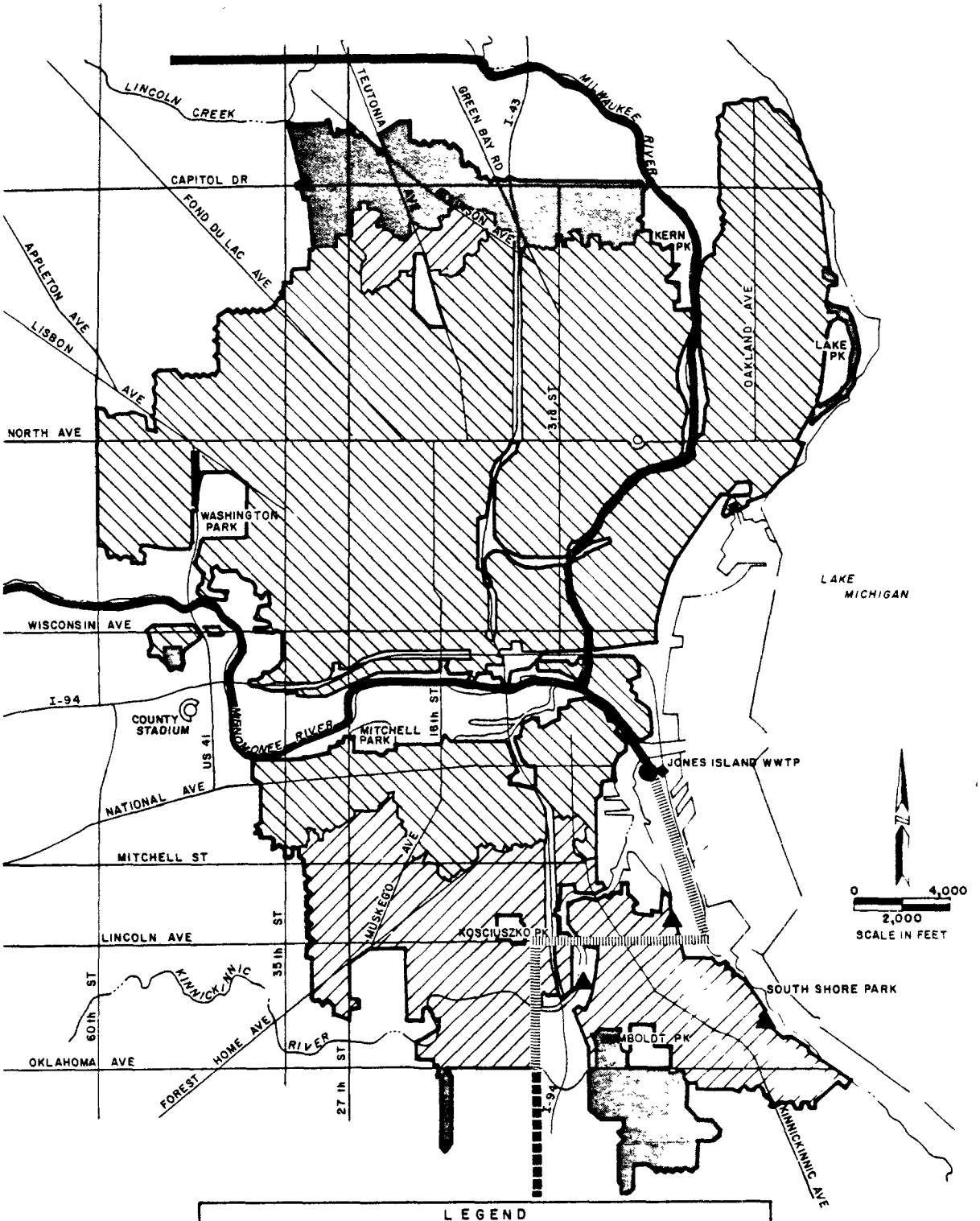


FIGURE 3-14

DATE APRIL 1981

HALF YEAR L.O.P. INLINE STORAGE ALTERNATIVE

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

TABLE 3.16
SYSTEM-WIDE LOP ANALYSIS

Storage (Acre-Feet)	Probability of Equaling or Exceeding Storage in a Given Year	Level of Protection (Years)	Average Annual Spill Volume (Acre-Feet)	Days of Spill	Spill as % of Total Days (14,456)
550	0.74	1.35	902	115	0.80
1,010	0.48	2.08	532	55	0.38
1,607	0.27	3.70	283	28	0.19
1,631	0.26	3.86	277	28	0.19
2,617	0.11	9.10	146	12	0.08
2,693	0.10	10. 0	139	12	0.08

1. Analysis based on 39+ years of hourly rainfall records.
2. Total flow to treatment plants = 550 MGD
3. Pumpout rate variable: Range 0-150 MGD - to South Shore WWTP only.
4. Total flow from combined sewer area limited to peak of 114 MGD.
5. Total flow from separated area assumes 48% effective clearwater reduction.
6. All flow from separated area is treated or stored and treat-d, no spills.
7. Spills represent combined sewer overflows only.
8. 100% of CSSA tributary to 240-inch tunnels.

1 Acre-Foot = 1233.5 Cubic Meters

Source: Letter from Gurschke, MMSD, to Baumann, DNR. August 14, 1980.

Since release of the Draft EIS, the MMSD at the request of EPA and DNR has continued to perform further analyses concerning the sizes and costs of various alternatives that may be able to comply with applicable water quality standards as required by the Dane County Stipulation.

These additional analysis take into account the preliminary findings set forth in the Draft SSES Report, that was released for public comment by MMSD in February of 1981. These analyses are also based upon a computer model of the conveyance capacity of the existing MIS, which is used to predict, under various assumptions, the volumes of CSO and bypasses from the separate sewer area during the forty year period of record (1940-1980) for which hourly rainfall data is available at General Mitchell Field.

By specifying certain information for an alternative, such as its storage volume, the daily wastewater volumes to be treated at the Jones Island and South Shore Treatment Plants, the degree of sewer separation in the CSSA, and the I/I removal level to be achieved in the separated sewer area, this model makes predictions about the daily volumes of CSO that would be discharged during each storm event during the 40-year period of record of hourly rainfall data.

Table 3.17 presents a summary of the storage volumes required and the corresponding costs under a given set of assumptions which specify the:

1. I/I removal percentage for the separated area
2. The degree of separation in the combined sewer service area
3. The level of protection for CSO.

By using this information, the EPA and DNR have tentatively determined that the Modified Total Storage Alternative with a level of protection for CSO somewhere between two to five years will be required to meet applicable water quality standards.

Recent analyses of level of protection for CSO versus total system cost have shown that the total storage volume required for a given level of protection is quite sensitive to the assumed I/I removal level and the daily volumes to be treated at the Jones Island and South Shore WWTPs. These analyses show that as the daily volumes to be treated at the two WWTPs decrease, the required storage volume and total system cost increase. Therefore, regardless of which alternative is implemented, in order to determine a storage volume that will provide a given level of protection for CSO that will

TABLE 3.17
TOTAL SYSTEM COST VERSUS LEVEL OF PROTECTION
FOR VARIOUS I/I REMOVAL LEVELS

6% I/I Removal

CSO LOP (yrs)	Without Partial Separation in CSSA: Storage Volume (ac-ft)	Without Partial Separation in CSSA: Capital Cost ($ x 10^9)	With Partial Separation in CSSA: Storage Volume (ac-ft)	With Partial Separation in CSSA: Capital Cost ($ x 10^9)
2	1400	1.52	1300	1.71
5	2700	1.69	1350	1.72

13% I/I Removal

CSO LOP (yrs)	Without Partial Separation in CSSA: Storage Volume (ac-ft)	Without Partial Separation in CSSA: Capital Cost ($ x 10^9)	With Partial Separation in CSSA: Storage Volume (ac-ft)	With Partial Separation in CSSA: Capital Cost ($ x 10^9)
2	1400	1.47	1100	1.65
5	2550	1.64	1150	1.66

19% I/I Removal

CSO LOP (yrs)	Without Partial Separation in CSSA: Storage Volume (ac-ft)	Without Partial Separation in CSSA: Capital Cost ($ x 10^9)	With Partial Separation in CSSA: Storage Volume (ac-ft)	With Partial Separation in CSSA: Capital Cost ($ x 10^9)
2	1150	1.52	700	1.67
5	2300	1.67	750	1.68

Source: MMSD

achieve applicable water quality standards, it will be necessary to determine the cost effective I/I removal level and the daily volumes which can be treated at each WWTP.

At this time it is anticipated that MMSD will adopt a Final SSES Report in May, 1981. This Report will set forth the MMSD recommended I/I removal level and will be used in conjunction with other information to more precisely determine the storage volume required to comply with both Court Orders.

3.13 FINAL ALTERNATIVES

The configurations of wastewater treatment facilities and interceptors determined by the EIS to be the most environmentally sound and technically feasible for each system-level are described below. The Subregional System-Level Alternative was not evaluated further because of high costs compared to the other system-levels and because of potentially severe water quality impacts especially in the Root River. In addition, there were no benefits of implementing this alternative which could not also be achieved through any of the other action alternatives. Accordingly, the Subregional Alternative was deleted from the list of final system-level alternatives. The "No Action" Alternative is included as a means for comparing the impacts of the other action alternatives.

3.13.1 The No Action Alternative

The No Action Alternative involves the maintenance of all existing sewage conveyance and treatment facilities in the planning area in their present condition until the year 2005. Only routine operating procedures and maintenance would be performed. Any equipment or sewer that breaks down during this period would be repaired without upgrading.

The service areas for the local treatment plants would remain the same, regardless of population changes.

With the No Action Alternative, the Jones Island, South Shore, and South Milwaukee WWTPs would continue to serve portions of Milwaukee County. Outside the County, six WWTPs would be operated by local communities: Muskego Northeast, Muskego Northwest, New Berlin Regal Manors, Germantown, Thiensville, and Caddy Vista (in the Town of Caledonia). In addition, all private WWTPs would continue operating. No steps would be taken (other than those already under construction) to expand sewer service, relieve overloaded systems, or eliminate CSO, bypasses, and diversions of untreated wastewater into area rivers. The alternative is illustrated in Figure 3.15.

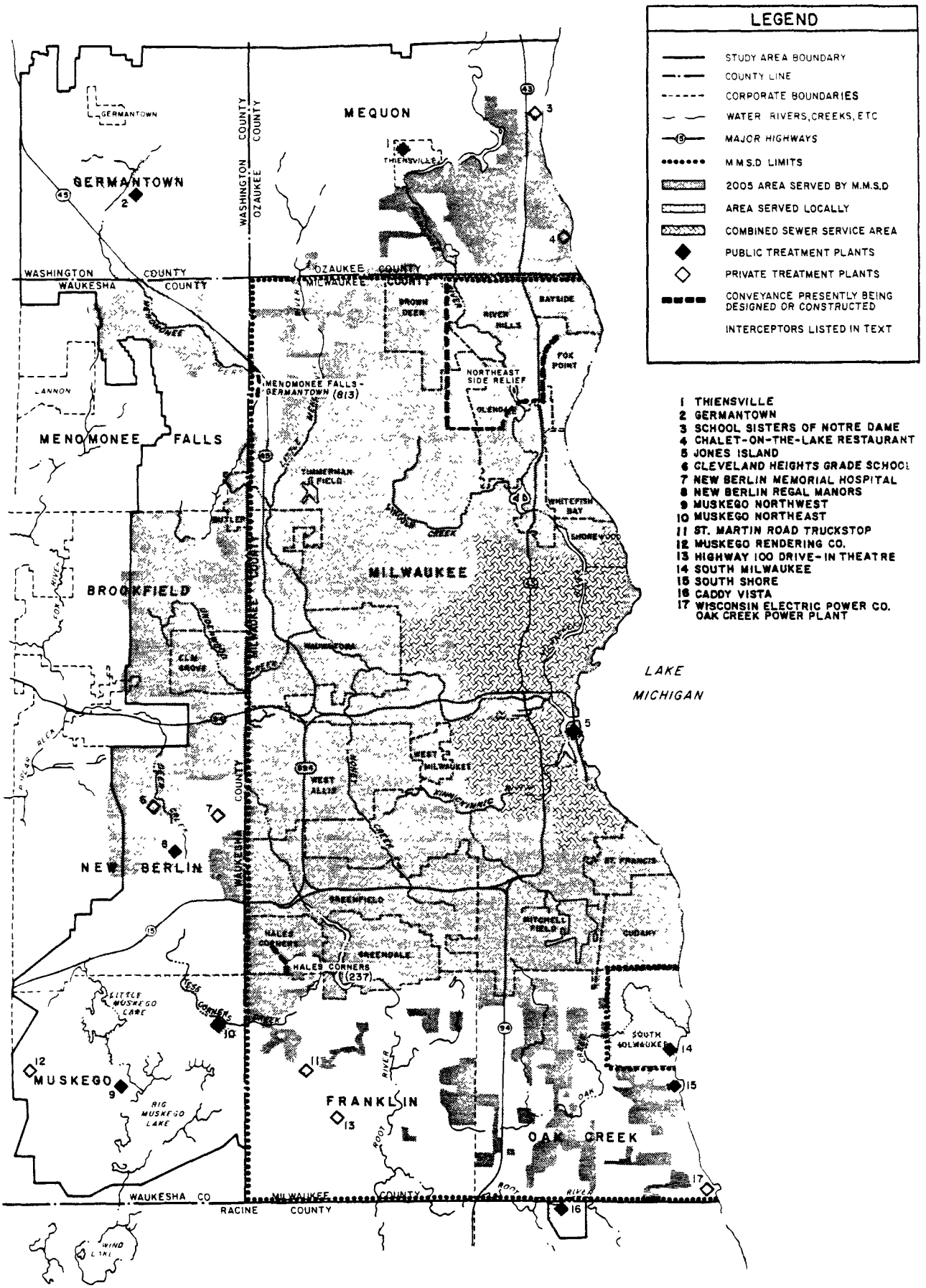


FIGURE 3-15

DATE APRIL 1981

SERVICE AREA and FACILITY MAP of the NO ACTION ALTERNATIVE

SOURCE MMSD

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3.13.2 The Final Local Alternative

3.13.2.1 Wastewater Treatment

As discussed earlier in this chapter, the final Local Alternative was developed using the strategy of treating wastewater flows within the planning area at numerous locations. The local alternative for each WWTP that was identified by EPA, DNR, and the EIS consultant as being the most environmentally sound and least costly is shown in Figure 3.16. It would include the following WWTPs.

Public WWTPs	Private WWTPs
Jones Island	Wisconsin Electric Power Company (WEPCO)
South Shore	School Sisters of Notre Dame
Thiensville	
Germantown	
New Berlin Southeast	
Caddy Vista	
South Milwaukee	
Muskego	

3.13.2.1.1 Jones Island and South Shore WWTPs: The Jones Island facility would be expanded to a maximum capacity of 300 MGD (13.1 m^3/sec). Equipment would be added to upgrade and expand the secondary treatment and solids handling processes. The South Shore WWTP would be expanded to treat a peak flow of 250 MGD (11.0 m^3/sec). Additional secondary treatment and solids handling equipment would be added to the facility.

3.13.2.1.2 Thiensville WWTP: The capacity of the Thiensville WWTP would be expanded, although the type of treatment process would remain the same. The expansion would take place on land to the north and west of the facility. New facilities for sludge processing would be included. Anaerobic digestors would be added to stabilize the sludge, which would be dried on sand beds located on the land to the north of the facility. The sludge would be trucked to a land application site. The effluent discharge location for the Thiensville WWTP would remain the same at the Milwaukee River.

3.13.2.1.3 Germantown WWTP: In Germantown, the land application alternative was identified as the most feasible. The existing WWTP would be abandoned and wastewater flows would be conveyed to a new infiltration-percolation site. At the new site, sewage would be treated in an aerated lagoon system and then discharged to infiltration-percolation ponds.

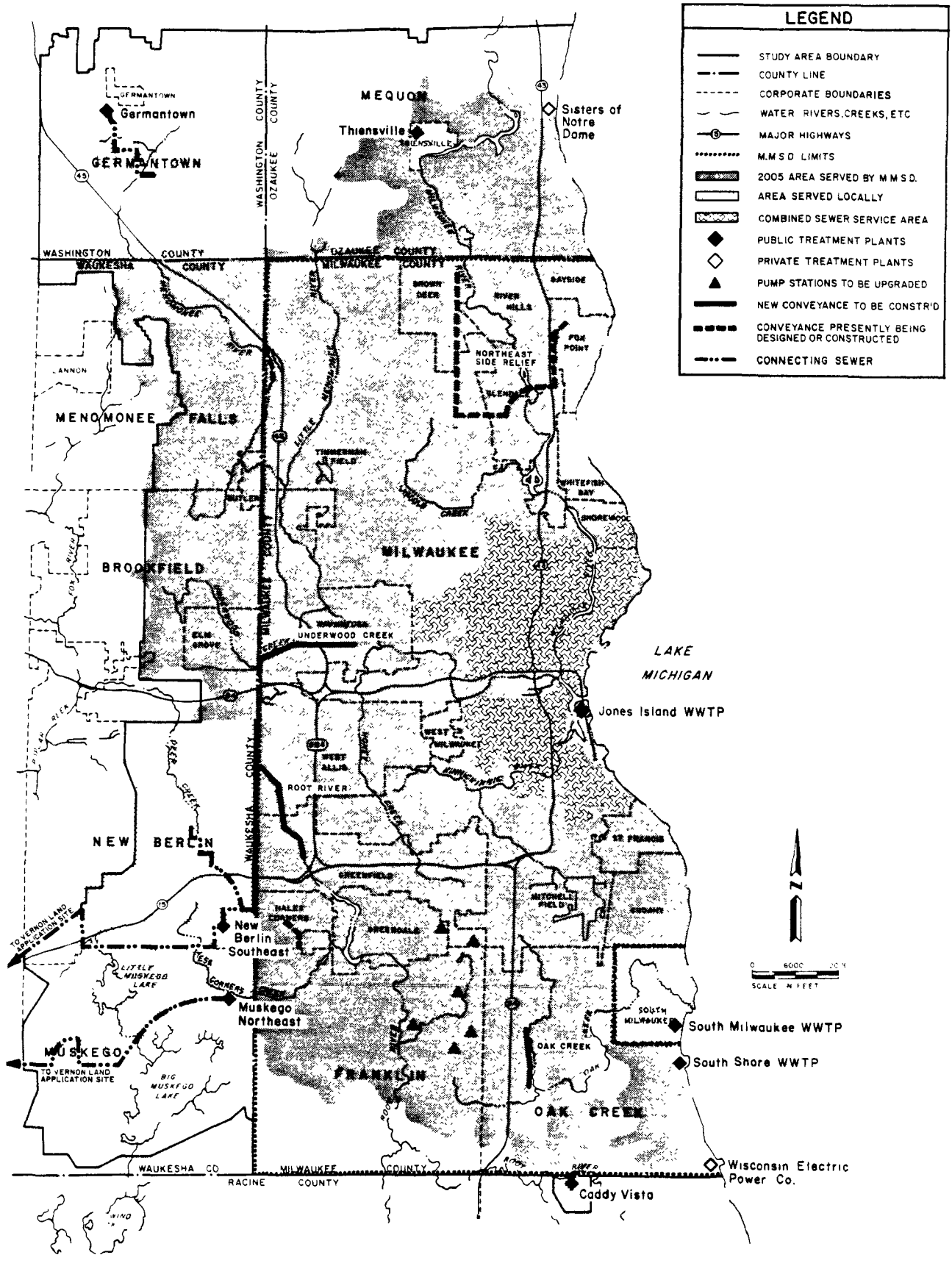

FIGURE 3-16

DATE APRIL 1981

SERVICE AREA AND FACILITY MAP OF THE LOCAL ALTERNATIVE

SOURCE MMSD

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The conveyance system for the new facility would consist of two pump stations and a 20-inch diameter force main. The conveyance route and new site are shown on Figure 3.16. The aeration lagoons would occupy 27.5 acres (11.1 ha). Seven infiltration-percolation ponds, each covering 11.6 acres (4.7 ha), would also be included.

3.13.2.1.4 New Berlin Southeast WWTP: In New Berlin, the Regal Manors WWTP would be abandoned. A new, aerated lagoon treatment facility would be constructed on a site at Sunny Slope and Grange Streets, shown on Figure 3.16. Influent wastewater would be treated in aerated lagoons and then transported to infiltration-percolation ponds in the Town of Vernon. The lagoons and buffer area would require approximately 211 acres (89.4 ha) of land.

The conveyance system for transporting the treated effluent to the land application site would include a 30-inch (76.2 cm) force main and one pump station. Twenty-one infiltration-percolation ponds, each 8.2 acres (3.3 ha) in size, would be constructed. An emergency storage site of 12.1 acres (4.9 ha) and 500 feet (152 m) of buffer area would also be included at the land application site.

3.13.2.1.5 Muskego WWTP: The Muskego Northeast and Northwest treatment facilities would be abandoned. The wastewater flows from the existing WWTPs in Muskego would be combined and pumped to the Town of Vernon. There the flows would be treated in aerated lagoons, which would require a 22 acre (8.9 ha) site. The treated effluent would be applied to seven infiltration-percolation ponds. The total system plus buffer area would require 115 acres of agricultural land.

3.13.2.1.6 Caddy Vista WWTP: The existing Caddy Vista WWTP would be abandoned and demolished. A new advanced secondary treatment facility would be constructed on the site. An additional 150 feet (45.7 m) would be needed on the south side of the existing site. Treated effluent from the new WWTP would be discharged to the Root River. Solids would be aerobically digested, dried on sand drying beds and trucked to a land application site.

3.13.2.1.7 South Milwaukee WWTP: The South Milwaukee WWTP would not be expanded, but the operation and maintenance procedures would be improved. The South Milwaukee WWTP currently has a solids management study underway.

3.13.2.1.8 Private WWTPs: The School Sisters of Notre Dame treatment facility would not be expanded, but would continue operating with its existing processes. Improvements to the

operation and maintenance procedures might be made during the planning period. The facility currently has no solids handling procedures. In the future, a private hauler would be used to transport solids to a land application site or discharge them into a public sewer system.

The WEPCO facility would also remain in operation using existing processes. Treated effluent would be discharged into Lake Michigan. Solids from the activated sludge process would be applied to land in the Village of Germantown, as is the current procedure. Operation and maintenance procedures might be improved during the planning period.

The Muskego Rendering Company facilities would not be abandoned. However, the treated effluent from this facility is high in suspended solids and BOD_5. Therefore, rather than discharging the treated effluent to infiltration-percolation ponds, the existing facility would serve as pretreatment prior to discharge of effluent to the Muskego sanitary sewer system, about 9,600 feet (2,926 m) away. A force main and lift station would be constructed to convey the effluent to the public sewer system.

3.13.2.1.9 Abandoned WWTPs: All other WWTPs in the planning area would be abandoned. These include:

Public WWTPs	Private WWTPS
New Berlin Regal Manor	St. Martins Road Truck Stop
Muskego Northwest (Woods Road)	Highway 100 Drive-In
Muskego Northeast	Cleveland Heights Grade School
Germantown	Chalet-on-the-Lake Restaurant
	New Berlin Memorial Hospital

All the private facilities would be connected to the nearest public sewer system.

3.13.2.2 Interceptors

In order to extend sewer service from the local WWTPs to unsewered areas that were designated for development during the planning period, the following interceptors would be constructed.

Northeast Side Relief System
Underwood Creek (East-West Alignment)
Root River (short route)
Franklin-Muskego (Franklin section only)
Franklin Northeast - the six pump stations would be upgraded
Oak Creek North Branch

The locations of these interceptors are shown on Figure 3.16.

In addition, connector sewers would be built outside of Milwaukee County in order to extend sewer service in Mequon and New Berlin. The location of these connector sewers are also shown on Figure 3.16.

3.13.3 The Final Regional Alternative

3.13.3.1 Wastewater Treatment

The Final Regional System-Level Alternative (shown in Figure 3.17) gives the MMSD responsibility for the conveyance, treatment, and storage of all wastewater flows in the planning area. This alternative employs the MIS system to convey flows to the South Shore and Jones Island WWTPs. All other public wastewater treatment facilities in the planning area would be abandoned. In addition, interceptor sewers would be built to divert wastewater flows from abandoned WWTPs to the MIS system and to extend service to some presently unsewered areas.

As with the Local Alternative, the Jones Island and South Shore WWTPs would be expanded and upgraded. The Jones Island WWTP would be expanded to a peak capacity of 300 MGD (13.1 m^3/sec). Secondary treatment and solids handling equipment would be added. Milorganite production would be abandoned. The South Shore WWTP would be expanded to a peak capacity of 250 MGD (11.0 m^3/sec). Secondary treatment and solids handling equipment would also be added to this facility.

3.13.3.2 Wastewater Conveyance

All other wastewater treatment facilities in the planning area would be abandoned. The flows to these existing facilities would be connected to the MIS system. The following interceptors would be used to convey these flows and to extend sewer service to currently unsewered areas.

Northeast Side Relief System
Underwood Creek (East-West alignment)
Root River
Hales Corners
Franklin-Muskego
Franklin Northeast - six pump stations would be upgraded
Oak Creek North Branch
Menomonee Falls-Germantown (East-West alignment)

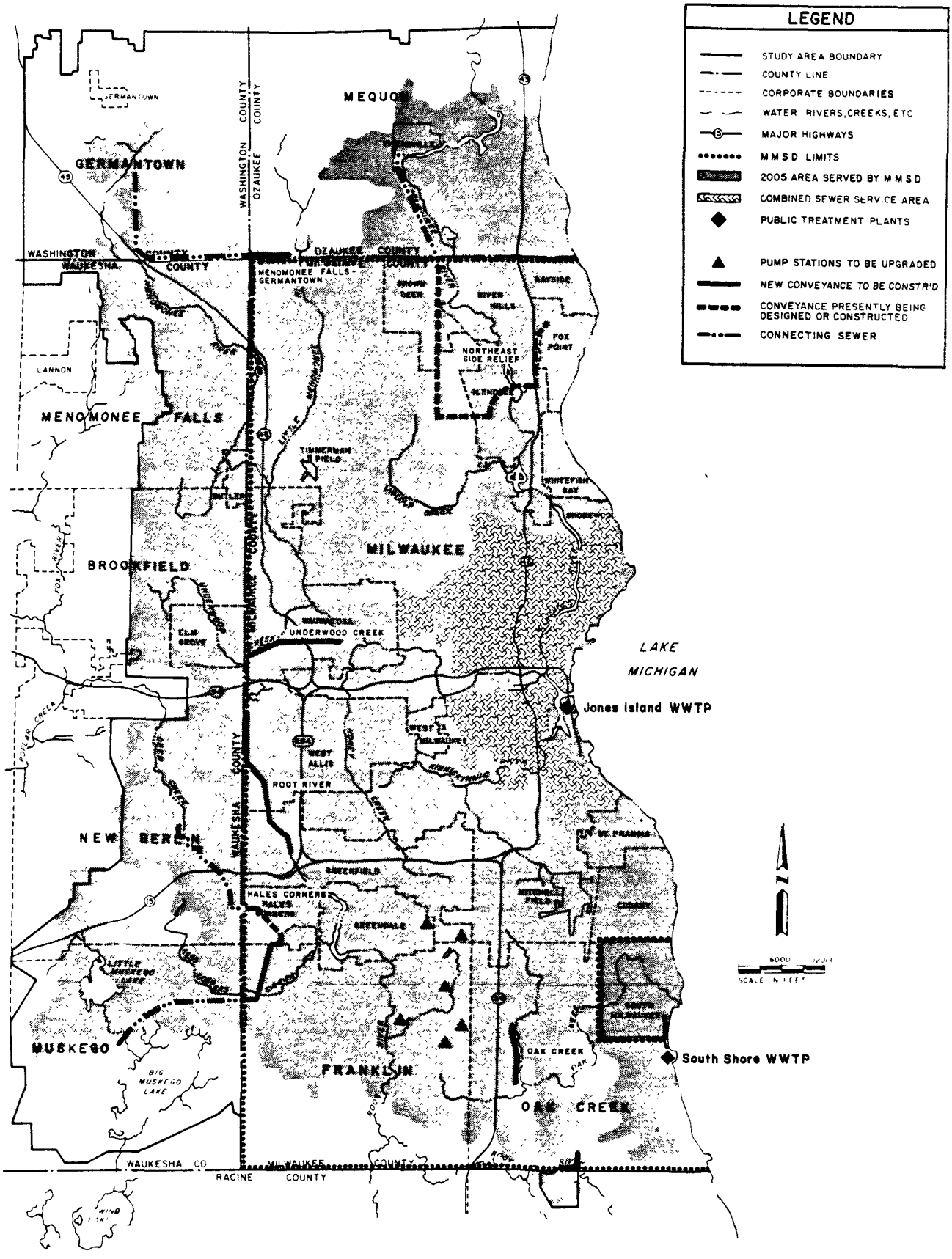

FIGURE 3-17

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SERVICE AREA AND FACILITY MAP OF THE REGIONAL ALTERNATIVE

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A number of sewers would be constructed in order to connect the local sewer service areas in Caddy Vista, Germantown, Muskego, New Berlin, South Milwaukee, and Thiensville to the MMSD. These connector sewers are shown in Figure 3.17.

The MIS sewer system would be rehabilitated and expanded in the ways noted in section 3.4.3 of this chapter.

3.13.4 Final Mosaic Alternative

In addition to considering the most cost effective and environmentally sound alternative at each systems level and No Action, a fourth alternative was developed by the MMSD that combined aspects of all the other final alternatives. This is referred to as the Mosaic Alternative. Like the other final alternatives, the Mosaic Alternative (illustrated by Figure 3.18) includes conveyance, storage, and treatment of wastewater from all communities in the planning area. The alternative was developed by examining the cost and environmental impacts of the systems levels, and considering public opinion to evolve an alternative that includes the most viable aspects of each system-level.

3.13.4.1 Wastewater Treatment

With the Mosaic Alternative, the Jones Island and South Shore WWTPs would be expanded and upgraded (see section 3.13.2.1.1). The South Milwaukee WWTP would also be included in the Mosaic Alternative. The facility would not be expanded, although operation and maintenance procedures might be improved. All other public WWTPs in the planning area would be abandoned.

Three private WWTPs would continue operating. The School Sisters of Notre Dame would operate at its present capacity. Operation and maintenance procedures might be improved, but no additional equipment or processes would be needed during the planning period. Solids from the treatment process would be stored in the existing sludge tank. A private contractor could be hired to periodically empty the tank.

The WEPCO facilities would also be retained. No expansion or upgrading of the facility would be necessary, although the operation and maintenance procedures might be improved. Solids from the WWTP would be land applied in the Village of Germantown, as they are now.

The Muskego Rendering Company treatment facility would be used for industrial pretreatment. The site's infiltration and percolation ponds would be abandoned. Effluent would be pumped to the local City of Muskego sanitary sewer system,

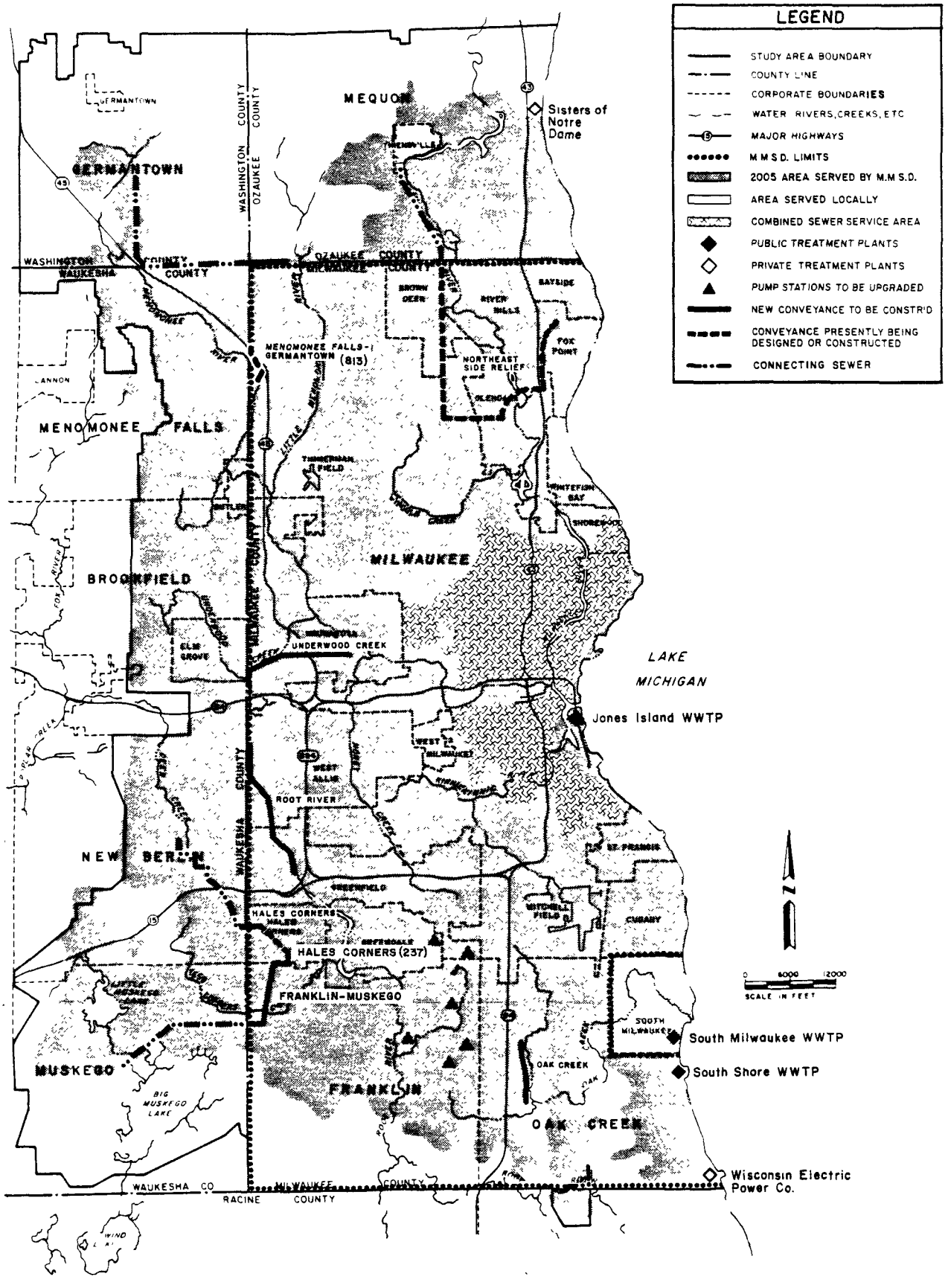

FIGURE 3-18

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SERVICE AREA and FACILITY MAP of the MOSAIC ALTERNATIVE

SOURCE MMSD

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9,600 feet (2,926 m) away. The conveyance system would consist of one lift station and a force main.

All other private WWTPs in the planning area would be abandoned. Flows from the existing facilities would be connected to the nearest acceptable public sewer system.

3.13.4.2 Wastewater Conveyance

In order to expand sewer service to presently unsewered areas, the following interceptors would be constructed.

Northeast Side Relief System
Underwood Creek (East-West alignment)
Root River
Hales Corners
Franklin-Muskego
Franklin Northeast - six pump stations would be upgraded
Oak Creek North Branch
Menomonee Falls-Germantown (East-West alignment)

All of the connector sewers discussed under the Regional Alternative would also be constructed under the Mosaic Alternative with the exception of the South Milwaukee Connector.

3.13.5 MMSD Recommended Plan

The MMSD Recommended Plan is the Mosaic Alternative with slight modifications. For this reason, the impacts described in Chapter 5 for the Mosaic Alternative would also occur with the MMSD Recommended Plan, unless it is stated otherwise. The MMSD Recommended Plan is shown on Figure 3.19.

3.13.5.1 Wastewater Treatment

The Jones Island and South Shore WWTPs would be rehabilitated and expanded in the manner described in section 3.13.2.1.1. The MMSD recommends that chlorine disinfection facilities for the Jones Island WWTP be located on a 9.5 acre (3.8 ha) lakefill in the Outer Harbor, adjacent to the existing site. This expansion would require the acquisition of less land and would be less costly than building on a new land site.

For the expansion of the South Shore WWTP, the MMSD recommends filling in 12 acres (5 ha) of Lake Michigan to the north of the WWTP and enclosing an additional 18 acres (12 ha) for future expansion. This recommendation is based upon the MMSD's determination that lakefill expansion would allow a more technically feasible layout for the plant than other alternatives.

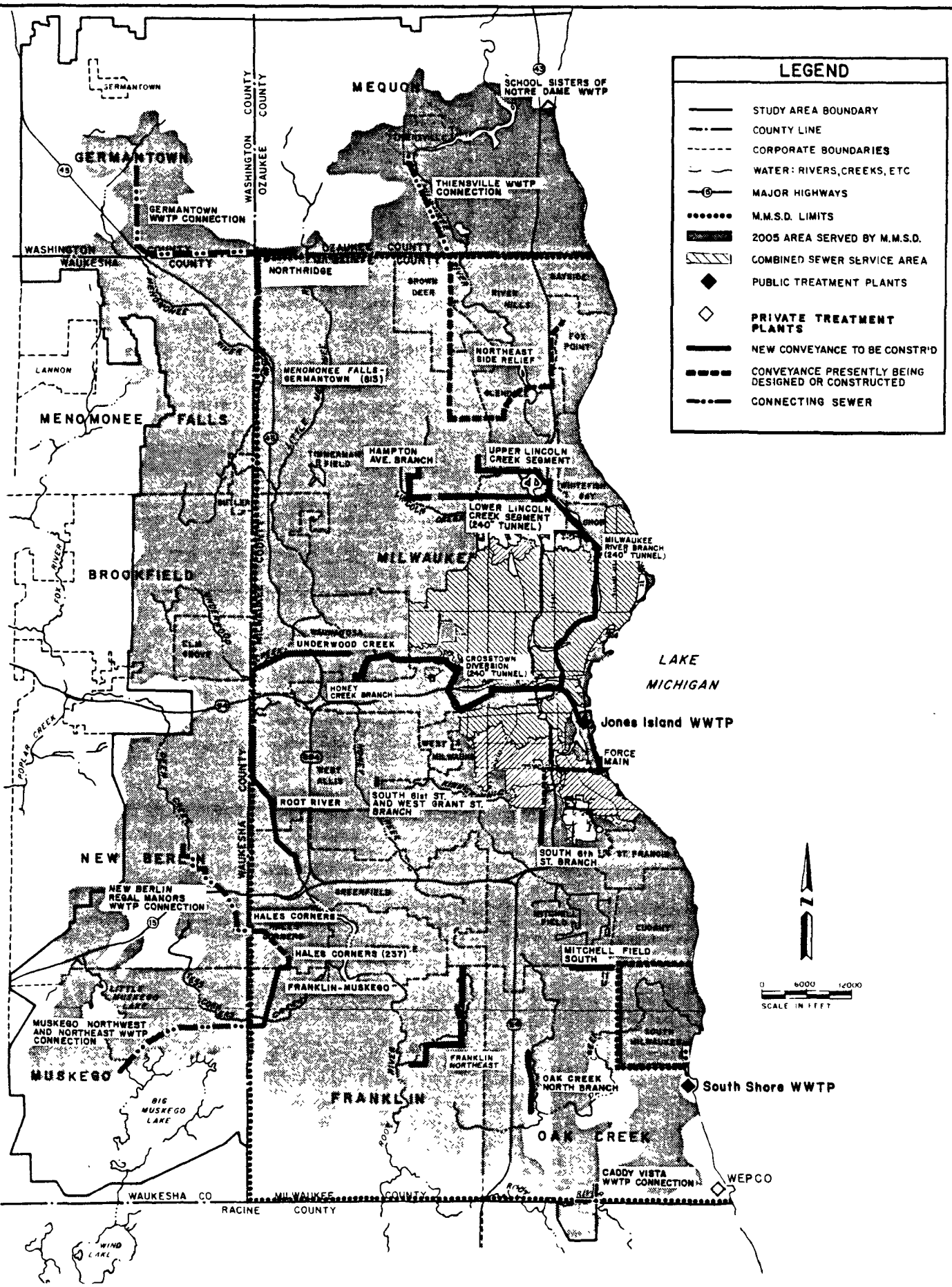

FIGURE 3-19

DATE APRIL 1981

SERVICE AREA AND FACILITY MAP OF MMSD RECOMMENDED PLAN

SOURCE MMSD

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The solids from these WWTPs would be landfilled and land applied as described in Section 3.8.1.

With the MMSD Recommended Plan, the South Milwaukee WWTP would continue operating at its present size, although operation and maintenance procedures might be improved. The WWTPs at the School Sisters of Notre Dame and WEPCO would operate as described in Section 3.13.4.1. The Muskego Rendering Company would use its WWTP to pretreat wastes before discharge to the local sewer system. All other private WWTPs would be abandoned.

3.13.5.2 Wastewater Conveyance

The MMSD Recommended Plan includes all the interceptors and connector sewers mentioned in Section 3.13.4.2, except that the MMSD recommends the construction of the Franklin Northeast Interceptor rather than upgrading the six pump stations.

The MMSD also recommended the construction of the Northridge and Mitchell Field Interceptors at some future date during the planning period. These interceptors have received a FNSI and are therefore not evaluated in this EIS.

3.13.5.3 CSO Abatement and Peak Flow Attenuation

The MMSD used the following factors in the selection of their Recommended Plan for CSO abatement and peak flow attenuation.

1. Construction difficulties - The Remote Storage, Jones Island Storage and Flow-Through Treatment Alternatives would require shallow interceptor construction through the downtown area. Damage to foundations would be a major risk.

2. Operational problems - The very high peak flows (450 MGD, 19.7 m^3/sec) at Jones Island for the Flow-Through Treatment Alternative would disrupt biological processes and could result in inadequate operation.

3. Operation and Maintenance - The Remote and Jones Island Storage Alternatives and the Flow-Through Treatment Alternative would have high O&M costs due to the large number of small, near-surface storage facilities required for CSO abatement. Operation and maintenance for the Inline Storage Alternative would be less costly than the CST Extension Alternative since solids removal equipment is not required in the storage cavern.

4. Flexibility - The MMSD felt that the Inline Storage Alternative would provide the greatest flexibility should the U.S. District Court Order be successfully appealed. However, it appears that much of the flexibility attributable to the Inline Storage system would also be true of the Modified CST/Inline Storage system.

Based on these factors the MMSD chose the Inline Storage Alternative as its Recommended Plan. The alternative is illustrated on Figure 3.19 and in detail on Figure 3.10.

3.13.6 EPA Preferred Alternative

The EPA Preferred Alternative is similar to the Mosaic Alternative with some exceptions. Differences in impacts between the two alternatives are discussed where appropriate in Chapter 5. The EPA Preferred Alternative is shown in Figure 3.20.

3.13.6.1 Wastewater Treatment Facilities

The EPA concurs with the MMSD Recommended Plan for wastewater treatment because the total present worth of the Local Alternative is $50 million more than the Mosaic Alternative. In addition, the Mosaic Alternative would use slightly less energy and resources and the annual operation and maintenance costs are lower for the Mosaic Alternative.

The Jones Island and South Shore WWTPs would serve the entire planning area except for South Milwaukee which would operate its own facility. All other public WWTPs would be abandoned. The two private wastewater treatment plants, School Sisters of Notre Dame and Wisconsin Electric Power Company, should also continue operations, and the Muskego Rendering Company should operate a private facility for pretreatment of effluent before its discharge to the local sewer system.

The EPA also concurs with the MMSD recommended plan with respect to liquids and solids treatment processes at the Jones Island and South Shore WWTPs. However, the MMSD recommendations for a 9.5 acre lakefill at the Jones Island WWTP and enclosing 30 acres and filling 12 acres at the South Shore WWTP are considered excessive by the EPA. EPA recommends limiting the Jones Island WWTP lakefill to 5.7 acres and the South Shore WWTP lakefill to 12 acres. This should allow expansion to proceed without any major construction difficulties. Lakefill expansion also ensures operation of the WWTPs in the most efficient manner.

The EPA concurs with the MMSD recommendation to disinfect the final effluent from the Jones Island and South Shore WWTPs with chlorine gas. The MMSD discharge permits require

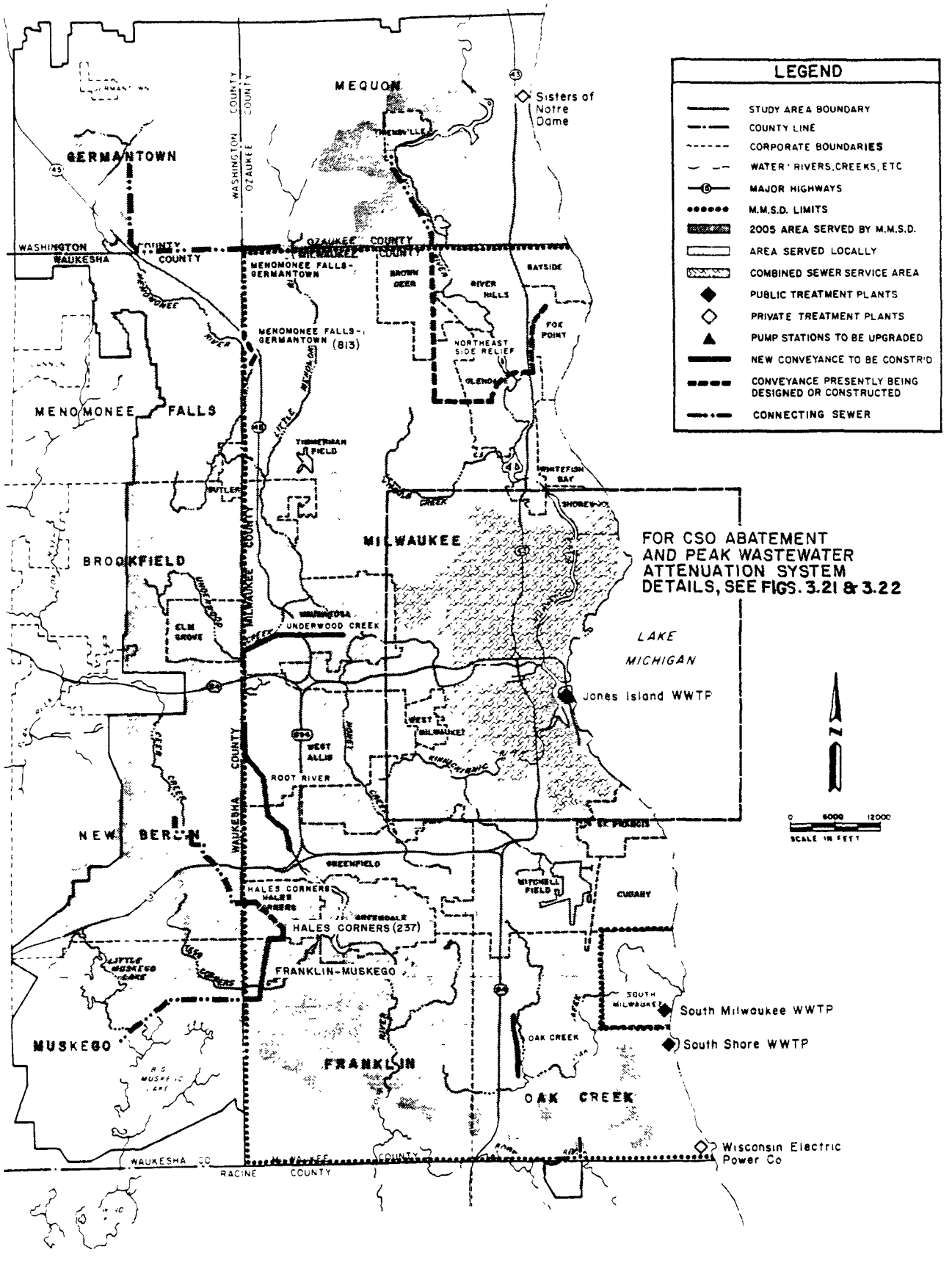

FIGURE 3-20

DATE APRIL 1981

SERVICE AREA AND FACILITY MAP OF EPA PRFERRED ALTERNATIVE

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a chlorine residual of 0.5 mg/l in the final effluent. The MMSD recommends dechlorination with sulfur dioxide to achieve this effluent limit. However, EPA proposes recommending that dechlorination should reduce residual chlorine to at least 0.05 mg/l without causing excessive sulfur dioxide overdosing. Adequate system controls such as feed forward control should be used to minimize sulfur dioxide overdose and to avoid the resultant unnecessary oxygen demand in the final effluent. This level of residual chlorine will minimize the toxic effects of combined and free chlorine in the Outer Harbor and Lake Michigan while continuing adequate pathogen control.

EPA also recommends that the MMSD evaluate alternatives for ammonia-nitrogen control at the Jones Island WWTP and implement the most cost-effective alternative. Ammonia-nitrogen control is necessary due to the EPA and DNR interpretation of the effluent mixing zone and the existing DNR un-ionized ammonia-nitrogen standard of 0.04 mg/l for the Outer Harbor. At a minimum the following conditions must be achieved:

1. The effluent mixing zone should be limited to a range of 900 to 2000 feet from the Jones Island outfall.

2. The passage between the Inner and Outer Harbor should be free from a toxic barrier which could be harmful to aquatic life.

3. The acute un-ionized ammonia-nitrogen toxicity standard (0.4 mg/l) should be met within the limited mixing zone and at the point of discharge.

4. The chronic un-ionized ammonia-nitrogen toxicity standard (0.04 mg/l) should be met at the boundary of the limited mixing zone.

3.13.6.2 Solids Handling

The EPA is in basic agreement with MMSD's recommendations to landfill Jones Island WWTP sludge and to agriculturally apply sludge from the South Shore WWTP. The concern about toxic substances and heavy metals and their potential effect on area farmland is valid, but the controls proposed by MMSD should be sufficient to avoid any adverse effects. It is important that MMSD rigorously implement its pretreatment program to minimize all toxic discharges to its system. If the pretreatment program is successful, reduced levels of toxic substances and heavy metals may allow land application of Jones Island WWTP sludge in the future.

3.13.6.3 Wastewater Conveyance

EPA is in agreement with the MMSD Recommended Plan for construction of intercepting and relief sewers. There are several cases, however, that are somewhat controversial, and one case where EPA cannot make a definitive recommendation at this time.

EPA concurs with the MMSD that the Menomonee Falls-Germantown, Hales Corner and Oak Creek interceptors should be constructed. However, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the local governments will need to work closely to prevent scattered development not in conformance with the Regional Land Use Plan. EPA also concurs with the MMSD that the Northeast Side Relief System, Underwood Creek, Root River, and Franklin-Muskego Interceptors should be constructed.

The Franklin Northeast interceptor was also recommended in the 208 Plan but MMSD, at least initially, found it to be more cost-effective to upgrade several pump stations. They later changed their recommendation after strong opposition at public hearings. EPA needs additional information concerning the existing on-site systems in the area and the ability to serve additional development on such systems. The 208 Plan conclusion was based primarily on the fact the soils in the area are classified by the Soil Conservation Service (SCS) as severely limiting. While this factor must be taken into consideration it alone cannot serve as the basis for supporting an interceptor recommendation. Until further information is available, EPA will be precluded from approving this portion of the facilities plan.

3.13.6.4 CSO Abatement and Peak Flow Attenuation

The EPA has decided not to identify and quantify an alternative for CSO abatement and peak flow attenuation to meet the requirements of the U.S. District Court Order because of uncertainties in some of the more critical estimating assumptions such as that of infinite transport capacity to the storage and treatment facilities, which may be invalid for flow contributed by large storm events occurring less frequently than once in ten years.

However, the EPA has made a recommendation for CSO abatement in order to meet applicable water quality standards. Based on the water quality data available at this time, EPA recommends the Modified Total Storage Alternative to attenuate peak flows from the separated sewer area and to provide a level of protection ranging between two and five years for the abatement of CSO in order to meet applicable water quality standards.

This alternative will not meet the more stringent requirements of the U.S. District Court Order to convey, store and treat CSO from the greatest storm of record over the past 40 years, and the alternative would only be implemented if the U.S. Supreme Court overturns the U.S. District Court Order.

The aspects of the Modified Total Storage Alternative providing a two to five year level of protection are outlined below.

Two Year Level of Protection CSO Alternative (see Figure 3.21)

- Complete sewer separation in 11% of the CSSA with no private property work.
- No sewer separation in the remaining portion of the CSSA.
- CSO from 68% of the CSSA would be tributary to 20-foot diameter tunnels and cavern storage facilities located at Milwaukee County Stadium and Jones Island with an approximate storage capacity of 1,060 acre-feet.
- CSO from 21% of the CSSA would be tributary to four near-surface storage facilities with an approximate storage capacity of 340 acre-feet.
- Excess flow from the separated sewer area would also be tributary to the 20-foot tunnels and the cavern storage facilities.[1]

Five Year Level of Protection CSO Alternative (see Figure 3.22)

- Complete sewer separation in 11% of the CSSA with no private property work.
- No sewer separation in the remaining portion of the CSSA.
- CSO from 88% of the CSSA would be tributary to 20-foot diameter tunnels and cavern storage facilities located at Milwaukee County Stadium and Jones Island with an approximate storage capacity of 2,500 acre-feet.
- CSO from 1% of the CSSA would be tributary to the near-surface storage facility with an approximate storage capacity of 50 acre-feet.

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[1]In calculating the storage volumes of the tunnels and cavern facilities, EPA assumed a 13% I/I removal rate.

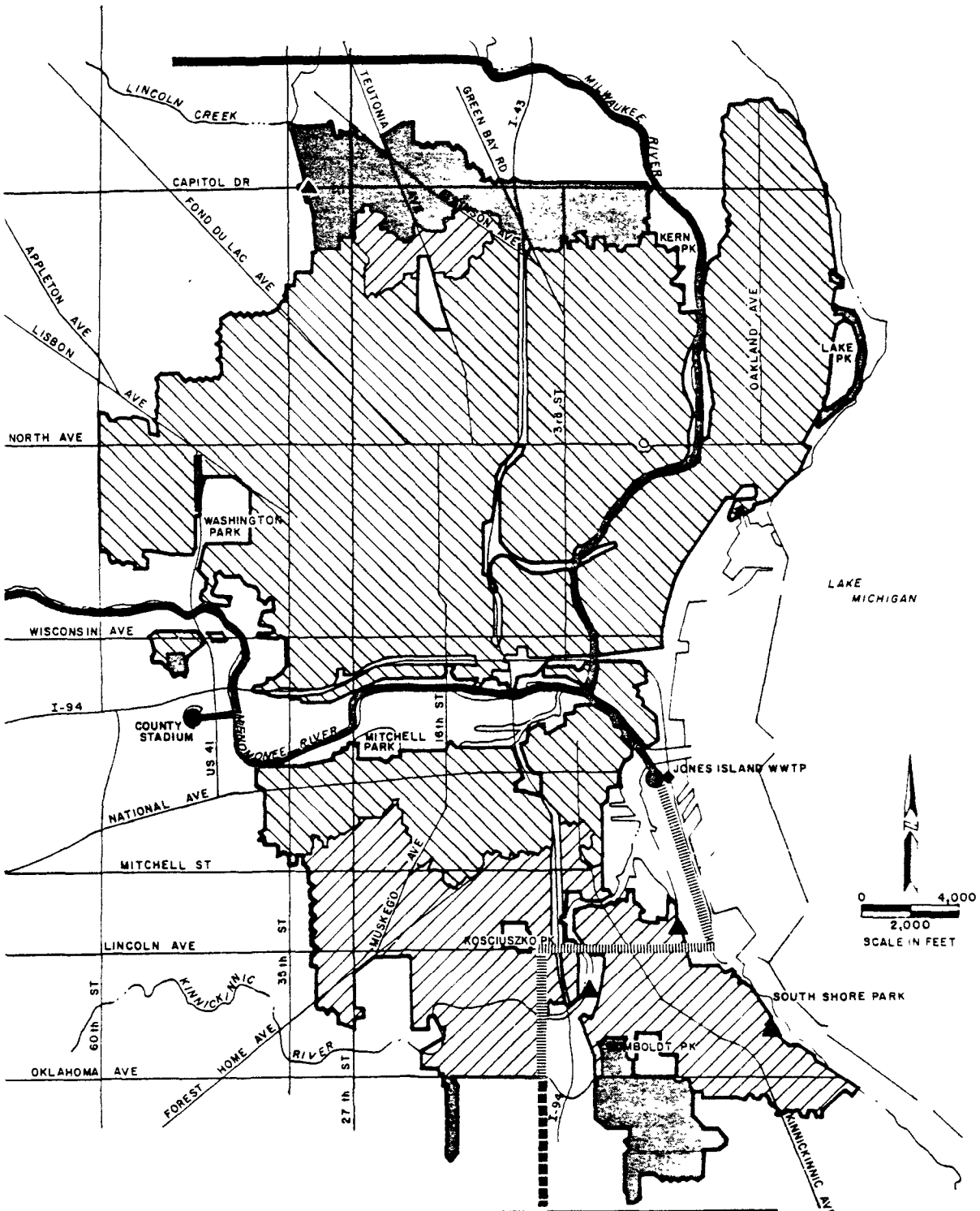

FIGURE 3-21

DATE APRIL 1981

TWO YEAR L.O.P. MODIFIED TOTAL STORAGE ALTERNATIVE

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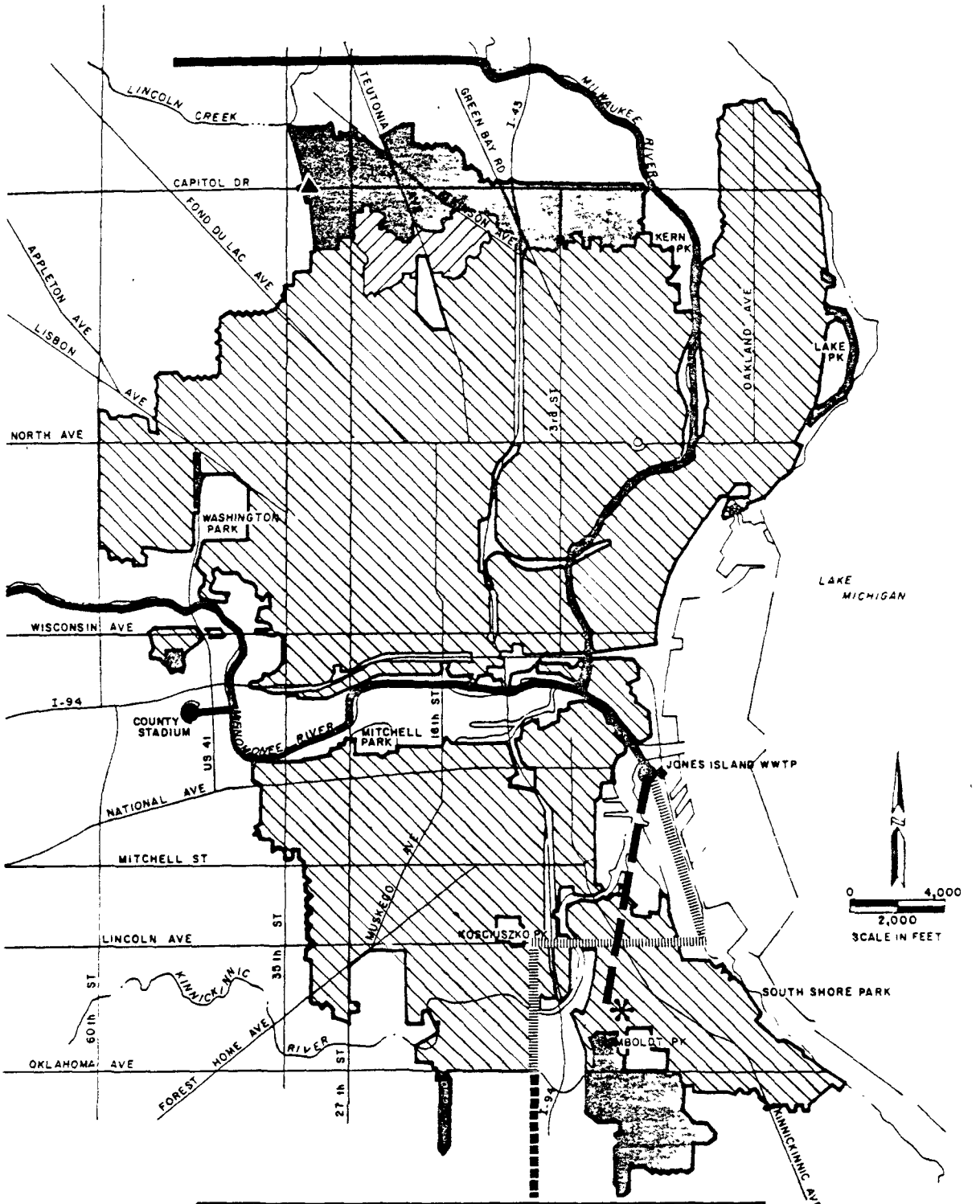

*NOTE: The MMSD has not proposed any specific alignment for the tunnel extension into the Kinnickinnic and Lake Michigan Basins.

FIGURE 3-22

DATE APRIL 1981

FIVE YEAR L.O.P. MODIFIED TOTAL STORAGE ALTERNATIVE

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- Excess flow from the separated sewer area would also be tributary to the 20-foot tunnels and the cavern storage facilities.[1]

The storage volume is impacted by several factors including the actual storage requirements resulting from greater I/I flow, the specific level of protection necessary to meet applicable water quality standards, and the specific treatment capacities at the Jones Island and South Shore WWTPs. The total storage volume cannot be finalized until the EPA, DNR and MMSD agree on these key issues during the design phase of the project.

In addition to the storage and treatment issues outlined above, the EPA recommends that further water quality analysis be conducted in order to definitely establish the minimum level of CSO control required to meet the provisions of the Clean Water Act. The EPA recommended water quality analysis should be applied to each waterway affected by CSO, and it includes the following elements:

- The characteristics of the existing collection and treatment system should be described, including CSO discharge locations and the frequency, quality, and quantity of overflows related to varying storm intensities.

- The overflow statistics should then be compared with instream analyses of water quality before, during and after several storm events. It may be necessary to use a continuous simulation model to develop the dynamics of instream water quality characteristics.

- The resultant water quality impacts based upon the pollutant reduction estimates associated with various levels of protection for CSO abatement should be calculated at a minimum in terms of the follow parameters: dissolved oxygen, un-ionized ammonia, phosphorus, sediment oxygen demand, fecal coliform, and nonpoint pollutant loadings.

- The water quality improvements due to each CSO abatement alternative should then be compared to the costs necessary to construct that CSO abatement alternative. This technical, environmental, and economic sensitivity analysis would identify the most cost-effective CSO abatement alternative needed to meet an attainable water quality standard.

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[1]In calculating the storage volumes of the tunnels and cavern facilities, EPA assumed a 13% I/I removal rate.

Because of the large quantities of rock and overburden that would result from the construction of any CSO abatement/peak flow attenuation alternative, the EPA also recommends that the MMSD continue facilities planning for developing a cost-effective and environmentally compatible alternative for the disposal of rock and overburden. This planning task must be submitted to EPA and DNR for approval prior to the start of construction.

3.13.6.5 Costs

The total system capital costs for EPA's preferred Alternative assuming a 13% I/I removal level would range from $1.47 billion for a 2-year level of protection of CSO to $1.63 billion for a 5-year level of protection of CSO. The total system capital costs for the U.S. District Court Order Alternative will be higher because of the increased level of protection and therefore larger storage requirements.

3.14 ENVIRONMENTAL CONSEQUENCES

The following section briefly compares the major impacts that the Final Alternatives would have on the environments of the MMSD planning area. For this discussion, it can be assumed that the MMSD Recommended Plan and EPA's Preferred Alternative would have impacts similar to those of the Mosaic Alternative. All the environmental impacts of the Final Alternatives, as well as the MMSD Recommended Plan and the EPA Preferred Alternative, are described in detail in Chapter 5 of this EIS.

3.14.1 Water Quality

3.14.1.1 Inland Wastewater Treatment Plants

An analysis of inland wastewater treatment plant alternatives was conducted for each effluent receiving stream under low flow conditions. Table 3.18 sets forth a summary of the water quality analysis for the final wastewater treatment plant alternatives. In most cases, abandonment of the wastewater treatment plants would substantially reduce the low flow of the receiving stream. Under the Regional and Mosaic Alternatives, both the existing DNR and the 208 recommended water quality standards would be achieved in all receiving waters. A detailed analysis of the feasible wastewater treatment plant alternatives is presented in Appendix VII, Water Quality. Chapter 5 of this EIS describes the water quality impacts of the final system-level alternatives.

TABLE 3.18

SUMMARY OF LOW FLOW STREAM AND LAKE WATER QUALITY CONDITIONS
DOWNSTREAM OF WASTEWATER TREATMENT PLANTS

Location	Parameter	Existing	No Action	Local	Regional and Mosaic
Root River Downstream of the Caddy Vista WWTP	Flow (cfs)	1.82	2.05	1.27	1.10
	BOD (mg/l)	13.2	14.7	11.3	6.0
	Phosphorus (mg/l)	1.34	1.45	1.3	0.59
	Chlorine (mg/l)	0.030	0.042	0.060	0
	Fecal Coliform (MFFCC/100ml)	843	200	200	200
	Un-ionized Ammonia Nitrogen (mg/l)	0.009	0.013	0.012	0.011
Menomonee River Downstream of the Germantown WWTP	Flow (cfs)	1.26	1.70	0.15	0.15
	BOD (mg/l)	13.38	13.71	3.90	3.90
	Phosphorus (mg/l)	1.05	1.08	0.16	0.16
	Chlorine (mg/l)	0.66	0.68	0.0	0.0
	Fecal Coliform (MCFFC/100ml)	320	200	200	200
	Un-ionized Ammonia Nitrogen (mg/l)	0.494	0.506	0.003	0.003
Tess Corners Creek Downstream of the Muskego Northeast WWTP	Flow (cfs)	0.618	0.783	0.01	0.01
	BOD (mg/l)	15.7	15.8	9.0	9.0
	Phosphorus (mg/l)	1.74	1.75	0.10	0.10
	Chlorine (mg/l)	0.49	0.49	0.0	0.0
	Fecal Coliform (MFFCC/100ml)	250	200	200	200
	Un-ionized Ammonia Nitrogen (mg/l)	0.007	0.007	0.008	0.008
Big Muskego Lake, receiving effluent from Muskego Northwest WWTP	Phosphorus WWTP Load (pounds/year)	10,600	10,600	0	0
	Total Lake Phosphrus Load (pounds/year)	21,300	21,300	3,700	3,700
	Steady State Lake Phosphorus Concentration (mg/l)	0.115	0.115	0.020	0.020
	Average Summer Chlorphyll-a Conc. (mg/l	70.3	70.3	5.7	5.7
	Average Summer Secchi Disc Depth (feet)	0.87	0.87	9.70	9.70
	Trophic Status	Eutrophic	Eutrophic	Mesotrophic	Mesotrophic
Deer Creek Downstream of the Regal Manors WWTP	Flow (cfs)	0.288	1.02	0.01	0.01
	BOD (mg/l)	50.4	51.4	12.0	12.0
	Phosphorus (mg/l)	0.97	0.992	0.10	0.10
	Chlorine (mg/l)	0.48	0.495	0	0
	Fecal Coliform (MFFCC/100ml)	306	200	200	200
	Un-ionized Ammonia Nitrogen (mg/l)	0.075	0.075	0.008	0.008
Milwaukee River Downstream of the Thinesville WWTP	Flow (cfs)	23.7	42.3	42.3	41.6
	BOD (mg/l)	9.68	9.38	9.62	9.0
	Phosphorus (mg/l)	0.278	0.272	0.277	0.274
	Chlorine (mg/l)	0.012	0.008	0.009	0
	Fecal Coliform (MFFCC 100ml)	362	200	200	200
	Un-ionized Ammonia Nitrogen (mg/l)	0.025	0.017	0.017	0.006

Source: ESEI

3.14.1.2 Combined Sewer Overflows and Bypasses

During rainfall events, CSO is discharged into the lower reaches of the Milwaukee, Menomonee, and Kinnickinnic Rivers, the Inner Harbor, and the Outer Harbor. Combined sewer overflows occur about 50 times each year. In addition, bypasses, overflows, and diversions of wastewater from the separated sewer systems occur in every community in the planning area. There are at least 263 permanent flow relief devices in the planning area.

Pollutant loads to the Inner Harbor from the CSSA under existing conditions and alternative future abatement conditions are set forth in Table 5-8. Those combined sewer overflow abatement alternatives which include the storage and treatment of both storm and sanitary wastewater (the Modified CST/Inline Storage and Modified Total Storage Alternatives) provide a higher level of water quality improvement than those alternatives which include total or partial separation of the storm and sanitary sewers (the Inline Storage and Complete Sewer Separation Alternatives). Abatement of the combined sewer overflows will affect water quality, loadings to the bottom sediments, sediment scouring and disturbance, and sediment quality conditions. Bypasses and other sewage flow relief devices would be eliminated under all of the CSO abatement alternatives.

3.14.1.3 Pollution Sources to the Outer Harbor and Lake Michigan

Pollutant loads to the Outer Harbor are primarily contributed from the Inner Harbor, from the Jones Island WWTP, from two CSO outfalls which discharge directly to the Outer Harbor, and from Lake Michigan inflow. Existing pollutant loadings to the Outer Harbor are set forth in Table 5-10. Inner Harbor and Jones Island WWTP loads of most pollutants to the Outer Harbor would be reduced under all future system-level conditions. However, a higher concentration of ammonia in the WWTP effluent will more than double the load of ammonia from the WWTP. Concentrations of phosphorus and suspended solids in the WWTP effluent could also increase slightly in the future. However, the total flow from the WWTP is expected to be reduced by at least 7% under future conditions.

An analysis was conducted to evaluate the impacts of possibly relocating the Jones Island WWTP outfall outside of the Outer Harbor. Relocation of the outfall would substantially improve water quality conditions and sediment quality conditions in the Outer Harbor. However, relocation of the outfall would increase total pollutant loads to the main body of Lake Michigan. Increased phosphorus loadings could increase

the eutrophic conditions of some nearshore areas. Increased ammonia discharges may result in occasional localized toxic effects on fish and aquatic life.

Lake Michigan is currently described as a relatively clean lake. However, there is some indication that the quality of the lake is deteriorating. Within the MMSD planning area, five wastewater treatment plants currently discharge directly to Lake Michigan: the South Shore WWTP, the South Milwaukee WWTP, the School Sisters of Notre Dame private WWTP, the Wisconsin Electric Power Company's Oak Creek plant, and the Chalet-on-the-Lake private WWTP. In addition, the Outer Harbor, which receives pollutants from the Inner Harbor and the Jones Island WWTP, also discharges into Lake Michigan. Annual pollutant loads to Lake Michigan are set forth in Table 5-15. The flow from the South Shore WWTP is expected to increase by 40% under future conditions. In addition, concentrations of some pollutants in the effluent such as phosphorus and suspended solids may increase in the future. Thus, reductions in pollutant loads to Lake Michigan from the Outer Harbor under future conditions are partially offset by increases from the South Shore WWTP. The Outer Harbor and South Shore WWTP are the largest sources of pollutants to the Lake, contributing over 98% of the total loads estimated to the Lake from the Milwaukee area.

Phosphorus has been shown to be a major nutrient controlling algae growth in the Great Lakes. Excessive levels of phosphorus may result in eutrophic (nutrient enriched) conditions and algae blooms in portions of Lake Michigan. The International Joint Commission (1980) estimated the existing (1976) phosphorus load to Lake Michigan and established a future target phosphorus load to provide for the continued protection and maintenance of the Lake's water quality. The proportion of the total phosphorus load to Lake Michigan contributed from the Milwaukee area is currently about 4.5 percent. Under future conditions, because of increased flow and possible increased phosphorus concentrations from the South Shore WWTP, the proportion of the total Lake Michigan load contributed from the Milwaukee area would increase to 5.8 percent.

3.14.2 Groundwater

With the No Action Alternative, the infiltration-percolation pond at the Muskego Rendering Company might be overloaded before 2005. If the facility is overloaded, groundwater in the area could be contaminated. Residential and commercial buildings in the area rely on shallow wells for their water supply. With any action alternative, this infiltration-percolation pond would be abandoned. Instead, the treatment

facility would be used to pretreat the Muskego Rendering Company wastewater before its discharge into a local sewer system.

The MMSD has recommended that the solids from the South Shore WWTP continue to be land applied during the growing season and landfilled during the winter, and that Jones Island WWTP solids be landfilled and no longer processed into Milorganite. Adherence to DNR standards for land application and landfill and a careful monitoring program should protect groundwater in the vicinity of the landfill and land application sites.

During construction of recommended facilities under any action alternative there would be the possibility of groundwater depletion or contamination. The construction of new sewers, interceptors, dropshafts and both near-surface and deep storage facilities would occur at elevations lower than the groundwater table. Where construction occurs below the groundwater table, site dewatering will be necessary which could result in significant localized drawdown of groundwater levels. Construction techniques such as installing sheet piling or sump pumping in lieu of dewatering wells could minimize these impacts. Contaminants could enter the aquifer from gasoline, oil, or untreated sewage spills at the construction site. Such impacts could be minimized by the careful handling of such materials and development of rapid clean-up procedures in the event a spill should take place. These spills should not occur in deep tunnel facilities as the TBM (tunnel boring machines) and spoil removal systems are electric-powered.

Tunnels and caverns in the Niagaran Aquifer could lower groundwater levels because they would be constructed below the piezometric surface of the aquifer, and groundwater would naturally tend to infiltrate the facilities . Where the piezometric surface of the Niagaran Aquifer would be drawn down to levels below the tunnel elevation due to well pumping, localized exfiltration would occur. Grouting of discontinuities in the rock to several feet in depth and tunnel linings could dramatically limit both infiltration and exfiltration from the tunnels. Exfiltration would also occur if flow depth control devices (such as sluice gates ahead of the dropshafts) were to fail, and water levels in the tunnels exceed the groundwater piezometric surface elevation. These devices should be equipped with backup facilities and, with proper maintenance, should provide reliable protection.

Further investigations by the MMSD will be required to ensure that risks to the groundwater from the tunnels are minimized prior to final approval of any deep tunnel system.

All action alternatives would include the above impacts. The Local Alternative would also include the construction of infiltration-percolation ponds in Vernon and Germantown. A thorough investigation of the sites for those facilities would be necessary prior to their construction. Proper site selection and design would minimize the hazard to groundwater.

3.14.3 Air Quality

The No Action Alternative would not affect air quality in the planning area. Although pollutant emissions are caused by generators, the incineration of screened materials, and trucking sludge to landfills, the greatest source of pollutant emissions associated with MMSD sewerage facilities is from the production of Milorganite. Approximately six percent of annual particulate emissions in Miwaukee County are from Milorganite production. With the No Action Alternative, these emissions would continue.

Any action alternative would have both temporary and long-term effects. The temporary impacts would be construction-related. The rehabilitation and expansion of the Jones Island and South Shore wastewater treatment plants would require about four years of construction. With the MMSD recommended expansion alternatives, all parameters of air quality would be increased on the average from 0.01% (sulfur dioxide) to 0.5% (for particulate matter) each year of the construction period.

The emissions associated with the construction of facilities to abate CSO and attenuate peak flows would vary according to the alternative selected. Table 3.19 outlines average annual emissions for different CSO abatement/peak wastewater flow attenuation alternatives.

The long-term direct impacts would be associated with the operation of the sewerage facilities included in each final alternative. The greatest impact of any action alternative would be the reduction in particulate emissions that would result from the abandonment of Milorganite production. Abandoning that process would also alter the use of energy at the WWTPs. All the action alternatives would require very similar changes in energy use, so they can all be compared to the No Action Alternative. Based on energy use, particulate emissions would be reduced (from the No Action Alternative) by 23.4% and sulfur dioxide by 8.3%. Other emissions would increase: carbon monoxide by 136.5%, hydrocarbons by 189.3%, and nitrogen oxide by 32.5%.

TABLE 3.19

AVERAGE ANNUAL POLLUTANT EMISSIONS (IN TONS) FOR 9-YEAR CONSTRUCTION PERIOD. CSO/I/I/ ALTERNATIVES

Pollutant	1985 County-wide[1] Emissions	Average Year Construction Emissions			
		Inline[2] Storage	Complete[3] Separation	Modified CST/ Inline	Total Storage
Particulate Matter	13,633	144	160	108	114
Sulfur Dioxide	178,437	10	16	7	10
Carbon Monoxide	161,247	235	292	247	296
Hydrocarbons	60,703	30	27	21	30
Nitrogen Dioxide	67,008	193	138	120	178

Sources: 1. SEWRPC, Planning Report 28. 1980.

2. MMSD, CSO, Vol. 1, Part 1, Chapter 8. 1980.

3. MMSD, CSO, Vol. 3, Part 2, Appendix 6D. 1980.

3.14.4 Cost

The No Action Alternative would not have any direct construction costs. However, the MMSD and the City of Milwaukee would violate two court orders if no action is taken to improve sewerage facilities or to eliminate CSO. The results of these violations could be fines or other penalties.

The costs of the action alternatives are shown in Table 1.6. These costs are estimated to be accurate to within +30% and -15%.

3.14.5 Fiscal Impacts

It is not possible to estimate all of the costs that the MMSD would incur if no action is taken to upgrade the sewerage facilities in the planning area. Although MMSD capital costs and user charges would not change greatly from the present, fines or other penalties could be levied for not complying with the U.S. District Court Order and the Dane County Circuit Court Stipulation.

It is possible to compare the fiscal impacts of Local, Regional, and Mosaic Alternatives. Table 3.20 shows the debt services for each alternative. Tables 3.21 and 3.22 compare the average annual community and household charges for each of these alternatives. As shown by these tables, the Regional Alternative would be the most expensive to Milwaukee County, requiring a greater amount of debt service in the 29 year period from 1980 to 2009 (allowing 20 years for bonds issued in 1989). The higher cost would be the result of connecting flows from the South Milwaukee WWTP to the MMSD.

Although the Regional Alternative would have the highest annual debt payments from 1980 to 2009 ($1,970,574,000), the tax rate levied by the County to finance the alternative would be lower. The addition of the City of South Milwaukee to the MMSD would increase the amount of taxable property by about $400 million. As a result of this increased tax base, the annual tax rate would be only $4.29 per $1,000 equalized property value, as compared to $4.37 for the Mosaic Alternative. Residents of the City of South Milwaukee would have a tax burden increase of 600% from a projected $33 per household for the Mosaic Alternative to $238 per household for the Regional Alternative.

The next most expensive alternative in terms of MMSD capital expenditures would be the Mosaic Alternative. From 1980 to 2009, the Mosaic Alternative would require a total of $1,966,223,000 in debt service. Because this alternative

TABLE 3.20

DEBT SERVICE BY ALTERNATIVE

Alternative	Total MMSD Debt Service 1980-2009*	Average Annual Debt Service 1985-2009*	Average Annual Contract Community Payments 1985-2009*	Average Annual Debt Service Allocated To Milw. Co. Property 1985-2009*	Milw. Co. Average Annual Tax Rate For MMSD 1985-2009*
Local	1,927,552	82,510	4,188	78,322	4.33
Regional	1,970,574	86,331	7,036	79,295	4.29
Mosaic	1,966,223	86,137	7,121	79,016	4.37

* In thousands of dollars
Assumptions=

20 Year G.O. bonds
6% interest rate
1980 dollars
75% Funding to an annual maximum of $60 million
0% inflation.
District-wide financing

Source: MMSD and ESEI

TABLE 3.21

1985-2005 AVERAGE ANNUAL COMMUNITY CHARGES (in thousands)

Community	Local		Regional		Mosaic	
	Capital	O&M	Capital	O&M	Capital	O&M
Bayside	$ 725	$ 99	$ 717	$ 93	$ 732	$ 94
Brookfield*	789	438	742	411	750	416
Brown Deer	1,491	366	1,472	344	1,502	348
Butler*	190	93	179	88	181	89
Caddy Vista*	166	76	36	22	36	22
Cudahy	1,910	1,002	1,888	946	1,926	956
Elm Grove*	358	150	337	140	341	142
Fox Point	1,204	207	1,192	194	1,216	196
Franklin	1,664	608	1,642	570	1,675	576
Germantown*	815	422	676	391	684	396
Glendale	3,016	541	2,972	509	3,032	515
Greendale	2,022	393	1,999	369	2,039	373
Greenfield	3,127	703	3,087	660	3,149	668
Hales Corners	778	179	770	168	786	170
Menomonee Falls*	1,664	919	1,561	862	1,580	872
Mequon*	1,173	626	1,100	588	1,114	594
Milwaukee	41,313	22,871	40,870	21,566	41,694	21,804
Muskego*	933	435	576	293	583	297
New Berlin*	2,958	754	1,626	948	1,646	959
Oak Creek	2,674	2,518	2,632	2,381	2,685	2,405
River Hills	403	50	398	47	406	47
St. Francis	780	305	770	287	786	290
Shorewood	1,480	303	1,466	284	1,495	288
South Milwaukee	250	414	1,841	406	250	414
Thiensville*	356	129	190	77	192	78
Wauwatosa	6,655	1,584	6,588	1,489	6,721	1,507
West Allis	6,153	1,829	6,093	1,720	6,216	1,739
West Milwaukee	1,064	893	1,504	846	1,075	855
Whitefish Bay	1,861	355	1,843	333	1,880	337

*Outside Milwaukee County

1. The assumptions used for this fiscal analysis are identified in Tables 5.36, 5.40 and 5.44

Source: MMSD

TABLE 3.22

1985-2005 AVERAGE ANNUAL HOUSEHOLD CHARGES AND PERCENTAGE OF AVERAGE INCOME

	Local			Regional			Mosaic		
Community	O&M	Cap.	%	O&M	Cap.	%	O&M	Cap.	%
Bayside	61	498	1.1	57	493	1.1	57	503	1.1
Brookfield*	61	138	0.5	57	131	0.5	57	131	0.5
Brown Deer	61	268	1.5	57	266	1.4	57	271	1.5
Butler*	61	41	0.4	57	39	0.4	57	39	0.4
Caddy Vista*	204	445	3.2	57	95	0.8	57	96	0.8
Cudahy	61	223	1.5	57	221	1.5	57	225	1.5
Elm Grove*	61	143	0.4	57	135	0.4	57	137	0.4
Fox Point	61	474	1.0	57	470	1.0	57	478	1.0
Franklin	61	297	1.5	57	294	1.5	57	299	1.5
Germantown*	59	114	0.7	57	94	0.6	57	95	0.6
Glendale	61	325	1.4	57	322	1.4	57	328	1.4
Greendale	61	342	1.6	57	339	1.5	57	345	1.5
Greenfield	61	266	1.3	57	264	1.2	57	269	1.3
Hales Corners	61	292	1.2	57	290	1.2	57	295	1.2
Menomonee Falls*	61	132	0.7	57	124	0.7	57	126	0.7
Mequon*	61	129	0.5	57	121	0.5	57	122	0.5
Milwaukee	61	173	1.5	57	172	1.4	57	175	1.5
Muskego*	79	169	1.0	57	104	0.7	57	105	0.7
New Berlin*	49	191	0.9	57	105	0.6	57	106	0.6
Oak Creek	61	251	1.4	57	249	1.3	57	253	1.3
River Hills	61	688	0.8	57	682	0.8	57	695	0.8
St. Francis	61	206	1.5	57	204	1.5	57	208	1.5
Shorewood	61	370	2.1	57	367	2.1	57	374	2.1
South Milwaukee	51	33	0.4	50	238	1.4	51	33	0.4
Thiensville*	78	215	1.0	57	115	0.6	57	116	0.6
Wauwatosa	61	303	1.5	57	300	1.5	57	306	1.5
West Allis	61	264	1.9	57	262	1.8	57	267	1.9
West Milwaukee	61	219	2.3	57	217	2.3	57	221	2.3
Whitefish Bay	61	390	1.3	57	386	1.3	57	393	1.3

*Outside Milwaukee County

1. The assumptions used for these fiscal analyses are identified in Tables 5.36, 5.40 and 5.44

would not include the City of South Milwaukee in the MMSD, the annual tax rate for the County (except South Milwaukee) would be higher than the Regional Alternative ($4.37 as opposed to $4.29 per $1,000 equalized property value). The higher property tax rate for Milwaukee County residents (compared to 4.33 for the Local Alternative) would be attributable to the cost of constructing local connecting sewers and I/I rehabilitation outside the County.

The least expensive alternative in terms of total cost to the MMSD (debt service) would be the Local Alternative. With this plan, the communities of Caddy Vista, Germantown, Muskego, New Berlin, Thiensville, and South Milwaukee would all maintain and upgrade their own treatment facilities. The average annual debt services for these six communities with each of the four alternatives are compared in Table 3.23.

TABLE 3-23

COSTS (IN THOUSANDS) TO LOCAL COMMUNITIES

Community	Local Alternative	Regional Alternative	Mosaic Alternative
Caddy Vista	166	36	36
Germantown	815	676	684
Muskego	933	576	583
New Berlin	2,958	1,626	1,646
South Milwaukee	250	1,841	250
Thiensville	356	190	192

The most costly system for these communities (except South Milwaukee) would be the Local Alternative. Comparison of the Local and Regional Alternatives reveals that it is less expensive for five of the six communities (all but South Milwaukee) to connect to the MMSD rather than to manage their own WWTPs.

3.14.6 Economic Impacts

Since the costs of the No Action Alternative cannot be fully accounted for, neither can its impacts on the Milwaukee area economy. However, a detailed analysis was performed to determine the effects of the action alternatives on Milwaukee's economy. This analysis suggested that the Local, Regional, and Mosaic Alternatives would have very similar economic impacts. If it is assumed that the tax money used to finance the MFP is money that would have been spent outside the Milwaukee area ("Least Case"), the project would increase gross output, earnings and employment. On the other hand, if it is assumed that the money used to finance the MFP

would have been spent in the region ("Worst Case"), gross output and employment would decline and the increase in earnings would be less. Table 3.24 shows the range of the net economic impacts of the Action Alternatives.

TABLE 3.24

RANGE OF NET ECONOMIC IMPACTS

	"Least Case"	"Worst Case"
Gross Output (x 10^3)	$ 2,578,133	$ - 981,306
Earnings (x 10^3)	840,042	36,313
Employment (Man-years)	31,390	- 17,100

These two scenarios are hypothetical. The actual impacts would fall within this range.

Different CSO abatement/peak flow attenuation alternatives would have varying impacts on the Milwaukee economy. However, it is assumed that an alternative that uses the local labor market would have a more positive impact on the local economy. In general, the construction of deep tunnels and cavern storage facilities would require sophisticated equipment that may not be available in the Milwaukee area. The Complete Sewer Separation Alternative would utilize more local labor than the partial or omplete torage lternatives. However, the rather intense disruption to CSSA businesses under Complete Sewer Separation could offset the positive impact of local employment.

3.14.7 Public Health

Each year, CSO and sanitary sewer bypasses allow more than 6.4 billion gallons of untreated sewage and stormwater to enter the Inner Harbor and the lower reaches of the Menomonee, Milwaukee, and Kinnickinnic Rivers. In addition, during wet weather, the treatment facilities in the planning area are overloaded, discharging partially treated effluent. These inputs can carry disease-producing organisms. With No Action, these inputs would continue. Any action alternative would eliminate these potential hazards to the public health.

3.14.8 Access and Traffic

All the action alternatives would require the rehabilitation, expansion, or construction of wastewater treatment facilities, and the construction of interceptors, connecting sewers, and facilities for the abatement of CSO and attenuation of peak

flows. With the Local Alternative, construction would take place at more WWTP sites. However, this construction should not greatly disrupt traffic.

Connector sewers would be open-cut. Usually, however, they would follow roads with average to wide right-of-ways or they would be constructed across rural land. Therefore, they would not substantially affect traffic or access. Most interceptors would be constructed by the tunnel method. As a result, their construction should not tear up many roads, but would be limited to access shafts and storage sites. Construction and supply vehicles would add to traffic congestion in the construction area.

The alternatives for the abatement of CSO and the attenuation of peak flows would disrupt Milwaukee's central business district to varying degrees. The Complete Sewer Separation Alternative would require the greatest amount of sewer construction (primarily open-cut) in the CSSA. With this alternative, 92% of the CSSA would be disrupted, including separation of plumbing within buildings. The Inline Storage Alternative would disrupt almost as much area, but would include no private property work. The Modified CST/Inline Storage Alternative would include partial sewer separation construction in 21% of the CSSA. The Modified Total Storage Alternative would have the least severe impacts on traffic and access. Only a few sites would require sewer construction.

The construction of storage facilities would require three to four years. In the vicinity of the construction sites, traffic would be increased by construction vehicles.

3.14.9 Energy Use

Any of the action alternatives would result in a reduction of between 27% and 37% from energy use with No Action Alternative. Total energy use for the alternatives is compared in Table 3.25.

TABLE 3.25

TOTAL ENERGY USE (IN BILLION BTU)

Alternative	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total
No Action	325.19	2249.56	6.0	76.97	249.83	2907.55
Local*	1,247.58	47.50	79.48	0.81	725.80	2141.03
Regional*	1,023.30	47.50	79.03	0.81	721.33	1871.98
Mosaic*	1,037.79	47.50	76.42	0.81	724.93	1890.45

*Assuming the Inline Storage Alternative

Energy use for CSO abatement/peak flow attenuation alternatives was also evaluated. The most energy intensive alternative would be the Modified Total Storage which would require 119 billion BTU each year. The Modified CST/Inline Storage would require 98 BTU/year, the Inline Storage would require 47 billion BTU/year, and Complete Sewer Separation 45 billion BTU/year.

3.14.10 Engineering Feasibility

The screening process described in this chapter used engineering feasibility as a criterion for evaluation. Alternatives that would include components that are considered infeasible were excluded from consideration. Thus, all aspects of the final alternatives employ sound engineering technology.

Some of the CSO components, primarily the deep tunnels and storage caverns, include innovative technology. Other cities, Chicago and Rochester for instance, are now in the process of constructing facilities using these components, although such systems are not currently in use.

CHAPTER 4

AFFECTED ENVIRONMENT

Chapter 4
AFFECTED ENVIRONMENT

4.0 INTRODUCTION

To evaluate the effects of final alternatives on the environments of the planning area, it is necessary to assess the present state of those environments. Thus, in this chapter, the human and natural environments of the planning area are described. The description begins with the natural environment including the subjects listed below.

- Waters of the Planning Area
- Aquatic Biota
- Threatened or Endangered Species
- Air Quality/Odors
- Geology
- Topography
- Soils
- Groundwater
- Floodplains
- Wetlands
- Wildlife Habitats

These discussions are followed by descriptions of the human or man-made environment. Included in this section are the topics listed below.

- Legal and Regulatory Environment
- Land Use
- Population
- Economy
- Municipal Revenues and Expenditures
- Sewerage System Costs
- Noise
- Odors
- Public Health
- Transportation, Traffic, and Access
- Archaeological and Historical Sites
- Recreation

These descriptions present those aspects of the environment of the planning area that could be affected by or that place limits on planning for the MFP. The discussion in Chapter 5, Environmental Consequences, builds on the information in this chapter.

4.1 NATURAL ENVIRONMENT

4.1.1 Waters of the Planning Area

The City of Milwaukee is situated on the shore of Lake

Michigan, at the confluence of three rivers: the Milwaukee, the Menomonee, and the Kinnickinnic. The Milwaukee Metropolitan Sewerage District (MMSD) planning area also includes Oak Creek and parts of the Root River to the south, and tributaries of the Fox River to the west. All the major lakes, streams, and creeks in the planning area are shown in Figure 4.1.

Lake Michigan, the fourth largest freshwater lake in the world, is 80 miles (135 km) wide at Milwaukee, and its length is 350 miles (560 km). The lake retains water for about 100 years before it flows out its natural outlet at the straits of Mackinac or the Chicago River.

Water consumption in the MMSD service area relies most heavily on water from Lake Michigan. All public water utilities within Milwaukee County use Lake Michigan as the source for water, with the exception of the City of Oak Creek Water and Sewer Utility which uses both Lake Michigan and groundwater wells (SEWRPC, Lake Michigan Estuary and Direct Drainage Area Subwatersheds Planning Program Prospectus, 1978). Average consumption for these utilities for 1977 has been estimated at approximately 282 million gallons per day (12.35 m^3/sec), with a served population of 1,147,000 persons (SEWRPC, 1978m). The daily per capita use is thus estimated at 246 gallons (931 liters) for these utilities. Private water utilities also provide water service and there are a number of industries which utilize their own wells for a supply of water.

The Milwaukee River upstream of the Inner Harbor is wide and shallow, with a watershed which extends well north of the planning area. Its tributaries within the planning area include Pigeon Creek in Thiensville, Indian Creek in Bayside, and Lincoln Creek in the City of Milwaukee. The Thiensville WWTP adds effluent to the Milwaukee River within the study area.

The Menomonee River is wholly contained in the planning area. The portion upstream of the Inner Harbor is shallow and extensively channelized. The river flows along the industrial Menomonee Valley in the City of Milwaukee. The principal tributaries of the river are Underwood Creek in the City of Wauwatosa and the Town of Brookfield, Honey Creek in the City of West Allis, and the Little Menomonee River in the City of Milwaukee.

The Kinnickinnic River is very small upstream of the Inner Harbor. The stream bed is completely channelized. Combined sewer overflows (CSOs) occur at several points along the river. Oak Creek flows through the Cities of Oak Creek and South Milwaukee. Its principal tributary is the North

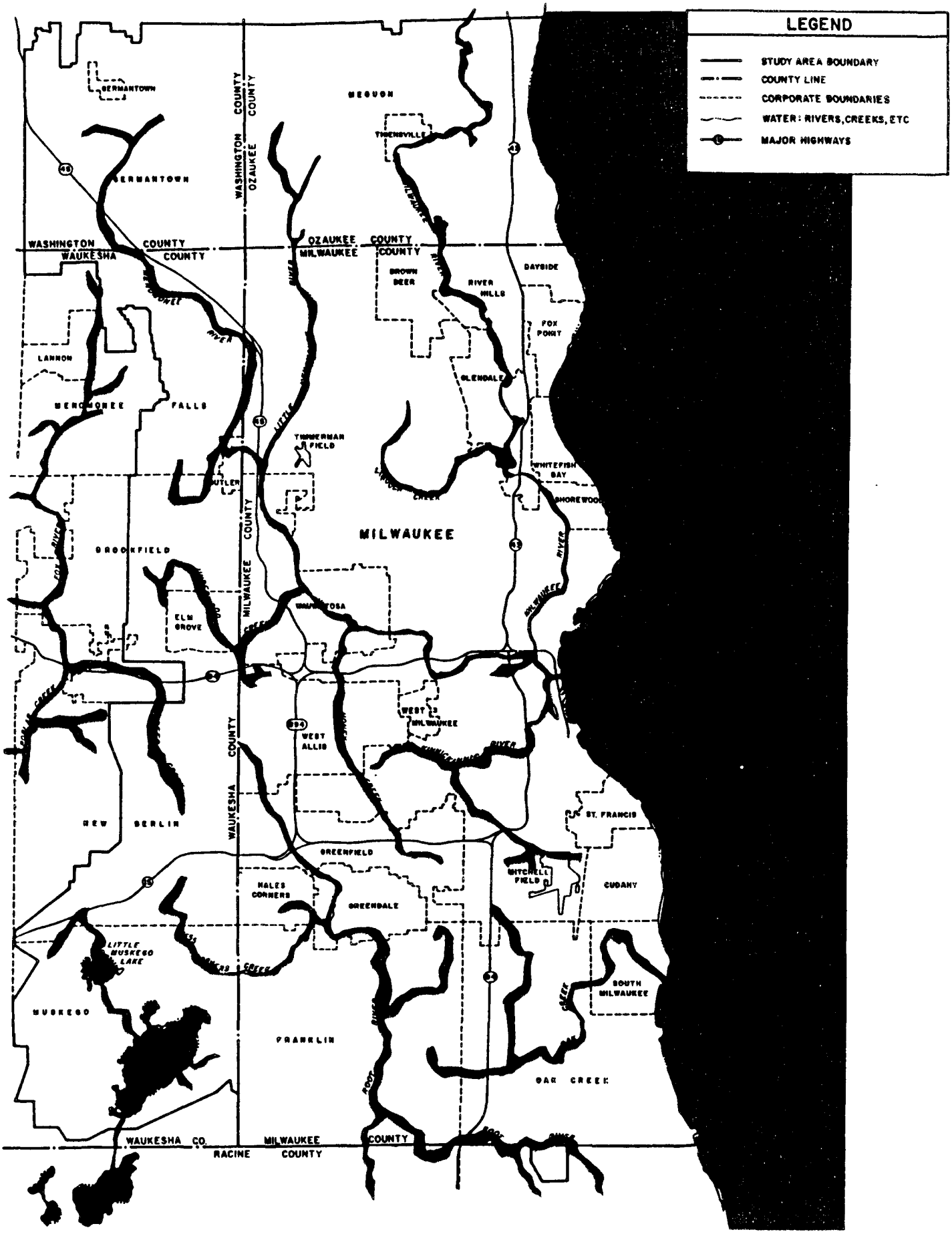


FIGURE 4-1

DATE APRIL 1981

LAKES AND STREAMS IN THE PLANNING AREA

SOURCE MMSD

PREPARED BY

EcolSciences ENVIRONMENTAL GROUP

Branch of Oak Creek. Both streams are very small with tree-lined, natural channels for most of their length. The Root River has its source in Milwaukee County, and flows south to Racine County.

The Fox River and its tributaries are in a different drainage basin than the other watersheds in the planning area. All of the other rivers flow to Lake Michigan, but the Fox River flows south to the Illinois River and ultimately to the Mississippi River. Deer Creek is a small, intermittent tributary to Poplar Creek which flows into the Fox River. Big Muskego Lake is located in southern Waukesha County. It has a volume of 275 million cubic feet (7,788,000 m^3).

4.1.1.1 Water Quality Parameters

The chemical and physical properties of a lake or stream influence the types of aquatic plants and animals that can exist in the water and the uses to which it can be put.

There is no one index of water quality; instead, many factors affect the quality of water for particular uses. The Wisconsin Department of Natural Resources (DNR) has set standards for several parameters to meet designated goals for the maintenance of waters for fish and human uses (shown in Table 4.1). The water quality classifications of streams and lakes in the planning area are shown in Table 4.2. Existing water quality conditions are compared to DNR standards in Figure 4.2.

Some water quality parameters are characteristic of both natural and polluted waters. These parameters are dissolved oxygen, suspended solids, and nutrients. Other parameters are measures of human pollution. These parameters include ammonia, toxic substances, pathogens, and other nonpoint and point source pollutants.

4.1.1.1.1 Dissolved Oxygen: The concentration of dissolved oxygen in water is a measure of its quality. While air is 20% oxygen, well-aerated water is only about 0.001% oxygen. Fish, other aquatic animals, and aquatic plants all require oxygen. Most fish need at least 5 milligrams of oxygen per liter (mg/l) of water (0.0005%), but some require 6 or 7 mg/l. These levels can be maintained in lakes and streams that are low in organic matter and in plant nutrients and have good natural reaeration by wind action or rapids. Microorganisms that feed on organic matter in the streams consume oxygen. If there is a large amount of organic matter in the stream from the leaves of overhanging trees, a large amount of dead aquatic plants, or discharges of inadequately-treated sewage, the oxygen level may be lowered.

TABLE 4.1

WISCONSIN DNR WATER QUALITY STANDARDS

	Lake Michigan	Fish and Aquatic Life Recreational Use	Intermediate Aquatic Life	Marginal Surface Waters	Variance (a)	Variance (b)
Dissolved Oxygen	6 mg/l min., 7 mg/l min. (fall)	5 mg/l min.	3 mg/l min.	1 mg/l min.	2 mg/l min.	2 mg/l min.
pH	between 6 and 9	between 6 and 9	between 6 and 9	between 6 and 9	between 6 and 9	between 6 and 9
Temperature	Natural	89°F max.	--	--	89°F max.	89°F max.
Dissolved Solids	500 mg/l max.	--	--	--	--	--
Chlorine	0.002 mg/l max.	0.01 mg/l max.	0.5 mg/l max.	0.5 mg/l max.	0.5 mg/l max.	0.5 mg/l max.
Total Ammonia	--	--	3 mg/l max. (summer) 6 mg/l max. (winter)	--	--	--
Un-ionized Ammonia-N	0.02 mg/l max.	0.04 mg/l max.	--	--	0.05 mg/l max.	0.05 mg/l max.
Fecal Coliforms:						
Geometric Mean	200/100 ml max.	200/100 ml max.	200/100 ml max.	200/100 ml max.	1000/100 ml max.	1000/100 ml max.
90% of Samples	400/100 ml max.	400/100 ml max.	400/100 ml max.	400/100 ml max.	2000/100 ml max.	

Source: Wisconsin Administrative Code, NR 102 and NR 104.

TABLE 4.2

DNR WATER QUALITY CLASSIFICATIONS OF AFFECTED
MILWAUKEE AREA LAKES AND STREAMS

Affected Stream or Lake	Location	Classification
1. Milwaukee River	Thiensville WWTP	Recreational Use, warmwater fish and aquati life
2. Milwaukee River	CSO Area, North of North Avenue	Recreational Use, warmwater fish and aquati life
3. Milwaukee River	CSO Area, South of North Avenue	Variance (b)
4. Menomonee River	Germantown WWTP	Recreational Use, warmwater fish and aquati life
5. Menomonee River	CSO Area	Variance (a)
6. Menomonee River	CSO Area	Variance (a)
7. Deer Creek	New Berlin: Regal Manors WWTP	Marginal Surface Waters
8. Deer Creek	New Berlin: Southeast WWTP	Marginal Surface Waters
9. Tess Corners Creek	New Berlin: Southeast	Intermediate Aquatic Life
10. Tess Corners Creek	Muskego: Northeast WWTP	Intermediate Aquatic Life
11. Big Muskego Lake	Muskego: Northwest WWTP	Recreational Use, warmwater fish and aquati life
12. Root River	Caddy Vista WWTP	Recreational Use, warmwater fish and aquati life
13. Oak Creek: North Branch	Oak Creek Interceptor	Recreational Use, warmwater fish and aquati life
14. Outer Harbor	Jones Island WWTP	Recreational Use, warmwater fish and aquati life
15. Lake Michigan	South Shore WWTP	Recreational Use, coldwater fish and aquati life

Source: Department of Natural Resources and the Wisconsin Administrative Code, NR104

[a]See Table 4.1, Variance (a)

[b]See Table 4.1, Variance (b)

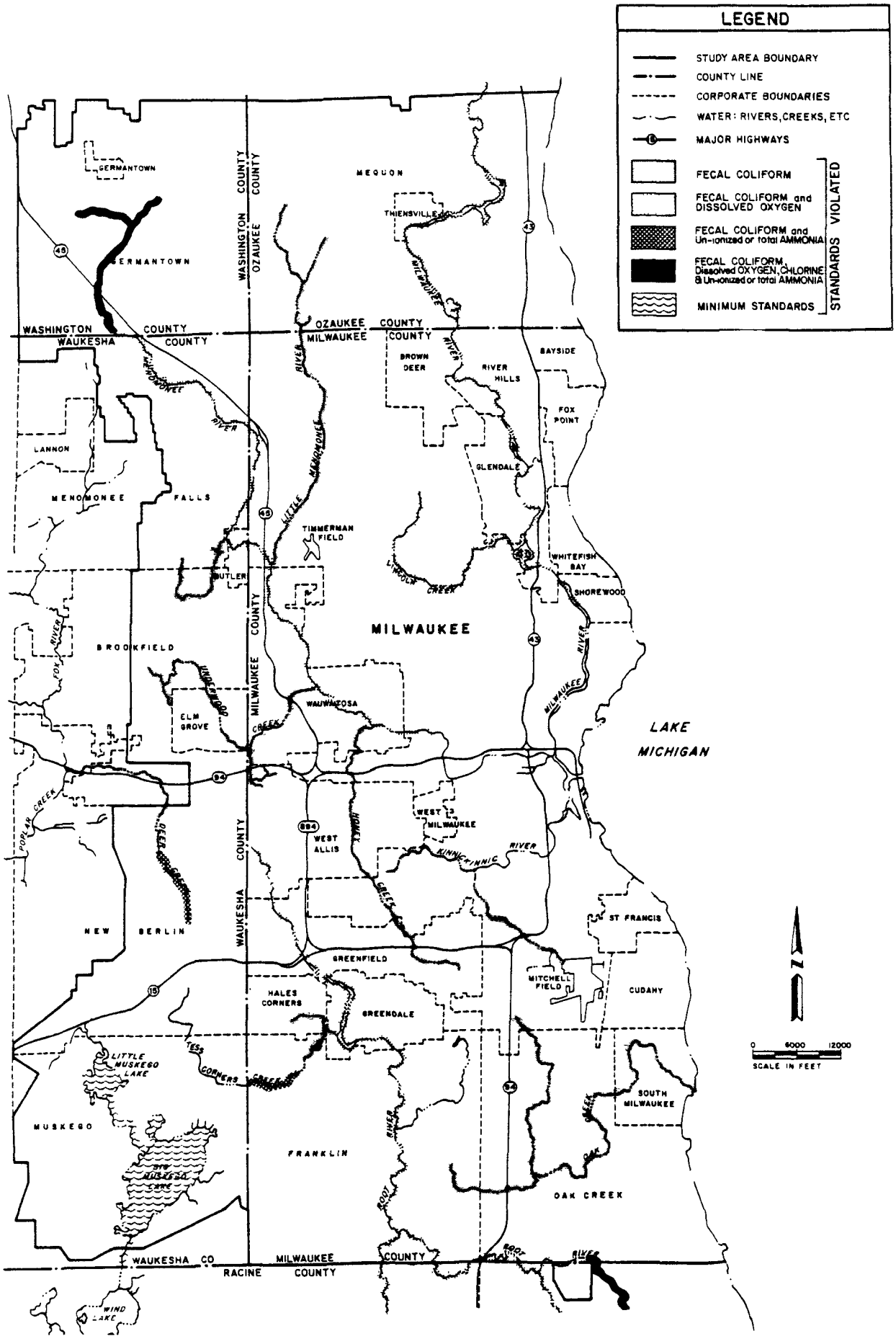


FIGURE 4-2

DATE APRIL 1981

EXISTING CONDITIONS OF WATERS IN THE PLANNING AREA

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

There are complex cycles of oxygen levels in natural waters which vary daily and seasonally. Aquatic plants play a major role in these cycles both as producers and consumers of oxygen. Temperature, the quantity of organic matter, and the degree of mixing within the body of water also contribute to the cyclical variations of dissolved oxygen.

During the day, plants produce oxygen through photosynthesis. At night photosynthesis does not occur, so plant and animal respiration and the decomposition of organic matter (especially the large quantities introduced by sewage discharges) can sharply decrease oxygen levels.

Oxygen levels also vary seasonally, declining in the winter when ice cover reduces water circulation and the light for photosynthesis. This decrease is most evident in lakes and slow-moving streams.

If oxygen levels are severely depleted in a body of water, many forms of aquatic life cannot survive. Organisms requiring dissolved oxygen are replaced by those which do not require oxygen (anaerobic forms). Anaerobic microorganisms generate foul odors and some types produce toxic substances (such as hydrogen sulfide and ammonia) that make water unsuitable for other organisms and human use.

The standard measure of oxygen consumption is biochemical oxygen demand (BOD). BOD is a laboratory measurement which is not directly applicable to natural conditions, but does serve as an indicator of the level of oxygen-demanding organic matter in a watercourse.

4.1.1.1.2 Suspended Solids: Suspended solids are particles of undissolved substances in lakes and streams. They reduce the transparency of the water which affects plant and animal life. Excessive suspended solids settle, covering valuable bottom habitats. Suspended solids and sediment reduce the water storage capacity of harbors, reservoirs, and lakes, and can interfere with feeding and spawning habitats and the respiratory organs of fish and other aquatic life. The decomposition of organic solids requires oxygen, and may lower oxygen levels in a stream or lake, potentially causing fish kills and foul odors. Suspended solids may also transport pathogens and other forms of pollution, such as nutrients, pesticides, or heavy metals.

4.1.1.1.3 Plant Nutrients: Phosphorus and nitrogen, substances naturally present in water and concentrated in sewage and effluent, act together to sustain plant growth. Normally, nitrogen is present in Wisconsin waters in excess of plant requirements. Thus, where adequate light is available, plant growth is limited by the supply of phosphorus in the water.

Excessive nutrients produce algae blooms. Algae affect the oxygen levels of a watercourse, and can interfere with swimming and boating. A lake with a high concentration of nutrients experiencing nuisance growths of weeds and algae is called eutrophic; a lake with a low concentration of nutrients is called oligotrophic. All lakes gradually accumulate phosphorus and other plant nutrients, but the process of eutrophication may be greatly accelerated by the addition of large amounts of phosphorus from fertilizers (agricultural runoff), urban runoff or sewage effluent.

4.1.1.2 Human Influences

4.1.1.2.1 Wastewater Treatment and Modifications: Discharges of effluent from wastewater treatment plants and bypasses of untreated sewage affect stream flow, can reduce levels of dissolved oxygen, and can introduce suspended solids, phosphorus, nitrogen, various toxic substances, and pathogenic organisms into a river. Stream flow is the amount of water in the stream. Effluent discharges to small, intermittently-flowing streams can greatly increase total flow. If the sewage is inadequately treated, the stream's water quality can be greatly impaired. However, if the wastewater is treated so that its chemical composition resembles that of the receiving stream, the effluent enlarges the stream and allows the existence of aquatic organisms that require permanently-flowing water.

Lake Michigan receives effluent discharges from six wastewater treatment plants (WWTPs) in the MMSD planning area: the Jones Island, South Shore, and South Milwaukee public WWTPs; and private facilities at the School Sisters of Notre Dame and Chalet-on-the-Lake Restaurant in the City of Mequon, and Wisconsin Electric Power Company (WEPCO) in the City of Oak Creek. A flow reversal of the Chicago River removes a maximum of 3200 cfs from Lake Michigan. The river ultimately discharges this water to the Mississippi River.

Six additional public treatment facilities discharge effluent to the waters of the MMSD study area, as shown below.

WWTP	Discharge Location
Thiensville	Milwaukee River
Germantown	Menomonee River
Muskego Northeast	Tess Corners Creek (a tributary of Root River)
Caddy Vista	Root River
New Berlin-Regal Manors	Deer Creek
Muskego Northwest	Big Muskego Lake

A portion of Lake Michigan near the City of Milwaukee has been partitioned off by a breakwater to form the Outer Harbor. The Outer Harbor receives waters from the Milwaukee, Menomonee, and Kinnickinnic Rivers and effluent from the Jones Island WWTP. It has four openings where its water exchanges with water from the main body of Lake Michigan. Water flows out of the Harbor at the rate of 730 cubic feet per second (21 m^3/sec), and wind driven currents bring a small amount of lake water into the Harbor. The Outer Harbor functions as a lake, with a volume of 1.2 billion cubic feet (33.8 x 10^6 m^3) and a water residence time of about 6 days. A flow reversal of the Chicago River removes a maximum of 3200 cfs (91 m^3/sec) from Lake Michigan, and ultimately discharges this water to the Mississippi River.

The Inner Harbor is the artificially deepened and channelized sections of the Milwaukee, Menomonee, and Kinnickinnic Rivers. Its waters are slow flowing; the Milwaukee River section has an average velocity of about six inches per second (0.15 m/sec) and the flow of the other portions is almost nil. Many of the MMSD combined sewers overflow directly to the Inner Harbor.

4.1.1.3 Pollutants from Human Activity

4.1.1.3.1 Ammonia: Ammonia is a form of nitrogen present in sewage effluent. When ammonia enters a lake or stream, some of it changes chemically (ionizes) and becomes harmless, but the remainder stays un-ionized. Un-ionized ammonia has a distinct, pungent odor, and is toxic to fish. The percentage of ammonia that remains un-ionized varies with the acidity and temperature of the water; the colder and more acid the water, the less the un-ionized percentage. Eventually, all ammonia entering a body of water becomes oxidized to a far less toxic form (nitrate). The amount of nitrogen in the ammonia form that is present in water is referred to as "ammonia-nitrogen."

4.1.1.3.2 Toxic Substances: Wastewater can contain a number of other toxic substances from industrial, commercial, residential, and transportation activities. These substances include cadmium, lead, zinc, chromium, copper, pesticides, and polychlorinated biphenyls (PCBs). Chlorine, another toxic substance, is used by sewage treatment facilities for disinfection of effluent. Although chlorine is toxic to aquatic animals even in small quantities, the chemical oxidizes very quickly to chloride which is not toxic. Also, chlorine can react with ammonia during the disinfection of WWTP final effluent to form chloramines. Chloramines are as toxic as chlorine but longer lasting in the environment. Both chlorine and chloramines are reported as total residual

chlorine in a WWTP effluent. Chlorine is primarily a problem near effluent outfalls. Other toxic substances in sewage efffluent accumulate in sediment, where they are available for ingestion by bottom-feeding organisms, posing the potential for bioaccumulation. Further, the substances may be resuspended in the water.

4.1.1.3.3 Pathogens: Pathogens are microorganisms in sewage that can cause disease in animals and humans. Examples are the typhoid bacterium, the polio virus, and intestinal parasites. Disinfection of wastewater reduces the number of pathogens, but does not eliminate them altogether. The fecal coliform bacterium (Escherichia coli) is a harmless bacterium that exists in human and animal wastes. Since this bacterium is easily detectable, it is used as an indicator of the possible presence of pathogens. The abundance of fecal coliforms in a stream or lake may indicate the presence of inadequately-treated sewage and possibly pathogenic organisms.

4.1.1.3.4 Nonpoint Source Pollution: Nonpoint sources of water pollution include storm water runoff from urban and rural land, atmospheric deposition, construction activities, and malfunctioning septic systems. SEWRPC Technical Report No. 21, Sources of Water Pollution in Southeastern Wisconsin: 1975 identified sources of nonpoint pollution. In the Menomonee River and Milwaukee River watersheds, nonpoint sources were estimated to contribute at least two-thirds of the total annual loads of all analyzed pollutants except fecal coliform. In the Kinnickinnic River watershed, nonpoint sources contributed most of the sediment and total nitrogen, and about one-third of the biochemical oxygen demand and total phosphorus loads. Combined sewer overflows and sewage flow relief devices were found to be major contributors of fecal coliform in all three watersheds.

4.1.1.4 Water Quality in the Planning Area

In the following discussion, the conditions of all streams and lakes that could be affected by the MFP are described generally. Also, the degree to which state standards for water quality are met is indicated. Additional details on water quality may be found in Appendix VII, Water Quality, and in Appendix V, Combined Sewer Overflow.

4.1.1.4.1 Milwaukee River: Near the location of the Thiensville WWTP, the Milwaukee River is low in suspended solids (16 mg/l during low flow conditions) and high in dissolved oxygen (normally near saturation). DNR has classified the river for recreational use and as a habitat for warm-water fish and aquatic life. As set forth in Figure

4.2, existing state standards for fecal coliform and dissolved oxygen are occasionally violated.

Upstream of the Thiensville WWTP, the river is affected by WWTP discharges and nonpoint source pollution from erosion and runoff. Downstream from the WWTP, the river is increasingly affected by sewer system bypasses and combined sewer overflows. Table 3-7 of Appendix V, Combined Sewer Overflow, notes that streams affected by sewer overflows and bypasses have concentrations of biochemical oxygen demand which average 40% to 50% higher than upstream concentrations. The average fecal coliform level in the Inner Harbor is 35 times the standard. Twenty-three bypass points from the Metropolitan Intercepting Sewers (MIS) and seventy bypass points from local collector sewers contribute raw sewage to the river. Each year, 62 combined sewer overflow points on the Milwaukee River from the Village of Shorewood to the river's mouth also add an average of 2 billion gallons (7.6 million m^3) of storm water and sewage.

These inputs of raw sewage temporarily increase turbidity and lower the concentration of dissolved oxygen as organic matter decomposes. They blanket the river bottom with sediment which consumes oxygen and generates foul-smelling gases, such as ammonia or hydrogen sulfide. In addition, the sewage contains plant nutrients, such as phosphorus, which allow algae to grow in nuisance proportions in the slower reaches of the river and the Inner Harbor. Any pathogens in the sewage present a public health hazard.

4.1.1.4.2 Menomonee River: At Germantown, the Menomonee River is a very small creek. An artificial pond was created at the Germantown WWTP to assure permanent downstream flow. The dissolved oxygen content of the stream is generally near the saturation point. However, the pond may exhibit large daily fluctuations in dissolved oxygen levels due to high levels of algae. Suspended solids concentrations are 25 mg/l on the average, but drop to 10 mg/l during low flow. Phosphorus concentrations are relatively high (1 mg/l).

The Menomonee River flows through the most industrialized section of Milwaukee. Pollution sources to the Menomonee River include industrial wastewater discharges and storm water runoff. In addition, nonpoint sources from areas upstream of the CSSA contribute to the river's pollution.

There are 13 MIS bypass points, 90 bypass points from local collector sewers, and 26 combined sewer overflow points on the Menomonee River and its tributaries. The bypasses are small compared to combined sewer overflows which total 2 billion gallons (7.6 million m^3) a year on about 50 days of

storms. Since the Menomonee River has about 20% of the flow of the Milwaukee River, the effects of each gallon of untreated sewage are greater. Oxygen levels decline, organic sediments accumulate on the river bottom, algal growth is stimulated, and fecal coliform counts increase. Occasionally, during CSO events, the stream violates the State standards for dissolved oxygen and fecal coliform.

4.1.1.4.3 Kinnickinnic River: No sewage treatment facilities discharge effluent to the Kinnickinnic River, but there are six MIS bypasses, and about 15 bypasses points from local collector sewers and combined sewer overflow outfalls. CSO is the largest source of pollution to the river, adding about one billion gallons (3.77 million m^3) of combined sewage each year. The effects of these inputs are great since there is so little flow in the river. The Kinnickinnic River occasionally violates State water quality standards for dissolved oxygen and fecal coliforms, especially in its Inner Harbor portion. Stormwater runoff from the river's highly urbanized watershed is also a substantial contributor to the river's pollution.

4.1.1.4.4 Oak Creek: The North Branch of Oak Creek has not been adequately surveyed for water quality. However, the indications are that, due to its small size and the predominantly rural land use surrounding it, the creek is turbid, rich in phosphorus and nitrogen, and sufficiently high in dissolved oxygen. It receives bypasses of raw sewage about five times a year from a pump station near the creek's northern end. These bypasses may temporarily lower dissolved oxygen levels, raise suspended solids, phosphorus, and nitrogen concentrations, and greatly increase fecal coliform levels.

4.1.1.4.5 Root River: The Root River's tributary in the City of Muskego, Tess Corners Creek, is intermittent upstream of the Muskego Northeast WWTP and permanent downstream. The creek has low levels of suspended solids (about 6 mg/l), moderate levels of phosphorus (0.5 mg/l), and moderate levels of dissolved oxygen (6 mg/l). Much of the phosphorus comes from the treatment plant.

The Hales Corners WWTP, which presently discharges to the tributary of the Root River in the Village of Hales Corners, will cease to operate in 1981 when the Hales Corners Interceptor is completed. The abandonment of the WWTP will reduce phosphorus, nitrogen, and suspended solids loadings to the upper Root River.

When the Root River crosses the Milwaukee-Racine County line at Caddy Vista, it is slow flowing and turbid with fluc-

tuating levels of dissolved oxygen (average 8 mg/l, fluctuations regularly occur between 5 and 10 mg/l). The Caddy Vista WWTP is an insignificant contributor to the Root River in terms of flow, but the reportedly frequent overloads and bypasses at the plant may affect the turbidity and the levels of oxygen, phosphorus, nitrogen, and fecal coliform in the portion of the river near the WWTP.

There are approximately 15 local collector bypass points on the Root River and its tributaries. Although there is no information on the extent of bypass pollution, it is probably small relative to the runoff pollution from new subdivisions and agricultural land in the watershed. These nonpoint sources add substantial amounts of silt, organic matter, phosphorus, and nitrogen to the river.

4.1.1.4.6 Big Muskego Lake: Located in the Fox River Basin, Big Muskego Lake is large in area (2,177 acres, 881 ha) but shallow in depth (average 2.5 feet, 0.76 m; maximum 4 feet, 1.22 m), and it is fringed by cattail marsh. The waters of the lake contain concentrations of phosphorus and ammonia-nitrogen which average about 0.1 mg/l and 0.04 mg/l, respectively. In addition, the sediments are rich in nutrients and organic matter. Whenever sediments are stirred up by wind, fish, or boats, they increase the levels of these materials in the water.

The lake receives large quantities of silt, nutrients, and organic matter from the Muskego Northwest WWTP and from agricultural runoff, and it is considered a eutrophic lake. The residence time (the time it would take for the full volume of the lake to be replaced by inflowing waters) is five months. The major inflow to Big Muskego Lake is Muskego Creek, which is the outflow from Little Muskego Lake, located just upstream.

Big Muskego Lake is well oxygenated in the warmer months at all depths since it is very shallow and well mixed by winds, with plants adding oxygen to the water. In the winter, when the lake is ice-covered, decaying organic matter and sediment oxygen demand may consume all the dissolved oxygen. A lack of oxygen may be the cause of fish kills that have been occurring during winter.

4.1.1.4.7 Deer Creek: Deer Creek, a small tributary of the Fox River, flows intermittently upstream of the New Berlin Regal Manors WWTP discharge point. The creek has low levels of suspended solids (averaging 17 mg/l) except during wet weather when runoff from the adjacent agricultural and residential land probably substantially increases the solids concentration. Due to effluent discharges, the phosphorus

and ammonia levels are probably high (5 mg/l and 8 mg/l, respectively), and there are high concentrations of residual chlorine.

4.1.1.4.8 Lake Michigan: Lake Michigan is currently classified as an oligotrophic, or relatively clean, nutrient-poor lake (International Joint Commission, 1980). However, some studies have indicated that Lake Michigan is slowly deteriorating. This trend is evidenced by the appearance of certain species of phytoplankton indicative of moderately polluted lakes (Great Lakes National Program, 1978). Chloride concentrations have been increasing at an accelerating rate. DDT and PCBs have contaminated some fish populations. Near-shore areas, including the Milwaukee area, exhibit more nutrient enrichment than the open waters of the Lake. Nevertheless, the overall quality of Lake Michigan is very good and a thorough circulation system prevents the accumulation of excessive levels of pollutants in most areas.

Because of its size and extensive currents, Lake Michigan is able to dilute the effluent directly discharged to it by the South Shore, School Sisters of Notre Dame Academy, Chalet-on-the-Lake Restaurant, and Wisconsin Electric Power Company sewage treatment plants. However, the size of the lake gives it a water retention time of 100 years, so additions of pollution to the lake are essentially cumulative.

The Outer Harbor illustrates the effects of eutrophication. A breakwater separates the harbor from the main body of Lake Michigan, and water remains in the harbor six days before moving to the lake. The Menomonee, Milwaukee, and Kinnickinnic Rivers empty into the harbor, which also receives effluent from the Jones Island WWTP and discharges from two CSO outfalls. Water exchange with Lake Michigan also occurs. These inflows carry solids, organic matter, phosphorus, ammonia, heavy metals, and chlorine into the Outer Harbor. Some pollutants undergo degradation in the Outer Harbor and most particulate pollutants are deposited into the bottom sediments. The Outer Harbor has ten to one hundred times the concentrations of some pollutants as Lake Michigan.

The water in the harbor is more turbid and contains less oxygen than lake water (although dissolved oxygen levels remain high). The Outer Harbor has greater algal growth and over the years a thick layer of sediment, rich in toxic substances and nutrients, has accumulated on the bottom. These sediments frustrate attempts to improve the water quality of the harbor. Removing inputs of phosphorus, for example, might not lower the ambient phosphorus concentration in the water because sediment decomposition and resuspension could keep levels high.

Approximately 10% of all the phosphorus added directly to Lake Michigan from municipal WWTPs located on its shoreline comes from the Jones Island and South Shore facilities. They are the sources of 3% of total phosphorus inputs (including runoff) to the Lake Michigan basin waterways (IJC, 1978). In addition, the phosphorus contributed by the WWTPs is more readily usable by algae than many of the other phosphorus inputs (IJC, 1978).

The WWTPs also have the localized effect of enriching the waters near WWTP outfalls. Elevated levels of suspended solids, phosphorus, ammonia, chlorine, dissolved solids, and temperature are found within 1000 feet (300 m) of the Jones Island and South Shore outfalls and within 100 feet (30 m) of the outfalls of the School Sisters of Notre Dame, the Chalet-on-the-Lake Restaurant, and WEPCO sewage treatment plants. In general, the waters of Lake Michigan (except in the Outer Harbor) consistently meet the criteria set by the State of Wisconsin.

4.1.2 Aquatic Biota

One goal of maintaining high water quality is to allow the native plants and animals to exist in area waters. To support fish populations, it is important to maintain a diverse community of aquatic insects, crustaceans, worms, and zooplankton. Different species require different habitat and water quality. Generally, a diverse biological community requires good water quality. Most game fish species require dissolved oxygen in excess of 5 mg/l, a low suspended solids content, and an absence of toxic substances. Some fish have more specialized requirements: a large, shallow, gravelly river for spawning; a large, deep, well oxygenated lake for over-wintering; or a special food source. Poor water quality may create an environment in which nuisance algae predominate.

Algae float in water or attach to surfaces in shallow water. Their growth is stimulated by sunlight, warm temperatures, and the availablity of nutrients. When the conditions are conducive, algal blooms or mats occur, creating a nuisance to boaters and swimmers as well as an eyesore.

Information on the aquatic flora and fauna that may be affected by the project are from Becker (1976), DNR (unpublished manuscript), MMSD (1979), and Mozley and Howmiller (1977).

4.1.2.1 Milwaukee River

The invertebrate community found in the Milwaukee River within the MMSD planning area varies. In the upper reaches,

pollution-tolerant species including some mayfly and caddisfly larvae can be found. Near the mouth of the river, there are only highly tolerant species, such as sludge worms. Although the majority of fish in the river are pollution-tolerant species like the common shiner, sand shiner, and white sucker, game fish do inhabit the upper reaches of the river.

The Milwaukee River, at Thiensville, has been reported to support many game fish species including rock bass, green sunfish, pumpkinseed, bluegill, smallmouth bass, largemouth bass, and yellow perch. Rare species, like the shorthead redhorse, the striped shiner, and the longear sunfish, have also been found in the river. The fish benefit from the river's large size, low suspended solids load, gravelly to sandy bottom, and abundant invertebrate food supply. Nuisance algae are not commonly found at Thiensville.

Downstream in the combined sewer overflow area, the level of dissolved oxygen is often too low and the concentration of suspended solids too high for many of these fish to survive. In these reaches, goldfish, carp, and suckers are the dominant fish species. The high turbidity limits light penetration and algal growth, although there is a large amount of algae in the lower Milwaukee River.

4.1.2.2 Menomonee River

The Menomonee River at Germantown supports warm-water forage fish like white sucker, carp, minnows, and catfish. The aquatic biota of the Menomonee River varies. In the cleaner, upper reaches, pollution-intolerant species of algae and benthic organisms dominate. The impoundment and the slower, downstream reaches of the river are laden with nuisance algae in the summer and fall.

The portion of the river that receives combined sewer overflows is, like the Milwaukee River, low in dissolved oxygen and high in suspended solids and nutrients. Only non-sport fish live there, and algal growths are numerous, limited only by the availability of light.

4.1.2.3 Kinnickinnic River

The water quality of the portion of the Kinnickinnic River affected by CSO limits the types of fauna that exist there. A survey carried out by the DNR (1979) found no fish at all in the river near 6th Street. Algae are abundant in the Inner Harbor portion of the river.

4.1.2.4 Root River Watershed

The benthic community in the upper reaches of the main stream

and tributaries is reported to be typical of good water quality conditions, although fair to poor conditions are reported in the lower reaches.

Tess Corners Creek has been reported to have game fish (bluegill and bass) and forage fish (white sucker). It has a low load of suspended solids and a high dissolved oxygen content. The shaded areas over much of its length help to eliminate extensive growths of nuisance algae, except where openings in the tree canopy occur. Whitnall Park Pond is covered by algal mats in the summer.

The Root River, at the Caddy Vista subdivision, contains pumpkinseed, largemouth bass, white and black crappie, yellow perch, and possibly other species of fish. The river is small, and the populations are not large. Nuisance algae and marsh (emergent) plants are present.

4.1.2.5 Oak Creek

The benthic fauna of Oak Creek consists of pollution-tolerant organisms. Fish populations also tend to be species tolerant of pollution such as fathead minnows, brook stickleback, white sucker, and sunfish. Lake Michigan species such as alewife, smelt, trout, and salmon have been reported from the lower reaches of the Oak Creek and hatchery salmon have been released in the creek.

The MMSD surveyed the North Branch of Oak Creek in 1979, but no fish were found. Nuisance algae are common in the channelized portions of the creek.

4.1.2.6 Deer Creek

The fauna of Deer Creek in the City of New Berlin have not been surveyed, but due to the intermittent nature of this stream, it is reasonable to assume that very few fish live there. The creek is filled with cattails.

4.1.2.7 Big Muskego Lake

Big Muskego Lake has populations of bluegill, bass, crappie, pumpkinseed, and catfish; it also receives northern pike and walleye from the stocking program at Little Muskego Lake (DNR 1971; DNR 1969). Because of its shallowness and the organic sediments, fish that remain in the main part of Big Muskego Lake over the winter are subject to low oxygen concentrations, high ammonia and sulfate levels, and possibly complete freezing. The fish that overwinter in Bass Bay (a deep, connected kettle basin to the northwest) have a greater chance of survival over the winter, but fish kills occur in both Bass Bay and Big Muskego Lake.

The lake is fringed with cattail marsh, and there are islands of cattails throughout the lake. Almost all of the lake is shallow enough to permit the growth of aquatic plants like water lilies. Algal mats are commonly found near the shores.

4.1.2.8 Lake Michigan

Nearshore Lake Michigan biota differ from the biota in the open lake. Phytoplankton are similar to those found in eutrophic inland lakes. The zooplankton and benthic organisms in the near shore area are also typical of enriched conditions. Some species of cladocera (water fleas) and copepods reported in the Outer Harbor are characteristic of eutrophic inland waters and typical of the mouths of rivers. Also found in the nearshore portions of Lake Michigan and the Harbor are benthic animals like Asellus, asonbug, and some species of scuds (Gammarys and Hyallela) which are tolerant of low oxygen and higher temperatures. Pollution tolerant caddisflies and mayflies as well as fingernail clams are also found in the area. Sludge worms comprise a majority of the macro-invertebrates in the Harbor.

The Outer Harbor, in the vicinity of the Jones Island WWTP, is heavily silted, enriched in plant nutrients, and laden with toxic substances. Many Lake Michigan fish enter the harbor area, including the brown trout, coho salmon, and alewife. Fishing from the breakwater is a common practice.

Attached algae are prolific on shallow surfaces in the Outer Harbor as a consequence of elevated levels of phosphorus and nitrogen in the water (Lin, 1971).

At the South Shore plant, there is no breakwater and mixing with lake water is thorough. The outfall is 1800 feet (549 m) from the northeast edge of the plant site and it is part of the habitat for trout, salmon, whitefish, cisco, and other fish.

If deposition of organic sediment occurred near the outfall, it could result in increased densities of deposit feeders, which in turn may result in increased densities of fish that eat deposit feeders. These fish are eaten by predaceous fish like salmon. At each step in this food chain, persistent toxic substances like PCBs and pesticides are concentrated and stored. Fish caught in Lake Michigan and sold commercially are regulated by the U.S. Food and Drug Administration when sold for interstate commerce, and by the Wisconsin Division of Health when sold for intrastate commerce. The PCB limit for commercially sold fish allowed under both regulations is 5 parts per million.

Wisconsin Natural Resources, (1979) reports;

> "The Wisconsin Division of Health has advised that fish consumers avoid eating more than one meal or ½ pound per week of the fish listed below; and, that lactating mothers, expectant mothers, and any females who anticipate bearing children, not eat any of these fish. The Division of Health also recommends that children ages 6 and under not eat these fish:
>
> Carp from Green Bay and Lake Michigan.
>
> Trout and salmon over 20 inches long from Green Bay and Lake Michigan.
>
> All species from the lower Fox River downstream from Lake Winnebago to Green Bay, except perch and northern pike in Little Lake Butte Des Morts.
>
> Bullheads and whitefish in Southern Green Bay south of a line from Pensaukee to Little Sturgeon.
>
> Catfish, carp and white bass in the Mississippi River from Prescott to and including Lake Pepin.
>
> All species in the Fox River from Portage north to, but not including, Buffalo Lake."

A biological sediment survey at the Oak Creek Power Plant site, located a few miles south of the South Shore WWTP outfall, indicated the presence of amphipods, isopods, oligochaetes, chironomids midge larvae, snails, and mayfly nymphs (WEPCO, 1974). These organisms are commonly found along much of the shore of Lake Michigan.

4.1.3 Threatened or Endangered Species

There are three species of endangered animals that could be affected by the alternatives of this project: the longjaw cisco (Coregonus alpenae) on the Federal list, the striped shiner (Notropis chrysocephalus), and the longear sunfish (Lepomis megalotis) on the State list. The longjaw cisco is a fish that has been reported to live in the deep waters of Lake Michigan, but its presence is currently in doubt.

The striped shiner is a fish species that is endangered in Wisconsin. It is found in the Milwaukee River upstream of Lincoln Creek and hardly anywhere else in Wisconsin (Becker, 1976). It requires a clean, shallow river for spawning.

The longear sunfish has been reported in the upper reaches of the Milwaukee River as well; it is a threatened species in Wisconsin, although it is more common in Michigan. It also prefers clean, shallow waters.

Several endangered migratory birds (the bald eagle, the peregrine falcon, the osprey, and the Cooper's hawk) have been seen flying by Milwaukee on their annual migrations. They are not known to nest or roost in the study area.

4.1.4 Air Quality

The quality of ambient air is quantified by measuring the concentration of pollutants it contains. Pollutants currently measured and controlled are suspended particulates, which consist of dust, smoke, and fumes; sulfur dioxide, a colorless gas; carbon monoxide, a colorless poisonous gas; nitrogen dioxide, a reddish brown gas; and ozone, another toxic gas.

The effects of these pollutants on human health were extensively studied prior to the setting of emissions or ambient air quality standards. Although the effects on human health vary with each pollutant, the increased frequency of cardiovascular or respiratory disease is of greatest significance. The results of long-term exposure to elevated pollutant levels can include higher death rates in persons over 50 years old, increased absences of industrial workers, and significant increases in death rate or illness in the general population.

Specific locations in the MMSD planning area have been identified as having air quality below the federal standards (nonattainment areas). In portions of Milwaukee County, suspended particulate levels are high primarily due to agricultural tilling and industrial dust (such as wind blown dust from stock piles). Other area particulate sources are fuel burning installations (such as power plants) and automobiles.

Sulfur dioxide standards are exceeded in portions of the City of Milwaukee. The primary source of sulfur dioxide is the burning of fossil fuel. Carbon monoxide, of which the major sources are automobiles and trucks, is in violation of standards in some 85 square miles (220 km^2) of Milwaukee County. Ozone standards are exceeded in the entire study area. Ozone is generated primarily from hydrocarbons and nitrogen dioxide reacting in sunlight. Common planning area sources of hydrocarbons are fuel combustion and solvent use. Nitrogen dioxide standards are not exceeded in the MMSD planning region. The majority of nitrogen dioxide in the region is emitted from autos and fuel-burning installations.

The Jones Island WWTP is located in an air quality non-attainment area for particulate matter, carbon monoxide, and ozone. Air quality data as measured less than one-half mile (0.8 km) from the plant is shown in Table 4.3.

Air pollutant emissions at the Jones Island WWTP are generated from turbine generators which produce electricity and from boilers used to create heat for plant processes. Each year, the combined emissions from these sources total approximately 8.5 tons (7.7 metric tons) particulate matter, 17.1 tons (15.5 metric tons) carbon monoxide, 13.7 tons (12.4 metric tons) sulfur dioxide, 87.7 tons (79.6 metric tons) nitrogen dioxide, and 6.6 tons (6.0 metric tons) hydrocarbons.

The South Shore WWTP is located in an area which has air quality attainment for particulate matter, carbon monoxide, nitrogen dioxide, and sulfur oxides. It is in the ozone nonattainment area. Table 4.3 shows existing air quality as measured near the South Shore plant, or determined by a computer-simulation model based on available air quality data. The table also compares the existing air quality to the NAAQS.

The sources of air pollutant emissions at the South Shore plant are the seven digester gas-fueled stationary engines. From 1978 to 1979, the emissions from these engines averaged (per year) 46.4 tons (42.1 metric tons) of carbon monoxide, 94.9 tons (86.2 metric tons) nitrogen dioxide, 134 tons (121.6 metric tons) sulfur dioxide, and 138 tons (125.3 metric tons) hydrocarbons (Environmental Technology and Engineering Corp., 1980).

An air pollution alert is the initial response to an emergency pollution episode. During the June-September period when ozone levels are highest, ozone alerts typically occur 4-5 times. During these alerts, all burning operations are prohibited and certain industrial operations are restricted.

4.1.5 Odors

Odors cannot be quantitatively measured. The perception of odors is subjective, and it can change the longer an individual is exposed to an odor. Some of the types and sources of odors associated with sewerage facilities are shown in Tables 4.4 and 4.5. To assess any odor problems associated with the sewerage system of the planning area, the EIS relied on DNR records of public complaints.

None of the sewerage facilities, except the South Shore WWTP, has been cited for odor problems. In an independent survey by the DNR of odor complaints between January, 1977

TABLE 4.3
NATIONAL PRIMARY AMBIENT AIR QUALITY STANDARDS
AND EXISTING AIR QUALITY AT JONES ISLAND
AND SOUTH SHORE WWTPS[a]

	Particulate Matter Annual Geometric Mean (ug/m^3)	Sulfur Dioxide Annual Arithmetic Mean (ug/m^3)	Carbon Monoxide 8 Hour Period mg/m^3	Nitrogen Dioxide Annual Arithmetic Mean (ug/m^3)	Ozone Photochemical Oxidants (ug/m^3)
Jones Island	85.7[b]	53.7[c]	10.7	47.6[c]	323[c]
South Shore	46.7[b]	30[e]	1[e]	50[d]	235
EPA Primary Standard	75[a]	80	9	100	235
EPA Secondary Standard	60	-	-	-	-

[a] Concentration in weight of pollutant per m^3 of ambient air at 25°C and 760 mm Hg.
[b] Measured at 600 E. Greenfield Avenue.
[c] Measured at 12253 Carferry Drive.
[d] Measured at 1001 15th Avenue, South Milwaukee.
[e] SEWRPC Computer Simulation.

	Formula	Characteristic Odor	Odor Threshold* (ppm)	Detection Threshold† (ppm)	Recognition Threshold† (ppm)	Adsorption of Vapors by Activated Carbon (%)	Boiling Point (°C @ 760 mm Hg)	Molecular Weight
Acetaldehyde	$CH_3 \cdot CHO$	Pungent fruity	0.004	—	0.21	7	20.2	44.05
Allyl Mercaptan	$CH_2 \cdot CH \cdot CH_2 \cdot SH$	Strong garlic, coffee	0.00005	0.016	—		67	74.15
Ammonia	NH_3	Sharp pungent	0.037	—	46.8	1-2	−33	17.03
Amyl Mercaptan	$CH_3 \cdot (CH_2)_3 \cdot CH_2 \cdot SH$	Unpleasant, putrid	0.0003	—	—		126	104.22
Benzyl Mercaptan	$C_6H_5 \cdot CH_2 \cdot SH$	Unpleasant, strong	0.00019	—	—		194	124.21
Butylamine	$C_2H_5 \cdot CH_2 \cdot CH_2 \cdot NH_2$	Sour, ammonia-like	—	—	0.24		78	73.14
Cadaverine	$H_2N \cdot (CH_2)_5 \cdot NH_2$	Putrid, decaying flesh	—	—	—		178	102.18
Chlorine	Cl_2	Pungent, suffocating	0.01	0.01	0.314		−34	70.91
Chlorophenol	$Cl\ C_6H_5O$	Medicinal, phenolic	0.00018	—	—		214	128.55
Crotyl Mercaptan	$CH_3 \cdot CH : CH \cdot CH_2 \cdot SH$	Skunk-like	0.000029	0.0077	—		98	90.19
Dibutylamine	$(C_4\ H_9)_2\ NH$	Fishy	0.016	—	—		159	129.25
Diisopropylamine	$(C_3H_7)_2\ NH$	Fishy	0.0035	—	0.085		84	101.19
Dimethylamine	$(CH_3)_2\ NH$	Putrid, fishy	0.047	—	0.047		7	45.08
Dimethyl Sulfide	$(CH_3)_2\ S$	Decayed vegetables	0.001	—	0.001		37	62.13
Dipheny Sulfide	$(C_6H_5)_2\ S$	Unpleasant	0.000048	—	0.0021		296	186.28
Ethylamine	$C_2H_5 \cdot NH_2$	Ammoniacal	0.83	—	0.83		17	45.08
Ethyl Mercaptan	$C_2H_5 \cdot SH$	Decayed cabbage	0.00019	0.0026	0.001	23	23	62.1
Hydrogen Sulfide	H_2S	Rotten eggs	0.00047	—	0.0047	3	−62	34.1
Indole	$C_2H_6\ NH$	Fecal, nauseating	—	—	—	25	254	117.15
Methylamine	$CH_3\ NH_2$	Putrid, fishy	0.021	—	0.021		−7	31.05
Methyl Mercaptan	$CH_3\ SH$	Decayed cabbage	0.0011	—	0.0021	20	8	48.1
Ozone	O_3	Irritating above 2 ppm	0.001	0.5	—		111	48
Propyl Mercaptan	$CH_3 \cdot CH_2 \cdot CH_2 \cdot SH$	Unpleasant	0.000075	0.024	—	25	67	76.16
Putrescine	$NH_2\ (CH_2)_4\ NH_2$	Putrid, nauseating			—	25	158	88.15
Pyridine	$C_6H_5\ N$	Disagreeable, irritating	0.0037	—	—	25	116	79.10
Skatole	$C_9H_9\ N$	Fecal, nauseating	0.0012	0.223	0.47	25	266	131.2
Sulfur Dioxide	SO_2	Pungent, irritating	0.009	—	—	10	−10	64.07
Tert-Butyl Mercaptan	$(CH_3)_3C \cdot SH$	Skunk, unpleasant	0.00008	—	—		65	90.19
Thiocresol	$CH_3 \cdot C_6\ H_4 \cdot SH$	Skunk, rancid	0.0001	0.019	—		195	124.21
Thiophenol	$C_6H_5\ SH$	Putrid, garlic-like	0.000062	0.014	0.28		170	110.18
Triethylamine	$(C_2H_5)_3\ N$	Ammoniacal, fishy	0.08	—	—		89	101.19

SOURCE: WPCF, 1979, *ODOR CONTROL for WASTEWATER FACILITIES* MANUAL of PRACTICE No. 22

TABLE 4.4

DATE APRIL 1981

ODOROUS SUBSTANCES

SOURCE See above

PREPARED BY ERM EcolSciences

Location	Waste-water	Grit	Screen-ings	Scum	Sludge	Waste Air	Slime on Walls	Organic Dirt on Surfaces	Sludge Deposits	Dark or Porous Walls	Chemical Spills	Eddy or Short-Circuited Areas
Gravity sewers	x					x	x		x			
Force mains	x					x	x		x			
Pumping stations:												
Wet wells	x			x			x	x	x	x	x	x
Dry wells	x							x		x		
Stilling wells				x			x	x	x	x		x
Grit chamber	x	x		x	x		x	x				
Screens	x		x				x	x	x	x		
Grease, screenings and grit handling		x	x	x	x		x	x				
Equalization tank	x			x	x	x	x	x	x			
Primary settling basin:	x			x	x		x	x	x	x		x
Sludge transfer					x			x	x	x		
Scum transfer	x			x			x	x		x		
Chemical addition						x	x				x	
Aeration tanks	x					x			x			x
Trickling filters	x			x		x	x	x	x	x		x
Ponds	x			x				x	x			
Biodisks						x	x	x		x		
Final settling basins	x			x	x	x	x	x	x	x	x	x
Granular media filters	x						x	x	x	x		
Sludge pumping					x			x	x	x		
Sludge thickening				x	x	x	x	x	x	x		
Sludge storage				x	x	x	x	x	x	x		
Sludge conditioning				x	x	x	x	x	x	x	x	
Sludge dewatering	x			x	x	x	x	x	x	x	x	
Sludge digestion					x	x	x	x	x	x		
Heat treatment					x	x	x	x	x			
Process sidestream handling	x				x		x	x	x			
Septage handling	x				x	x	x	x	x	x	x	
Land irrigation	x					x	x	x	x	x		
Effluent structure	x					x	x	x		x	x	
Ventilation system						x		x	x	x		
Sumps for drainage	x			x	x		x	x		x	x	
Channels for drainage	x			x			x	x	x	x	x	x
Flow distribution structures				x			x	x	x	x		x
Chemical contact tanks						x	x	x	x	x	x	x
Carbon columns							x	x		x	x	
Sludge incineration						x		x				
Sludge composting					x	x	x	x	x	x	x	
Sludge spreading					x							

SOURCE: WPCF, 1979, *ODOR CONTROL for WASTEWATER FACILITIES* MANUAL of PRACTICE No. 22

TABLE 4.5

DATE APRIL 1981

LOCATIONS IN WASTEWATER SYSTEMS WHERE ODORS MAY DEVELOP

SOURCE See above

PREPARED BY ESE EcolSciences

and April, 1978, of the 963 complaints that were registered, the South Shore WWTP received 167, the second highest number in the survey. The cause of the odors at the South Shore WWTP is poor sludge digestion which allows unstabilized sludge to be pumped to outdoor storage. Since residential areas are located to the north and west of the WWTP, odors from this inadequately treated sludge have been a nuisance. Also, the two other most frequently-cited (DNR survey) sources of odors, the Peter Cooper Factory and Hynite Corp., are located within one-half mile of the WWTP, and they may account for some odors attributed to the South Shore WWTP.

The Jones Island WWTP is an older facility and it is susceptible to odors because technology available at the time of its construction is now outdated. Also, the WWTP receives a large volume of sewage from animal and grain proccessing plants, and this type of waste is particularly prone to creating odors. However, Jones Island is located near a heavily industrial area and odors from the WWTP have not been cited as a significant concern to the surrounding community. The WWTP is located near a recreational area, the Summerfest Grounds. Odors emitting from the Jones Island facility could potentially disturb activities at this site.

In addition to the treatment facilities, the rivers in the Inner Harbor area have been cited for odors.

4.1.6 Geology

Wisconsin has a long history of geologic activity attributed to glaciers. The most recent period of glaciation in Wisconsin occurred approximately 22,000 years ago. The geology of the planning area is largely the result of glacial processes, including the erosion of the original bedrock, glacial deposition of rock and sediment materials, and post-glacial erosion and deposition by surface waters and wind. The product of these processes is a surface layer of glacial drift, which is any rock material, such as boulders, gravel, sand, or clay that was transported or deposited by glacial ice or meltwaters. The glacial drift deposits in this region vary in thickness from approximately 20 feet (6 m) to 200 (60 m) feet. Underlying the glacial drift are sedimentary bedrock formations which were formed more than 225 million years ago, in the Paleozoic era of geological time. These upper bedrock deposits are generally dense, non-porous dolomite, but also include limestone, interbedded sandstone, and shale.

The Paleozoic bedrock, together with the Precambrian rock beneath it, form a dome-like structure to the west of the City of Milwaukee called the Wisconsin Arch. From the Arch,

the bedrock dips slightly eastward to southeastward toward a bedrock depression in Michigan's lower penninsula, known as the Michigan Basin. The glacial drift deposits at the surface follow this sloping contour of bedrock. Beneath the Paleozoic rock, the older Precambrian rock is both igneous (formed by intense heat) and metamorphic (formed in response to an environment altered by pressure, heat, and chemical substances). This bedrock includes granite and quartzite. It does not outcrop within the planning area.

4.1.7 Topography

The planning area is characterized by rolling to flat topography. The moderate slopes of the region are the result of glacial ice which altered the earth's surface through erosion and deposition. In the urban areas surrounding and including the City of Milwaukee, the land generally rises less than 10% from horizontal, which is considered favorable to most forms of urban development and expansion. Shallow slopes present fewer engineering and technical difficulties for construction than slopes steeper than 12%. Areas along Lake Michigan and further out from the urbanized Milwaukee area contain slopes ranging to 25%. High-angled slopes increase runoff and erosion rates during periods of heavy rainfall.

The Kettle Moraine, formed by the geologic processes of glacial ice, is just west of the planning area. The greatest elevation there is 1320 feet (402 m) above mean sea level at Holy Hill in Washington County. The lower elevations occur near the shores of Lake Michigan and are approximately 580 feet (177 m) above mean sea level. Within the planning area, especially in the western portion, elevations reach 900 feet (274 m).

The Milwaukee, Kinnickinnic, and Menomonee Rivers transect the planning area and drain to Lake Michigan via the Milwaukee Harbor. These river valleys range in elevation from 580 to 640 feet (177 - 195 m) above mean sea level. As a sub-continental divide crosses the western portion of the planning area (generally NW to SE), the Fox River and its associated tributaries drain to the Fox River watershed rather than to Lake Michigan. The elevation of the Fox River basin is approximately 810 - 820 feet (247 - 250 m).

4.1.8 Soils

The movement of the glaciers in Wisconsin during the Ice Ages was chiefly responsible for the types of soil found in the planning area. Soils differ by composition, depth, and drainage ability. The characteristics of the soils determine their suitability for certain uses; shifting soils will not

support some kinds of construction and poorly drained soils are unsuitable for on-site septic systems. (Figure 4.3 shows areas in the planning area that are unsuitable for septic systems on lots less than one acre.)

The soils in Milwaukee and Waukesha Counties are underlain by silt loam and silty clay. These soils range from being well drained to somewhat poorly drained, and in low areas, drainage and flood protection are needed. Generally, the soils are poorly suited for on-site septic systems. Most of the area has soils well suited for farming. However, some of the soils require costly preparation if used for foundations or roads.

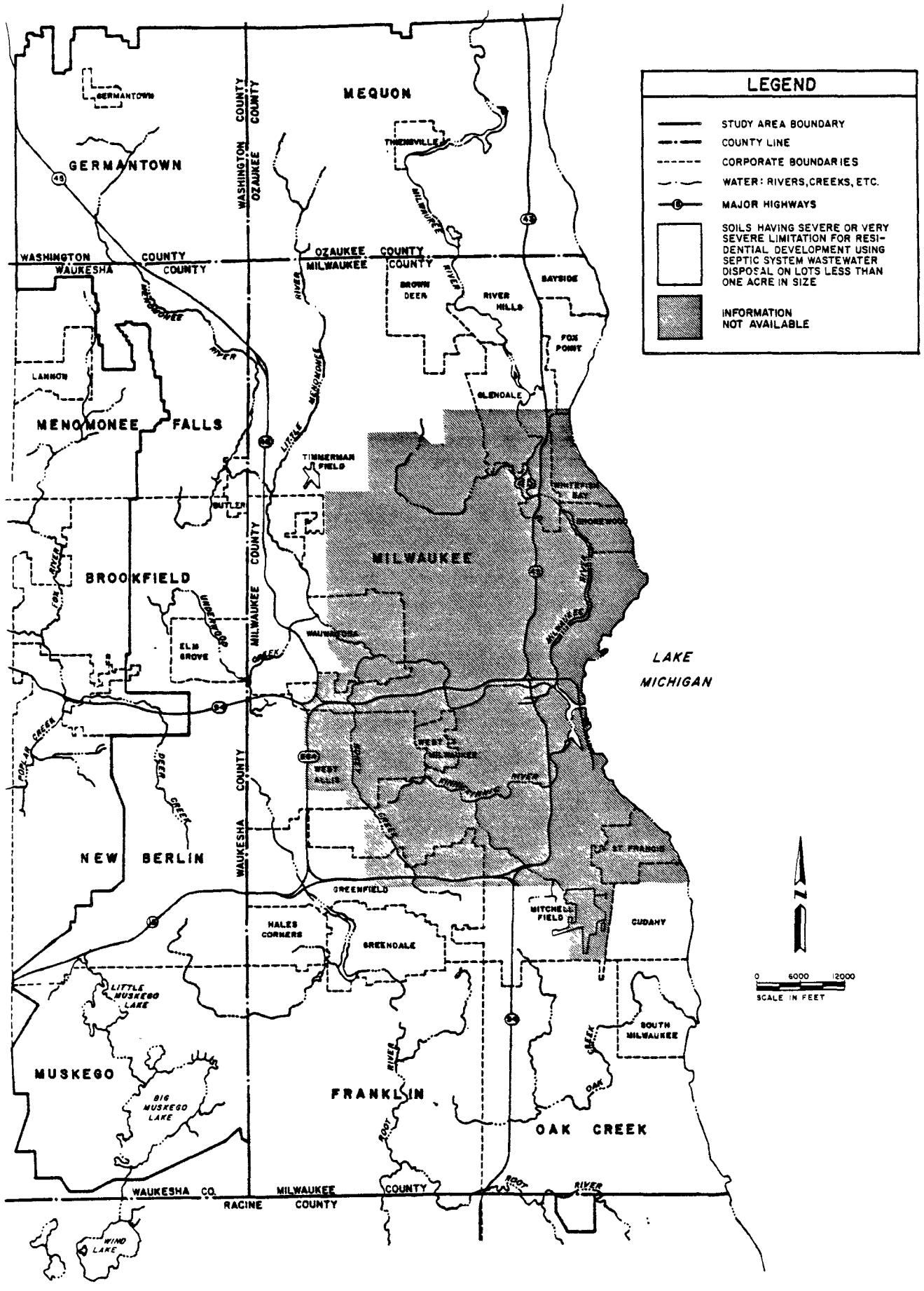
Another major soil type in Milwaukee and Washington Counties is a silt loam or silty clay loam soil on top of sandy loam. These soils are well drained, but drainage patterns are irregular, slightly limiting their use for onsite sewage disposal. These soils are stable and only slightly limited for construction.

4.1.9 Groundwater

The area surrounding, and including, Milwaukee is underlain by three major aquifers (water-bearing geologic formations) found in the following sequential rock layers: Surficial sand and gravel deposits (0 to 400 feet, 0-122 m, thick) deposited by glaciers, Niagara dolomite (0 to 500 feet, 0-152 m, thick), and sandstone formations (more than 1,500 feet, 457 m, thick) (see Figure 4.4).

The aquifers in the glacial sand and gravel deposits and the Niagara dolomite are hydrologically connected within the study area, and function together as a single, shallow, unconfined aquifer, although some portions of the Niagaran aquifer are confined (under pressure). (An unconfined aquifer is one in which the water table forms the upper boundary.)

The Niagaran formation is mainly dense dolomite and groundwater is transported through the formation by means of fissures and bedding planes. This shallow aquifer is separated from the deeper sandstone aquifer by a layer of sedimentary rock known as the Maquoketa shale. The Maquoketa shale serves as a barrier and prevents water from passing easily from one aquifer to the other. The shallow aquifer is recharged (replenished) locally by downward percolation of surface water, and normal discharge is to wells, streams, and Lake Michigan.



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APRIL 1981

SMALL LOT SEPTIC SYSTEM SUITABILITY

SOURCE MMSD and SEWRPC

PREPARED BY
EcolSciences
ENVIRONMENTAL GROUP

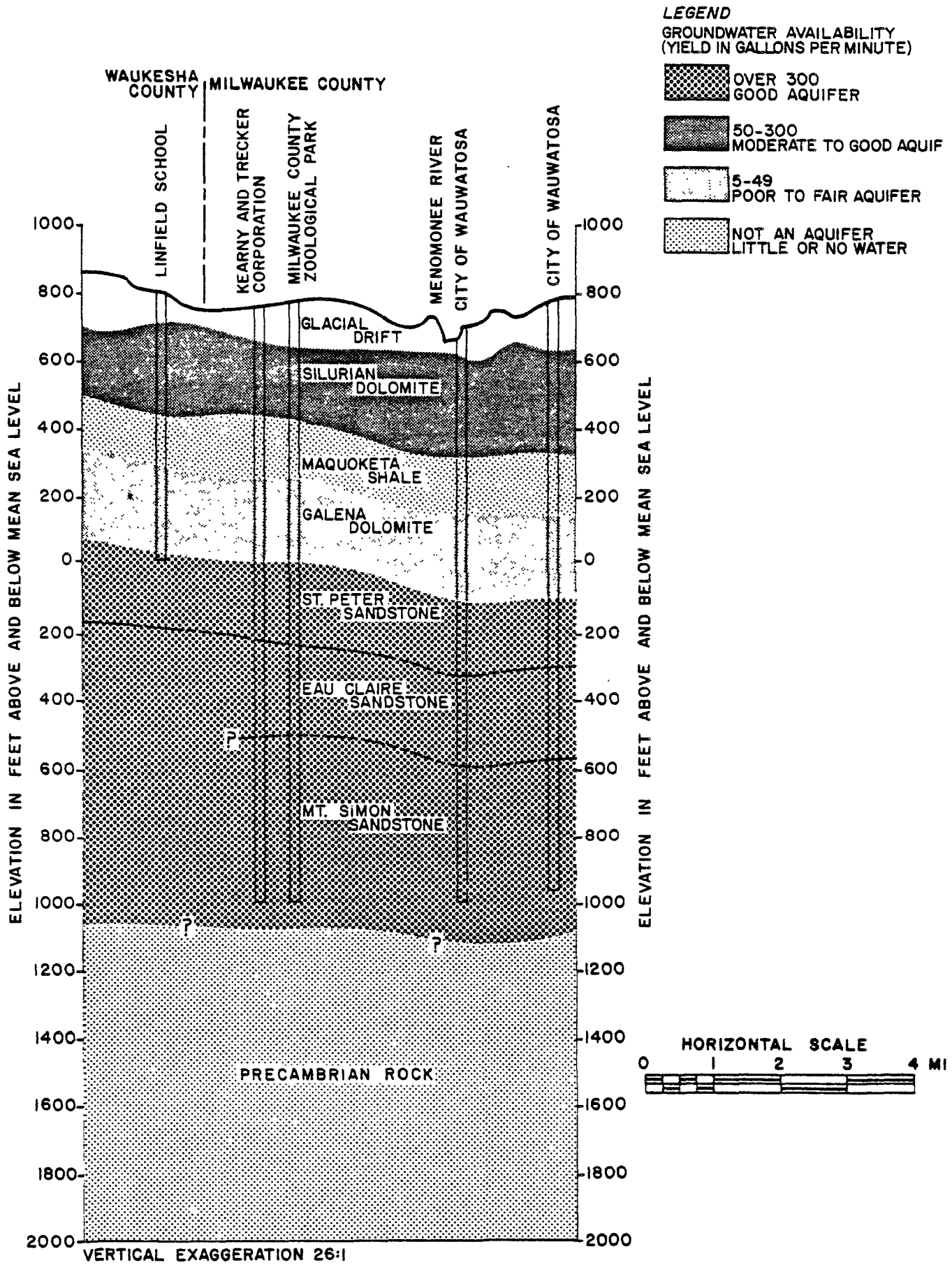

FIGURE 4-4

DATE APRIL 1981

AQUIFERS OF THE PLANNING AREA
(A typical cross section)

SOURCE U.S.G.S.

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

The deep sandstone aquifer is confined between the Maquoketa shale and deeper crystalline rock, both of which are resistant to water penetration. Recharge to the sandstone aquifer occurs primarily by downward percolation at points where the sandstone formation reaches the surface, west of the City of Milwaukee. Groundwater movement is eastward, toward the City of Milwaukee. A limited amount of percolation occurs from the Niagara dolomite through the Maquoketa shale and by means of wells open to both formations. The sandstone aquifer generally discharges through deep wells for industrial, municipal, commercial, and domestic uses. In southeastern Wisconsin, records between 1960 and 1970 show the deep sandstone aquifer provided 65% and the shallow aquifers provided 35% of groundwater used. Recent estimates show that the deep sandstone aquifer has been accommodating most of the increased groundwater usage that is occurring.

Groundwater in the planning area is considered to be of generally good quality. However, it is very hard and may have localized high concentrations of chloride and iron. All three aquifers have similar concentrations of calcium, silica, magnesium, and dissolved solids. The deepest aquifer has the smallest concentrations of chloride, sodium, and potassium while the uppermost aquifer has the smallest concentration of sulfate.

4.1.10 Floodplains

The floodplain of a river is a relatively wide area contiguous to, and often lying on both sides of, its channel. The floodplain, which is generally flat or gently sloping, is gradually formed over a long period of time as the river meanders through, and slowly erodes, its surrounding area. Normally, a river or stream will overflow its channel about once every two years.

Because of high water tables, flood hazards, and limited soil capabilities, floodplains are not suitable for urban development. They often contain valuable wetland, woodland, and wildlife habitat areas. Also, floodplains have important floodwater conveyance and storage functions, and hence must be considered an integral part of a stream system.

Each community in the planning area has delineated the floodplain which would be covered by water by the largest flood expected to occur about once every 100 years (the 100-year floodplain). These are shown in Figure 4.5. To prevent flood damage, new structures may only be built on the floodplain if they are floodproof and if they will not raise the flood level. One treatment plant, the New Berlin Regal Manors WWTP, is located on a floodplain (the Deer Creek floodplain, a tributary of the Fox River).

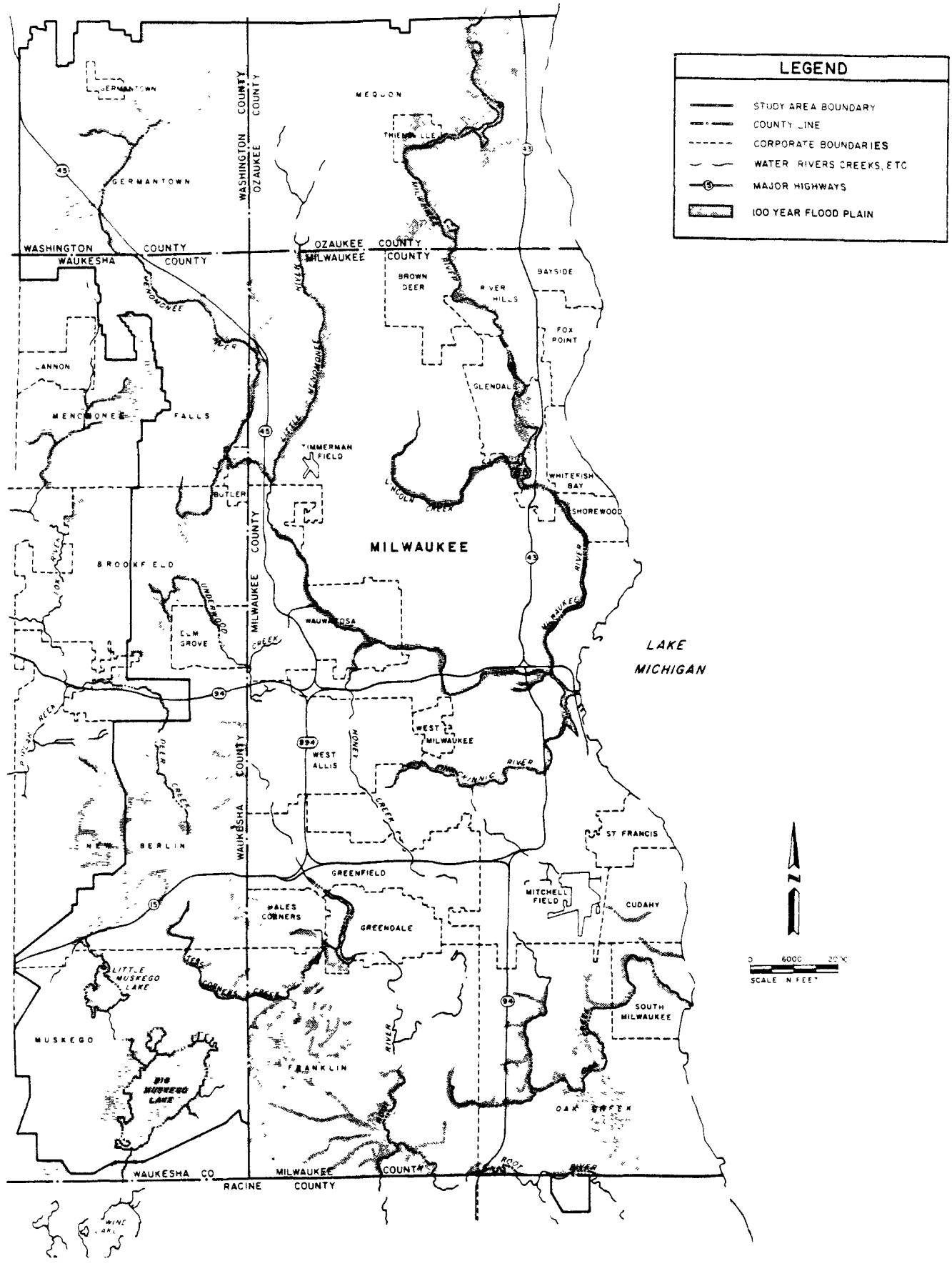

FIGURE 4-5

DATE APRIL 1981

100 YEAR FLOOD PLAINS

SOURCE MMSD and SEWRPC

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

4.1.11 Wetlands

Wetlands (marshes, swamps, bogs, or peatlands) are valuable natural areas, providing habitat for a variety of plants and animals as well as flood control, groundwater recharge, and surface water cleansing. The location of wetlands in the planning area is shown in Figure 4.6. The marsh surrounding Big Muskego Lake, adjacent to the Muskego Northwest WWTP could be affected by the MFP. The dominant vegetation species on this marsh are reeds and cattails. Deer are abundant on this marsh, especially near the surrounding woods. The marsh plants take up some of the nutrients that are added to the lake by the treatment plant and agricultural runoff. The Root River Interceptor could affect a small wetland located south of Morgan Avenue in the City of Greenfield. The wetland is described as a former agricultural field currently in a stage of old field succession.

4.1.12 Wildlife Habitat

Wildlife habitat includes the woodlands, wetlands, and prairie in the planning area that support various forms of wildlife. This discussion focuses on those habitats that disappear most rapidly with encroaching development.

Figure 4.6 shows the woodlands, wetlands, and prairie in the planning area. Most of the habitat is found in the peripheral areas, with some near recent urbanization in New Berlin, Muskego, Franklin, and Oak Creek. In addition, much of the shoreline bluff of Lake Michigan, which is too steep for development, has remained natural and serves as habitat for birds and small mammals. The bluff area north of the South Shore WWTP is such a habitat.

The site of the proposed New Berlin Southeast Treatment Plant is an abandoned farm that has old-field vegetation mixed with young woodlots. Its chief value to wildlife is its size (5500 acres, 2226 ha, of contiguous land). In addition, the varied nature of the vegetation and the potential for the woods to mature over the planning period contributes to the value of this wildlife habitat.

The Muskego Northwest WWTP is located just off the marshes that fringe Big Muskego Lake. These extensive wetlands support a large deer population as well as a large number of small mammals and birds.

The floodplain of Tess Corners Creek in Muskego and Franklin is wooded for much of its length. It is a valuable roosting area for birds and travelling corridor for small mammals.

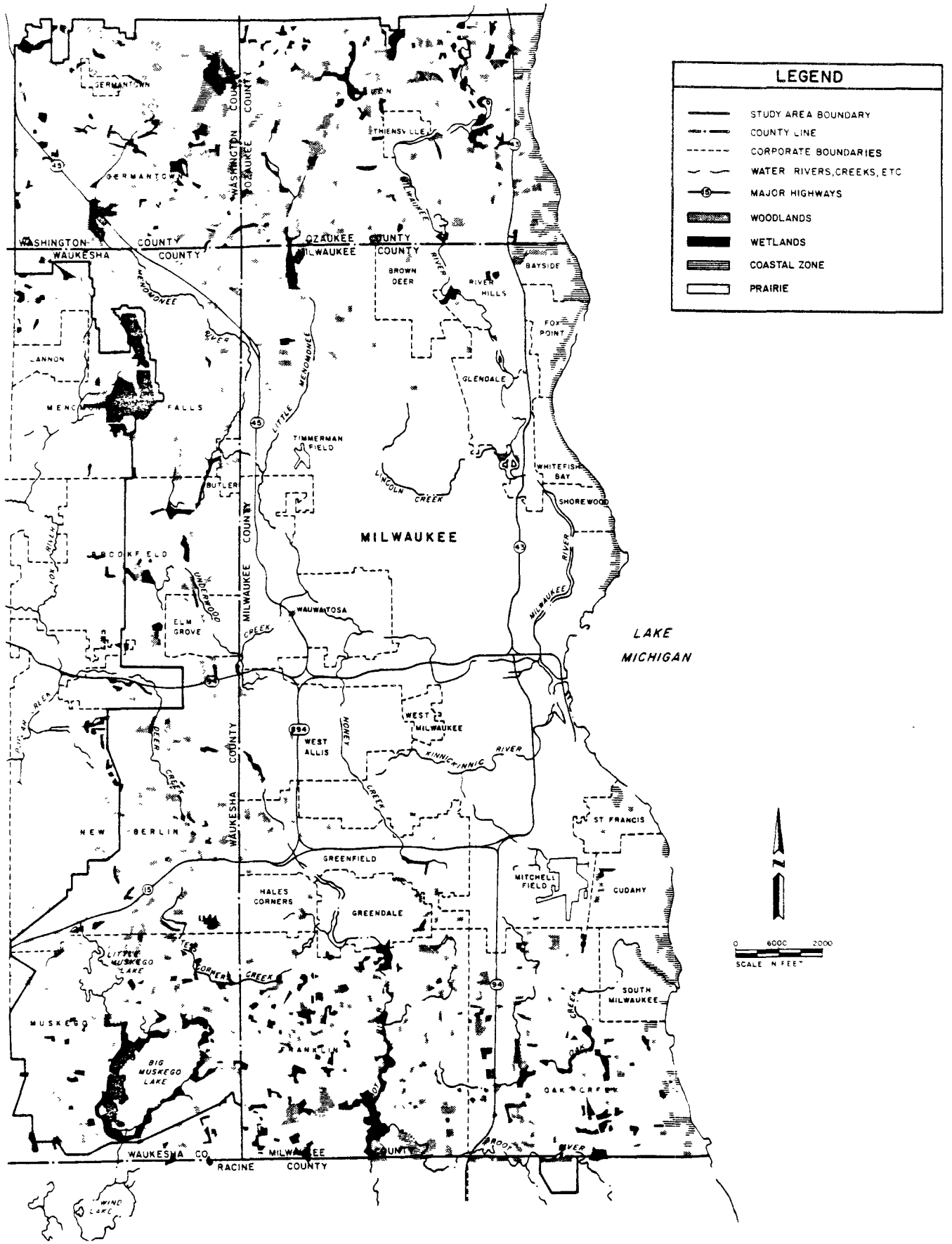

FIGURE 4-6

DATE APRIL 1981

WOODLANDS, WETLANDS, AND PRAIRIE PRIMARY REFERENCE MAP

SOURCE MMSD and SEWRPC

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

The site of the proposed Muskego WWTP is an abandoned farm that adjoins a stand of old oak trees. The stand is only a few acres, but it has some trees that are in excess of 24 inches, (61 cm) in diameter.

4.2 MANMADE ENVIRONMENT

4.2.1 Legal and Regulatory Environment

There are many laws, rules, and regulations involved in the initiation and implementation of the proposed Master Facilities Plan. The MMSD must meet the requirements of federal and state laws and the regulations which implement the laws, as well as the requirements set forth in two court orders. Table 4.6 lists the implementing rules and regulations which carry out the mandates of the legislation affecting the MFP. Facilities plans must meet the requirements of both the federal and state rules included in this table.

4.2.1.1 Judicial Requirements

As detailed in Chapter 2 of this EIS, two court orders have imposed legal requirements on the MMSD. The U.S. District Court of Northern Illinois, which was partially reversed by the Federal Appeals Court, imposed the requirements for meeting discharge permits limits, eliminating bypassing from the separated sewers system, and eliminating CSO according to a strict timetable. The Dane County Circuit Court stipulation requires the rehabilitation of treatment plants, construction and rehabilitation of relief and interceptor sewers, solids management, the elimination of overflows and bypasses in the separated system and the abatement of CSO according to a timetable less stringent than the Federal Court order.

4.2.1.2 Major Legislative Requirements

The legislation affecting the MFP most directly are the Federal Clean Water Act and Chapters 144 and 147 of the Wisconsin Statutes. The Federal Clean Water Act (CWA) (Public Law 95-217) establishes the policy of cleaning up the Nation's waters. The Clean Water Act included, "whenever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water to be achieved by July 1, 1983." The Clean Water Act sets standards for water quality, establishes a permit system for control of pollutant discharges and areawide planning for wastewater treatment, requires permits for construction in navigable waters, and authorizes a construction grants program to assist municipalities in financing the costs of pollution abatement.

TABLE 4.6
LAWS AND REGULATIONS **

Federal

Clean Water Act of 1977
National Historic Preservation Act of 1974
Architecture and Historic Preservation Act of 1974
The Clean Air Act
Coastal Zone Management Act
Fish and Wildlife Coordination Act of 1958
Executive Order 11988 - Floodplain Management
National Environmental Policy Act
Executive Order 11990 - Protection of Wetlands
Resources Conservation and Recovery Act of 1976
Wild and Scenic Rivers Act
Toxic Substances Control Act
Rivers and Harbors Act of 1899
Noise Control Act of 1972
Federal Soil and Water Resources Act of 1977
Solid Waste Disposal Act (1973)
Water Resources Planning Act (1965)
Relocation Assistance Act
Executive Order 11593 - Protection of the Cultural Environment
Presidential Memorandum on Environmental Quality and Water Resources Management. July 12, 1978

Wisconsin	Topics
*Chapter 144, Wis. Stats.	plan approval, PCB, grants, standards, well approval
*Chapter 147, Wis. Stats.	discharge permits, monitoring, policy, effluent limits, public notice
*Chapter 30, Wis. Stats.	structures, fills or dredging in navigable waters including wetland
Chapter 29.415, Wis. Stats.	endangered and threatened species protection
Chapter 1.11, Wis. Stats.	environmental review
NR 1.95, Wis. Adm. Code	wetland policy
NR 3, Wis. Adm. Code	discharge permit, public participation
NR 102, Wis. Adm. Code	water quality standards
NR 104, Wis. Adm. Code	water quality standards designatio
NR 108, Wis. Adm. Code	general wastewater system requirements
*NR 110, Wis. Adm. Code	sewer extensions, plans, design, disinfection, phosphorus removal, sludge management
NR 112, Wis. Adm. Code	dewatering well approval
NR 114, Wis. Adm. Code	operator certification
NR 121, Wis. Adm. Code	areawide water quality plans
NR 128, Wis. Adm. Code	grants
NR 150, Wis. Adm. Code	environmental review, EIS
NR 157, Wis. Adm. Code	PCB
NR 160, Wis. Adm. Code	federal grant priority list
NR 185, Wis. Adm. Code	solid waste management
NR 200, Wis. Adm. Code	discharge permit applications
NR 201, Wis. Adm. Code	discharge permit fact sheet
NR 210, Wis. Adm. Code	effluent limits, disinfection, monitoring
NR 214, Wis. Adm. Code	land disposal of liquid wastes
Local	zoning, building permits

*Permits/approvals required

**This is a partial list of regulations that apply most directly to the MFP projects

The National Environmental Policy Act (NEPA) (Public Law 91-190) requires environmental review of proposed federal actions and establishes the requirement for the preparation of environmental impact statements. Chapter 2 of this EIS explains the requirements of NEPA in greater detail.

At the state level, Chapter 144 of the Wisconsin Statutes has established water quality and solid waste disposal standards, and requires DNR approval of plans for WWTPs, air emissions, and potable water wells. In addition, the Wisconsin Fund Grant Program was authorized to assist municipalities in the design and construction of wastewater treatment facilities.

Chapter 147, Wisconsin Statutes, establishes Wisconsin's water quality goals, sets up effluent limits, requires discharge permits, establishes policy and monitoring requirements, and requires public notice of permits to be issued.

Chapter 1.11, Wisconsin Statutes, the Wisconsin Environmental Policy Act (WEPA), requires environmental review of state actions and establishes the requirement for EIS preparation. It also is discussed in Chapter 2.

4.2.1.3 Additional Legislative Requirements

Other federal legislation which affects the MFP includes the Fish and Wildlife Coordination Act, which requires involvement by the Department of the Interior in federal actions; the River and Harbor Act of 1899, which regulates outfall structures and other structures in navigable waters; and the Coastal Zone Management Act. The Resource Conservation and Recovery Act, PL 94-580, requires the EPA to provide regulations on safe and proper disposal of solid wastes including sewage sludge.

The National Historic Preservation Act also affects the facilities planning. On September 11, 1979, the West Plant of the Jones Island WWTP was determined to be eligible for the National Register of Historic Places. In accordance with regulations for the Protection of Historical and Cultural Properties (36 CFR Part 800), the EPA must avoid creating any adverse impact to any property on the National Register. Therefore, the EPA prepared a Preliminary Case Report for the proposed rehabilitation and expansion of the Jones Island WWTP. This report included measures for avoiding adverse impacts to the WWTP. The Advisory Council on Historic Preservation has commented on the Case Report to ensure that all impacts would be avoided or mitigated in a satisfactory manner. After the Advisory Council determined that the Jones Island WWTP would not be adversely affected, a Memorandum of Agreement (MOA) was developed by the MMSD,

EPA, DNR, State Historic Preservation Officer (SHPO), and the Advisory Council. The MOA outlines the actions to avoid or mitigate adverse impacts to the WWTP and specifies those adverse effects that would be acceptable. The MOA has been signed by the EPA and included in Section 5.2.10 of this EIS.

4.2.1.4 Permits and Approvals

In order to proceed with the proposed MFP, the MMSD must obtain permits and approvals from federal and state agencies empowered to administer the legislative authorities listed above. The MFP cannot proceed without these permissions, and the requirement for some of them initiated the NEPA and WEPA processes which culminated in this EIS.

The MFP must be approved by the EPA and DNR according to the provisions of the Clean Water Act and Chapter 144. This approval will make the MMSD eligible for design and construction grants from EPA and DNR under the CWA and Wisconsin Statutes.

Discharge permits for WWTPs must be issued by the DNR, both under the authority of Chapter 147, Wisconsin Statutes, and delegated federal authority. The effluent limits set by those permits are imposed to meet the water quality standards authorized by the CWA and Chapter 144 as implemented by federal and state regulations. Sewer system improvements and certain aspects of treatment (sludge management and solid waste landfills) also require permits and approvals by DNR under the Wisconsin Administrative Code.

Federal and State permits are also required for Master Facilities Plan projects involving dredging or filling navigable waters and wetlands, locating outfall structures, or construction involving stream crossings. The Army Corps of Engineers issues the Federal permits which are outlined in Section 404 of the Clean Water Act and Chapter 10 of the River and Harbor Act of 1899. The DNR issues a separate permit which is described in Chapter 30 of the Wisconsin Statutes.

4.2.1.5 Other Agencies

Other state agencies have regulatory power over aspects of the MFP. The Department of Agriculture, Trade, and Consumer Protection requires agricultural impact statements for projects affecting agricultural lands. The Department of Industry, Labor and Human Relations regulates plumbing and worker safety (the Federal Occupational Safety and Health Act).

4.2.1.6 Other Environmental Concerns

4.2.1.6.1 Wetlands: To protect the Nation's wetlands, Executive Order 11990 was issued in May, 1977. This order encourages Federal agencies to take the leadership in protecting wetlands. All federally sponsored or funded programs shall minimize the destruction of these valuable areas.

4.2.1.6.2 Floodplain Management: In recognition of the importance and sensitivity of floodplains, Executive Order 11988 was issued in May, 1977 to encourage all federal agencies to avoid construction in floodplains, whenever possible. In addition, Chapter 87.30 of the Wisconsin Statutes regulates the construction of wastewater treatment of conveyance facilities in the floodway or flood fringe. Treatment plants in the flood fringe must be protected from flood waters and be accessible by road from high ground. Sewers in the flood fringe must be water tight. Construction activities in flood fringes require special precautions.

4.2.1.6.3 Threatened and Endangered Species: The United States Department of the Interior lists species of animals and plants that are in danger of extinction so that steps can be taken to protect them. The DNR prepares a similar list of endangered species in Wisconsin. Both lists include two classifications: threatened species and endangered species. Endangered species are those that might soon become extinct. Threatened species are those that might soon be endangered. Species on the Wisconsin Endangered and Threatened Species list are those whose existence in Wisconsin is in jeopardy. Species on the Federal list are in danger in all or a significant portion of their range (DNR Pub 1-1520 80).

4.2.1.6.4 Recreation: Although EPA sewage treatment funds cannot be used to fund recreation projects, the Heritage Conservation and Recreation Service (HCRS) provides funding for recreational facilities through its Land and Water Conservation Program (LAWCON) and Urban Park and Recreation Recovery Program. The Wisconsin DNR funds recreational projects, including multiple use projects in some circumstances, through the Outdoor Recreation Act Program (ORAP) and administers the Federal LAWCON funds for the State of Wisconsin. The Block Grant Assistance Program under the Department of Housing and Urban Development may also be a source of funding for recreational programs associated with water pollution control.

Recreational grant programs have eligibility requirements which a community must meet before specific projects can be funded by HCRS or the state. These federal and state grants

will enable a community to enhance their local recreational programs. Communities interested in general information on LAWCON Programs and dual use facilities should contact the Heritage Conservation and Recreational Service, Lake Central Region in Ann Arbor, Michigan. For further information on the eligibility requirements for LAWCON or ORAP funds, the Wisconsin Department of Natural Resources, in Madison, Wisconsin should be contacted. Also, for information on block grants, contact Community Planning and Development, in Milwaukee, Wisconsin.

4.2.1.6.5 Air Quality: The U.S. Environmental Protection Agency established national ambient air quality standards (NAAQS) for five criteria pollutants in 1971 (see Table 4.7). Primary standards were determined to protect public health and secondary standards to protect public welfare (the environment). Some of the secondary standards are the same as the primary standards. The Clean Air Act Amendments of 1977 placed emphasis on attainment and maintenance of the NAAQS.

4.2.1.7 Regional Planning Considerations

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) is the designated planning agency for the areawide water quality (208) plan for Southeastern Wisconsin. The SEWRPC Region comprises seven counties: Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha. The MMSD planning area lies within the SEWRPC Region and comprises all of Milwaukee County and adjacent portions of Waukesha, Washington, Racine and Ozaukee Counties.

In compliance with Section 208 of the Clean Water Act, the water quality management plan sets forth general recommendations to abate nonpoint sources of pollution to a level which would allow recommended water quality standards to be achieved. Prior to implementation of a nonpoint source control program, the water quality management plan recommends that a detailed nonpoint source control plan be prepared by local government management agencies.

4.2.1.7.1 Land Use: The quality of waters in the planning area is affected by the type, intensity, and distribution of land uses. Agricultural runoff has different characteristics than runoff from urban areas. Industrial wastewater may differ from residential wastewater. Densely populated areas have greater capacity sewer systems than undeveloped areas. Thus, to evaluate the impacts of any alternative considered for the MFP, it is necessary to analyze existing and planned land use.

TABLE 4.7

SUMMARY OF NATIONAL AMBIENT AIR QUALITY STANDARDS
ISSUED APRIL 30, 1971, AND REVISED SEPTEMBER 15, 1973
AND FEBRUARY 8, 1979

POLLUTANT	PERIOD OF MEASUREMENT OR CALCULATION	CONCENTRATION (weight of pollutant per cubic meter of ambient air corrected to 25°C and 760 millimeters of mercury) PRIMARY STANDARD	SECONDARY STANDARD
Particulate Matter (PM)	Annual (geometric mean)	75 micrograms	60 micrograms
	24 hour	260 micrograms[b]	150 micrograms[b]
Sulfur Oxides (SO_x) (measured as sulfur dioxide)	Annual (arithmetic mean)	80 micrograms (0.03 part per million	--
	24 hour	365 micrograms	--
	3 hour	(0.14 part per million)[b]	1,300 micrograms (0.5 part per million)[b]
Carbon Monoxide (CO)	8 hour	10 milligrams (9 parts per million)[b]	Same as Primary
	1 hour	40 milligrams (35 parts per million)[b]	Same as Primary
Hydrocarbons (HC) (nonmethane measured as methane)	3 hour (6 a.m. to 9 a.m.)	160 micrograms (0.24 part per million)[b]	Same as Primary
Nitrogen Dioxide (NO_2)	Annual (arithmetic mean)	100 micrograms (0.05 per million)	Same as Primary
Oxone[c] (O_x)	1 hour	235 micrograms (0.12 part per million)[d]	Same as Primary
Lead	3 months	1.5 micrograms[b]	Same as Primary

[b] Concentration not to be exceeded more than once per year.

[c] Formerly expressed as photochemical oxidants.

[d] Concentration not to be exceeded more than one hour averaged over any consecutive three-year period.

Source: 40 CFR 50: National Primary and Secondary Ambient Air Quality Standards.

4.2.1.7.2 Existing Land Use: Figure 4.7 shows the location of existing land uses in the planning area. In 1970, 1,170,022 persons resided in this 418 square mile (1083 Km^2) area. More than one-half (54%) of the land in the planning area is developed: 26% for residential use and the rest for transportation routes, industry, commerce, or recreation. The remainder of the land is undeveloped, and the majority (31%) is used for agriculture. The rest (15%) is water, wetland, woodland, or unused land. Table 4.8 shows the amount of existing land use by type, in the MMSD planning area.

For further information about land use, see the MMSD System Plan-EA, Chapter 4. Section 3.13 of the CSO Appendix to this EIS discusses land use in the Combined Sewer Service Area in greater detail.

The original source for the statistical information on existing and planned land use is the SEWRPC Planning Report NO. 25, Volumes 1 and 2. This report is one element of the SEWRPC Regional Water Quality Management (208) Plan for Southeastern Wisconsin.

4.2.1.7.3: Land Use Planning: In addition to preparing an inventory of existing land uses, SEWRPC has developed a recommended land use plan for the year 2000, shown in Figure 4.8. This plan allocates future land use within each county of the Region based on forecast population levels. The year 2000 plan advocates altering the recent trend of urban sprawl, and returning to a centralized pattern of medium density, contiguous development in planned neighborhood units.

The design of the year 2000 plan incorporates three general guidelines:

- New urban development should occur at medium density in planned neighborhood units in areas readily provided with essential urban services such as sanitary sewers, water supply, and mass transit.

- No urban development should take place on land designated as a primary environmental corridor (wetlands, woodland, 100-year floodplain, or wildlife habitat).

- New urban development should not be allowed in areas delineated as prime agricultural land.

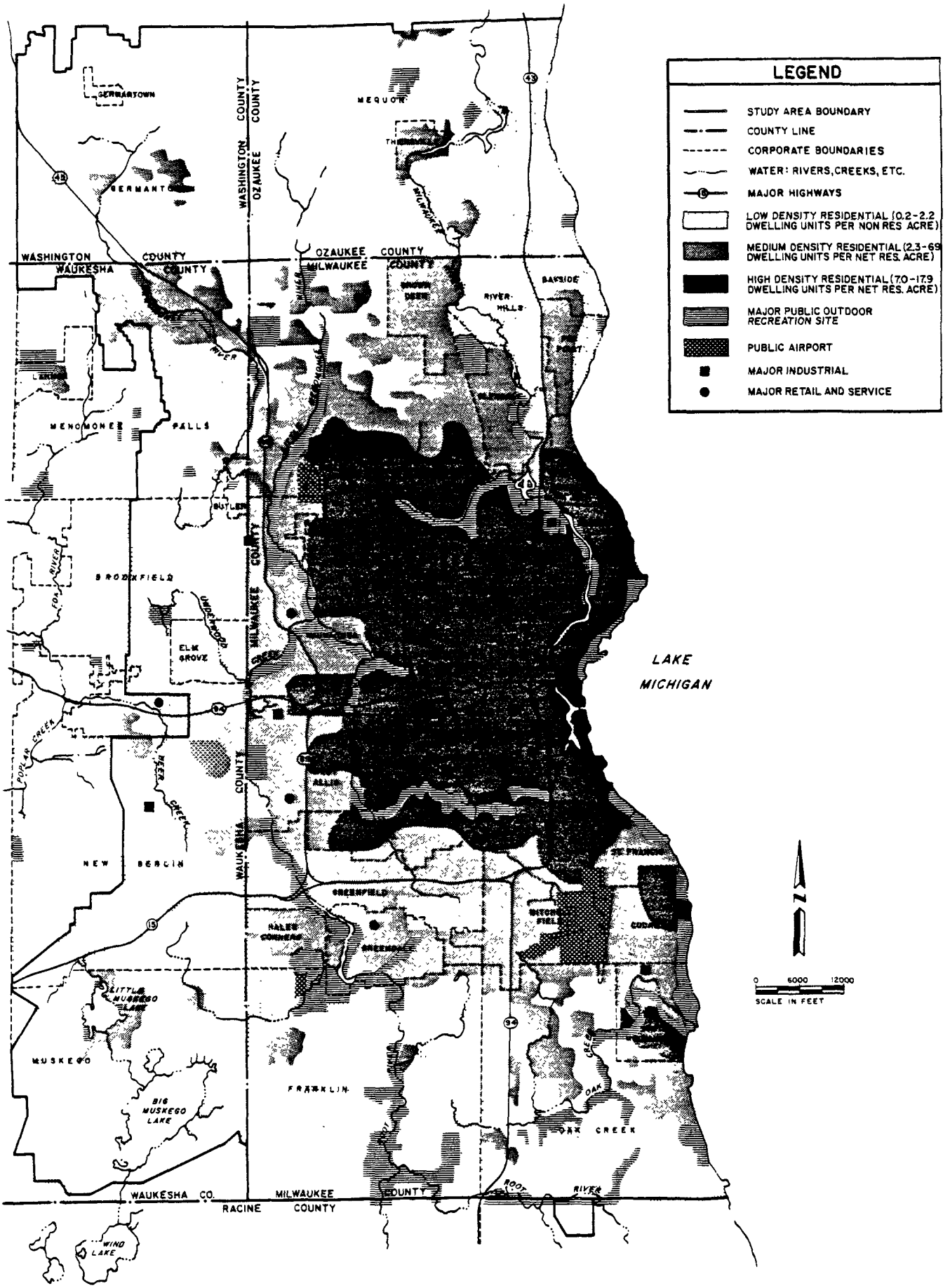

FIGURE 4-7

DATE APRIL 1981

EXISTING LAND USE - 1975

SOURCE MMSD and SEWRPC

PREPARED BY

EcolSciences ENVIRONMENTAL GROUP

TABLE 4.8
PRESENT AND FUTURE
LAND USE
MMSD PLANNING AREA

Use	1975 Acres	1975 %	1985 Acres	1985 %	2000 Acres	2000 %
Residential	69,741	26%	73,577	27%	84,211	32%
Transportation/Utilities	41,384	15	42,775	16	46,257	17
Recreation	12,211	5	12,577	5	12,905	5
Government/Institutional	9,180	3	9,246	3	9,538	4
Industrial	6,073	2	7,128	3	8,291	3
Offstreet Parking	4,255	1	4,605	2	5,095	2
Commercial	3,685	1	3,792	1	3,940	1
Total Developed	146,499	(53%)	153,700	(57%)	170,237	(64%)
Agriculture	82,151	31	77,336	28	65,072	23
Water/Wetlands	15,008	6	13,054	5	13,056	5
Unused Lands	13,059	5	12,690	5	9,678	4
Woodlands	10,061	4	9,972	4	8,709	3
Extractive	1,254	1	1,253	1	1,253	1
Total Undeveloped	121,533	(47)%	114,305	(43%)	97,768	(36%)
Planning Area Total	268,032	100%	268,005		268,005	

Source: MMSD System Plan EA Table 4-13A

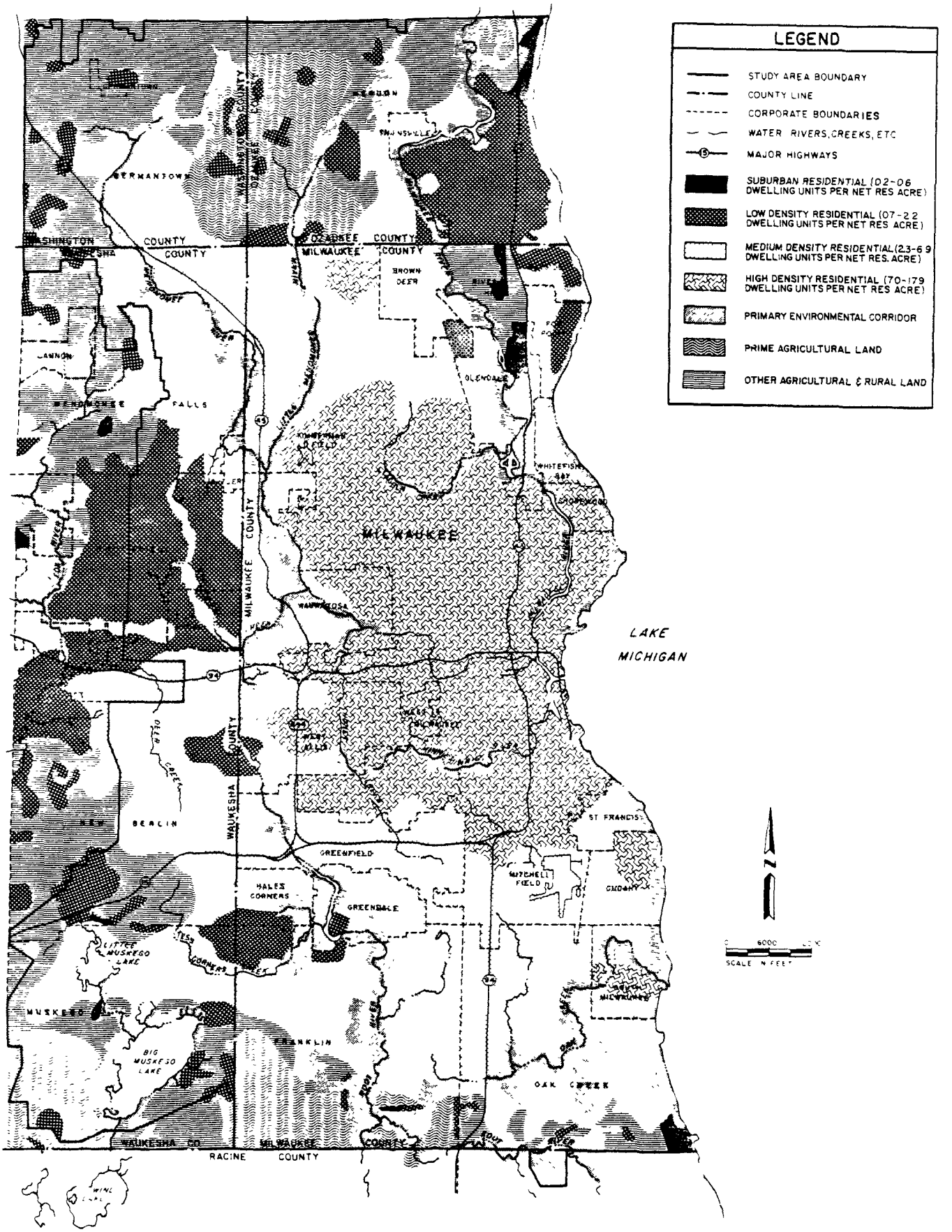

FIGURE 4-8

DATE APRIL 1981

LAND USE PLAN 2000

SOURCE MMSD and SEWRPC

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

The year 2000 plan calls for the maintenance and expansion (as necessary) of existing urban areas. The plan specifically discourages scattered (leapfrog) development, and emphasizes the need for filling in those remaining pockets of undeveloped land contiguous to existing development. Forecast 1985 and year 2000 land use for the MMSD planning area is shown in Table 4.8.

Land use planning is also conducted on a local level. In an effort to implement the year 2000 land use plan, SEWRPC encourages all communities in the region to prepare local land use plans. To date, 16 of the 29 communities in the MMSD planning area have established such plans. Table 4.9 outlines the planning practices of communities in the planning area.

4.2.1.7.4 Land Use Controls: There are various mechanisms for implementing land use planning within a municipality. Some of the major mechanisms include zoning codes, subdivision regulations, sewer moratoria, and septic tank regulations.

Zoning is a power granted to local government by state legislation. By adopting a zoning code, a municipality can regulate land use, as well as the type, location, height, coverage, and bulk of structures on the land. Zoning is, perhaps, the most effective mechanism for implementing local and regional land use planning.

Subdivision regulation is another method that allows local government to guide land use. Most municipalities enact this type of legislation which requires that developers submit subdivision plans for approval by local government before construction can begin. All of the communities in the planning area, except West Milwaukee and Whitefish Bay, have adopted subdivision regulations.

Because of inadequate sewerage facilities, the DNR ocasionally imposes sewer moratoria or allocation systems to suspend or limit further sewer connections. A moratorium limits the availability of sewered land. From May, 1976 to 1977, the DNR imposed a sewer moratorium on the MMSD. Following the moratorium, the current wasteload allocation system was developed. This system limits the amount by which each MMSD community may increase its annual wastewater volume and BOD and suspended solids concentrations. The 1979 allocations are shown on Table 4.10.

TABLE 4.9

LOCAL LAND USE PLANNING

Locality	Local Land Use Plan	Zoning Code	Reflects SEWRPC Plan	Description
Bayside	No	Yes	No	Environmental corridor along Lake Michigan shoreline is zoned for residential development by Bayside.
Brookfield	1959	Yes	No	Environmental corridor is zoned for development by Brookfield.
Brown Deer	No	Yes	Yes	
Butler	1966 (Dated & Unused)	Yes	Yes	Zoning code was developed with SEWRPC.
Caddy Vista	1972 (Racine Plan)		Yes	Racine plan was developed with assistance of SEWRPC.
Cudahy	No	Yes	Yes	
Elm Grove	No	Yes	Yes/No	Environmental corridor is not properly zoned.
Fox Point	No	Yes	No	Environmental corridor along Lake Michigan shoreline (1 acre) is zoned for residential development by Fox Point.
Franklin		Yes	No	Prime agricultural land, environmental corridors and other non-urban lands are zoned for development by Franklin.
Germantown	1978	Yes	Yes	Was developed with the assistance of SEWRPC in 1978.
Glendale	1976	Yes	Yes	
Greenfield	1961	Yes	No	Root River environmental corridor is zoned residential.
Hales Corners	No	Yes	Yes	
Menomonee Falls	1973	Yes	Yes	
Mequon	In Process	Yes	No/Yes	Present zoning allows for development on prime agricultural land. The proposed plan would correct this.
Milwaukee	In Process	Yes	Yes	The Milwaukee Planning Commission is the only agency in the planning area to formally adopt the regional plan.
Muskego	Yes	Yes	Yes/No	Development is zoned for the northern section (reflects SEWRPC). However, it includes more acreage than SEWRPC.
New Berlin	Yes	Yes	No	Areas designated as non-urban by SEWRPC are zoned for development.
Oak Creek	1973	Yes	Yes	Some variation between SEWRPC and Oak Creek plan.
River Hills	Yes	Yes	No	No provision for protecting the environmental corridor along the Milwaukee River.
St. Francis	1963	Yes	No	Lake Michigan environmental corridor is not protected.
Shorewood	In Process	Yes	Yes	
South Milwaukee	No	Yes	Yes	
Thiensville	No	Yes	No	Primary environmental corridors are not protected.
Wauwatosa	1978	Yes	Yes	
West Allis	No	Yes	Yes/No	Same primary environmental corridors are improperly zoned.
West Milwaukee	No	Yes	Yes	
Whitefish Bay	Yes	Yes	Yes	

TABLE 4.10
1979 SEWER ALLOCATIONS

Community	1979 Allocation (GPD)	1979 Used (GPD)	% Used
Bayside	12,942	861	7
Brookfield	40,226	48,575	121
Brown Deer	27,318	37,826	138
Butler	2,551	5,745	225
Cudahy	50,400	36,808	73
Elm Grove	8,692	6,314	73
Fox Point	9,048	0	0
Franklin	45,194	562,435	1,245
Glendale	37,170	27,682	74
Greendale	25,384	4,018	16
Greenfield	100,659	50,608	50
Hales Corners	13,230	2,296	17
Menomonee Falls	51,168	45,719	89
Mequon	72,394	68,374	94
Milwaukee	1,275,058	791,354	62
New Berlin	85,215	129,602	152
Oak Creek	149,917	173,304	116
River Hills	4,595	9,184	200
St. Francis	22,762	54	0
Shorewood	14,343	0	0
Wauwatosa	75,287	53,333	71
West Allis	102,644	106,235	103
West Milwaukee	35,070	0	0
Whitefish Bay	15,330	15,330	100
TOTAL	2,276,797	2,244,667	99%

When sewer service is unavailable, the use of on-site sewage disposal (septic tanks) becomes more attractive. Septic tank use is regulated by local and State health codes on the basis of soil quality. Soil surveys and analyses are used to determine the suitability of an area for on-site sewage disposal. When sewer service is limited or unavailable, septic tank limitations can become an effective land use control. Figure 4.3 shows the areas in the MMSD planning area that are suitable for septic tank use on lots of less than one acre.

In addition to land use controls initiated by municipalities, legislation from State and Federal government has established goals for the control of land use. Legislation concerning floodplains, the coast of Lake Michigan, and prime agricultural land are examples of this type of land use control that apply to the MFP.

4.2.1.8 Funding Programs

Federal and State funding for municipal sewage treatment projects, such as the MFP, is controlled and allocated by the Wisconsin DNR on the basis of a formal priority list. This list, the Project Priority List (PPL) is prepared according to Wisconsin's federally-approved priority system, which is set forth in Chapter NR 160 of the Wisconsin Administrative Code and EPA regulations. The PPL is used to determine the distribution of funds from two sources: the Federal Construction Grants Program and the Wisconsin Fund. The priority system assigns priority values and ranks projects on the basis of a six factor formula described in NR 160. The 1980 PPL priority values and rankings for MFP projects are shown in Table 4.11. Not all of the component projects of the Milwaukee Water Pollution Abatement Program have been submitted for funding.

Federal funds are administered by the EPA and appropriated to the state as part of the Construction Grants Program of the Clean Water Act of 1977. This program authorizes up to 75% federal funding to all eligible projects. It has been the policy of the Wisconsin DNR to allocate these funds to all Step 1 (planning) and Step 2 (design) projects regardless of their priority values and ranking on the PPL. Therefore, a certain percentage (approximately 62% in 1980) of the total available federal grant money designated for Wisconsin is set aside for Step 1 and Step 2 grants.

Approximately 25% of the 1980 federal grant money is available

TABLE 4.11

1980 PROJECT PRIORITY

	1980 Project Priority List Rank	1980 Wis. Fund Intent to Apply List Rank	Priority Value	Project	Description
1	9		30.922	Muskego, City	Connection to
2	31		29.418	Milwaukee MSD	Solids Mgmt., Filters and Dryers
3	34	12	29.354	Milwaukee MSD	Fac. Plan Completion, J.I. Exp.
4	36	14, 15	29.301	Milwaukee MSD	Construction NE, NE Relief Sew.
5	40	18, 19, 20, 21	29.099	Milwaukee MSD	Additions, South Shore
6	44		28.936	Milwaukee MSD	Franklin, Muskego INT
7	61		28.340	Milwaukee MSD	Hales Corners
8	64	36	27.944	Milwaukee MSD	NE Relief North
9	65		27.910	Milwaukee MSD	81st Street Sewer
10	89		27.294	Thiensville, Village	Connection to
11	94		27.125	Milwaukee MSD	Caddy Vista, Connection to MI
12	152	94	25.926	Milwaukee MSD	Root River INT
13	188		24.717	Milwaukee MSD	Underwood Creek
14	210	133-136	23.877	Milwaukee MSD	Sewer System
15	241	156-160	22.701	Milwaukee MSD	CSO Step 1,2,3
16	269		22.118	Milwaukee MSD	Franklin NE
17	324		20.798	Milwaukee MSD	Oak Creek INT
18	348		19.760	Milwaukee MSD	Northridge SE
19	349		19.402	Milwaukee Menomonee	Construction
20	350		19.229	Milwaukee MSD	Ryan Creek INT

for Step 3 (construction) grants and the use of these funds is allocated to eligible projects according to rank on the PPL. The remainder of the federal money (approximately 13%) is set aside for various other funding requirements. The DNR estimates (Harder memo, 2/20/1980) that it would be unlikely for Step 3 projects below number 16 on the PPL to receive federal funds, although a few projects in the 16 to 30 range might receive some funding.

The Wisconsin Fund, which is available to municipal projects that are not federally funded, is authorized to fund up to 60% of eligible municipal sewage treatment project construction (Step 3) costs. Those projects too far down on the PPL to be in the fundable range for federal grants, would be able to apply for Wisconsin Fund grants. To be eligible for Wisconsin Fund grants, the municipal project must be on the PPL and the municipality must submit an Intent to Apply by the end of each year. At the beginning of the following year, those municipalities submitting Intents to Apply are placed on a new list which is used to allocate the Wisconsin Fund grants. This list is based on the priority system, so the projects will be ranked in the same order as on the PPL.

4.2.1.9 The CSO Program

Planning for a solution to the CSO problems was also specifically governed by federal, state, and court-ordered requirements. The EPA issued Program Requirements Memorandum (PRM) 75-34 which established guidelines for the determination of the fundable size of CSO abatement projects. In order for a CSO abatement project to be eligible for EPA funding, it must be shown that marginal costs are not substantial compared to marginal benefits. The monetary, social, and environmental costs should be compared to the beneficial uses to be protected by the project. The fundable CSO abatement solution may not, however, be the solution required to meet water quality standards.

Based on the Dane County Court Stipulation and the Wisconsin State Statutes, the Wisconsin DNR requires that all MMSD CSO abatement alternatives result in the achievement of applicable water quality standards. The DNR will use the data developed in the MFP and in this EIS to assess the type of CSO abatement alternatives required to achieve applicable water quality standards.

The Dane County Court Stipulation has established a timetable for the construction of facilities for the abatement of CSO. The stipulation set July 1, 1993 as the compliance date for the achievement of water quality standards, provided

that Federal and State funds are available to finance eligible costs. If such funding is not available, the MMSD must still commit at least $13 million (in 1976 dollars) annually towards the abatement of CSO until the project is completed.

4.2.2 Population

Metropolitan Milwaukee, including Milwaukee, Ozaukee, Washington and Waukesha Counties, is studied as the Milwaukee Standard Metropolitan Statistical Area (SMSA). The SMSA is the primary study area for this population analysis. The entire MMSD Planning Area (with the exception of Caddy Vista) lies within the Milwaukee SMSA.

Table 4.12 shows the population trends of the nation, state, SMSA, SMSA counties, MMSD Planning Area, and planning area communities from 1900 to 1978. From 1900 to 1960, the population grew steadily in the Milwaukee SMSA at a rate approximately 1.5 times that of the nation. During this period the greatest amount of growth occurred in the City of Milwaukee and adjacent communities.

This trend began to change from 1960 to 1975, when the Milwaukee SMSA population grew only 11%, in comparison to the national rate of 19%. During this time, population growth shifted outward from the central city. In addition, from 1960 to 1975, the City of Milwaukee declined in population from 741,324 to 670,663, a drop of 10%. Several of the older suburbs which had been growing rapidly in the first half of the century also lost population, especially West Milwaukee (-25%), Shorewood (-10%) and Whitefish Bay (-12%). Yet, communities such as Germantown, Greendale, Greenfield, Menomonee Falls, Mequon, New Berlin, and Oak Creek underwent rapid growth during this period. By 1975, the MMSD planning area comprised 81% of the SMSA population (1,141,211 persons).

The trend of dispersed population growth continued from 1975 to 1978. The population of the SMSA declined by 1%, from 1,416,793 persons to 1,399,289 persons, as migration out of the SMSA began. Twelve communities in the MWPAP planning area had declining populations during this period, as a result of migration to newer SMSA (suburban) communities and migration out of the SMSA entirely. For a more detailed discussion of population trends in the Milwaukee area, see the MMSD System Plan EA Chapter 4.

4.2.2.1 Population Forecasts

There are four major sources for population forecasts for the Milwaukee SMSA: the U.S. Bureau of Economic Analysis, the Wisconsin Department of Administration (DOA), the Milwaukee

TABLE 4.12
POPULATION TRENDS (1900-1978)

Area	1900 Population	1950 Population	% SMSA	% Change Population 1900-1950	1960 Population	1970 Population	1975 Population	% SMSA	% Change Population 1960-1975	1978 Population	% Change Population 1975-1978
USA	75,994,575	151,325,798	--	99.1	179,323,175	203,184,772	213,032,000	--	18.8	217,700,000	2.2
Wisconsin	2,069,042	3,434,575	--	66.0	3,952,771	4,417,933	4,607,000	--	16.6	4,652,755	1.0
Milwaukee County	330,017	871,047	85.9	163.9	1,036,047	1,054,249	1,012,536	71.5	-2.3	960,993	-5.1
Ozaukee County	23,539	33,902	3.3	43.7	46,119	63,839	76,579	5.4	40.8	69,914	7.7
Washington County	23,539	33,902	3.3	43.7	46,119	63,839	76,579	5.4	40.8	83,282	8.7
Waukesha County	35,229	85,901	8.4	143.8	158,249	231,338	262,746	18.5	66.0	285,100	8.5
SMSA	405,198	1,014,211	100.0	150.3	1,278,856	1,403,887	1,416,793	100.0	10.8	1,399,289	-1.2
MMSD Planning Area	N/A	N/A	--	--	N/A	1,170,022	1,141,211	80.5	--	N/A	
Bayside	--	--	--	--	3,181	4,461	4,538	0.3	42.7	4,560	0.5
Brookfield	--	--	--	--	19,812	32,140	33,371	2.4	68.4	35,638	6.8
Brown Deer	--	--	--	--	11,280	12,582	13,570	1.0	20.3	14,250	5.0
Butler	--	1,047	0.1	--	2,274	2,261	2,230	0.2	-1.9	2,105	-5.9
Caledonia (Racine Co)	2,805	5,713	--	103.7	9,696	16,748	18,581	--	91.6	19,483	4.8
Cudahy	--	12,182	1.2	--	17,975	22,078	21,653	1.5	20.5	21,144	-2.4
Elm Grove	--	--	--	--	4,994	7,201	7,692	0.5	54.0	8,038	4.5
Fox Point	--	2,585	0.3	--	7,315	7,939	7,911	0.6	8.1	7,895	-0.2
Franklin	--	--	--	--	10,006	12,247	13,950	1.0	39.4	16,856	20.8
Germantown	--	357	0.0	--	622	6,974	8,539	0.6	1,272.8	9,713	13.7
Glendale	--	--	--	--	9,537	13,426	13,480	1.0	41.3	13,722	1.7
Greendale	--	2,752	0.3	--	6,843	15,089	16,844	1.2	146.1	17,975	6.7
Greenfield	--	--	--	--	17,636	24,424	31,641	2.2	79.5	30,250	-4.5
Hales Corners	--	--	--	--	5,549	7,771	8,773	0.6	58.1	8,890	1.3
Menomonee Falls	587	2,469	0.2	259.4	18,276	31,697	33,429	2.4	82.9	32,842	-1.7
Mequon	--	--	--	--	8,543	12,150	14,820	1.0	73.5	16,654	12.3
Milwaukee	285,315	637,392	62.8	123.4	741,324	717,372	670,663	47.3	-9.5	620,162	-8.1
Muskego	--	--	--	--	--	11,573	13,410	0.9	--	15,241	13.6
New Berlin	--	--	--	--	15,788	26,910	31,333	2.2	98.5	33,260	6.1
Oak Creek	--	--	--	--	9,372	13,928	15,748	1.1	68.0	16,070	2.0
River Hills	--	567	0.1	--	1,257	1,561	1,547	0.1	23.1	1,590	4.8
St. Francis	--	--	--	--	10,065	10,489	9,925	0.7	-1.4	10,269	3.5
Shorewood	--	16,199	1.6	--	15,990	15,576	14,336	1.0	-10.3	14,163	-1.2
South Milwaukee	3,392	12,855	1.3	279.0	20,307	23,297	23,290	1.7	15.2	22,673	-3.1
Thiensville	--	897	0.1	--	2,507	3,182	3,819	0.3	52.3	4,015	5.1
Wauwatosa	2,842	33,324	3.3	1,072.6	56,923	58,676	55,712	3.9	-2.1	54,416	-2.4
West Allis	--	42,959	4.2	--	68,157	71,649	68,966	4.9	1.2	66,791	-3.2
West Milwaukee	--	5,429	0.5	--	5,043	4,405	3,787	0.3	-24.9	3,529	-7.3
Whitefish Bay	512	14,665	1.4	2,764.3	18,390	17,402	16,200	1.1	-11.9	15,800	-2.5

Department of City Development (DCD), and SEWRPC. All of these agencies have made population forecasts for the years 1985 and 2000, shown on Table 4.13. However, all these projections differ, and estimates of the actual 1979 population indicate that they all may be high.

In conformation with EPA regulations, the MWPAP and EIS have used the SEWRPC forecasts for their studies. The SEWRPC population forecasts indicate that the decreasing population trend of the past decade will end. SEWRPC expects Milwaukee County, which suffered population declines in the 1970s, (see Table 4.12) to increase in population throughout the remainder of this century. By the year 2000, the population would approximately reach its 1970 level. Waukesha County would experience the greatest numerical increase, but Ozaukee and Washington Counties would grow by greater percentages (109% for Ozaukee County and 124% for Washington County).

4.2.2.2 Households

A household is defined as the people living in one housing unit. Public services are allocated based on the number of households in a community. In the Milwaukee SMSA, the number of households increased from 1960 to 1978, and even during the time from 1975 to 1978, when population was declining. Table 4.14 presents the number of households and average persons per household for the planning area.

The increase in the number of households is due to population increases in some communities, but also to a decrease in average household size (persons per household). In Milwaukee County, population declined from 1960 to 1978, but the number of households steadily increased. In the other three SMSA counties, the decline in average household size was not very great, however the number of households increased due to population increases. SEWRPC forecast the numbers and size of households through the year 2000. These estimates are also presented in Table 4.14.

4.2.3 Economy

To assess the economic climate of the Milwaukee area, industry has been divided into two groups: exporting and non-exporting. Exporting or basic industries produce goods and services which are sold outside of the economic area; non-exporting or non-basic industries produce and sell goods and services locally. Basic industries provide the flow of income into an area which is necessary to create and to support non-basic industries. Therefore, both income and employment in the are are independent on basic (exporting) industries.

TABLE 4.13
POPULATION FORECASTS FOR THE MILWAUKEE SMSA
AND FOR THE PLANNING AREA

Milwaukee SMSA Source	1970	1985	2000
OBERS (U. S. Bureau of Economic Analysis 1977)	1,408,675[e]	1,499,300	1,591,100
DOA (Wisconsin Department of Administration 1975)	1,403,688[a]	1,555,990	1,766,240
SEWRPC (1978)	1,403,688[a]	1,528,300	1,727,200
DCD (Milwaukee Department of City Development 1977)	1,403,688[a]	1,451,500	1,569,700
Planning Area			
SEWRPC (1978)	1,146,725[a]	1,164,600	1,264,200

[e] estimated

[a] actual; from 1970 census (U. S. Department of Commerce 1971). The actual 1978 population of the Milwaukee SMSA was 1,399,300. (DOA 1978)

TABLE 4.14
NUMBER AND AVERAGE SIZE OF HOUSEHOLDS

Area	Number of Households				Average Household Size (Persons per Household)			Forecasted: Planned Number of households in 2000	Forecasted: Average Household Size in 2000 (Persons) [1]
	1960[1]	1970[1]	1978[3]	1960-1978[4]	1960[2]	1970[2]	1978[3]		
Milwaukee County	314,875	338,605	356,900	13%	3.21	3.04	2.80	400,300	2.56
Ozaukee County	10,417	14,753	20,200	94	3.65	3.66	3.49	32,500	3.48
Wasington County	12,532	17,385	24,500	95	3.64	3.63	3.45	42,300	3.34
Waukesha County	42,394	61,935	81,300	92	3.66	3.66	3.52	117,800	3.50
SMSA	380,218	432,678	482,900	27	3.29	3.17	2.98	592,900	2.79
Bayside	854	1,220	1,515	77	3.72	3.59	3.13	1,284	2.88
Brookfield	5,064	8,185	10,689	110	3.90	3.91	3.65	11,804	3.64
Brown Deer	2,832	3,465	4,280	51	3.97	3.60	3.20	5,373	3.00
Butler	N/A	N/A	N/A	-	N/A	N/A	3.81	591	3.65
Caledonia	2,476[5]	4,203[5]	N/A	-	N/A	3.78	N/A	-	3.62
Cudahy	5,288	6,807	7,010	33	3.38	3.23	3.02	8,343	2.86
Elm Grove	1,217	1,776	2,411	98	3.89	3.78	3.65	1,712	3.64
Fox Point	2,009	2,263	2,624	31	3.64	3.42	3.13	2,678	2.88
Franklin	2,327	2,941	5,000	115	4.02	4.02	3.40	12,509	3.00
Germantown	N/A	1,744	2,871	-	N/A	4.00	3.36	8,572	3.52
Glendale	2,793	3,710	4,561	63	2.51	3.43	3.13	6,784	3.00
Greendale	1,833	3,939	5,006	173	3.73	3.83	3.65	5,399	2.99
Greenfield	4,626	6,897	10,300	123	3.77	3.48	3.25	12,977	2.99
Hales corners	1,474	2,169	2,454	66	3.76	3.57	3.65	2,713	2.99
Menomonee Falls	4,701	7,954	N/A	-	3.87	3.97	3.81	16,662	3.65
Mequon	2,270	3,163	4,923	117	3.62	3.76	3.36	11,120	3.45
Milwaukee	230,987	236,981	240,870	4	3.13	2.96	2.68	249,841	2.55
Muskego	2,288	2,944	4,148	81	3.85	3.92	3.66	5,938	3.61
New Berlin	3,972	6,768	9,052	128	3.96	3.98	3.66	15,265	3.69
Oak Creek	2,367	3,585	5,130	117	3.96	3.88	3.23	15,418	3.00
River Hills	336	438	529	57	3.53	3.42	3.13	1,174	2.88
St. Francis	2,434	2,952	3,560	46	3.77	3.33	3.02	4,122	2.86
Shorewood	5,675	5,913	6,100	7	2.80	2.61	2.33	4,859	2.50
South Milwaukee	5,698	6,650	7,320	28	3.55	3.48	3.23	7,828	2.86
Thiensville	672	894	1,187	77	3.72	3.56	3.36	1,205	3.45
Wauwatosa	15,820	17,927	18,570	17	3.24	3.05	3.07	18,684	2.75
West Allis	20,397	23,546	25,237	24	3.32	3.00	2.75	25,845	2.59
West Milwaukee	1,837	1,845	1,333	-27	2.73	2.35	2.75	1,998	2.31
Whitefish Bay	5,319	5,391	5,500	-3	3.45	3.22	2.93	4,874	2.50

4.2.3.1 Manufacturing

The manufacturing sector has the greatest influence on the economy of the Milwaukee area. This sector contains the vast majority of the exporting industries in the area and the greatest percentage of employment. The next largest is the service sector, including finance, insurance, and real estate. In 1970, manufacturing employment stood at 201,339 (35% of the total employment that year), and contained all of the major exporting industries in the Milwaukee SMSA. Table 4.15 compares the main industrial sectors (by employment) for the Nation, the State, and the Milwaukee SMSA. Table 4.16 lists the major exporting industries of the Milwaukee SMSA.

Machinery manufacture is the largest manufacturing industry by employment in the area, and it is an important exporting industry. A number of other manufacturing industries also employ great numbers of people in the Milwaukee area: primary metal, fabricated metal, electrical equipment, transportation equipment, food and kindred products, printing, publishing, paper, and chemical and allied products. Tables 4.15 and 4.16 illustrate the number of people employed in these areas in the Milwaukee SMSA and compare these numbers to those for the State of Wisconsin and the Nation.

In recent years, the rate of employment growth in Milwaukee's basic industries has fallen below the national rate. From 1960 to 1973, employment in the City of Milwaukee declined. This decline in the City, as well as the slowed growth in the SMSA and State, can be attributed primarily to the employment declines of the manufacturing sector. The result has been a loss of jobs in the City of Milwaukee and fewer new jobs in the SMSA and the State. Table 4.17 illustrates the changes in employment in the Nation, State, and SMSA. In the SMSA, the manufacturing employment growth rate from 1960 to 1970 was 5.5% while for the State it was 6.0%. These rates are considerably below the national average of 15.2% for manufacturing employment during the same period.

While many employment sectors are experiencing declining growth rates, manufacturing is continuing to lead the overall economic trend of declining employment growth. This does not mean that growth in the entire manufacturing sector is declining. There are a few manufacturing subsectors with increasing growth rates, such as fabricated metal and chemical and allied products. However, the declines of the electrical equipment, transportation equipment, food and kindred products, and other manufacturing subsectors more than offset the gains made by metals and chemicals. The decline in employment in the area implies that the economic environment has become

TABLE 4.15
EMPLOYMENT BY MANUFACTURING SUBCATEGORIES
NATION, WISCONSIN, AND THE SMSA

	Nation (x 1000)		Wisconsin		SMSA	
Subcategory	1960	1970	1960	1970	1960	1970
Ordnance & Assessories	220	242	-----	-----	-----	-----
Lumber & Wood	627	573	19,899	16,981	>2,490	>1,836
Furniture & Fixtures	383	460	8,490	7,976		
Stone, Clay, Glass	604	640	6,381	8,618	-----	-----
Primary Metal	1,231	1,316	24,148	31,177	>27,540	>34,173
Fabricated Metal	1,135	1,380	27,662	42,954		
Machinery (non-electric)	1,479	1,982	87,363	109,184	>76,172	>83,718
Electrical Equipment	1,467	1,917	51,223	50,522		
Transportation Equipment	1,569	1,799	51,218	40,451	21,329	13,782
Other Durable Goods	744	886	27,888	24,352	11,834	17,237
Food & Kindred Products	1,790	1,783	63,366	50,856	19,420	14,796
Tobacco	94	83	453	123	-----	45
Textile Mill Products	924	956	7,133	6,910	>4,656	>4,376
Apparel, Fabricated Textiles	1,233	1,366	8,195	7,409		
Printing, Publishing, Paper	1,512	1,808	65,545	75,265		
Chemical and Allied Products	828	1,049	8,034	11,556	>12,535	>19,689
Other Non-Durables	954	1,111	25,732	25,502	14,891	11,732
Non-Specified Industry	---	---	1,066	2,819	-----	-----
Total Manufacturing	16,790,000	19,349,000	483,796	512,655	190,867	201,339

Source: U.S. Department of Commerce, Bureau of the Census, Characteristics of the Population, U.S. and Wisconsin, for 1960 and 1970 and Barrett & Blair, 1976.

> = categories collapse

TABLE 4.16
KEY EXPORT (BASIC) INDUSTRIES
MILWAUKEE SMSA

Sector	Percentage of Total Manufacturing Employment
Food and Kindred Products	9.3
Printing and Publishing	6.6
Leather and Leather Products	3.7
Primary Metals	6.4
Fabricated Metals	14.3
Machinery except Electrical	26.4
Electric Distribution and Electronics Equipment	17.3
TOTAL	84.9%

TABLE 4.17
CHANGE IN MAJOR EMPLOYMENT CATEGORIES
NATION, STATE, SMSA
1960 - 1970

Employment Categories	Change in Nation	Percent Change	Change in Wisconsin	Percent Change	Change in SMSA	Percent Change
Total Employment	14,098,000	23.5	258,183	17.6	102,674	21.8
Agriculture	(2,261,000)*	(39.5)*	(58,924)*	(34.8)*	--	--
Mining	(89,000)*	(12.6)*	26	0.9	(479)*	(-)*
Construction	496,000	17.2	8,357	11.7	3,345	15.6
Manufacturing	2,553,000	15.2	28,854	6.0	10,472	5.5
Trans., Comm. & Public Utilities	489,000	12.2	3,196	3.9	2,919	10.0
Wholesale Trade	3,523,000	30.9	7,725	44.2	9,630	17.9
Retail Trade			50,125	23.0	23,427	13.8
Finance, Insurance, Real Estate	1,019,000	38.2	16,839	37.3	49,528	40.0
Service & Misc.	4,189,000	56.4	137,403	52.1		
Government	4,182,000	50.1	13,691	27.7	3,832	20.2
Industry Not Reported						

*Parenthesis indicate a decline.

Source: Data developed from U. S. Department of Commerce, Bureau of the Census, Characteristics of the Population, U. S. and Wisconsin, for 1960 and 1970, and Barrett and Blair.

unfavorable for some manufacturing subsectors, and some industries are moving out of the area.

4.2.3.2 Other Sectors

The manufacturing sector is not the only sector with declining employment growth rates. The SMSA growth rates for the wholesale and retail trade, the government, and the construction sectors are also below the averages of their national counterparts. Only the service sectors (finance, insurance, real estate) have an employment growth rate higher than the national average. Table 4.17 also compares growth rates for these sectors.

Representatives of the Public Works Improvement Program and the Laborers Union for Milwaukee, Ozaukee, Washington, and Waukesha Counties confirm that the growth rate for the construction industry continues to decline in the Milwaukee area. The Public Works Improvement Program represents about 55 firms in the Milwaukee area. The Laborers' Union represents 2,500 active laborers, 800 of which are experienced in sewer related construction. These sources state that there is an extensive local labor pool in the construction industry. Also, there are some firms experienced in tunnel construction, although not specifically experienced with construction of the depth and magnitude required for deep tunnels.

4.2.3.3 Locational Trends

The locational trends of industry and employment in the Milwaukee area have been much the same as the trends in housing. Industries have been moving out of the City of Milwaukee to suburban and rural locations. A report prepared for the Office of State Planning and Energy in June, 1977 shows that there have been numerous plant relocations in the SMSA. In the period from 1964 to 1974, 1,041 firms left the City of Milwaukee and relocated in suburban Milwaukee, Racine, and Kenosha. Fifty-three firms moved from the City of Milwaukee to areas outside the SMSA, yet still in the State of Wisconsin (firms that left the State entirely were not considered in the study). Of the relocating firms, 19% were service sector firms, 17% were wholesale and retail trade firms, and 17% were manufacturing firms. Manufacturing firms, however, comprised approximately 50% of the relocating employment. Based upon employment, the majority of the relocating firms were small. Approximately 57% of the firms had 10 or fewer employees, and 92% had 50 employees or fewer. There was only one relocating firm that employed more than 1,000 people.

These locational trends have caused significant commercial and industrial growth in Waukesha County and suburban Milwaukee County, much of which is evident in large shopping centers and industrial parks. There are several reasons for movement of industry: outdated plants and buildings; lack of necessary space at locations in the City; pick-up, delivery, and parking problems; high land costs (property taxes); and the desire to follow the movement of residential development (particularly in the case of service industries).

Nationally, the locational shifts of industry have been to the South. This is especially true in the manufacturing sector. The Midwest and the Northeast have been experiencing declines in manufacturing employment while the South is enjoying growth in those sectors. From 1965 to 1975 manufacturing employment declined 6.8% in the North and Midwest, but it increased 44.2% in the South. There are several possible reasons for this shift of manufacturing firms to the South: proximity to new markets, better labor markets, available land, lower land costs, reduced energy costs, and preferential tax structures. These national and local trends could contribute to the slow growth of manufacturing in the Milwaukee area.

4.2.3.4 Employment

Even with the recent trend of declining employment growth in the Milwaukee area, the unemployment rates have been consistently below those of the State and the Nation. In 1950, the seven county SEWRPC region had an unemployment rate of 3.4%, considerably lower than the 3.8 % level of the State and the 5.3%, level of the Nation. By 1972, the regional unemployment rate had risen to 4.7%, yet it was still below the 5.0% levels of the State and the 5.6% level of the Nation.

The Metropolitan Milwaukee Association of Commerce has compiled data on unemployment in the Milwaukee SMSA from 1968 to 1978 (presented in Table 4.18). As is shown in that table, the trend of low unemployment has continued. The Milwaukee area has been experiencing lower levels of unemployment than the national average, although these levels parallel the pattern of the national rate. Like the nation, the SMSA reached its highest level of unemployment in 1975, when SMSA unemployment reached 8%. By 1977, it had declined to 4.3%.

4.2.3.5 Income

The recent shifts in industry and employment have resulted

TABLE 4.18

SMSA EMPLOYMENT

Year	Employment	Unemployment Rate
1968	601,000	2.7%
1969	613,000	2.7%
1970	613,000	2.7%
1971	607,000	5.0%
1972	602,000	4.4%
1973	635,000	3.8%
1974	624,000	4.1%
1975	616,000	8.0%
1976	637,000	6.3%
1977	646,000	4.3%
1978	680,000	4.3%

Source: MMAC

in long-term losses of potential income for the Milwaukee area, mainly due to the decline in employment in the manufacturing sector. This loss in the manufacturing sector contributes to the overall income loss in two ways: the first is a decrease of business receipts to the area from the exporting industries; the second is a loss of disposable personal income due to declining employment. The rise in employment in the service sector has not been able to offset the decline of the manufacturing sector. Service industries provide little, if any, inflow of income to the economy since they rarely produce exportable services. In addition, the personal incomes of service employees are generally lower than those of manufacturing employees.

From 1970 to 1976, the manufacturing sector in the City of Milwaukee lost 24,000 jobs and $69 million in potential wages. The service sector gained more than 35,000 jobs, but added only $49 million in wages and income. Table 4.19 lists the 1978 average household income (before taxes) by community for the planning area. These household incomes are derived by multiplying the 1978 per capita incomes (as published by the Wisconsin Department of Revenue) by the persons per household figure for each community (MWPAP, EA, 1980).

4.2.3.6 Affected Industries and Firms

The MFP may affect industries by increasing property tax rates for capital expenditures and by raising user charges for operation and maintenance costs. The 20 firms with the highest equalized property value (which determines property tax rates) and the 20 firms with the highest user charges in Milwaukee County were chosen as those most likely to be affected by the MFP. The list includes 31 firms since some of the firms were in both categories.

The 31 firms were grouped into three categories for comparison: heavy manufacturing (16 firms); malt beverage and dairy products (5 firms); and food processing, paperboard products, chemical, and leather tanning (10 firms). Table 4.20 identifies the companies on this list. The 16 heavy manufacturing firms generally have high taxable property values and low wastewater discharge. The other firms have average to low taxable property values with high wastewater discharge (see Table 4.21).

The income generated for the local economy by the 31 selected firms is shown in Table 4.22. The value added (final price less cost of materials) by the firms is shown both in dollars and as a percent of the value added.

TABLE 4.19

1978 AVERAGE HOUSEHOLD INCOMES BY COMMUNITY*

1.	River Hills	$89,000
2.	Fox Point	52,000
3.	Elm Grove	51,500
4.	Bayside	51,500
5.	Brookfield	37,000
6.	Mequon	36,500
7.	Whitefish Bay	33,500
8.	Hales Corners	29,500
9.	Thiensville	28,500
10.	Glendale	28,000
11.	New Berlin	26,500
12.	Greenfield	26,000
13.	Greendale	26,000
14.	Menomonee Falls	26,000
15.	Butler	25,000
16.	Germantown	25,000
17.	Muskego	24,500
18.	Wauwatosa	24,500
19.	Franklin	23,500
20.	Oak Creek	23,000
21.	Brown Deer	22,500
22.	South Milwaukee	21,000
23.	Shorewood	20,500
24.	Caddy Vista	20,500 * Estimated
25.	Cudahy	19,000
26.	St. Francis	18,000
27.	West Allis	17,500
28.	Milwaukee	16,000
29.	West Milwaukee	12,000
30.	Planning Area Weighted Average	20,500

Bureau of the Census 1978 Milwaukee SMSA Estimate = 21,896

*Incomes rounded to nearest $500

Source: 1978 Wisconsin Department of Revenue Per Capita Income by Community multiplied times the Average Household Size by Community

TABLE 4.20
FIRMS MOST LIKELY TO BE AFFECTED BY THE MWPAP

Heavy Manufacturing

Paints & Allied Products
1. P. P. G. Industries

Primary Metals
2. Babcock & Wilcox

Fabricated Metals
3. Ladish

Machinery Except Electrical
4. Allis Chalmers
5. Briggs & Stratton
6. Rexnord
7. Harnischfeger
8. Cross & Trecker
9. Falk

Electric & Electronic Equipment
10. Allen-Bradley
11. General Motors
12. General Electric
13. Cutler-Hammer

Transportation Equipment
14. American Motors
15. A. O. Smith
16. Harley-Davidson

Brewing and Dairy Products

Malt Beverages
17. Miller Brewing[1]
18. Pabst Brewing[1]
19. Schlitz Brewing[1]
20. Froedtert Malt

Dairy Products
21. Borden

Other Manufacturing

Food Processing Excluding Beverages and Dairy Products
22. Universal Foods[1]
23. Krause Milling
24. Patrick Cudahy
25. S. E. Wisconsin Products

Paperboard Products
26. Wisconsin Paperboard

Miscellaneous Chemicals
27. Peter Cooper[1]

Leather Tanning
28. Pfister-Vogel Tanning[1]
29. Cudahy Tanning
30. Flagg Tanning
31. Gebhardt-Vogel Tanning

Source: MMSD, 1980

[1] One of the six wet industries.

TABLE 4.21
SEWERAGE PROPERTY TAXES AND USER CHARGES
FOR THREE INDUSTRIAL GROUPS
(x $1000)

Description	1979 Sewerage Costs With Existing 50% Line A Tax Exemption			1979 Sewerage Costs Adjusted for 100% Line A Tax Exemption		
	User Charge	Property Tax	Total	User Charge	Property Tax	Total
Costs in Thousands at 1980 Price Levels						
Group A	$ 716.5	$ 506.6	$1,223.1	$ 716.5	$ 308.0	$1,024.50
Group B	3,038.0	120.2	3,158.2	3,038.0	112.0	3,150.0
Group C	3,572.1	23.7	3,595.8	3,572.1	16.9	3,589.0
Total	$7,326.6	$ 650.5	$7,977.1	$7,326.6	$ 436.9	$7,763.5
Sewerage Cost Components as a Percentage of Total						
Group A	59%	41%	100%	70%	30%	100%
Group B	96%	4%	100%	96%	4%	100%
Group C	99%	1%	100%	100%	-	100%
Total	92%	8%	100%	94%	6%	100%

Note: Dollar amounts in thousands at 1960 price levels.

[1] [2] In 1979 50% of Line A items were exempt from taxation.
The adjustment shows what the 1970 sewerage costs would have been with 100% of the Line A items exempt. Full exemption of these items will occur by 1981.

A - Heavy Machinery
B - Breweries and Dairy Products
C - Other Manufacturing

TABLE 4.22
VALUE ADDED FOR SELECTED INDUSTRIES
(x $1000)

Description	Value Added	Selected Industries Estimated Value Added[1]
Meat Products	$78,000	$36,660
Dairy Products	61,300	43,520
Grain Mill Products	17,600	10,560
Malt Beverages	398,000	390,040
Misc. Food Prod.	26,900	7,800
Paperboard Prod.	66,500	*
Paints & Allied	28,100	20,230
Misc. Chemicals	35,100	7,720
Leather Tanning	70,400	26,750
Foundries	182,000	36,400
Metal Forgings	232,100	164,790
Engines & Turbines	453,800	331,270
Farm Equipment	193,600	193,600
Construction Mach.	500,000	225,000
Metal Working Mach.	152,300	62,440
Industrial Mach.	286,200	226,100
Electric & Electronic	735,100	433,710
Transportation Equip.	397,300	353,600
Total	$3,914,300	$2,570,190
All Manufacturers	$5,855,700	

*Ratio of selected industrial employment to total industry employment is too low to estimate value added.

[1]Value added is the final price of a product less the cost of materials

Value added for selected industrials estimated by the ratio of a firm's employment to total employment in its Standard Industrial Code (SIC) category and applying this ratio to total value added in the same SIC category.

Source: U.S. Department of Commerce Bureau of the Census. "1976 Annual Survey of Manufactuers"

Employment in the 31 firms represents a large percentage of total Milwaukee County employment in their respective industries. Table 4.23 shows 1977 Milwaukee County employment for the represented industries as well as the percentage of employment provided by the selected firms. Total Milwaukee County employment in these industries was 96,345 persons, 65,470 of which were employed by the 31 selected firms. Total Milwaukee County employment in 1977 was 421,280.

Since Line A property items (including manufacturers' materials and finished products, merchants' inventory, and livestock), are being exempted from property taxation (and will be fully exempt by 1981) the taxable property of the 31 firms has declined. In 1979, their taxable property, with a 50% Line A exemption, was approximately $1.016 billion. The taxable property of the same 31 firms will decline to $615 million (1975 dollars) by 1981, assuming that there are no changes in property.

The sewerage costs for the 31 selected firms are shown in Table 4.21 There are six wet industries among the 31 and these have the greatest flows and wasteloads. They also have the highest user charges, totaling approximately $5.093 million. The total user charge for the remaining firms is $2.232 million.

4.2.4 Municipal Revenues and Expenditures

The Milwaukee area has long had a reputation of being a heavily taxed metropolitan area. (Figure 3.13 of the CSO Appendix shows the average annual tax assessment for single family houses in the Combined Sewer Service Area.) Table 4.24 compares estimates of the state and local taxes paid by a family of four in Milwaukee and seven other large midwestern cities. At all income levels, the percentage of income devoted to state and local taxes is much higher in Milwaukee than in the other cities. It is also much higher than the average for 30 of the nations largest cities.

At an income level of $22,500, a family of four in Milwaukee will be taxed 13.2% of their income by state and local government. In comparison the 30 city average is 9%. At the other end of the spectrum in Nashville, Tennessee, the same family of four will be taxed only 4.2% of their income by state and local government. At a $22,500 income level, only New York, Philadelphia, and Boston residents pay a higher proportion in taxes than Milwaukee residents. Although the City of Milwaukee has the highest taxes in the area, the gap between city and suburban tax levels is narrowing due to the rise in suburban tax rates.

TABLE 4.23
EMPLOYMENT IN SELECTED INDUSTRIES
AS A PERCENT OF INDUSTRY EMPLOYMENT
IN MILWAUKEE COUNTY

		Selected Industrials	
	1977 Employment	1977-78 Employment	% Of Industrial
Meat Products	2,110	1,000	47%
Dairy Products	420	300	71
Grain Mill Products	375	225	60
Malt Beverages	8,080	7,935	98
Misc. Food Prod.	615	180	29
Paperboard Prod.	2,575	70	3
Paints & Allied	625	450	72
Misc. Chemicals	1,030	230	22
Leather Tanning	2,680	1,015	38
Foundries	4,954	1,000	20
Metal Forgings	5,895	4,200	71
Engines & Turbines	12,155	8,905	73
Farm Equipment	up to 2,500	5,895	*
Construction Mach.	10,475	4,685	45
Metal Working Mach.	3,930	1,610	41
Industrial Mach.	6,535	5,160	79
Electric & Electronic	20,195	11,955	59
Transportation Equip.	11,935	10,655	89
	96,345	65,470	

Note: Manufacturing employment in 1977 in Milwaukee County was 154,000; total employment was 421,280. Employment in the selected industrials represents about 42% of manufacturing employment and 16% of total county employment.

* Reason for discrepancy between SIC total and reported employment for selected industrial cannot be determined. Assume 100% for purposes of analysis.

Sources: U. S. Department of Commerce. Bureau of the Census. "County Business Patterns, 1977, Wisconsin" Wisconsin Department of Natural Resources. NR101 Summary Data File. 1978. on industrial discharges. MMSD User Charge files. 1979. MWPAP, 1980.

TABLE 4.24
ESTIMATED STATE AND LOCAL TAXES PAID BY A FAMILY OF FOUR
IN SELECTED CITIES, BY INCOME LEVEL: 1977

City	$7,500 Income		$15,000 Income		$22,500 Income		$30,000 Income		$40,000 Income		$50,000 Income	
	Total Tax Paid	Percent of Income	Total Tax Paid	Percent of Income	Total Tax Paid	Percent of Income	Total Tax Paid	Percent of Income	Total Tax Paid	Percent of Income	Total Tax Paid	Percent of Income
Milwaukee	$769	10.3	$1,869	12.5	$2,975	13.2	$4,132	13.8	$5,516	13.8	$6,737	13.5
Cleveland	551	7.4	1,048	7.0	1,563	7.0	2,132	7.1	2,782	7.0	3,321	6.6
Columbus	465	6.2	895	6.0	1,370	6.1	1,882	6.3	2,492	6.2	3,010	6.0
Indianapolis	742	9.9	1,409	9.4	1,984	8.8	2,644	8.8	3,378	8.5	4,145	8.3
Kansas City, MO	518	6.9	1,063	7.1	1,628	7.2	2,214	7.4	2,907	7.3	3,554	7.1
Memphis	604	8.1	993	6.6	1,307	5.8	1,642	5.5	2,014	5.0	2,257	4.5
Nashville	462	6.2	733	4.9	953	4.2	1,168	3.9	1,446	3.6	1,619	3.2
St. Louis	670	8.9	1,337	8.9	1,996	8.9	2,696	9.0	3,479	8.7	4,163	8.3
30-City Average	650	8.7	1,348	9.0	2,029	9.0	2,770	9.2	3,683	9.2	4,503	9.0

Note: Data based on average family of four (wage earner, spouse, and two children) which owns its own home and lives in city where taxes apply. Comprises state and local sales, income, auto, and real estate taxes.

Source: U. S. Bureau of the Census, Statistical Abstract of the United States: 1979. (100th Edition.) Washington, D.C., 1979.

Table 4.25 shows 1980 budgets and revenue sources for the MMSD planning area communities. Table 4.26 shows the property values and property tax rates for each community. Average home values have been determined for each community in order to estimate future household capital charges for sewer improvements. The property tax is assumed to finance debt service or directly pay for capital improvements to the sewerage system.

4.2.5 Sewerage System Charges

4.2.5.1 User Charge System

In order to be eligible for funding through the Federal Construction Grants Program, the MMSD has developed a User Charge System. The system, put into effect on January 1, 1979, is a method to distribute the annual operation and maintenance expenses incurred by the MMSD to the users of the sewerage system. Each municipality in the MMSD and each contract community is billed for its residential, commercial, and industrial use. The charges are based on four parameters: volume of flow, biochemical oxygen demand (BOD), total suspended solids (TSS), and number of connections to buildings. A unit cost has been developed for each parameter and is used to determine individual charges. The 1980 unit costs are $0.1061 per 1,000 gallons ($0.0280 per1000 liters) of flow, $0.0175 per pound of BOD ($0.0386 per kilogram of BOD), $0.0887 per pound of TSS ($0.1955 per kilogram of TSS), and $28.45 per connection per year. The community distributes their charges by any formula they deem appropriate.

The residential portion of each community's bill is based on the average flow and quality (BOD and TSS) of domestic wastewater, the average number of people per household, and the number of households in the community.

The commercial charge to the municipality is for those users, other than residential, that discharge primarily domestic wastewater, including commercial, governmental, dry industrial (e.g., machining or assembling operations), institutional organizations, and multi-family apartment complexes. All commercial users are assumed to discharge wastewater of the same strength (BOD and TSS) as domestic wastewater, but not the same volume. The flows are determined for each commercial user on the basis of metered water consumption or, if the business pumps water from a well, by the estimated average, hourly employee discharge as estimated by commercial activity (see the MMSD User Charge Program for further details).

TABLE 4.25
1980 BUDGETS AND BUDGET SOURCES

Communities	Adjusted 1980 Budgets	% Change Over 1979	% of Budgets Financed by					Municipal Expenditures Total 1979 Per Person Costs
			Net Property Taxes (1)	State Tax Credits (2)	Other State Sources (3)	Federal Sources	Other Local Revenues (4)	
Milwaukee	$320,561,722	11.6%	19%	6%	34%	20%	21%	$459
Bayside	1,137,875	6.0	50	7	28	2	13	230
Brookfield	8,943,760	8.3	42	6	30	3	19	232
Brown Deer	3,535,720	11.1	30	6	35	3	26	223
Butler	724,586	9.7	36	13	28	4	19	314
Cudahy	5,743,792	6.6	28	11	40	5	16	255
Elm Grove	1,792,654	10.6	45	6	28	4	19	202
Fox Point	2,474,122	10.5	46	6	21	2	25	223
Germantown	3,179,117	12.6	NA	NA	NA	NA	NA	291
Glendale	5,017,180	9.6	47	15	23	3	12	334
Greendale	3,768,361	7.9	35	7	36	3	19	194
Greenfield	7,921,429	13.0	28	5	31	2	34	232
Hales Corners	1,688,927	9.6	34	6	37	2	21	173
Menomonee Falls	8,398,607	16.3	37	7	32	5	19	220
Mequon	4,613,839	7.6	35	6	29	2	28	258
Muskego	2,969,311	10.0	25	3	40	3	19	177
New Berlin	6,293,433	17.1	31	7	40	3	19	161
Oak Creek	6,893,601	10.7	26	12	41	4	17	388
River Hills	1,120,839	14.1	60	11	14	1	14	618
St. Francis	2,999,226	7.5	32	7	43	7	11	272
Shorewood	4,570,352	5.0	40	7	22	4	27	307
S. Milwaukee	6,252,915	9.5	27	8	39	4	22	252
Thiensville	840,290	10.0	39	6	30	2	23	190
Wauwatosa	18,496,172	7.6	40	11	22	5	22	316
West Allis	25,431,924	9.1	35	9	30	4	21	349
W. Milwaukee	2,606,265	1.0	20	19	38	5	18	703
Whitefish Bay	3,793,289	2.4	40	6	26	2	26	234

(1) Net property taxes are after subtraction of estimated state tax credits on general and personal property.
(2) Estimated state tax credits on general and personal property applied to municipal taxes.
(3) "Other State Sources" include state aids, shared revenues, state reimbursement for exempt manufacturers' machinery and equipment, and personal property tax relief transfer payments.
(4) Other local revenues include: special assessments, fees and fines, licenses, interest in investments, accumulated surplus, etc.

Source: Citizen's Governmental Research Bureau.

TABLE 4.26
1979 PROPERTY VALUES AND TAX RATES

	1979 Property Value	Household Capital Charging Method	Tax Rate	Household Capital Charge	O&M Charge Method	House-hold O&M	Total Household Charge	% of Income
Bayside								
Bayside	$115,000	Property Tax	$.86	$99	Flat Rate	$63	$162	.32%
*Brookfield	89,000	Property Tax	.27	24	Flat Rate	66	90	.24
Brown Deer	62,000	Property Tax	.86	53	Meter	66	119	.53
*Butler	52,000	Avg. Consumption/ H. H.		11	Meter	59	70	.28
*Caddy Vista	45,000	Property Tax & Flat Rate			Flat Rate		162	.79
Cudahy	51,500	Property Tax	.86	44	Meter	62	106	.56
*Elm Grove	111,500	Flat Rate		37	Flat Rate	61	98	.19
Fox Point	109,500	Property Tax	.86	94	Flat Rate	61	155	.30
Franklin	68,500	Property Tax	.86	59	Flat Rate	66	125	.53
*Germantown	62,500	Flat Rate		16	Flat Rate	64	80	.32
Glendale	75,000	Property Tax	.86	65	Meter	61	126	.45
Greendale	79,000	Property Tax	.86	68	Meter	65	133	.51
Greenfield	61,500	Property Tax	.86	53	Meter	63	116	.45
Hales Corners	67,500	Property Tax	.86	58	Flat Rate	65	123	.42
*Menomonee Falls	67,000	N/A					44	.17
*Mequon	94,500	Flat Rate		27	Flat Rate	65	92	.25
Milwaukee	40,000	Property Tax	.86	34	Meter	58	92	.57
*Muskego	63,000	Flat Rate		61	Flat Rate	35	96	.39
*New Berlin	68,000	Flat Rate		18	Flat Rate	66	84	.32
Oak Creek	58,000	Property Tax	.86	50	Meter	63	113	.49
River Hills	159,000	Property Tax	.86	137	Flat Rate	63	200	.22
St. Francis	47,500	Property Tax	.86	41	Meter	58	99	.56
Shorewood	85,500	Property Tax	.86	74	Meter	55	129	.63
South Milwaukee	55,500	Property Tax (one rate 1.15)		(7)	Property Tax (1.15)	(54)	61	.29
*Thiensville	81,500	Flat Rate		4	Flat Rate	68	72	.25
Wauwatosa	70,000	Property Tax	.86	60	Meter	55	115	.47
West Allis	61,000	Property Tax	.86	52	Meter	58	110	.63
West Milwaukee	50,500	Property Tax	.86	43	Flat Rate	56	99	.84
Whitefish Bay	90,000	Property Tax	.86	77	Meter	57	134	.40

*Contract Communities
Source: All four counties "Statistical Report of Property Valuations."

Industrial users include wet industries such as tanneries, breweries, food and kindred products, and veterinarian services. Industrial users are charged according to their actual water use. However, because the wastewater from these users has greater strength than domestic flow, they are charged according to average domestic flow plus a surcharge formula to account for the strength of their discharge.

Currently a flat fee is charged per connection for infiltration and inflow into the system. This practice will be reviewed upon completion of the Sewer System Evaluation Study and the rehabilitation program that follows.

4.2.5.2 Capital Financing

According to Wisconsin law (Chapter 59.96, Sec. 7), the Milwaukee Metropolitan Sewerage Commission shall place the amount of funds required for financing capital improvements in the budget. The County Board of Supervisors is required and directed to provide for this amount by tax levy, by issuing corporate bonds, or by a combination of the two methods. If bonds are issued, they are limited to a maximum maturity of twenty years. In order to pay for the debt service on the bonds, "there shall be annually levied by said county board a direct tax upon all taxable property in said district sufficient to pay the annual interest thereon, and also to pay and discharge the principal thereof at maturity."

The present method of financing improvements within the MMSD conforms to these Statutes. The 1980 tax rate levied by Milwaukee County on all property in the County (except tax exempt property) to pay for debt service on MMSD capital improvements is $0.86 per $1000 of state equalized property value. Based on this tax rate, the EIS consultant has estimated the approximate dollar amount the average household in each Milwaukee County Community would be assessed. Commercial, industrial, and institutional property in the County is also assessed at the rate of $0.86 per $1000. To determine any property tax assessment for MMSD capital improvements in 1980, the equalized value of a property is multiplied by 0.00086 (see Table 4.27).

4.2.5.3 Contract Communities

Service to the seven municipalities outside of the MMSD boundaries is provided on a contract basis. Up until the institution of the User Charge System, operation and maintenance charges were included in the contract formula (they are now included as part of the User Charge Program). The contract formula distributes the charges for MMSD capital expenditures. The distribution is carried out in a two-part

TABLE 4.27
1980 TAX RATES
PER $1000 EQUALIZED

	1979 Equalized Taxable Property Value	Municipal Purposes	Public Schools	County, State, Forestry	MMSD Sewerage	Vocational School	Gross Total	State Credit	1980 Net Tax Rate	Total Equalized Property Tax on a $50,000 House
Bayside	$ 179,223,700	$3.65	$11.48	$3.22	$.86	$1.41	$20.62	$ 2.45	$18.17	$ 909
*Brookfield	1,201,525,480	3.63	12.60	2.27		1.24	19.74	2.30	17.44	872
Brown Deer	316,448,400	3.99	14.01	3.22	.86	1.41	23.49	3.67	19.82	991
*Butler	84,379,390	4.24	13.25	2.27		1.24	21.00	3.71	17.29	865
*Caddy Vista										
Cudahy	422,583,090	5.36	13.19	3.22	.86	1.41	24.04	4.98	19.06	953
*Elm Grove	262,714,570	3.46	12.61	2.27		1.24	19.58	2.07	17.51	876
Fox Point	299,433,600	4.32	11.62	3.22	.86	1.41	21.43	2.56	18.87	944
Franklin	354,962,560	2.43	14.51	3.22	.86	1.41	22.43	3.60	18.83	942
*Germantown	251,696,040								19.47	973
Glendale	600,909,730	5.16	9.82	3.22	.86	1.41	20.47	3.58	16.89	845
Greendale	442,625,280	3.61	13.68	3.22	.86	1.41	22.78	3.24	19.54	977
Greenfield	680,028,850	4.06	11.99	3.22	.86	1.41	21.54	2.91	18.63	932
Hales Corners	187,018,930	3.78	14.02	3.22	.86	1.41	23.30	3.12	20.18	1,009
*Menomonee Falls	730,339,060	5.10	13.36	2.27		1.24	21.97	2.60	19.37	969
*Mequon	566,010,670	3.38	11.24	2.25		1.41	18.28	2.20	16.08	804
Milwaukee	9,345,674,700	8.69	15.45	3.22	.86	1.41	29.63	5.77	23.86	1,193
*Muskego	319,675,770	2.57	9.72	2.27		1.24	15.80	1.42	14.38	719
*New Berlin	832,419,000	2.87	13.56	2.27		1.24	19.95	2.63	17.32	866
Oak Creek	487,888,750	5.05	11.28	3.22	.86	1.41	21.82	5.72	16.10	805
River Hills	93,281,500	8.59	10.95	3.22	.86	1.41	25.03	3.65	21.38	1,069
St. Francis	168,063,880	7.25	13.01	3.22	.86	1.41	25.75	3.96	21.79	1,090
Shorewood	368,554,510	5.95	14.24	3.22	.86	1.41	25.67	3.66	22.01	1,101
South Milwaukee	417,882,350	5.19	14.44	3.22		1.41	24.26	3.96	20.30	1,016
*Thiensville	97,129,270	3.89	11.24	2.25		1.41	18.79	2.26	16.53	827
Wauwatosa	1,624,519,380	5.80	9.97	3.22	.86	1.41	21.26	3.54	17.72	886
West Allis	1,451,894,730	7.77	13.36	3.22	.86	1.41	26.62	4.36	22.26	1,113
West Milwaukee	257,630,540	3.96	13.36	3.22	.86	1.41	22.80	7.47	15.33	767
Whitefish Bay	462,833,850	3181	14.86	3.22	.86	1.41	24.16	3.14	21.02	1,051

* Outside Milwaukee County

formula, reflecting allowances for reasonable return on investment (approximately 7.5%) and annual depreciation (2%).

The contract communities contributed 3,013 million gallons (11.4 million m^3) of sewage to be treated in 1979, at a cost of $177.67 per million gallons ($6,940.55 per million m^3). The 1979 MMSD billing to each contract community for capital costs is outlined in Table 4.28.

TABLE 4.28

	Population Served	Capital Charges-1979	Cost Per Capita
MMSD	998,200	$10,229,368	$10.25
Brookfield	13,867	$ 129,273	$ 9.32
New Berlin	9,088	110,638	12.17
Mequon	12,817	152,311	11.88
Elm Grove	7,850	91,427	11.65
Butler	2,105	50,496	23.99
Bayside	N/A	2,161	-
Menomonee Falls	N/A	8,081	-
		$ 544,387	

Source: CGRB

4.2.6 Noise

Noise is measured on a scale of "decibels" (dB). The scale runs from zero dB, the threshold of human hearing, to 130 dB, the level at which sound becomes painful. A change in noise level of five dB or less is generally unnoticeable. The noise levels of some common activities are shown on Table 4.29.

Noise is categorized into three types: constant, fluctuating, or intermittent. Constant noises are continuous and non-varying, such as the hum of a motor. Because they do not vary, constant noises are the easiest to adapt to and the least offensive. Fluctuating noises vary on a somewhat regular basis and the level of fluctuation is not extreme. Traffic is an example of fluctuating noise. This type of sound is somewhat irritating, but generally not considered a nuisance. Intermittent noises are sharp, loud sounds which occur at irregular intervals. These noises are often loud enough to be painful, and they are hard to adjust to. A common example of an intermittent noise is blasting or use of heavy equipment for construction.

TABLE 4.29
WEIGHTED SOUND LEVELS AND HUMAN RESPONSE

Sound Source	dBA	Trend of Response
	130	Painfully loud. Limit amplified speech.
Jet takeoff at 200 feet	120	Maximum vocal effort
Discotheque, Riveting Machine	110	
Jet takeoff at 2,000 feet Shout (0.5 feet)	100	Very annoying
Heavy diesel truck at 50 feet	90	
Food blender Garbage disposal Loud radio or hi-fi	80	Annoying
Freight train at 50 feet Cash register	70	Complaining possible
Typical large store Automobile (average) 35-40 mph Air conditioning unit at 20 feet	60	
Residence		Acceptance
Quiet conference room	50	Quiet
Living room	40	
Bedroom Whisper at 5 feet	30	Very quiet
Rustling of leaves, broadcast studio	20	
	10	Just audible
Faintest possible sound	0	Threshold of hearing

Source: MMSD Appendix 4k

In evaluating the effects of noise on the surrounding environment, the background or ambient noise level must also be considered. Ambient noise depends on land use and time of day and year. A fluctuating noise at a certain decibel level that might not be disturbing if located in an industrial area, might be a nuisance if located in a residential area.

The noises associated with the operation of wastewater treatment facilities are usually constant. These noises are caused by pumps, blowers, compressors, generators, and other mechanical equipment. Table 4.30 describes the effects of noise from the existing WWTPs on surrounding communities, based on land use in the surrounding area, the sensitivity of the area to disturbances from noise, and the relative ambient noise levels. Presently, noise has not been cited as a problem at any of the WWTPs in the planning area.

4.2.7 Public Health

Sewage treatment plants disinfect effluent before discharging it to watercourses to protect people who may come in contact with the water from dangerous microorganisms. Sewage can contain microbes (pathogens) that can cause typhoid fever, cholera, dysentary, skin infections, and hepatitis (Wullschleger et al., 1974). Disinfection kills enough of these pathogens to reduce the public health risk to an acceptable level.

At each point where untreated sewage is discharged into surface waters, whether by bypasses, overflows, or diversions from storm sewers, there is a greatly increased risk of disease to anyone who comes into bodily contact with that water. Fecal coliform bacteria are often used as an indicator of the presence of untreated sewage.

4.2.8 Transportation, Traffic and Access

There are 239 miles (385 km) of freeways in the seven county SEWRPC region. SEWRPC forecasts an additional 106 miles (171 km) of freeways by the year 2000. In Milwaukee County (in 1978) there were 64 miles (103 km) of freeway, with an additional 22 miles (35 km) planned by the year 2000. There are also 734 miles (1181 km) of arterials in Milwaukee County with a planned year 2000 increment of 41 miles (66 km).

General Mitchell Field is the largest airport within the area, comprising 2,080 acres (842 ha). In 1977, 234,904 flights were generated and a total of 1,310,534 passengers were served by this facility. Other airports in the area include, Timmerman Field, a 477 acre (193 ha) midsized

TABLE 4.30
SENSITIVITY TO NOISE NEAR LOCAL WWTPs

Facility	Major Area Land Use	Relative Ambient Noise Levels	Sensitivity to Expected Levels
Jones Island WWTP	H. Industrial	High	Insensitive
South Shore WWTP	M. Res./ M. Ind.	Low to Moderate	Moderately Sensitive
School Sisters of ND WWTP	L. Res.	Low	Very Sensitive*
Chalet on Lake WWTP	L. Res.	Low	Slightly Sensitive
Thiensville WWTP	M. Res./Comm.	Moderate	Slightly Sensitive
Germantown WWTP	M.Res./Open	Low to Moderate	Moderately Sensitive
South Milwaukee WWTP	H.Res./L.Ind.	Moderate to High	Moderately Sensitive
WEPCo. WWTP	L.Res./Open	Moderate to High	Insensitive
Caddy Vista WWTP	M.Res./Open	Low	Very Sensitive
Cleveland Heights GS WWTP	M. Res.	Low to Moderate	Very Sensitive*
N.B. Regal Manors WWTP	M. Res.	Low to Moderate	Moderately Sensi
Muskego NE WWTP	L.Res./M.Res.	Moderate	Very Sensitive
Muskego NW WWTP	L.Res./Open	Low	Moderately Sensitive
Muskego Rendering WWTP	Open	Moderate	Insensitive
Hwy. 100 Drive-in WWTP	M.Res./Open	Moderate	Slightly Sensitive
St. Martin's Rd. Truck Stop	M. Res.	Moderate	Moderately Sensitive
N.B. Mem. Hospital WWTP	M. Res.	Moderate	Moderately Sensitive

*Close proximity to educational institution. Sensitivity varies as to whether school is in session. If not in session - moderately sensitive.

L - Light
M - Moderate
H - Heavy

Res. - Residential
Ind. - Industrial
Comm. - Commercial

general utility airport, and three small general utility airports located in western suburbs.

4.2.9 Archaeological and Historical Sites

An extensive culture history and tabulation of historic and cultural resources was prepared for the MMSD planning area. It is located in the Summary Support Data File of the MMSD Wastewater System Plan - Environmental Assessment.

Its findings concluded that there are a total of 218 known prehistoric archaeological sites in the planning area consisting of campsites, burial sites, village sites, and artifact caches. Archaeological remains recovered indicate that the planning area has been occupied by various cultures over the past 12,000 years. There are also 34 known historic archaeological sites of either Euro-American or historic tribal origin.

More than 860 structures were identified possessing historical architectural, or local significance. According to the National Register of Historic Places in Wisconsin, November 1980, there are 50 sites of national, state, or local significance listed on the National Register in Milwaukee County. Also, in Milwaukee County there are another 21 sites that are eligible for listing. In the City of Brookfield and the Village of Menomonee Falls in Waukesha County, there are 4 sites on the National Register which have local and state significance.

Of major historical significance in the planning area is the Jones Island (West Plant) WWTP. It was the first large-scale application of activated sludge wastewater treatment in this country, and has been designated a National Historic Civil Engineering landmark. The West Plant was determined eligible for the National Register of Historic Places on September 11, 1979.

4.2.10 Recreation

Recreational areas in Milwaukee County include playgrounds, parks, golf courses, zoos, campgrounds, and picnic areas. In 1970, Milwaukee County contained 9,924 acres (4016 ha) devoted to recreational use, which is approximately 6.4% of the County. As of 1974, 12,211 acres (4942 ha) of land within the MMSD planning area were designated for recreational purposes. (See Figure 4.9).

Water is, or can be, a primary recreational resource. The Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) recognize the importance of water for recreation by setting a national goal of fishable and

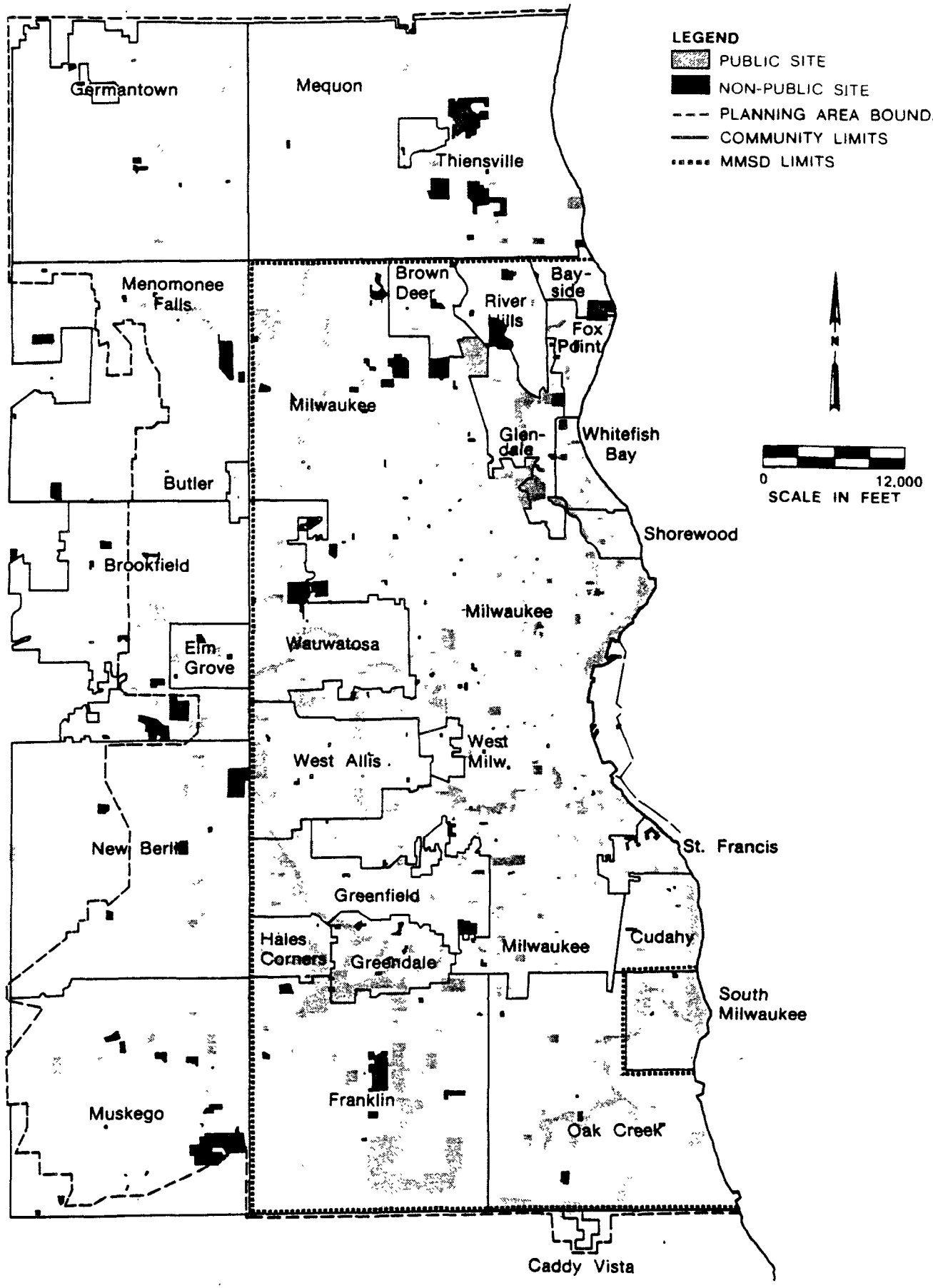

FIGURE 4-9

DATE APRIL 1981

PARKS AND OPEN SPACE SITES

SOURCE MILWAUKEE COUNTY PARK DEPT. AND MMSD

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swimmable waters by 1983. However, the lower portions of the Milwaukee, Menomonee, and Kinnickinnic Rivers are now restricted for recreational use to limited or no body contact. Also, Lake Michigan beaches in Milwaukee County have to be closed on occasion due to the addition of pollutants from combined sewer overflows. The Bay View and South Shore Park Beaches were closed an average of 27 days per year from 1969 to 1976.

Although sport fishing is a popular recreational activity in the planning area, the lower reaches of the rivers, where water quality is degraded, do not support extensive or diverse fish populations. Thus, fishing is limited. Also, because of the toxic chemicals in the waters, some of the fish living in the planning area contain chemical residue in their edible portions in excess of the recommended standards.

4.2.11 Energy

Milwaukee County is the largest consumer of energy in the planning area. In 1978, energy use in the County was estimated to be 317.5 trillion BTU per year. If future growth occurs as predicted, the energy demand should substantially increase.

In 1978, a survey of energy use at the Jones Island and South Shore WWTPs and at each local treatment plant was conducted by the MMSD (Tech Memo 3/1/79). The results of this survey are shown on Table 4.31. As the table shows, the wastewater treatment facilities in the planning area rely heavily on electricity and natural gas. Electricity is the major, or only, power source for most of the WWTPs. The Jones Island WWTP consumes a great quantity of natural gas, primarily for power generation and sludge drying. The South Shore WWTP relies heavily on digester gas, a byproduct of the facility's solids handling system, as a source of energy.

4.2.12 Resources

A treatment plant survey conducted by the MMSD in 1978 collected data on chemical consumption used for wastewater treatment. The results of this survey are shown in Table 4.32. As can be seen from that table, large amounts of chlorine, pickle liquor, and ferric chloride are used at the treatment plants.

Chlorine is used as a disinfectant usually as the final step before the effluent is discharged. Pickle liquor and ferric chloride are used to control phosphorus. Pickle liquor is a waste product of metal processing plants, numerous of which are located in the Milwaukee area. Polymer and alum are used to thicken and settle sludge during the treatment and solids handling processes.

TABLE 4.31
ENERGY USE AT PUBLIC TREATMENT PLANTS[1]

Plant	Electricity (kwh)	Natural Gas (Therms)	Fuel Oil (Gallons)	Digester Gas (Therms Consumed)	Total Equivalent BTUs ($\times 10^9$)
Caddy Vista	12,800	NA	--	--	0.13
Germantown	592,000	--	2,000	--	6.50
Hales Corners[2]	76,200	--	5,980	--	1.65
Jones Island	16,126,300[3]	21,966,800	534,700	--	2,442.20
Menomonee Falls-Riverside[2]	584,000	--	4,530	--	6.78
Menomonee Falls-Parkview[2]	185,500	--	--	--	1.95
Muskego Northeast	752,500	--	--	--	7.90
Muskego Northwest	316,400	--	--	--	3.32
Regal Manors	310,700	--	--	--	3.26
South Milwaukee	2,670,000	--	42,900	--	261.79
South Shore	3,531,600	391,700	--	1,851,700	34.00
Thiensville	260,200	--	NA	--	2.73
Total (Equivalent BTU $\times 10^9$)	266.89	2,235.85	84.09	185.54	2,772.21
Percent of Total	(9.6%)	(80.7%)	(3%)	(6.7%)	

[1]Information for Private WWTPs not available.

[2]Treatment plant considered abandoned prior to the planning period.

[3]Includes 1,649,530 kwh (17.32 x 10^9 BTU) for pump station operations operated by the MMSD.

TABLE 4.32
RESOURCE CONSUMPTION IN AREA WASTEWATER TREATMENT PLANTS

Treatment Plant	Chlorine (lbs)	Pickle Liquor (gal.)	Polymer (lbs)	Alum (gal.)	Ferric Chloride (lbs)
Caddy Vista	NA	--	--	--	--
Germantown	4,950	37,900	--	--	--
Muskego N.E.	2,400	21,300	--	--	--
Muskego N.W.	3,200	26,700	--	--	--
Regal Manors	2,470	--	--	--	--
School Sisters of Notre Dame	365	--	--	--	--
Thiensville	4,600	--	1,600	37,500	--
Wisconsin Electric Power Company	1,100	--	--	--	--
Jones Island	1,825,000	414,000	--	--	36,500,000
South Shore	774,530	6,116,670	2,624,400	--	--
Total	2,619,000	6,617,000	2,626,000	37,500	36,500,000

1 pound = 2.2 kg.

1 gallon = .26 liter

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES

5.0 INTRODUCTION

This chapter of the EIS describes the environmental impacts of the four final system-level alternatives and the five alternatives for the storage of combined sewer overflow (CSO) and infiltration and inflow. These alternatives were described in Chapter III. The discussion of environmental consequences is organized by the criteria used to screen the alternatives. These criteria represent aspects of the natural and human environments that could be affected by the MFP or its alternatives. The criteria are reiterated below.

Natural Environment	Man-Made Environment
Water Quality	Future Development and Land Use
Aquatic Biota	Indirect Fiscal Impacts
Threatened or Endangered Species	Cost
Air Quality and Odors	Fiscal Impacts
Groundwater	Economic Impacts
Floodplains	Noise
Wetlands	Public Health
Wildlife Habitat	Safety
Prime Agricultural Land	Access and Traffic
	Archaeological and Historic Sites
	Recreation and Aesthetics
	Energy
	Resources
	Engineering Feasibility
	Legality

It was determined that no alternative would require construction in scientific study areas. Therefore this issue is not discussed further in this chapter.

Each criterion is discussed in a separate section, including the effects of the No Action, Local, Regional, and Mosaic (MMSD Recommended) Alternatives. For most criteria, the four final alternatives are discussed separately. However, when two or more alternatives would result in the same impacts, they are discussed together. Where insufficient information exists to assess specific impacts, the alternatives are grouped together for discussion. Also, where adverse environmental impacts are identified, possible mitigating measures are presented.

Both the MMSD Recommended Plan and EPA's Preferred Alternative are very similar to the Mosaic Alternative. The environmental impacts described for the Mosaic Alternative would also occur with the MMSD Recommended Plan and the EPA Preferred Alternative unless the text specifically states otherwise.

As was noted in Chapter 3, the EPA Preferred Alternative includes the Modified Total Storage Alternative with a level of protection of two to five years. If the U.S. District Court Order is not overturned by the Supreme Court, this alternative would not be implementable.

5.1 NATURAL ENVIRONMENT

5.1.1 Water Quality

The EIS has analyzed the impacts of the final alternatives on water quality in the Milwaukee River, Menomonee River, Kinnickinnic River, Root River, Deer Creek, Tess Corners Creek, the Inner Harbor, the Outer Harbor, and Lake Michigan. The following section presents the effects of the four Final System Level Wastewater Treatment Plant Alternatives and the five Combined Sewer Overflow Alternatives. Existing water quality is described in Chapter 4.

The effects on water quality of future alternative wastewater treatment plant configurations are discussed in detail in Appendix VII, Water Quality. The water quality impacts of combined sewer overflows and alternative methods of abating these overflows are set forth in Appendix V, Combined Sewer Overflow.

5.1.1.1 Inland Wastewater Treatment Plants

The EIS evaluated the downstream existing and future water quality of each stream that receives WWTP effluent within the MMSD planning area. The analysis assumed stream low flow conditions. The water upstream of the treatment plants was estimated from SEWRPC (1978L) and the MMSD (1980). The analysis of the impacts of alternatives assumes the implementation of the reductions of nonpoint source pollution which are recommended in the 208 Plan. Thus, the waters upstream of the WWTPs are assumed to meet 208 recommendations for fecal coliforms and phosphorus. These assumptions are discussed in greater detail in Section 3.1.1 of revised Appendix VII, Water Quality.

In addition to direct impacts on water quality (described below), the action alternatives would allow the expansion of the MMSD service area, and thus the elimination of some failing septic systems. As a result, this pollution to groundwater and surface water would be reduced.

5.1.1.1.1 Caddy Vista WWTP: The Root River now violates the DNR standards for fecal coliforms, dissolved oxygen, residual chlorine, and the 208 recommended standards for fecal coliforms, dissolved oxygen, residual chlorine, and phosphorus. With

the implementation of the 208 Plan, the fecal coliform standard would be met under all final alternatives. Table 5.1 sets forth downstream, low-flow water quality conditions for each final alternative.

With the No Action and Local Alternatives, the Caddy Vista WWTP would continue discharging effluent to the Root River, and flows would increase by 55%. With either alternative, the 208 recommended standards for residual chlorine and phosphorus, and the DNR chlorine standard would continue to be violated. The No Action Alternative would increase downstream pollutant concentrations for all pollutants evaluated except fecal coliforms. The Local Alternative would increase the concentrations of all pollutants evaluated except fecal coliforms, total nitrogen, and total ammonia-nitrogen. Neither alternative is expected to cause violations of the DNR standards or 208 recommended standards for dissolved oxygen.

With the Regional and Mosaic Alternatives, the Caddy Vista WWTP would be abandoned. As a result, the low flow of the river would be reduced by 40% and all pollutants evaluated, except un-ionized ammonia-nitrogen, would be reduced by 38% or more. The un-ionized ammonia-nitrogen level would increase slightly because the water's pH would rise, and at higher pH levels, greater levels of ammonia become un-ionized.

5.1.1.1.2 Germantown WWTP: The Germantown WWTP discharges effluent to an impoundment on the Menomonee River. Downstream of the WWTP, the river now violates both the DNR and 208 recommended standards for residual chlorine, dissolved oxygen, fecal coliforms, and un-ionized ammonia-nitrogen. Water quality under low flow conditions is set forth in Table 5.2 for all the final alternatives.

With the No Action Alternative, the water quality of the Menomonee River would remain very similar to existing conditions. It is not expected that the Germantown WWTP would cause violations of the dissolved oxygen standard for the Menomonee River, although some violations occur within the impoundment.

With any action alternative, the facility would cease discharging effluent to the Menomonee River. As a result, the concentrations of all pollutants evaluated would be substantially reduced. All DNR standards and 208 recommended standards would be met.

5.1.1.1.3 Muskego Northeast WWTP: The Muskego Northeast WWTP discharges to Tess Corners Creek. Table 5.3 shows the existing and future conditions of Tess Corners Creek. The creek now violates DNR standards for residual chlorine and

TABLE 5.1

WATER QUALITY UNDER LOW FLOW CONDITIONS IMMEDIATELY
DOWNSTREAM OF THE CADDY VISTA WWTP

Parameter	Existing Conditions[a]	YEAR 2005 ALTERNATIVE CONDITIONS: No Action Alternative	Percent Change from Existing Conditions	Local Alternative	Percent Change from Existing Conditions	Regional and Mosaic Alternatives	Percent Change from Existing Conditions
Receiving Water	Root River	Root River		Root River		Root River	
Flow[b] (CFS)	1.82	2.05	+ 12.63	1.27	-30.22	1.10	- 39.56
BOD_{ult} (mg/l)	9.79	14.7	+ 50.15	11.3	+15.42	6.0	- 38.71
Total Nitrogen (mg/l)	7.3	7.4	+ 1.36	6.9	- 5.48	3.45	- 52.74
Total Phosphorus (mg/l)	1.04	1.45	+ 39.42	1.30	+25.00	0.59	- 43.27
Chlorine (mg/l)	0.04	0.5	+1150.00	0.06	+50.00	0	-100.00
Fecal Coliform (No/100 ml)	843	200	- 76.27	200	-76.27	200	- 76.27
PH (standard units)	7.51	7.69	+ 2.39	7.71	+ 2.66	7.90	+ 5.19
Total Ammonia-N (mg/l)	0.6555	0.621	- 5.19	0.547	-16.49	0.32	- 51.14
Un-ionized Ammonia-N (mg/l)	0.009	0.013	+ 44.44	0.012	+33.33	0.011	+ 22.22

[a] The Caddy Vista WWTP currently discharges to the Root River. The Muskego Northeast WWTP discharges to the Root River via Tess Corners Creek upstream of the Caddy Vista WWTP.

[b] Includes the 7-day, 10-year low flow (Q_7^{10}) of the river plus the average daily base discharge from the WWTP.

SOURCE: ESEI

TABLE 5.2

WATER QUALITY UNDER LOW FLOW CONDITIONS IMMEDIATELY DOWNSTREAM OF THE GERMANTOWN WWTP

Parameter	Existing Conditions[a]	YEAR 2005 ALTERNATIVE CONDITIONS: No Action Alternative	Percent Change from Existing Conditions	Local, Regional and Mosaic Alternatives	Percent Change from Existing Conditions
Receiving Water	Menomonee River	Menomonee River		Menomonee River	
Flow[b] (CFS)	1.26	1.70	+34.92	0.15	- 88.09
BOD_{ult} (mg/l)	13.38	13.71	+ 2.47	3.90	- 70.85
Total Nitrogen (mg/l)	24.23	24.93	+ 2.89	3.63	- 85.02
Total Phosphorus (mg/l)	1.05	1.08	+ 2.86	0.16	- 84.76
Chlorine (mg/l)	0.66	0.68	+ 3.03	0	-100.00
Fecal Coliform (No/100 ml)	320	200	-37.50	200	- 37.50
PH (standard units)	7.97	7.97	0	7.70	- 3.38
Total Ammonia-N (mg/l)	12.9	13.2	+ 2.32	0.146	- 98.87
Un-ionized Ammonia-N (mg/l)	0.494	0.506	+ 2.43	0.003	- 99.41

[a] The Germantown WWTP currently discharges to the Menomonee River. No other WWTPs within the planning area discharge upstream of the Germantown WWTP.

[b] Includes the 7-day, 10-year low flow (Q_7^{10}) of the river plus the average daily base discharge from the WWTP.

SOURCE: ESEI

TABLE 5-3

WATER QUALITY UNDER LOW FLOW CONDITIONS IMMEDIATELY DOWNSTREAM OF THE MUSKEGO NORTHEAST WWTP

YEAR 2005 ALTERNATIVE CONDITIONS

Parameter	Existing Conditions[a]	No Action Alternative	Percent Change From Existing Conditions	Local, Regional and Mosaic Alternatives	Percent Change From Existing Conditions
Receiving Water	Tess Corners Creek	Tess Corners Creek	------	Tess Corners Creek	-----
Flow[b] (CFS)	0.618	0.783	+26.7	0.01	-98.4
BOD (mg/l)	15.7	15.8	+ 0.64	9.0	-42.7
Total Nitrogen (mg/l)	13.3	13.3	0	1.62	-87.8
Total Phosphorus (mg/l)	1.74	1.75	+ 0.57	0.10	-94.3
Chlorine (mg/l)	0.49	0.49	0	0	100.0
Fecal Coliform (No/100 ml)	250	200	-20.0	200	-20.0
pH (standard units)	7.5	7.5	0	7.9	+ 5.33
Total Ammonia-N (mg/l)	0.496	0.497	+ 0.20	0.25	-49.6
Un-ionized Ammonia-N	0.007	0.007	0	0.008	+14.3

[a]The Muskego Northeast WWTP currently discharges to Root River via Tess Corners Creek. No WWTP currently discharges to Tess Corners Creek upstream of Muskego Northeast WWTP.

[b]Includes the 7-day, 10-year flow (Q_7^{10}) of the river plus the average daily base discharge from the WWTP.

Source: ESEI

fecal coliforms and 208 recommended standards for residual chlorine, total phosphorus, and fecal coliforms.

With the No Action Alternative, Tess Corners Creek would not change markedly. The violations of DNR and 208 recommended standards would continue.

With any action alternative, effluent discharges to Tess Corners Creek would cease. As a result, the low flow would be reduced from 0.6 cfs to 0.01 cfs. In addition, the concentrations of all pollutants evaluated would be greatly reduced. All standards would be met with an action alternative.

Low levels of dissolved oxygen are not expected with any final alternative.

5.1.1.1.4 Muskego Northwest WWTP: The Muskego Northwest WWTP now discharges to Big Muskego Lake. The Lake's existing conditions and its conditions under the final alternatives are set forth in Table 5.4.

With the No Action Alternative, the water quality of Big Muskego Lake would not change greatly.

With any action alternative, the Muskego Northwest WWTP would cease discharging effluent to Big Muskego Lake. Actual improvement of the water quality of Big Muskego Lake is highly dependent on the amount of bottom sediments which continue to be resuspended by wind action. However, the EIS analysis indicates that abandonment of the plant and implementation of 208 recommended nonpoint source pollution controls could reduce the nutrient concentration by up to 83% and increase the water clarity by as much as 10 times.

5.1.1.1.5 Regal Manors WWTP: The Regal Manors WWTP now discharges effluent to the Fox River via Deer Creek. Downstream of the plant, the DNR standards for fecal coliforms and chlorine are exceeded. Also, the 208 recommended standards for fecal coliforms, residual chlorine, un-ionized ammonia-nitrogen, and phosphorus are violated. Low flow water quality conditions for Deer Creek are presented in Table 5.5.

With the No Action Alternative, flows to the Regal Manors WWTP would increase, causing the low flow of Deer Creek to increase by more than 300%. Otherwise, the water quality would be very similar to existing conditions.

With any action alternative, the WWTP would cease discharging effluent to Deer Creek, and the low flow would be greatly reduced. There would also be a substantial reduction in the concentrations of all pollutants evaluated.

TABLE 5.4

PREDICTED TROPHIC STATUS OF BIG MUSKEGO LAKE
UNDER ALTERNATIVE MUSKEGO NORTHWEST WWTP CONDITIONS

Parameter	Existing Conditions and No Action Alternative	Local, Regional and Mosaic Alternatives	Percent Change from Existing Conditions
WWTP Phosphorus Load (pounds/year)	10,600	0	- 100.00
Total Lake Phosphorus Load (pounds/year)	21,300	3,700	- 82.63
Steady-State Lake Phosphorus Concentration[a] (mg/l)	0.115	0.020	- 82.61
Average Summer Chlorophyll -a Concentration[a] (mg/l)	70.3	5.7	- 91.89
Average Summer Secchi Disc Depth[a] (water clarity) (feet)	0.87	9.70	+1215.00
Trophic Status[b]	Eutrophic (very nutrient rich)	Mesotrophic (moderately nutrient-rich)	

[a] Determined by application of the Wisconsin Department of Natural Resources lake model, NEWTROPHIC, using the Dillon and Rigler (1974) technique.

[b] Based on Trophic State Index presented in Carlson (1977).

[c] Assumes nonpoint source controls are implemented, as recommended in the areawide water quality management (208) plan.

SOURCE: ESEI

TABLE 5-5

WATER QUALITY UNDER LOW FLOW CONDITIONS IMMEDIATELY DOWNSTREAM OF THE REGAL MANORS WWTP

YEAR 2005 ALTERNATIVE CONDITIONS

Parameter	Existing Conditions	No Action Alternative	Percent Change From Existing Conditions	Local, Regional and Mosaic Alternatives	Percent Change From Existing Conditions
Receiving Water	Deer Creek	Deer Creek		Deer Creek	
Flow[b] (CFS)	0.288	1.02	+354.	0.01	-96.5
BOD_{ult} (mg/l)	50.4	51.4	+ 1.98	12.0	-76.2
Total Nitrogen (mg/l)	26.1	26.7	+ 2.30	1.62	-93.8
Total Phosphorus (mg/l)	0.970	0.992	+ 2.27	0.10	-89.1
Chlorine (mg/l)	0.480	0.495	+ 3.12	0	100.
Fecal Cliform (No/100 ml)	306	200	- 34.6	200	-34.6
pH (standard units)	7.10	7.10	0	7.90	+11.3
Total Ammonia-N (mg/l)	13.9	13.9	0	0.25	-98.2
Un-ionized Ammonia-N (mg/l)	0.075	0.075	0	0.008	-89.3

[a]The Regal Manors WWTP currently discharges to the Fox River via Deer Creek. No other WWTP's within the planning area discharge upstream of the Regal Manors WWTP.

[b]Includes the 7-day, 10-year flow ($Q_7{}^{10}$) of the river plus the average daily base discharge from the WWTP.

Source: ESEI

It is expected that dissolved oxygen levels may be low occasionally with any alternative as a result of the oxygen demand exerted by rich organic sediments.

5.1.1.1.6 Thiensville WWTP: The Thiensville WWTP is the only public wastewater treatment plant in the MMSD planning area which discharges to the Milwaukee River. However, twelve relatively small public wastewater treatment plants located upstream of the planning area discharge to the Milwaukee River or its tributaries (SEWRPC, 1979). Table 5.6 sets forth the water quality conditions for the Milwaukee River. The DNR standards for residual chlorine and fecal coliform and the 208 recommended standards for residual chlorine, phosphorus, fecal coliforms, and un-ionized ammonia-nitrogen are slightly exceeded under existing conditions. With any alternative, the low flow of the Milwaukee River would increase by 76% to 78% due primarily to increased flows from upstream WWTPs.

With the No Action and Local Alternatives, the Thiensville WWTP would continue to discharge effluent to the Milwaukee River. However, with the increased low flow, pollutant concentrations can be expected to decrease slightly. All standards except the 208 recommended standard for phosphorus would be met with either alternative. Discharges from the Thiensville WWTP would not cause dissolved oxygen problems in the Milwaukee River.

With the Regional and Mosaic Alternative, the Thiensville WWTP would be abandoned. As a result, the concentrations of all pollutants evaluated would be reduced to a slightly lower level than is expected with the No Action or Local Alternative. All standards except the 208 recommended standard for phosphorus would be met. The violation of the phosphorus standard would occur with any alternative due to discharges from upstream WWTPs.

5.1.1.2 Combined Sewer Overflows and Bypasses From Separated Sewers

The impacts of the MFP to the water quality of the Inner Harbor and the Outer Harbor are discussed in regard to CSO Abatement/Peak Flow Attenuation Alternatives only. Implementation of the Local, Regional, or Mosaic Alternatives for the inland wastewater treatment plants would have very similar effects on the Inner and Outer Harbors. With the Regional and Mosaic Alternatives, all local WWTPs in the MMSD planning area would be abandoned (except South Milwaukee which discharges effluent to Lake Michigan). With the Local Alternative, only the Thiensville WWTP would discharge effluent to a river in the MMSD planning area. Since effluent from the

TABLE 5.6

WATER QUALITY UNDER LOW FLOW CONDITIONS IMMEDIATELY DOWNSTREAM OF THE THIENSVILLE WWTP

Parameter	Existing Conditions[a]	YEAR 2005 ALTERNATIVE CONDITIONS: No Action Alternative	Percent Change from Existing Conditions	Local Alternative	Percent Change from Existing Conditions	Regional and Mosaic Alternatives	Percent Change from Existing Conditions
Receiving Water	Milwaukee River	Milwaukee River		Milwaukee River		Milwaukee River	
Flow[b] (CFS)	23.7	42.3	+78.48	42.3	+78.48	41.6	+ 75.53
BOD_{ult} (mg/l)	9.68	9.38	- 3.10	9.62	- 0.62	9.0	- 7.02
Total Nitrogen (mg/l)	2.92	2.67	- 8.56	2.68	- 8.22	2.34	- 19.86
Total Phosphorus (mg/l)	0.278	0.272	- 2.16	0.277	- 0.36	0.264	- 5.03
Chlorine (mg/l)	0.012	0.008	-33.33	0.009	-25.00	0	-100.00
Fecal Coliform (No/100 ml)	362	200	-44.75	200	-44.75	200	- 44.75
PH (standard units)	8.30	8.32	+ 0.24	8.32	+ 0.24	8.38	+ 0.96
Total Ammonia-N (mg/l)	0.322	0.207	-35.71	0.211	-34.47	0.06	- 81.37
Un-ionized Ammonia-N (mg/l)	0.025	0.017	-32.00	0.017	-32.00	0.006	- 76.00

[a]The Thiensville WWTP currently discharges to the Milwaukee River. No other WWTP within the planning area discharges upstream of the Thiensville WWTP.

[b]Includes the 7-day, 10-year low flow (Q_7^{10}) of the river plus the average daily base discharge from the WWTP.

SOURCE: SEWRPC

Thiensville WWTP constitutes less than 2% of the low flow of the Milwaukee River, it can be assumed that the flow entering the Inner Harbor would be very similar with any action alternative.

During rainfall events, combined sewers which contain storm-water runoff and sanitary wastes discharge their contents into the waterways in the Milwaukee area. Because of the high concentrations of pollutants in these combined sewer overflows (CSO), these discharges result in severe "shock load" effects on aquatic organisms; in high levels of fecal coliforms and pathogens; in the scouring and resuspension of organic sediments; in the accumulation of particulate organic and inorganic matter within the river channels, Inner Harbor, and Outer Harbor; and in the acceleration of eutrophic conditions in the near-shore areas of Lake Michigan.

The streams and portions of Lake Michigan affected by combined sewer overflows are illustrated in Figure 5.1. The overflows affect about 10.9 miles of streams, or 7.3% of the total stream miles within the planning area. The combined sewer overflows which discharge to the rivers and directly to the Lake also affect the water quality of the Inner Harbor, Outer Harbor and,to a lesser extent, Lake Michigan.

In addition, bypasses, overflows, and diversions of wastewater from the separated sewer systems occur in every community in the planning area. There are at least 263 permanent bypasses in the planning area, in addition to portable pumps used to prevent backups of sewage into basements. The pollutant loads to the rivers of the planning area from bypasses in the separated sewer area are detailed in Table 5.7.

5.1.1.2.1 The Inner Harbor: Pollutant loadings to the Inner Harbor affect the water quality of the harbor itself; the physical, chemical, and biological characteristics of its bottom sediments; and the water quality and sediment characteristics of the Outer Harbor and Lake Michigan.

The pollutant loads to the Inner Harbor were quantified, based on flows and pollutant concentrations from the combined sewer service area (CSSA) and from the drainage areas located upstream of the CSSA.

Loadings were estimated for water volume suspended solids, total phosphorus, ultimate biochemical oxygen demand, ammonia-nitrogen, lead, cadmium, copper, zinc, and fecal coliforms. Table 5.8 presents estimated loadings to the Inner Harbor under existing conditions and the No Action, Complete Sewer Separation, Inline Storage, Modified CST/ Inline Storage, and Modified Total Storage Alternatives.

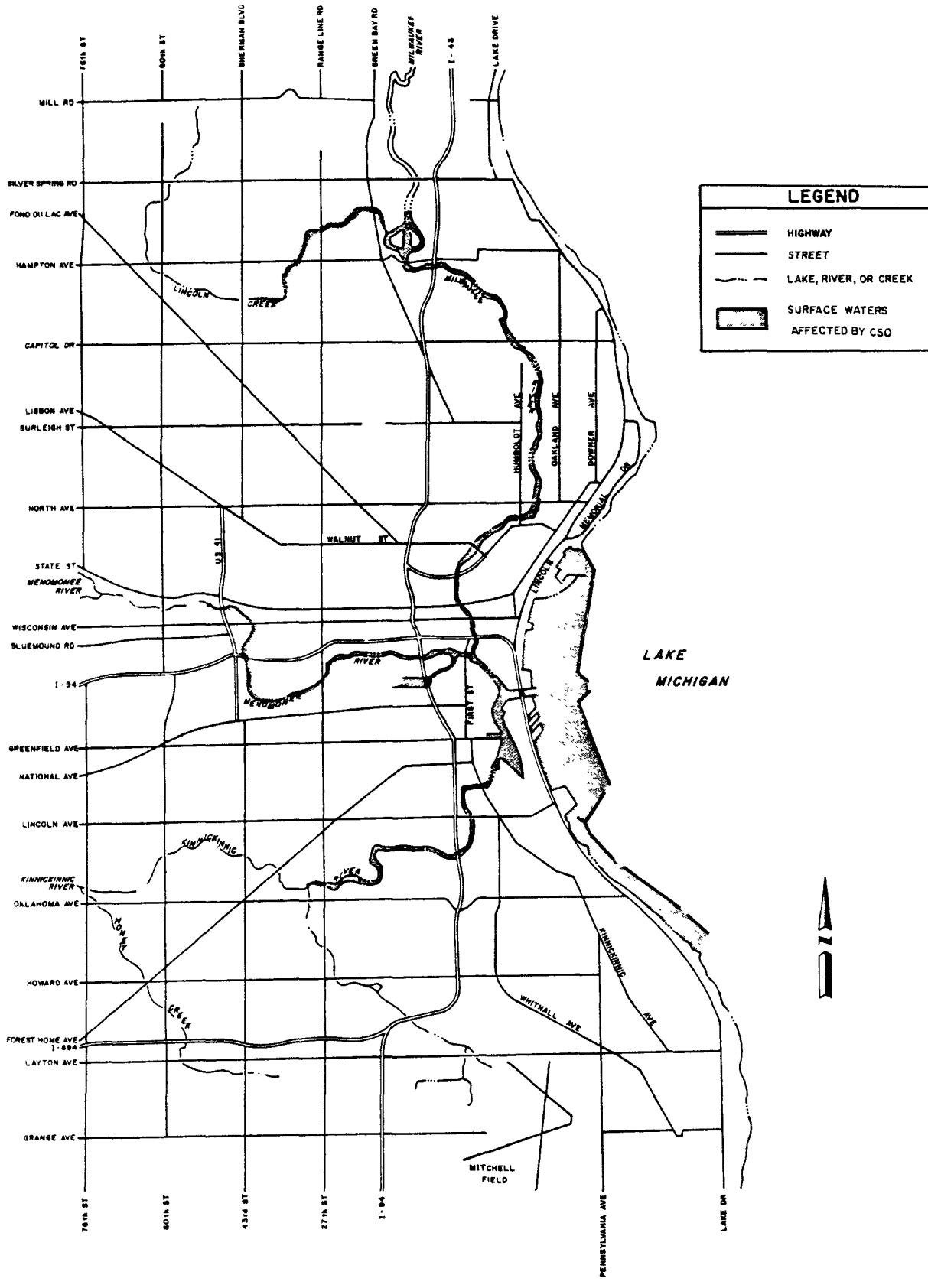

FIGURE 5-1

DATE APRIL 1981

SURFACE WATERS AFFECTED BY COMBINED SEWER OVERFLOWS

SOURCE MMSD

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

TABLE 5.7
ANNUAL POLLUTANT LOADS FROM
SEPARATE SEWER BYPASSES IN THE PLANNING AREA

Parameter	Concentration[a]	Milwaukee River[b]	Menomonee River[b]	Kinnickinnic River[b]	Root River[b]	Direct to Lake Michigan[b]
Water	--	300 million gallons	100 million gallons	25 million gallons	25 million gallons	50 million gallons
Suspended Solids	370	926,000	309,000	77,100	77,100	154,000
Total Phosphorus	8.4	21,000	7,000	1,750	1,750	3,500
Biochemical Oxygen Demand-Ultimate	630	1,580,000	525,000	131,000	131,000	262,000
Ammonia-Nitrogen	14.6	36,500	12,200	3,040	3,040	6,080
Lead	0.3	750	250	62.6	62.6	125
Cadmium	0.04	100	33.4	8.34	8.34	16.7
Copper	0.2	500	167	41.7	41.7	83.4
Zinc	1.0	2,500	834	208	208	416.0
Fecal Coliform	6.2×10^6	7.03×10^{16}	2.34×10^{16}	5.86×10^{15}	5.86×10^{15}	1.17×10^{16}

[a]All concentrations in mg/l except for fecal coliform which are in MFFCC/100 ml.

[b]All loads are in thousands of pounds except for fecal coliforms which are in total counts.

Source: ESEI

TABLE 5-8
ANNUAL POLLUTANT LOADS TO THE MILWAUKEE INNER HARBOR
UNDER EXISTING CONDITIONS AND ALTERNATIVE
COMBINED SEWER OVERFLOW ABATEMENT PLANS

	EXISTING						NO ACTION						COMPLETE SEWER SEPARATION					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Water (10^6 gallons)	5500	--	102	126,000	--	100	5400	98	--	126,000	100	--	6100	111	113	127,000	101	101
Suspended Solids (10^6 pounds)	14.0	--	101	89.8	--	127	13.9	99	--	70.8	79	--	12.7	91	91	69.6	78	98
Total Phosphorus (10^3 pounds)	91.5	--	102	368	--	123	90.1	98	--	298	81	--	56.0	61	62	264	72	89
Biochemical Oxygen Demand-Ultimate (10^6 pounds)	6.34	--	101	22.5	--	122	6.30	99	--	18.4	82	--	1.80	28	29	13.9	62	76
Ammonia-N (10^3 pounds)	98.8	--	110	286	--	124	90.1	91	--	230	80	--	30.5	31	34	171	60	74
Lead (10^3 pounds)	27.2	--	101	50.4	--	114	27.0	99	--	44.4	88	--	30.5	112	113	47.9	95	108
Cadmium (10^3 pounds)	0.92	--	102	2.70	--	121	0.90	98	--	2.24	83	--	0.509	55	57	1.84	68	82
Copper (10^3 pounds)	4.62	--	103	65.7	--	131	4.50	97	--	50.3	77	--	50.9	110	113	5.09	77	101
Zinc (10^3 pounds)	40.9	--	101	84.7	--	115	40.5	99	--	73.4	87	--	20.4	50	50	53.2	63	72
Fecal Coliforms (MFFCC/100 ml x10^{15})	172	--	117	175	--	118	147	85	--	148	85	--	0.693	0.4	0.5	1.60	1	1

TABLE 5-8 (Continued)
ANNUAL POLLUTANT LOADS TO THE MILWAUKEE INNER HARBOR
UNDER EXISTING CONDITIONS AND ALTERNATIVE
COMBINED SEWER OVERFLOW ABATEMENT PLANS

	IN-LINE STORAGE						MODIFIED CST/IN-LINE						MODIFIED TOTAL STORAGE					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Water (10^6 gallons)	4050	74	75	125,000	99	99	1330	24	25	122,000	97	97	709	13	13	121,000	96	96
Suspended Solids (10^6 pounds)	11.8	84	85	68.7	76	97	3.40	24	24	60.3	67	85	1.48	11	11	58.4	65	82
Total Phosphorus (10^3 pounds)	51.1	56	57	259	70	87	14.8	16	16	222	60	74	6.50	7	7	214	58	72
Biochemical Oxygen Demand-Ultimate (10^6 pounds)	168	26	27	13.8	61	75	0.482	8	8	12.6	56	68	0.209	3	3	12.3	55	67
Ammonia-N (10^3 pounds)	28.6	29	32	169	59	73	8.22	8	9	148	52	64	3.55	4	4	144	50	63
Lead (10^3 pounds)	30.2	111	112	47.6	94	107	8.74	32	32	26.2	52	59	3.55	13	13	21.0	42	47
Cadmium (10^3 pounds)	0.441	48	49	1.78	66	79	0.163	18	18	1.50	56	67	0.059	6	7	1.40	52	62
Copper (10^3 pounds)	5.00	108	111	50.8	77	101	1.63	35	36	47.4	72	94	0.590	13	13	46.4	71	92
Zinc (10^3 pounds)	17.3	42	43	50.2	59	68	5.48	13	14	38.3	45	52	2.36	6	6	35.2	42	48
Fecal Coliform (MFFCC/100 ml $x10^{15}$)	0.580	0.3	0.4	1.49	1	1	0.170	0.1	0.1	1.08	0.6	0.7	0.080	0.05	0.05	0.991	0.6	0.7

Source: ESEI

The CSSA now contributes to the Inner Harbor about 15% to 60% of its total load of most pollutants and over 98% of its fecal coliform load. The No Action Alternative would include implementation of the Areawide Water Quality Management (208) Plan upstream of the CSSA and the elimination of bypasses from Metropolitan Interceptor Sewers which occur within the CSSA. The implementation of the 208 Plan would reduce total loads to the Inner Harbor to 77% to 88% of the existing loads.

With Complete Sewer Separation, loads of suspended solids, lead, and copper from the CSSA would not increase or would increase only slightly, since these pollutants are largely contributed by street runoff. Loads of total phosphorus, biochemical oxygen demand, ammonia-nitrogen, cadmium, and zinc from the CSSA would be reduced to about one-third to two-thirds of the existing loads.

The EIS evaluation which assumes that rooftop storm runoff is relatively unpolluted, shows that with the Inline Storage Alternative, total pollutant loads to the Inner Harbor and loadings from the CSSA would be only slightly lower than loadings with Complete Sewer Separation. Hence, although the Inline Storage Alternative would provide treatment for some stormwater runoff, it would offer little improvement to water quality compared to the Complete Sewer Separation Alternative.

With the Modified/CST Inline Storage Alternative, loadings to the Inner Harbor from the CSSA would be reduced to 0.1% to 36% of existing loads. Total loads to the Inner Harbor would be reduced to less than 75% of existing loads. The largest reductions in total Inner Harbor loads would occur for lead, zinc, and fecal coliforms.

The Modified Total Storage Alternative would achieve the highest reduction in pollutant loads to the Inner Harbor. Pollutant loads from the CSSA would range from 0.05% to 13% of the existing loads. Total loadings to the Inner Harbor of ammonia-nitrogen, lead, zinc, and fecal coliforms would be one-half or less of existing loads. The fecal coliform total load would be reduced to only 0.6% of the existing load of 1.75×10^{17} fecal coliform counts per year.

Most CSO events occur from April through October. Seasonal (April-October) Inner Harbor pollutant loadings were quantified to estimate the impacts of CSSA discharges during the period when they are most likely to occur, and therefore provide a comparison to annual loadings. The seasonal analysis, presented in detail in Section 5.1.6.4 of Appendix V, Combined Sewer Overflow, indicated that CSSA loads comprise

up to a 50% greater portion of the seasonal total Inner Harbor loads compared to annual loadings.

Water quality in the Inner Harbor is determined by annual pollutant inputs, by the deposition of some of the pollutant loads in harbor sediments, and the removal of some pollutants by biological or chemical processes. To determine the average pollutant concentrations within the harbor, the annual pollutant loads which are not deposited or removed are divided by total annual water flow to the Inner Harbor. Pollutant concentrations for the Inner Harbor are presented in Table 5.9.

Due to differences in upstream loadings, stream reaches within the Inner Harbor are affected to varying degrees by CSSA loadings. For example, because of its small upstream drainage area, the Kinnickinnic River is more greatly affected by CSO than the Milwaukee or Menomonee Rivers. CSSA contributions of pollutants represent a two to three times higher proportion of the total load to the Kinnickinnic River, compared to total Inner Harbor loadings. A storm event analysis was conducted to assess the impacts of CSO events as they occur. The analysis, presented in Section 5.1.6.5 of Appendix V, indicated that pollutant concentrations during a storm event may be up to five times higher than the average annual concentrations.

It has been demonstrated that CSSA pollutant loads are more likely than upstream loads to settle out in the Inner Harbor (Meinholz, et al., 1979b). Thus, the alternatives considered for CSO abatement would have less of an effect on pollutant concentrations in the Inner Harbor than they do on pollutant loads (see Table 5.9). For example, while Modified Total Storage would reduce the existing biochemical oxygen demand load to the Inner Harbor by about 45%, the average biochemical oxygen demand concentration would be reduced by only about 30%. Hence, differences between the alternatives are less obvious when considering pollutant concentrations than when considering pollutant loads.

5.1.1.2.2 The Outer Harbor: The primary sources of pollutant loads to the Outer Harbor are the Inner Harbor, the Jones Island Wastewater Treatment Plant, two combined sewer overflow outfalls which discharge directly to the Outer Harbor, and Lake Michigan inflow. In analyzing the impacts of CSO abatement alternatives on water quality in the Outer Harbor, it is assumed that with the Inline Storage, Modified Total Storage, and Modified CST/Inline Storage Alternatives, all CSO would be treated at the Jones Island WWTP. Loadings deposited into the Inner Harbor bottom sediments are not included as loads to the Outer Harbor.

TABLE 5-9

PREDICTED AVERAGE POLLUTANT CONCENTRATIONS IN THE INNER HARBOR UNDER EXISTING CONDITIONS AND ALTERNATIVF CSO ABATEMENT PLANS

	Existing	Future				
Parameter		No Action	Complete Sewer Separation	Inline Storage	Modified CST/Inline	Modified Total Storage
Suspended Solids (mg/l)	27	20	20	20	20	20
Total Phosphorus (mg/l)	0.24	0.19	0.18	0.18	0.16	0.15
Biochemical Oxygen Demand$_{Ult}$ (mg/l)	16.6	13.0	12.0	12.1	11.4	11.3
Ammonia Nitrogen (mg/l)	0.27	0.22	0.16	0.16	0.15	0.14
Lead (mg/l)	0.021	0.017	0.021	0.020	0.013	0.011
Cadmium (mg/l)	0.002	0.002	0.001	0.001	0.001	0.001
Copper (mg/l)	0.038	0.029	0.029	0.030	0.029	0.029
Zinc (mg/l)	0.047	0.040	0.030	0.029	0.024	0.022
Fecal Coliform (MFFCC/100 ml)	36,700	31,000	333	315	260	216

Source: ESEI

Table 5.10 presents estimated pollutant loads to the Outer Harbor under existing conditions and with the No Action, Complete Sewer Separation, Inline Storage, Modified CST/Inline Storage, and Modified Total Storage Alternatives.

The CSSA contributes less than 1% of the water and between 3% and 90% of the total pollutant loads to the Outer Harbor. More than 10% of the total Outer Harbor loads of phosphorus, lead, zinc, and fecal coliforms are contributed from the CSSA. Because most CSSA particulate substances are deposited within the Inner Harbor and because of the impact of the Jones Island WWTP discharges and Lake Michigan inflow, pollutants from the CSSA have a less direct impact on the Outer Harbor than on the Inner Harbor. With abandonment of Milorganite production at the Jones Island WWTP, ammonia-nitrogen loads to the Outer Harbor would greatly increase unless mitigative measures are implemented.

With Complete Sewer Separation, total loads to the Outer Harbor of all pollutants except fecal coliforms and ammonia-nitrogen would be reduced to 82% to 96% of the existing loads. Fecal coliform loads would be reduced to 1.3% of the existing load.

With Inline Storage, much of the rooftop storm runoff from the CSSA would be stored, treated at the Jones Island WWTP, and ultimately discharged to the Outer Harbor. Because of the relatively low concentrations of pollutants in rooftop stormwater, the Inline Storage Alternative would reduce loadings to the Outer Harbor only slightly from Complete Separation. The reduction in loads from the CSSA would be partially offset by increased loads from the Jones Island WWTP.

With the Modified CST/Inline Storage Alternative, all CSSA loads would be reduced to less than one-half of the existing loads. Greatest reductions in total Outer Harbor loads would be achieved for fecal coliform, biochemical oxygen demand, and phosphorus. Modified Total Storage of CSO would provide the largest reduction in CSSA loads, with all loads representing less than 15% of the existing loads. However, due to increased discharges from the Jones Island WWTP and to loads from other sources, the total Outer Harbor loads would be reduced to 75% to 87% of the existing loads, except for fecal coliform, which would be reduced to 1% of the existing load, and for ammonia-nitrogen, which would increase to 316% of the existing load unless mitigative measures are implemented at the Jones Island WWTP.

A very small proportion (less than 1%) of the total flow to the Outer Harbor is contributed from the CSSA, and a large

TABLE 5-10
ANNUAL POLLUTANT LOADS TO THE MILWAUKEE OUTER HARBOR
UNDER EXISTING CONDITIONS AND ALTERNATIVE
COMBINED SEWER OVERFLOW ABATEMENT PLANS

	EXISTING						NO ACTION						COMPLETE SEWER SEPARATION					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Water (10^6 gallons)	5800	--	102	701,000	--	100	5700	98	--	701,000	100	--	6,400	110	112	701,000	100	100
Suspended Solids (10^6 pounds)	2.18	--	100	54.2	--	117	2.18	100	--	46.5	86	--	2.00	92	92	47.3	87	102
Total Phosphorus (10^3 pounds)	62.9	--	101	552	--	119	62.0	99	--	464	84	--	46.6	74	75	451	82	97
Biochemical Oxygen Demand Ultimate (10^6 pounds)	2.82	--	100	40.2	--	119	2.81	100	--	33.9	84	--	1.56	56	56	33.0	82	97
Ammonia-N (10^3 pounds)	95.25	--	100	2850	--	34	95.25	100	--	8440	327	--	32.2	34	34	7980	280	95
Lead (10^3 pounds)	10.1	--	100	69.3	--	112	10.1	100	--	61.9	89	--	13.0	129	129	66.3	96	107
Cadmium (10^3 pounds)	0.726	--	102	8.07	--	112	0.711	98	--	7.20	89	--	0.400	55	56	6.89	85	96
Copper (10^3 pounds)	2.46	--	102	125	--	112	2.41	98	--	112	90	--	2.73	111	113	110	88	98
Zinc (10^3 pounds)	23.3	--	101	172	--	110	23.1	99	--	156	91	--	11.6	50	50	144	84	92
Fecal Coliform (MPFCC/100 ml x 10^{15})	148	--	100	159	--	101	148	100	--	157	99	--	0.733	0.5	0.5	2.14	1.3	1.4

TABLE 5-10 (Continued)
ANNUAL POLLUTANT LOADS TO THE MILWAUKEE OUTER HARBOR
UNDER EXISTING CONDITIONS AND ALTERNATIVE
COMBINED SEWER OVERFLOW ABATEMENT PLANS

	IN-LINE STORAGE						MODIFIED CST/IN-LINE						MODIFIED TOTAL STORAGE					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Water (10^6 gallons)	4300	74	75	701,000	100	100	1,500	26	26	701,000	100	100	709	12	12	701,000	100	100
Suspended Solids (10^6 pounds)	1.85	85	85	47.3	87	102	1.01	46	46	47.2	87	102	0.148	7	7	46.4	86	100
Total Phosphorus (10^3 pounds)	42.5	68	69	447	81	96	14.4	23	23	423	77	91	5.04	80	81	414	75	89
Biochemical Oxygen Demand Ultimate (10^6 pounds)	1.46	52	52	33.0	82	97	0.481	17	17	32.1	80	95	0.169	6	6	31.8	79	94
Ammonia-N (10^3 pounds)	30.2	32	32	8380	294	99	9.84	10	10	8660	304	103	3.55	4	4	9000	316	107
Lead (10^3 pounds)	12.9	128	128	64.8	93	105	4.95	49	49	63.2	91	102	1.31	13	13	60.5	87	98
Cadmium (10^3 pounds)	0.347	48	49	6.84	85	95	0.144	20	20	6.70	83	93	0.043	6	6	6 62	82	92
Copper (10^3 pounds)	2.67	109	111	110	88	98	1.06	43	44	110	88	98	0.282	11	12	109	87	97
Zinc (10^3 pounds)	9.86	42	43	143	83	92	3.79	16	16	140	81	90	1.21	5	5	138	80	88
Fecal Coliform (MFFCC/100 ml x 10^{15})	0.610	0.4	0.4	2.04	1.3	1.3	0.203	0.1	0.1	1.64	1	1	0.080	0.05	0.05	1.53	1	1

Source: ESEI

portion of the CSSA pollutants are deposited in the Inner Harbor or Outer Harbor bottom sediments. Therefore, there would be little variation in average Outer Harbor water quality conditions with the different CSO abatement alternatives. Average pollutant concentrations in the Outer Harbor are set forth in Table 5.11.

5.1.1.2.3 Sediment Loadings and Quality: Based on EPA sediment quality guidelines, both the Inner and Outer Harbor sediments are classified as heavily polluted, and will remain heavily polluted under all CSO abatement alternatives. The heavily polluted classification indicates that a low diversity, low quality benthic community would be expected to exist in the bottom sediments.

Pollutant loadings to the bottom sediments of the Inner Harbor and Outer Harbor were estimated in Section 5.1.4.4 of Appendix V. Sediment loadings would be greatly affected by the abatement of CSO, because CSO solids are more likely than solids contributed from upstream sources to settle out in the Inner and Outer Harbors. This difference is due to the fact that large solid particles in upstream flows have been deposited upstream. Therefore, the effects of CSSA pollutants compared to total Inner Harbor pollutants is best emphasized by considering the loads to the bottom sediments. Annual loadings to the Inner Harbor sediments and Outer Harbor sediments are set forth in Tables 5.12 and 5.13.

With the abatement of CSO, sediment quality would be expected to improve slightly. In the Inner Harbor, the reduction in concentrations of biochemical oxygen demand in the bottom sediments would be the greatest, by up to 73%. CSO abatement would reduce all other pollutants by less than 50% of the existing concentrations. In the Outer Harbor, abating CSO would not greatly change sediment quality conditions. All pollutants would be reduced by less than 20% of the existing concentrations.

When scoured (i.e., disturbed by high flows), river sediments can exert increased oxygen demands on the water column. This phenomenom is caused by the release of chemical substances which quickly react with and consume oxygen. Meinholz et al., (1979b) have identified sediment scour at CSO outfalls as the primary cause of extended dissolved oxygen depletions following storm events. Those CSO abatement alternatives which include storage and treatment of all CSSA sewage and storm runoff (i.e., the Modified Total Storage and the Modified CST/Inline Storage Alternatives) would result in less scouring, and therefore less dissolved oxygen depletion, than those alternatives which include total or partial separation of sanitary and storm sewers (i.e., the Complete Sewer Separation and Inline Storage Alternatives).

TABLE 5-11

PREDICTED AVERAGE POLLUTANT CONCENTRATIONS
IN THE OUTER HARBOR UNDER EXISTING CONDITIONS
AND ALTERNATIVE CSO ABATEMENT PLANS

	Existing	Future[a]				
Parameter	Existing	No Action	Complete Sewer Separation	Inline Storage	Modified CST/Inline	Modified Total Storage
Suspended Solids (mg/l)	2.8	2.8	2.8	2.8	2.8	2.8
Total Phosphorus (mg/l)	0.08	0.07	0.07	0.07	0.06	0.06
Biochemical Oxygen Demand$_{Ult.}$ (mg/l)	5.9	5.0	4.9	4.9	4.8	4.7
Ammonia-Nitrogen (mg/l)	0.56	1.5	1.4	1.5	1.6	1.6
Lead (mg/l)	0.010	0.009	0.009	0.009	0.009	0.007
Cadmium (mg/l)	0.0013	0.0011	0.0011	0.0011	0.0011	0.0011
Copper (mg/l)	0.019	0.017	0.017	0.017	0.017	0.017
Zinc (mg/l)	0.027	0.024	0.022	0.022	0.022	0.022
Fecal Coliform (MFFCC/100 ml)	600	590	10	10	10	10

[a] Slight differences in pollutant concentrations may not be indicated due to rounding of the values.

Source: ESEI

TABLE 5-12
ANNUAL POLLUTANT LOADS
INTO THE INNER HARBOR SEDIMENTS

	EXISTING						NO ACTION						COMPLETE SEWER SEPARATION					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	oad	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Settleable Solids (10^6 pounds)	12.5	--	100	61.8	--	125	12.5	100	--	49.4	80	--	11.4	91	91	48.3	78	98
Total Phosphorus (10^3 pounds)	33.8	--	102	113	--	122	33.3	99	--	92.7	82	--	12.6	37	38	72.0	64	78
Biochemical Oxygen Demand Ultimate (10^6 pounds)	3.88	--	101	4.88	--	105	3.86	99	--	4.64	95	--	0.34	9	9	1.12	23	24
Lead (10^3 pounds)	18.6	--	101	28.9	--	110	18.5	99	--	26.2	91	--	19.2	103	104	27.0	93	76
Cadmium (10^3 pounds)	0.250	--	104	0.60	--	122	0.24	96	--	0.49	82	--	0.137	55	57	0.387	64	79
Copper (10^3 pounds)	2.41	--	103	25.4	--	129	2.35	98	--	19.7	76	--	2.66	101	113	20.0	79	102
Zinc (10^3 pounds)	19.9	--	101	35.3	--	113	19.7	99	--	31.2	88	--	9.91	50	50	21.4	61	69

TABLE 5-12 (Continued)
ANNUAL POLLUTANT LOADS
INTO THE INNER HARBOR SEDIMENTS

	IN-LINE STORAGE						MODIFIED CST/INLINE						MODIFIED TOTAL STORAGE					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Settleable Solids (10^6 pounds)	10.6	85	85	47.5	77	96	3.06	24	24	40.0	65	81	1.33	11	11	38.2	62	77
Total Phosphorus (10^3 pounds)	11.5	34	35	70.9	63	76	3.33	10	10	627	55	68	1.46	4	4	60.9	54	66
Biochemical Oxygen Demand Ultimate (10^6 pounds)	0.32	8	8	1.10	23	24	0.091	2	2	0.871	18	19	0.040	1	1	0.82	17	18
Lead (10^3 pounds)	19.0	102	102	26.8	93	102	5.51	30	30	13.2	46	50	2.24	12	12	9.97	34	38
Cadmium (10^3 pounds)	0.119	48	50	0.368	62	75	0.044	18	18	0.294	49	60	0.016	6	7	0.27	45	55
Copper (10^3 pounds)	2.61	108	111	199	78	101	0.851	35	36	18.2	72	92	0.308	13	13	17.6	69	89
Zinc (10^3 pounds)	8.40	42	43	199	56	64	2.66	13	14	14.2	40	46	1.15	6	6	12.6	36	40

Source: ESEI

TABLE 5-13
ANNUAL POLLUTANT LOADS
INTO THE OUTER HARBOR SEDIMENTS

	EXISTING						NO ACTION						COMPLETE SEWER SEPARATION					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	$ Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Settleable Solids (10^6 pounds)	2.07	--	100	38.1	--	126	2.07	100	--	30.3	80	--	1.90	92	92	31.1	82	103
Total Phosphorus (10^3 pounds)	5.57	--	101	80.8	--	123	5.52	100	--	65.6	81	--	2.09	38	38	62.4	77	95
Biochemical Oxygen Demand-Ult. (10^6 pounds)	0.64	--	100	5.49	--	117	0.64	100	--	4.71	86	--	0.059	9	9	4.23	77	90
Lead (10^3 pounds)	3.08	--	101	11.1	--	119	3.06	100	--	9.34	84	--	3.19	104	104	9.46	85	101
Cadmium (10^3 pounds)	0.041	--	100	0.531	--	121	0.040	100	--	0.440	83	--	0.023	58	58	0.422	79	96
Copper (10^3 pounds)	0.40	--	100	14.8	--	116	0.390	100	--	12.8	86	--	0.445	111	114	11.4	77	89
Zinc (10^3 pounds)	3.29	--	101	17.2	--	120	3.27	100	--	14.3	83	--	1.64	50	50	12.7	74	89

TABLE 5-13 (Continued)
ANNUAL POLLUTANT LOADS
INTO THE OUTER HARBOR SEDIMENTS

	IN-LINE STORAGE						MODIFIED CST/IN-LINE						MODIFIED TOTAL STORAGE					
	CSSA			Total			CSSA			Total			CSSA			Total		
Parameter	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action	Load	% Of Existing	% Of No Action
Settleable Solids (10^6 pounds)	1.75	85	85	31.0	81	102	0.95	46	46	31.0	81	102	0.141	7	7	30.2	79	100
Total Phosphorus (10^3 pounds)	1.90	34	34	62.3	77	95	1.04	19	19	61.9	77	94	0.155	3	3	61.2	76	93
Biochemical Oxygen Demand-Ult. (10^6 pounds)	0.056	9	9	4.23	77	90	0.028	4	4	4.23	77	90	0.004	1	1	4.21	77	89
Lead (10^3 pounds)	3.15	102	103	9.43	85	101	1.72	56	56	8.61	78	92	0.237	8	8	7.21	65	77
Cadmium (10^3 pounds)	0.019	48	48	0.419	79	95	0.012	30	30	0.418	79	95	0.002	5	5	0.41	77	93
Copper (10^3 pounds)	0.445	111	114	11.4	77	89	0.247	62	63	11.3	76	88	0.032	8	8	11.1	75	87
Zinc (10^3 pounds)	1.39	42	43	12.5	73	87	0.779	24	24	12.1	70	85	0.121	4	4	11.6	67	81

Source: ESEI

In-stream measures, such as dredging or flow augmentation, might also be needed to abate dissolved oxygen depletions caused by interactions with the bottom sediments.

5.1.1.3 The Outer Harbor and Lake Michigan

5.1.1.3.1 The Outer Harbor: The average flows and pollutant concentrations for the Jones Island WWTP effluent and for the Outer Harbor under existing and future conditions are shown in Table 5.14. Future Outer Harbor conditions assume complete storage and treatment of combined sewer overflows. Because maximum allowable DNR effluent limits for the Jones Island WWTP effluent are assumed, concentrations of suspended solids and phosphorus increase slightly with the final alternatives. The ammonia-nitrogen concentration in the effluent is expected to triple, resulting in a corresponding increase in the average ammonia-nitrogen concentration in the harbor. Although the total flow from the Jones Island WWTP would decrease by up to 7%, the concentrations of lead, cadmium, copper, zinc, and fecal coliform in the effluent are assumed to remain the same as existing concentrations.

In Section 4.1.1 of Appendix VII, Water Quality, an analysis is presented of the impacts of relocating the Jones Island WWTP outfall beyond the Outer Harbor. This analysis included pollutant loadings, water quality, sediment loadings, and sediment quality in the Outer Harbor for both the existing location and a relocation site. If the outfall is relocated outside of the Outer Harbor, the Outer Harbor concentrations of all pollutants except ammonia-nitrogen would be reduced by up to 50%. Relocating the outfall would reduce ammonia-nitrogen concentrations to only 12% of the concentration expected if the outfall is not relocated. Pollutant loadings to the Outer Harbor bottom sediments would be reduced by up to 90%. The concentrations of biochemical oxygen demand in the bottom sediments would be the most greatly reduced, from 139,000 mg/kg at its existing location to 21,100 mg/kg with relocation. Therefore, relocation of the Jones Island WWTP outfall would have a substantial impact on the content of organic matter in the Outer Harbor bottom sediments.

However, relocation of the outfall would increase total pollutant loads to the main body of Lake Michigan. Relocation of the outfall would increase the phosphorus load to Lake Michigan from the Milwaukee area by 5.4% of the existing load and by 4.0% of the load expected assuming the implementation of the Mosaic and Modified Total Storage Alternatives. In addition, outfall relocation would increase ammonia concentrations near the outfall. The DNR establishes effluent limits for un-ionized ammonia-nitrogen based on the acute toxicity level. Assuming expected future effluent concentrations, if

TABLE 5-14
AVERAGE FLOWS AND POLLUTANT CONCENTRATIONS
FOR THE JONES ISLAND WWTP EFFLUENT AND THE OUTER HARBOR

Parameter	Existing		Future	
	Jones Island WWTP Effluent	Outer Harbor	Jones Island WWTP Effluent[b]	Outer Harbor[a,b]
Flow (million gallons/year)	49,000	701,000	45,600	701,000
Suspended Solids (mg/l)	28	2.8	30[a]	2.8
Total Phosphorus (mg/l)	0.6	0.08	1[a]	0.06
Biochemical Oxygen Demand - ult. (mg/l)	30	5.9	30[a]	4.7
Ammonia - Nitrogen (mg/l)	5.2	0.56	18	1.6
Lead (mg/l)	0.07	0.010	0.08	0.0007
Cadmium (mg/l)	0.008	0.0013	0.007	0.0011
Copper (mg/l)	0.07	0.019	0.06	0.017
Zinc (mg/l)	0.16	0.027	0.15	0.022
Fecal Coliform (MFFCC/100ml)	200	600	200[a]	10

[a] Proposed future effluent limitations.

[b] Includes total storage and treatment of combined sewer overflows (Modified Total Storage Alternative).

Source: ESEI

the outfall discharges directly to Lake Michigan, the acute toxicity level* of 0.2 mg/l un-ionized ammonia-nitrogen might be violated. The MMSD (Summary Support Data File Vol. 1, 1980) investigated the possibility of public health hazards created by relocation of the outfall. During normal operation, the relocated outfall would present a very remote risk to public health.

Abandoning Milorganite production at the Jones Island WWTP and implementing anaerobic digestion instead (as recommended by the MMSD, 1980) would approximately triple the existing concentration of ammonia in the WWTP effluent. Assuming future conditions, the total load of ammonia to the Outer Harbor would be 180% to 216% higher than the existing load (Table 5-3, Appendix V, Combined Sewer Overflow). With the abatement of combined sewer overflows, ammonia would be the only pollutant evaluated which would have future loads to the Outer Harbor higher than the existing loads.

In Section 4.1.2 of Appendix VII, Water Quality, the impacts of the increased ammonia discharge are described. In the Outer Harbor, increased ammonia loads are not likely to significantly increase algal growth; plant growth in the Outer Harbor is usually limited by the availability of light or phosphorus, rather than nitrogen.

The process whereby ammonia is changed to nitrate depends on nitrifying bacteria which also consume oxygen. An analysis of this nitrification process (Lee et al., 1980) has shown that the numbers of nitrifying bacteria in the harbor are relatively low, due primarily to rapid flushing of the harbor. This analysis showed that increasing the effluent ammonia-nitrogen concentration from 6 mg/l to 18 mg/l would have a negligible effect on dissolved oxygen levels. In the WWTP effluent, the acute toxicity level of 0.4 mg/l un-ionized ammonia-nitrogen would be violated during critical summer periods. For a majority of the time, however, the Outer Harbor would meet the acute toxicity level. The mixing zone for the WWTP outfall (that area which would violate the DNR standard for the Outer Harbor of 0.04 mg/l un-ionized ammonia-nitrogen) could extend up to 2,600 feet from the outfall.

5.1.1.3.2 Direct Sources to Lake Michigan: Within the MMSD planning area, five wastewater treatment plants currently discharge directly to Lake Michigan: the South Shore WWTP, the South Milwaukee WWTP, the Sisters of Notre Dame Academy private WWTP, the Wisconsin Electric Power Company's Oak

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*That level which would seriously harm biota in the short-term.

Creek plant, and the Chalet-on-the-Lake private WWTP. In addition, the Outer Harbor, which receives pollutants from the Inner Harbor and Jones Island WWTP, also discharges pollutants into Lake Michigan.

Annual pollutant loadings to Lake Michigan are set forth in Table 5.15. The Outer Harbor and South Shore WWTP are the greatest sources within the MMSD service area of pollutants to the Lake, contributing over 98% of the total loads presented in Table 5.15. Future increases in pollutant loads from the South Shore WWTP due to increased effluent flows and concentrations would be partially offset by decreases in the loads of total phosphorus, biochemical oxygen demand, lead, cadmium, and fecal coliforms from the Outer Harbor. The largest increase in loads to Lake Michigan is expected for ammonia-nitrogen. A detailed ammonia-nitrogen analysis for the South Shore WWTP is presented in Appendix VII, Water Quality.

Phosphorus has been shown to be the nutrient limiting algal growth in the Great Lakes. Excessive levels of phosphorus may result in eutrophic (nutrient-enriched) conditions and algal blooms in portions of Lake Michigan. The International Joint Commission (1980) estimated the existing (1976) phosphorus load to provide for the continued protection and maintenance of the Lake's water quality. If current phosphorus discharge levels are maintained through the planning period, and the wastewater volumes tributary to the South Shore WWTP increase as predicted, the proportion of the total phosphorus load to Lake Michigan contributed from the Milwaukee area is expected to decrease from 4.5% to 4.0%. If, during the planning period, current phosphorus discharge levels increase to the maximum level currently permitted and if the wastewater volumes tributary to the South Shore WWTP increase as predicted, the proportion of the total phosphorus load to Lake Michigan contributed from the Milwaukee area increases from 4.5% to 5.8%. These phosphorus loadings may increase nuisance growths of algae along the Milwaukee near-shore area.

5.1.1.4 Lakefills Associated with the MMSD Recommended Plan and EPA Preferred Alternative

The MMSD proposes filling in 9.5 acres of the Outer Harbor for the expansion of the Jones Island WWTP and 12 acres of Lake Michigan for the expansion of the South Shore WWTP (an additional 18 acres would be closed off). The EPA Preferred Alternative would be a 5.7 acre lakefill for the Jones Island WWTP and a 12 acre lakefill for the South Shore WWTP (without closing off the additional 18 acres).

Filling in these portions of the Outer Harbor and Lake Michigan would cause short-term, localized impacts. The

TABLE 5-15

ANNUAL POLLUTANT LOADINGS TO LAKE MICHIGAN

Parameter	OUTER HARBOR[c]		SOUTH SHORE WWTP		South Milwaukee WWTP[d]	Sisters of Notre Dame WWTP[d]	Wisconsin Electric Power Company, Oak Creek Plant[d]	Chalet on the Lake WWTP[e]
	Existing	Future[a]	Existing[b]	Future				
Water (10^6 gallons)	701,000	701,000	30,000	42,000	986	5.84	21.9	N/A
Suspended Solids (10^6 pounds)	16.4	16.4	4.1	10	0.3	0.002	0.005	N/A
Total Phosphorus (10^3 pounds)	468	351	160	350	11	0.3	0.8	N/A
Biochemical Oxygen Demand - ult. (10^6 pounds)	34.5	27.5	3.3	10	0.3	0.002	0.005	N/A
Ammonia-Nitrogen (10^3 pounds)	3,274	9,354	4,000	5,300	66	0.4	1.5	N/A
Lead (10^3 pounds)	58.5	40.9	15.3	21.0	0.7	Negligible	Negligible	N/A
Cadmium (10^3 pounds)	7.6	6.4	1.7	2.5	0.08	Negligible	Negligible	N/A
Fecal Coliform (10^{15} counts)	15.92	0.3	0.3	0.3	0.01	0.00005	0.0001	N/A

N/A: Not Available

[a] Assumes complete storage and treatment of combined sewer overflows (Modified Total Storage Alternative).

[b] Includes sewer relief bypassing.

[c] Loads from the Outer Harbor to Lake Michigan. Includes Jones Island WWTP effluent loads which do not settle out in the Outer Harbor.

[d] Future conditions assumed to be same as Existing.

[e] Existing data for the Chalet on the Lake WWTP were not available. The Chalet-on-the Lake WWTP is assumed to be abandoned under future conditions.

Source: ESEI

turbidity of the area would increase, thus reducing light penetration. Bottom sediments and any attached pollutants would be resuspended, possibly reducing levels of dissolved oxygen. The color of the water might also change temporarily.

5.1.1.5 The EPA Preferred Alternative for the Abatement of Peak Flows

The impacts of the EPA Preferred Alternative on the water quality of streams and lakes not receiving combined sewer overflow are the same as those for the Mosaic Alternative as described in Section 5.1.1.1 and in Appendix VII, Water Quality. For waterways which receive combined sewer overflow, the water quality impacts would be similar to the impacts of the Modified Total Storage Alternative, as set forth in Appendix V, Combined Sewer Overflow, except that occasional combined sewer overflows would occur. Violations of the dissolved oxygen and fecal coliform standards could occur on a limited basis during these overflow events. However, the water quality impacts of the spill events would be reduced as a result of the large amount of dilutions provided by the large river flows which would be expected during a spill event. As set forth in Chapter 3, the EPA recommends that additional studies be conducted to identify the most cost-effective CSO abatement alternative needed to meet an attainable water quality standard.

5.1.2 Aquatic Biota

Aquatic biota are affected by pollutant loads, toxic substances, dissolved oxygen levels, and nutrient concentrations. The EIS has analyzed the effects of alternative future wastewater systems on the short-term and long-term habitat, food sources, and health of aquatic communities.

5.1.2.1 No Action Alternative

With the No Action Alternative, inadequately treated wastewater and bypassed sewage would continue to pollute area waterways. Inputs of poorly treated or untreated sewage into a body of water temporarily lower dissolved oxygen levels due to the decomposition of organic matter. Also, toxic substances may reach harmful levels. Siltation renders the affected areas less hospitable to most aquatic species. Mobile aquatic animals would avoid the affected areas until the reccurrence of more hospitable conditions. Only species tolerant of periodic high-pollutant concentrations would remain during bypass conditions.

Five WWTPs would continue to discharge effluent to Lake Michigan. Three of these, School Sisters of Notre Dame,

Wisconsin Electric Power Company (WEPCO), and South Milwaukee, would function adequately. Their discharges would not affect the water and sediment quality in Lake Michigan during the planning period.

However, the Jones Island and South Shore WWTPs would not function properly on a consistent basis. During wet weather, the Jones Island WWTP presently discharges inadequately-treated effluent to the Outer Harbor. This situation would continue if the sewerage facilities are not improved. As a result of this and other upstream sources of pollution, trout and salmon may tend to avoid the harbor. In addition, the growth of nuisance algae would be facilitated. Increased ammonia levels in the effluent from the Jones Island WWTP might result in toxicity to fish in the central portions of the harbor.

The South Shore WWTP would also be overloaded at times during the planning period, allowing the discharge of partially treated, chlorinated effluent directly into Lake Michigan. Although currents would prevent plant nutrients from collecting near the discharge point, organic matter would settle there. Fish may avoid the plume of effluent, but they might be attracted to the food source provided by beds of bottom dwelling animals that would feed on the organic deposits around the discharge point. These deposits might contain toxic substances such as heavy metals and pesticides, and in this way these substances could enter the food chain.

The only construction that would occur with the No Action Alternative would be the construction of sewer laterals in already sewered areas. Therefore, there would be few construction-related impacts to aquatic biota. Construction impacts would be limited to the addition of silt and attached pollutants. Proper construction techniques would help mitigate these impacts.

5.1.2.2 Local, Regional and Mosaic Alternatives

The Local, Regional, and Mosaic Alternatives would have similar impacts on Aquatic Biota. Effluent discharges to the Menomonee River at Germantown, to Deer Creek at New Berlin, and to Tess Corners Creek in Muskego would cease, which would reduce the flows of the upper reaches of these watercourses to close to zero during very dry weather. If the streams dry up, the biological communities characteristic of a flowing water habitat would be replaced by a community adapted to intermittent streams. The individual organisms trapped by cessation of flow would eventually die. Other organisms would be displaced to permanently flowing reaches. These organisms would not be replaced until conditions are

more hospitable for them. The fish that feed on these organisms (white suckers, bass, and bluegill, for example) would move downstream to permanently-flowing reaches.

Deer Creek is filled with cattails, making it resemble a marsh. With the reduction in flow, marsh vegetation would remain and a marsh community may become established. Tess Corners Creek and the upper Menomonee River might also develop stands of marsh vegetation.

Big Muskego Lake and the Whitnall Park Pond already contain dense populations of algae. With any action alternative, this growth of algae would continue or even increase due to the accumulated nutrients that would support eutrophication. Removal of the accumulated nutrients, by dredging the sediments or harvesting algae, would be necessary to reverse the eutrophication. Unless such a program is carried out, the biota of these bodies of water would remain characteristic of highly eutrophic conditions.

The Outer Harbor also has nuisance algal growths. However, none of the action alternatives would greatly alter the input of phosphorus to the Harbor, so algal growth would continue at a high level. Nevertheless, the action alternatives would add less phosphorus to the Outer Harbor and to Lake Michigan, and thus contribute less to the long-term eutrophication of the Lake. Increased ammonia levels from Jones Island effluent might occasionally result in fish toxicity in the area immediately surrounding the outfall.

In Lake Michigan, effluent from the South Shore WWTP would tend to repel fish. The area affected by the effluent would vary depending on currents and winds, but it would probably remain close to the surface. Organic matter would collect at the outfall locations, encouraging the growth of large populations of deposit-feeding worms. These organic deposits would contain high concentrations of heavy metals, which could be incorporated into the aquatic worms. Since fish feed upon these worms, the potential for introducing these toxic substances into the aquatic food-chain would continue.

5.1.2.3 Lakefills Associated with the MMSD Recommended Plan and the EPA Preferred Alternative

The lakefills included in the MMSD Recommended Plan and the EPA Preferred Alternative (see Section 5.1.1.3) would permanently remove lake bottom and the overlying water column from use by aquatic biota. The temporary changes described in Section 5.1.1.3 could increase nutrient levels in the vicinity of the construction area, possibly increasing algal growth. The increase in turbidity could cause eggs,

nests, and food to be covered and could interfere with the breathing organs of some species of aquatic life. Mobile aquatic organisms would probably be repelled from the affected area.

5.1.3 Threatened and Endangered Species

The EIS evaluated the direct impacts to threatened and endangered species and their habitats.

5.1.3.1 No Action Alternative

Two species of fish on the State Threatened and Endangered Species Lists may inhabit the Milwaukee River near Thiensville. These are the striped shiner, an endangered species, and the longear sunfish, a threatened species. The striped shiner has been reported in the Milwaukee River in Milwaukee County as recently as 1979. The longear sunfish has not been reported in the planning area since 1950. In order to survive, these fish need clear water and a gravelly stream bed for spawning. Bypasses and overflows in the Thiensville sewer system would contribute to the degradation of the natural habitat of these fish by adding small amounts of silt to the river. Thus, the No Action Alternative could reduce the numbers of these species of fish. There are no other threatened or endangered species that would be affected by this alternative. There would be no construction occurring in the Thiensville area under the No Action Alternative and, therefore, there would be no construction impacts to the threatened or endangered species known to be present in the planning area.

The Federal government lists the longjaw cisco as endangered. This is a deep water fish that has been reported in Lake Michigan. However, it has not been reported since 1963, and in any case would not be affected by the No Action Alternative.

Among threatened and endangered birds reported in the planning area are the endangered peregrine falcon and the threatened Cooper's hawk. No reports of these species nesting in the affected area have been recorded, and they are not likely to be affected by any of the alternatives under consideration.

5.1.3.2 Local, Regional, and Mosaic Alternatives

None of these alternatives should disrupt any endangered or threatened species of fish in the planning area. The quality of the Milwaukee River would not be altered by either the expansion or the abandonment of the Thiensville WWTP. Neither the striped shiner nor the longear sunfish would be affected.

There would be no construction occurring in the Thiensville area under the Local, Regional, and Mosaic Alternatives and therefore, there would be no construction impacts to the threatened or endangered species known to be present in the planning area.

5.1.4 Air Quality

The EIS evaluated the emissions of pollutants and odors for each final alternative, and identified possible measures to mitigate adverse impacts.

5.1.4.1 No Action Alternative

5.1.4.1.1 Pollutant Emissions: With the No Action Alternative, there would be little change in the amount of pollutants emitted to the air from sewerage facilities in the planning area. These emissions result from generators, sludge drying, incineration of screened materials, and the vehicles used for transporting sludge to disposal sites.

Currently, the greatest source of air pollutants from the operation of these facilities is the process of drying sludge to produce Milorganite. In 1979, 1,226 tons (1,112 metric tons) of particulates (dust) were introduced into the air from this process (about 6% of the total emissions in Milwaukee County). With the No Action Alternative, the amount of particulates from Milorganite production would remain the same (Milorganite production is at its maximum).

The amounts of air pollutants associated with the other sewage treatment processes in the planning area would also remain about the same throughout the planning period. Wastewater flows are not expected to increase between 1985 and 2005, so the WWTPs would operate approximately as many hours as they do now. The pollution from these sources is relatively insignificant to air quality in the planning area. Dust emissions due to construction activity with the No Action Alternative would be minimal.

5.1.4.1.2 Odors: The No Action Alternative could increase odor problems in the planning area. Raw or inadequately treated wastewater would be periodically discharged into area waters. These discharges would continue to create unpleasant odors from the rivers of the planning area.

There have also been complaints about odors from the large wastewater treatment plants in the planning area. With the No Action Alternative, the four remaining sludge lagoons at the South Shore WWTP would continue to operate, thus generating odors. Odors from the Jones Island WWTP have not been cited as a public concern.

Most of the other WWTPs in the planning area are located near subdivisions. Although the surrounding communities have not complained about odors from these WWTPs, the increases in flows expected during the planning period could overload the facilities, possibly creating nuisance odors.

Occasionally, the wastewater conveyance systems are also the sources of odors. These problems generally arise from a system malfunction or improper maintenance, and they are usually temporary. None of the alternatives would alleviate this problem.

The No Action Alternative would include little construction other than sewer laterals in already sewered areas. There would be few construction-related odors associated with the alternative.

5.1.4.2 Local, Regional and Mosaic Alternatives

5.1.4.2.1 Pollution Emissions: All the action alternatives would include the rehabilitation and expansion of the Jones Island and South Shore WWTPs and methods to abate CSO and to reduce peak flows. Each of these components of the MFP would have construction impacts and long-term operating impacts on air quality.

Construction would create dust (particulate emissions) and equipment fumes. The amount of pollutants added to the air would vary depending on the percentage of silt in the soil, the weather (wind and rain), the moisture content of the soil, and the alternatives selected for WWTP expansion and CSO abatement and peak flow attenuation.

Dust emissions under extreme conditions (high wind and dry weather) could cause localized short-term violation of the particulate standard unless mitigative measures are taken. Such measures for control of fugitive dust sources generally involve watering, chemical stabilization, or reduction of surface wind speed using windbreaks or source enclosures. The construction for the expansion and rehabilitation of the Jones Island and South Shore WWTPs would take less than four years. The lakefill alternatives for these WWTPs would create the greatest amount of dust. Construction erosion control practices in conformance with the Milwaukee County Soil and Water Conservation District Technical Guide are recommended to be implemented for all MFP-related construction projects.

For the most part, the impacts on air quality from the various alternatives for CSO abatement would be construction-related. The CSO solutions involving open-cut sewer construction (Complete Sewer Separation and Inline Storage)

would produce the most dust. Unlike other MFP construction projects which would require only temporary construction sites, the CSO abatement project would require longer construction time for dropshafts, access shafts, and near-surface storage facilities. Some of these sites would be located in or near sensitive residential and recreational areas. Precautions for minimizing dust should also be followed for this construction.

Construction vehicles would emit small quantities of fumes. The amount of emissions would be limited by the small number of vehicles and their operation time. Vehicles should have emission rates within EPA and DNR regulations.

The average annual construction impacts of the MMSD Recommended Plan for the rehabilitation and expansion of the Jones Island and South Shore WWTPs and the joint facilities for CSO storage and peak flow attenuation are shown in Table 5.16. The figures in the table would vary if alternatives other than the MMSD Recommended Plan were selected. The ranges of construction emissions for the South Shore WWTP and the CSO/Peak Flow Abatement Alternatives are shown in Table 5.17. (The MMSD did not calculate the construction impacts for all Jones Island alternatives). For more detailed information on the construction impacts of different aspects of these alternatives, see the Jones Island, South Shore, and CSO Appendices.

The most significant long-term impact of any action alternative would be the 6% reduction of county-wide particulate emissions due to the abandonment of Milorganite production. In addition, changes in energy use at the WWTPs would affect their emissions. Table 5.18 compares air pollutant emissions from energy use with the No Action and Local Alternatives. The Local Alternative was used in this analysis because it would require the most energy of any action alternative, although energy use under all the action alternatives would be similar. This table does not include purchased electricity. With any action alternative, the use of electricity would be at least twice that of No Action. The increase in the use of electricity could require greater use of coal and nuclear energy for generating electricity. Greater reliance on coal for the production of electricity might result in emissions which could increase the parameters listed in Table 5.18.

TABLE 5.16

AVERAGE
CONSTRUCTION EMISSION
OF MMSD PREFERRED
ALTERNATIVES
IN TONS
PER YEAR

	Jones Island[1]	South Shore[2]	CSO[3]	Total	1985 County - Wide[4] Total	MWPAP % of Total Emissions
Particulate Matter	56	9	144	209	13,633	1.5%
Sulfur Dioxide	14	4	10	28	178,437	0.02%
Carbon Monoxide	425	9	235	669	161,247	0.4%
Hydrocarbons	30	12	30	72	60,703	0.1%
Nitrogen Dioxide	160	50	193	403	67,008	0.6%

[1]MMSD, Jones Island Facility Plan Element, 1980

[2]HNTB, Technical Memo, 1980

[3]MMSD, CSO, vol. 1, 1980

[4]SEWRPC Planning Report 28, 1980. The year 1985 is used for comparative purposes only.

1 ton = 0.9078 metric ton

TABLE 5.17

RANGES OF AVERAGE ANNUAL
CONSTRUCTION IMPACTS
IN TONS

	South Shore WWTP		CSO/Peak Flow Alternatives	
	Least Case Alternative	Worst Case Alternative	Least Case Alternative	Worst Case Alternative
Particulate Matter	3	34	108	160
Sulfer Dioxide	2	5	7	16
Carbon Monoxide	5	11	235	296
Hydrocarbons	6	13	21	30
Nitrogen Dioxide	25	56	120	193

TABLE 5.18

AIR POLLUTION EMISSIONS
(Year 2005)
RELATED TO ENERGY USE

	No Action	Local Alternative
Particulate Matter*	12.8	9.8
Sulfur Dioxide*	52.7	48.3
Carbon Monoxide*	69.5	164.4
Hydrocarbons*	142.5	412.2
Nitrogen Oxide*	312.1	413.5

*tons/year

In addition to the direct impacts on air quality from construction and operation of sewerage facilities, any growth or land use inconsistent with the Regional 208 Plan could affect regional air quality planning. As urbanization increases, less agricultural land use and more residential and industrial land use also occurs. With the increased development, air pollution problems can be expected to increase.

5.1.4.2.2 Odors: The interceptors that would be constructed with the Local, Regional or Mosaic Alternatives to convey wastewater flows to treatment facilities would not be susceptible to odors. Interceptors are usually constructed at considerable depths. The groundwater is under such pressure at these depths that exfiltration from the sewers is unlikely. Even if exfiltration of sewage from the pipes should occur, it is unlikely that wastes would surface in sufficient quantity to cause noticeable odors.

Odor problems during the construction of CSO alternatives would be minimal. Some objectionable odors could be released during sewer construction as a result of disconnection of sanitary laterals or from the disconnection of existing separate sanitary sewers from the combined system in portions of the CSSA. These odors would be eliminated as soon as the reconnections were made and the trenches were backfilled. Consequently, these minor odor problems would be short-lived.

Odors might also occur at WWTPs. Since the Jones Island WWTP is located in an industrial area, its expansion and upgrading would probably not increase odors. The South

Shore WWTP is located near residential areas and has been cited for nuisance odors. With the upgrading of this facility, additional sludge lagoons at that site would be abandoned. This action and improvements in operations should reduce the odor problems from this facility. As has been stated, the South Shore WWTP may not be the only source of odors in this area. If this is the case, elimination of the sludge lagoons at South Shore would not affect nuisance odors in the area.

All other WWTPs in operation with the Local or Mosaic Alternatives are located near residential communities. Improvements to the operations of these facilities should reduce the possibility of future nuisance odors. With the Local Alternative, three facilities would employ land application techniques for partially-treated wastewater. Prior to land application, complete stabilization of sludge is required to kill any pathogens. This process would considerably reduce if not eliminate the possibility of foul odors from the application sites.

The lower reaches of the Menomonee, Milwaukee, and Kinnickinnic Rivers frequently give off unpleasant odors. The abatement of CSO and other bypasses would eliminate one source of these odors, raw sewage. However, it is not certain that the rivers' odors would improve noticeably because of their already degraded condition. In-stream measures such as flow augmentation, aeration, and dredging could reduce odors generated by the rivers.

Other long-term impacts would be associated with the final CSO alternatives as a result of deposits of solids decomposing in conveyance and storage facilities. Deposition of solids in conveyance systems is usually avoided by proper hydraulic design. However, blockages created by large objects lodging in smaller diameter sewers might trap solids, creating a localized odor problem. The large size of the majority of sewers required under each of the CSO abatement alternatives would substantially reduce the possibility of these blockages. Where deposition of solids in storage facilities would likely occur, aeration equipment would maintain aerobic (non-septic) conditions.

The screening equipment used at dropshafts and near surface storage silos (with the Modified CST/Inline and the Modified Total Storage Alternatives) to collect and store solids could produce odors. Since these facilities would be located underground, the odors could reach the surface through ventilation equipment and during removal of the collected material from the facility for disposal. Odors escaping through vents could be eliminated by the use of deodorizing filters. Any odors released during transfer of stored

solids could be reduced by using covered containers to minimize exposure to the atmosphere.

In the event that solids would collect in deep tunnels and storage caverns, odor problems could occur near ventilation exhausts. As with screening structure vents, deodorizing filters could be used to eliminate potential problems.

5.1.5 Groundwater

The EIS analysis of groundwater studied the impacts of dewatering, leaching, and sewer exfiltration on groundwater supplies.

5.1.5.1 No Action Alternative

With the No Action Alternative, the service areas of the MMSD and the Local WWTPs would not be expanded. Thus, the No Action Alternative would not extend sewer service to lots now served by septic systems. As a result, the potential for contamination of the sand and gravel aquifer from failing septic systems would continue. Most homes in areas served by septic tanks rely on groundwater for their water supply.

The Muskego Rendering Company in western Muskego now discharges treated wastewater effluent to an infiltration-percolation pond. Although this pond operates adequately, flows from the plant are expected to increase, overloading this pond and creating the potential for groundwater contamination in the area.

The MMSD applies sludge produced at the South Shore WWTP to agricultural lands in Southeastern Wisconsin. This practice could be continued without adverse impacts to groundwater if site selection criteria, application rate limits, and monitoring of sludge composition and groundwater conditions are carried out as directed by DNR regulations.

5.1.5.2 Local, Regional, and Mosaic Alternatives

With any action alternative, interceptors would be constructed to provide sewer service to some areas presently served by septic systems. These new interceptors would allow the abandonment of failing septic tanks in their service areas, thus eliminating these potential sources of contamination to local groundwater supplies. Septic systems would remain in operation in the more remote areas of the planning area where sparse population does not warrant interceptor construction.

With any action alternative, the infiltration-percolation pond at the Muskego Rendering Company would be abandoned. The company would continue operation of its treatment facilities to treat wastewater prior to its discharge to the local sewer system. With the elimination of this percolation pond, the potential for contamination of local wells will be reduced.

With the Local Alternative, three WWTPs in the planning area would employ aerated lagoons followed by infiltration-percolation ponds where the partially treated wastewater would be applied to land. Because this method uses soil interaction to reduce pollutants, it is important to have the greatest distance possible to groundwater at the application sites; hence, a deep water table is essential.

Even with a deep water table, specific soil characteristics or underground channels could allow effluent to reach groundwater before its nutrients and solids are fully removed. The result could be pollution of the shallow groundwater. Due to the slow movement of groundwater, this would be a long-term impact.

Sewage effluent contains many substances that could pollute groundwater. Soil acts as an efficient treatment medium, and pollutants like metals and phosphates would be rapidly taken up by soil particles. The main danger to groundwater from land application would be pollution by nitrate, which is highly concentrated in sewage effluent and poorly removed by soil. Nitrate has been linked to a blood disorder, Methemoglobinemia, and so its concentration in drinking water is limited by the EPA.

To protect users of groundwater in the vicinity of the land application sites in Vernon, Muskego, and Germantown, a thorough investigation of the soils beneath potential pond locations, including percolation tests, should be conducted before the sites are approved. If the tests are inconclusive, tile drains should be installed under the ponds to monitor the percolate and determine if groundwater quality is in danger. If the groundwater should be threatened, the percolate could be pumped to the surface, retreated, and recycled to the pond.

Nitrate contamination could be reduced by planting a fast-growing wetland plant in the infiltration ponds, allowing it to take up the nitrogen, and harvesting it regularly. As an example, the grass Phragmites communis would be capable of withdrawing three times the amount of nitrate that would be annually added to these infiltration-percolation ponds over a growing season.

It is likely that land application facilities could be successfully designed and operated without jeopardizing local groundwater supplies. Due to high concentrations of metals and other toxic substances, infiltration ponds might be unsuitable for growing crops once they are no longer useful for sewage disposal.

The MMSD Recommended Plan and the EPA Preferred Alternative include the continued application of sludge from the South Shore WWTP to agricultural land and the landfilling of solids from the Jones Island WWTP.

Treatment plant solids contain toxic substances such as nitrates and metals that could leach through the soil and contaminate groundwater. Pretreatment of industrial wastes would be expected to reduce levels of contaminants in sludge, but the degree of success of the MMSD pretreatment program cannot be predicted at this time.

To prevent groundwater contamination, the DNR has established criteria for the selection of land application sites. Application rates are limited by permissible levels of metals and nitrates in the soil. Furthermore, the DNR requires extensive monitoring of sludge composition and groundwater conditions. These precautions would minimize the likelihood of groundwater contamination at land application sites. Precautions such as providing an impervious leachate barrier, an underdrain and collecting system, and a leachate treatment and/or disposal system are now required at landfill sites by DNR construction and operation permits. These precautions should be adequate to protect local groundwater supplies.

5.1.5.2.1 Impacts to the Sand and Gravel Aquifer

The construction of new local, intercepting, and near-surface collecting sewers, near-surface storage, screening facilities and dropshaft structures required by the various action alternatives could affect the sand and gravel aquifer. Since most of these structures would be constructed at or below the groundwater table, groundwater would tend to infiltrate into the structures through leaky joints and cracks in the concrete. If the structures are constructed above the groundwater table or if the hydraulic head within the structure is raised above that of the surrounding groundwater, exfiltration would occur through any leaks or cracks in the concrete.

Most local sewer construction would be associated with the correction of the CSO problems in central Milwaukee and the Village of Shorewood. New sewers would be constructed

throughout the CSSA for the Complete Sewer Separation Alternative and Inline Storage Alternative, and in 21% of the CSSA for the Modified CST/Inline Alternative. The Inline, Modified CST/Inline, and Modified Total Storage Alternatives would require near-surface collectors, near-surface storage, screening structures, and dropshafts which would also be constructed in the sand and gravel aquifer. In the CSSA, groundwater is mainly tapped from the Niagaran and sandstone aquifers and cased through the sand and gravel. Pollutants would be reduced by the soil in the sand and gravel before reaching any well in the dolomite formation.

Interceptors would be built in some areas where individual structures, as well as community water supplies, rely on groundwater. In these areas, wells could draw contaminated water if they were located near an interceptor and were pumping during an exfiltration event. Interceptors are generally constructed at lower elevations than local sewers, thus reducing the possibility of exfiltration. Proper sizing of sewers and hydraulic design would reduce the possibility of surcharge. Installing water tight seals and inspecting all joints during construction as well as regular maintenance and inspection should also limit the quantity of exfiltration.

Care should also be taken in installing all facilities because excessive dewatering could lower adjacent groundwater tables. If the groundwater tables are lowered, wells might dry up or buildings might subside. With due caution and proper pre-construction and construction techniques, the lowering of the water table could be minimized. On sites where long-term construction is expected, construction of sheet pilings or slurry walls would limit horizontal groundwater flow into the excavation site and could reduce the amount of water to be removed from the site. Sump pumping and limited use of dewatering wells are also possible mitigating measures.

Spills of gasoline, oil, raw sewage, and other contaminants are possible hazards to groundwater at the construction site. Proper handling of these materials as well as development of a rapid cleanup program would reduce impacts of such spills.

5.1.5.2.2 Impacts to the Niagaran Aquifer

Tunnels, caverns, and connecting structures (dropshafts and return pump shafts) would be the only structures constructed in the Niagaran aquifer. The aquifer itself is mainly dense dolomite with discontinuities (fissures and bedding planes) which convey water through the formation. Both the size and frequency of these discontinuities vary. Because the exact

horizontal and vertical alignments of control structures, and operating proceduces have not yet been identified, the following assumptions are necessary to make a reliable prediction of tunnel-related impacts:

1. The vertical alignment is assumed at the elevation of approximately 300 feet mean sea level (MSL) with a slope of 1 ft/1000 ft.

2. The horizontal alignment shown in Figure 3.9 is assumed, with possible dropshaft sites, public rights-of-way, and required separated sewer connections as controlling factors.

3. All tunnels are assumed to be 20 feet in diameter and lined with a 1 foot thick concrete liner.

4. All dropshafts are assumed to be equipped with gate structures to limit flows to the tunnel. Excessive flows could be bypassed at existing overflow outfalls. The pump station could also be used to control flow depths.

Given the above assumptions, construction impacts would be limited to possible drawdown of the piezometric levels of the water in the aquifer to a point where local well capacities are reduced or curtailed. The proposed construction method is to pump accumulated water (sump pumping) from the tunnels and to apply grout to all discontinuities intersected. Grouting is a common practice. Grout is a concrete-like material which is pumped to various depths in the discontinuity, sealing it. Chicago's Tunnel and Reservoir Project (TARP) called for grouting of discontinuities to depths of one tunnel diameter. (MSDGC 1979). In the geotechnical report attached to the Addendum to Appendix V of this EIS, Converse Ward Davis Dixon, Inc., (CWDD) estimated inflow for an ungrouted and unlined tunnel to range from 1,200 to 14,000 gpm/mile. The report also estimated that at 1000 feet from the tunnel, the drawdown in piezometric surface would be from 1% to 3% before grouting.

Data on inflow reductions can be seen in Table 5-19. As can be seen from the table, grout has been used to reduce up to 53% of inflow in other tunnels.

Where faults or other large discontinuities are encountered, large quantities of water could infiltrate the tunnel. Large quantities of inflow could create a localized piezometric depression along the alignment of the fault. Figure 5.2 shows existing and possible faults in the Milwaukee area. The fault extending southwest through central Milwaukee was

TABLE 5.19

EFFECT OF GROUTING ON
TUNNEL EXFILTRATION/INFILTRATION - CASE STUDIES

Case No	Tunnel Configuration				Measured Inflow Quantities			
	diameter (ft)	length (ft)	depth below ground (ft)	depth below groundwater (ft)	Before Grout		After Grout	
					gpm/ft	mgd/mile	gpm/ft	mgd/mile
1	17	18,400	190-220	160±	0.025	0.19	0.007	0.05
2	14	17,121	200±	200±	0.033	0.25	0.006	0.047
3	20	5mi	200-200±	200-300±	0.017	0.13	0.009	0.069
4	30	5mi	200-300±	200-300±				
5	7.5	1,500			0.27	2.05	-	-
6	7.5	6,400			0.086	0.65	-	-

Source: MMSD

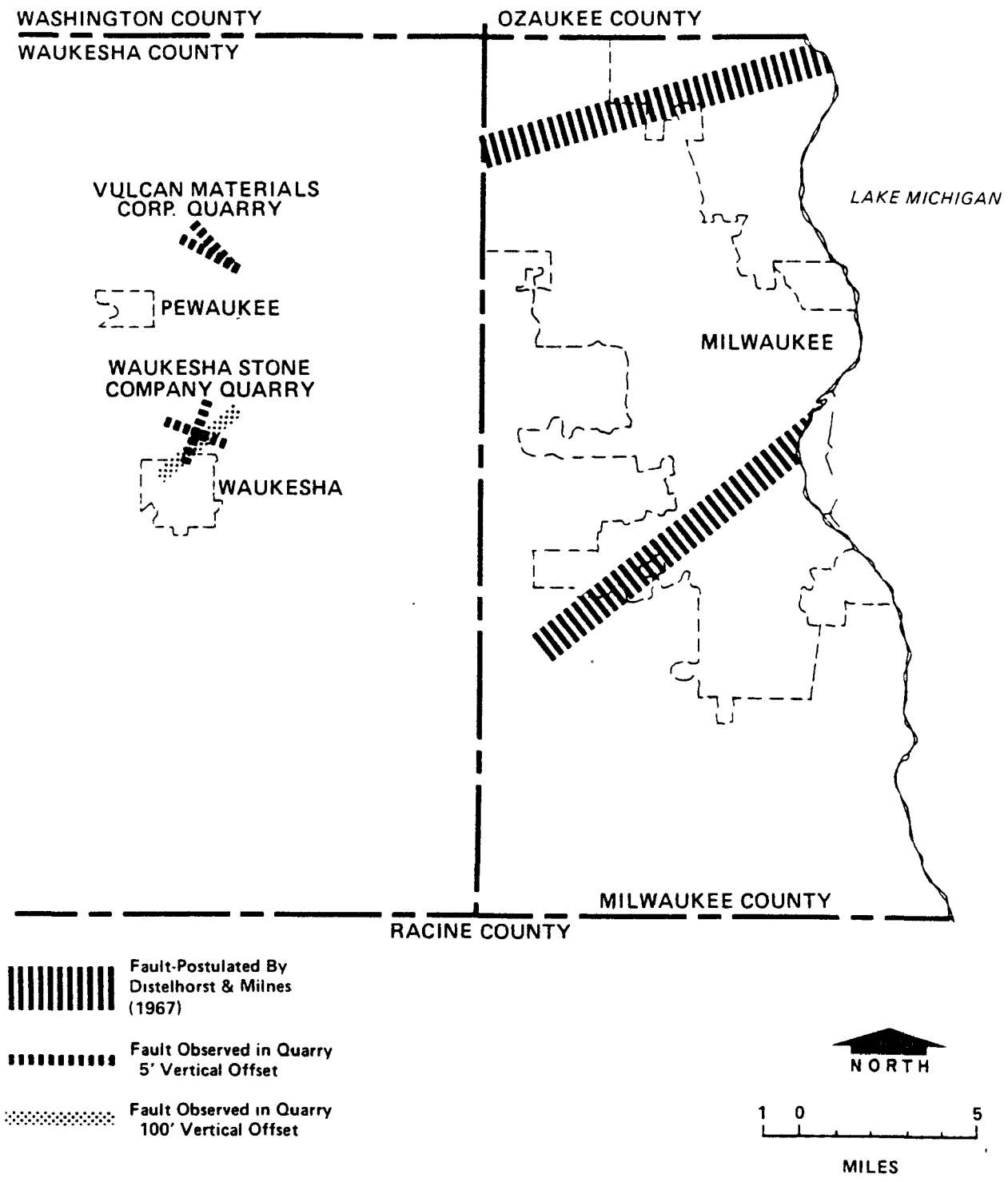

FIGURE 5-2

DATE APRIL 1981

FAULTS IN THE MILWAUKEE AREA

SOURCE M.M.S.D.

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

postulated by Distelhost and Milnes in 1967. Subsequent borings performed along the proposed fault have not conclusively proved that this feature is a fault. The existence and location of all possible faults along the tunnel route should be documented prior to construction. Proper instrumentation in the tunnels during construction could also locate such large discontinuities before tunnel operations actually encountered the geologic feature.

Where known faults exist, impacts could be minimized by aligning the tunnel perpendicularly to the fault, thus reducing the exposed surface area of the fault. Pre-grouting (pumping grout either radially from the tunnel or down from the surface along the fault line to seal openings in the feature prior to direct contact with tunnelling operations) would also mitigate the possibility of adverse impacts.

The existence of faults often indicates the potential for seismic activity. Should earth movement directly intersect the tunnel, it would be necessary to close the tunnel and reseal any damaged walls. Although distant siesmic activities can be felt for hundreds of miles on the surface, it has been shown that the effects on structures in rock openings are significantly less severe (Dowding, 1977).

Wastewater could exfiltrate from the tunnels only when the static pressure of the water inside the structures is greater than the piezometric pressure of the surrounding groundwater. Such a situation could occur if the tunnels filled to a height greater than the height of the piezometric surface of the groundwater (e.g., if local pumping caused a cone of depression).

Flow depths within the tunnel could be limited by positive head controls such as gate structures located prior to dropshafts and by use of the pump station at the downstream end. If each structure is also supplied with a backup facility, the possibility of the operators losing control of flow depths in the tunnels would be quite small. Using the conservative assumption that gates, pumps and backup facilities for each tunnel are each only 90% reliable, all flow control devices would have to fail simultaneously for the tunnels to fill to such an extent that wastewater backed up into dropshafts (surcharged). The probability of the occurence of such an event would be 0.0001 (one in ten thousand). This probability would be further reduced by the fact that such an event would have to occur during a storm that would require more storage than would be available in the underground system. Proper testing and maintenance of control equipment could ensure reliabilities of greater than 90%.

Low piezometric pressure already exists at two locations along the tunnel route. The first is in the vicinity of I-43 and Hampton Avenue where the non-pumping cone of depression dips to 520 ft. Mean Sea Level (MSL). The second, more severe area is located near I-94 and North 27th Street where the non-pumping piezometric surface drops to below 480 ft. MSL. The cause of this second cone of depression has been traced to industrial well pumpage in the area, especially by the Universal Foods Corp. which draws an average of 35 million gallons per month for cooling water at its Red Star Yeast plant. Plant records show that pumping reduces the pressure levels an additional 210 feet to an approximate elevation of 270 ft. MSL. It is doubtful that pumping levels in the depression area near Hampton Avenue are as low as near 27th Street because of the types of industry and water use reported there.

Should exfiltration occur, its quantity and rate would be controlled by the pressure differential between the aquifer and the stored flows. Thus, if the flow depth in the tunnels is controlled and rises only slightly above the piezometric pressure elevation, exfiltration quantities would be minimal. Because the tunnels might infiltrate, they would exert an area of depression similar to a well.

If exfiltration events are short in duration, it is quite possible that exfiltrated pollutants could be recaptured in the tunnels when conditions conducive to infiltration are re-established. Pollutants not recaptured would move through the aquifer along the hydraulic gradient of the aquifer toward the east at a slope of 0.0028 ft./ft. Pollutants which enter a cone of depression created by localized pumping would migrate to and be removed by the well creating the drawdown. This could be a severe impact if wells near the area are used for drinking water.

The MMSD is continuing a program to identify and classify all known wells in the tunnel corridors. Wells are classified by their depth, construction, and use. Use classifications include active wells, inactive wells maintained as standby sources, inactive wells with pumps intact, inactive wells which are capped, inactive wells which are properly abandoned, and wells of unknown condition. The data available to date have shown that the majority of wells in the tunnel corridor are inactive, and those that are active supply mainly air conditioning and cooling water needs. In order to protect active or inactive auxilliary wells where use of contaminated water could cause severe impact, the safest alternative is to case the well through the dolomite formation.

The grouting and lining program proposed for control of infiltration would also control exfiltration. In addition, the permeability of the lining might also decrease over time due to impregnation of pores in the wall by particulate matter carried in the raw sewage. Other measures to control exfiltration include positive flow depth control in the tunnels, construction of a drain system around the tunnel to recapture exfiltration, and pumping of inactive wells in the tunnel corridor immediately after an exfiltration event to control the spread of and remove a majority of pollutants from the aquifer.

Further borings and aquifer tests, continued well identification, and seismic analyses should be conducted to adequately identify all geologic features and to obtain other data necessary for safe construction and operation of a system within the Niagaran aquifer.

5.1.5.2.3 Impacts to the Sandstone Aquifer

No facilities would be constructed in the sandstone formation, so no direct impacts to this formation would occur. It would be possible that exfiltrated pollutants might enter this aquifer from the Niagaran formation. This contamination could occur via the many non-pumping active and inactive wells which are open to both the Niagaran and sandstone aquifer. If polluted waters entered these wells, they could be conveyed vertically to the sandstone aquifer. This situation could be mitigated by proper abandonment of inactive wells by methods described in the Wisconsin Administrative Code Section NR 112.21. Other mitigative measures include the casing of wells as they pass through the Niagaran Aquifer and the pumping of inactive wells immediately after an exfiltration event.

Although it is possible that a number of older, improperly abandoned wells may not be found in the central Milwaukee area, only those wells which penetrate to the sandstone aquifer are considered significant. Vertical movement is created in wells open to the sandstone because the piezometric pressure of the sandstone is less than that of the Niagaran aquifer. Those wells which do not penetrate the Maquoketa shale will not create movement since there is no significant pressure differentials through the aquifer. Wells drilled to the sandstone would generally be high capacity in nature because of the expense involved in drilling to that depth. Such wells would only be needed by industrial or large commercial water users and should thus be traceable.

5.1.5.2.4 Potential Long-Term Impacts

Impacts which could occur over the life of the planning period are related to the possibility of lowering of the potentiometric surface of the Niagaran aquifer to below tunnel depths. SEWRPC Technical Report Number 16, A Digital Computer Model of the Sandstone Aquifer in Southeastern Wisconsin, projects pumping rates regionally to the year 2000. The report predicts extensive increases in pumpage from the sandstone aquifer in the western suburban areas, especially Waukesha. Although the majority of these high capacity wells are open to both the Niagaran and sandstone, it is likely that the majority of flow will be drawn from the sandstone aquifer. This prediction is based on a comparison of the transmissivities of the two aquifers which shows a rate of 10,000 to 25,000 gpd/ft for the sandstone as compared to 500 to 5,000 gpd/ft for the Niagaran formation. The report also notes a continued decrease in pumpage from the central areas of Milwaukee County. Based on the preceding details, plus the fact that the predicted large pumping centers are west of or near the western edge of the Niagaran formation as seen in Figure 5-3, it is doubtful that pumpage would greatly decrease the potentiometric surface of the Niagaran aquifer. The location of the wells near the western edge is important to note. The dolomite formation is wedge-shaped, with its thinnest points on the western edge. Because flow through the dolomite occurs by discontinuities, the decreased depth of contact will decrease the possible numbers of discontinuities and thus flow from the Niagaran formation.

The SEWRPC report predicts that pumpage would cause such large scale drawdown in the sandstone aquifer that the cone of influence of the Waukesha area wells would reverse the general flow of the sandstone aquifer beneath Milwaukee from its present eastward flow to a westward flow. If pollutants were to migrate vertically in an inactive well to the sandstone beneath the tunnel corridor, they would migrate eastward along the existing hydraulic gradient of the aquifer. Should the predictions of the model prove true, these pollutants would migrate westward toward the pumping centers, contaminating these water supplies. By sealing inactive wells, minimizing exfiltration from the tunnels, and using present standby wells to control contaminant movement, the possibility of vertical migration would be greatly reduced.

The SEWRPC model shows that drawdown in the sandstone aquifer could be severe enough to establish water table conditions (piezometric surface is below the elevation of the confining layer) in the aquifer. Such an occurrence would reduce piezometric elevations in the Niagaran formation. The two

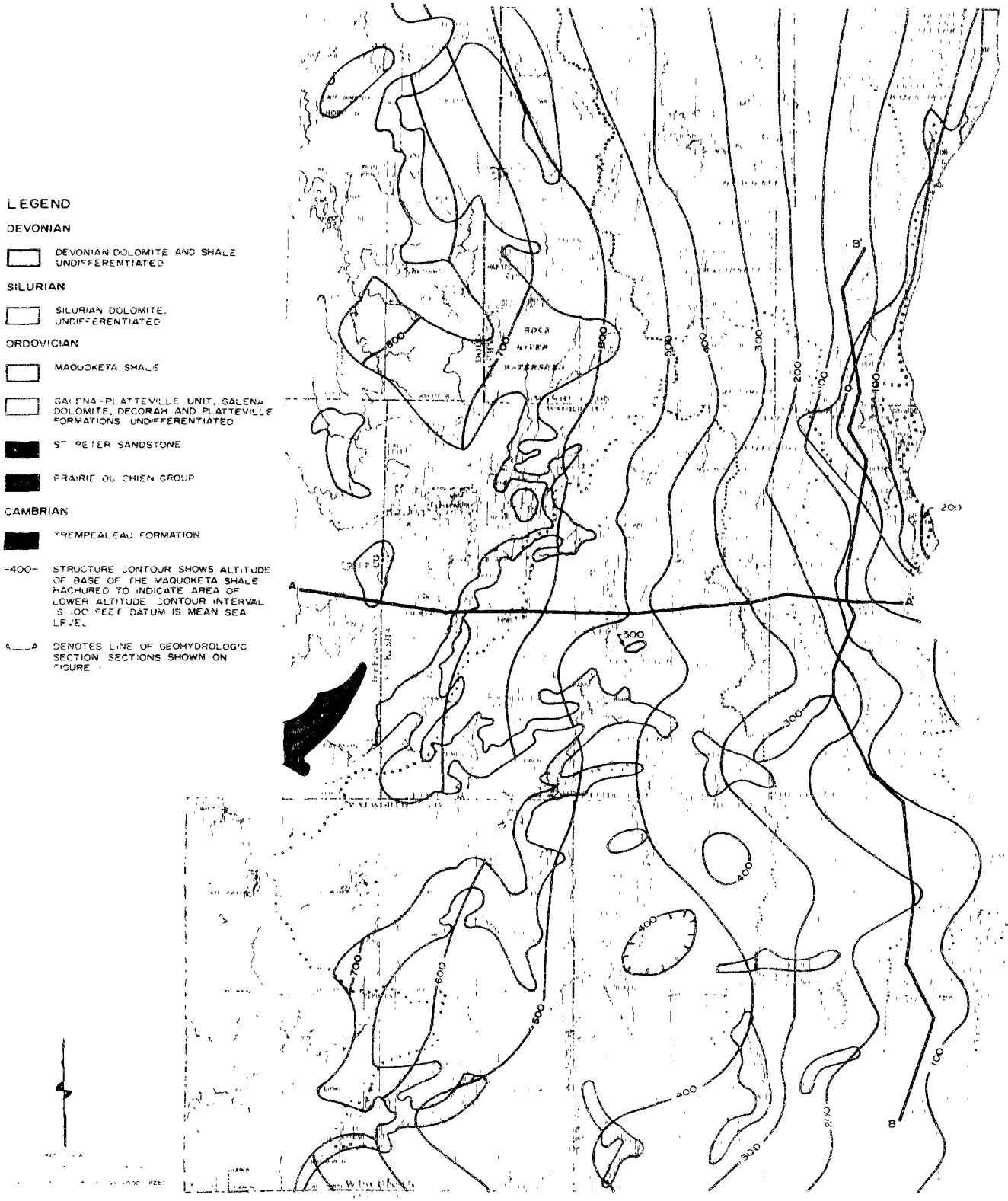

FIGURE 5-3

DATE APRIL 1981

BEDROCK GEOLOGY AND STRUCTURE CONTOURS ON THE BASE OF THE MAQUOKETA SHALE

SOURCE USGS and SEWRPC

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

formations are separated by the Maquoketa shale and the Galena-Platteville dolomite formations. The Maquoketa shale is considered the main confining feature with a hydraulic conductivity of 0.00005 gpd/ft^2. The shale is an average of 200 feet thick, and assuming it were completely saturated, the transmissivity of the formation would be 1.25 gpd/ft as compared to 500 to 5,000 gpd/ft for the Niagaran formation. Thus the downward movement from the Niagaran to the sandstone would be highly restricted. By sealing deep inactive wells, losses to the sandstone would be further reduced. More evidence of the barrier between the two aquifers can be seen in the Wisconsin Geologic and Natural History Survey Circular Number 9 by Devaul and Circular Number 21 by Erickson. These two publications show a continuing record of water levels in wells from 1940 to 1971. The general trend of water levels in wells open only to the dolomite in Milwaukee was static while nearby wells open to the sandstone or both the dolomite and sanstone showed marked decreases.

Based on the above information, it is probable that, even if these predictions concerning the sandstone aquifer are accurate, the effect on the Niagaran aquifer would not be significant. It is, however, recommended that the MMSD study this possibility further prior to construction of a tunnel system. It is essential that all structure and groundwater movement within both the Niagaran and sandstone aquifer be fully defined and understood prior to constructing and operating a system such as the proposed tunnel system. Should widespread contamination of the two aquifers occur by tunnel exfiltration, pollutants would remain in the aquifers for centuries, making them unfit as a drinking water supply. However, data available to date support the belief that a tunnel could be safely constructed and operated in the Niagaran formation without severe impact to groundwater supplies in southeastern Wisconsin.

5.1.6 Floodplains

The preservation of floodplains in their natural state is important since these lands allow for the storage of the periodic rise of water levels. The EIS evaluated potential impacts to existing floodplains from construction and urban development.

5.1.6.1 No Action Alternative

If no action is taken to expand existing wastewater treatment facilities, the amount of housing development that could take place during the planning period would be limited by the capacity of the existing sewer system. For the most part, new development would take place in areas that are

already sewered. Since there are strict requirements for septic systems and special permits are required for construction on floodplains, it is unlikely that there would be increased pressure to build in these environmentally sensitive areas.

5.1.6.2 Local, Regional and Mosaic Alternatives

Although every community in the planning area has some land within a 100-year floodplain, the only floodplains that might be affected by these alternatives are in Oak Creek and New Berlin. The Germantown WWTP is located near a floodplain, but the floodplain would not be disturbed.

All these alternatives include the construction of the Oak Creek Interceptor to be routed along the North Branch of Oak Creek. The MFP recommends that Oak Creek and its floodplain be maintained in a natural state. Nevertheless, downstream flooding could be increased. Planting marsh vegetation or placing rocks along the river's banks would lessen the possibility of downstream flooding. In addition, this construction might require a temporary damming of the creek. If such action is necessary, the likelihood of flooding upstream of the interceptor during a heavy rainstorm would increase.

All action alternatives would include abandoning the New Berlin Regal Manors WWTP which is located on the floodplain of Deer Creek. The land could then be maintained as an open floodplain.

Some CSO facilities would be constructed in floodplains. For the Inline, Modified CST/Inline, and Modified Total Storage Alternatives, three dropshafts would be constructed in the floodplain. Precautions should be included in design to protect these structures and to keep them operational if inundated during a flood. The Modified CST/Inline and Modified Total Storage Alternatives would require screening structures ahead of the dropshafts. If these facilities are also constructed on the floodplain, access structures should be flood-proofed for the protection of equipment from floodwater damage.

All CSO alternatives might require the modification or repair of existing outfalls, many of which lie in floodplains or stream channels. This work should not affect floodwaters once construction is completed. If, however, flooding occurred during the period in which CSO outfalls were being repaired, and these floods inundated the outfall site, the erosion of exposed soil and gravel could increase sedimentation and the turbidity of the rivers.

With the implementation and enforcement of the Regional Land Use Plan (SEWRPC PR25), there would be little chance of any MFP alternative inducing growth on floodplains. The 100-year floodplains of the study area have been designated by SEWRPC as primary environmental corridors. This designation would control any potential development in these sensitive areas. However, full control rests with regulatory actions of the DNR and local units of government.

5.1.7 Wetlands

The EIS analyzes the impacts of the final alternatives on the wetlands of the planning area. The EIS evaluates whether each alternative would require construction on or disruption of valuable wetlands.

5.1.7.1 No Action Alternative

Wetlands would be unaffected by the No Action Alternative. Since there would be no construction of sewer facilities, zoning would limit most development to areas that already have sewer service.

5.1.7.2 Local Alternative

The only wetland in the planning area that could be affected by the Local Alternative is located in Muskego. The Muskego Northwest WWTP is bordered on two sides by a marsh. The construction of a new pump station at the WWTP site to convey wastewater to Vernon would not take place on marshland, but there is a possibility of short-term disturbances to the marsh from construction equipment or practices. Contractors should be careful not to dump soil or place equipment on the marsh. Erosion control procedures should be strictly controlled at this site during construction.

Implementation of the Local Alternative should not induce the development of any wetland areas. Wetlands are designated by SEWRPC as primary environmental corridors. Therefore, future development in these areas would be restricted.

5.1.7.3 Regional and Mosaic Alternatives

Only one wetland in the planning area could be affected by the construction required by the Regional and Mosaic Alternatives. The route of the Franklin-Muskego Interceptor could come close to a small cattail marsh between Forest Home Avenue and College Avenue. This wetland should be avoided during construction. Precautions should be taken at this site to prevent erosion.

Like the Local Alternative, these alternatives would not induce growth on wetland areas. The Year 2000 Land Use Plan limits development on primary environmental corridors, including wetlands.

5.1.8 Wildlife Habitats

The EIS analyzes whether the construction and operation of the facilities associated with each final alternative would remove or disrupt wildlife habitat.

5.1.8.1 No Action Alternative

With the No Action Alternative, there would be no new sewer construction, except that now underway. The disruption of wildlife habitat might result from private construction, which could only take place on presently sewered land or on lots with soils meeting state standards. Since these standards have been strengthened over the last two years, it is unlikely that much septic tank development would occur, so the potential for disturbing wildlife habitat is minimal.

5.1.8.2 Local Alternative

The Local Alternative would result in impacts to wildlife habitats in the vicinity of the South Shore WWTP, in New Berlin, and in Muskego. The South Shore WWTP could be expanded by building a new lakefill to the north of the present site, by cutting the bluff to make more land at lake level, or by building on top of the bluff. If the bluff is cut, some of its habitat would be destroyed, and the exposed surface would be more susceptible to erosion. These impacts could be mitigated by replanting vegetation and initiating erosion control methods, such as terracing. Neither of the other two options for the expansion would have significant impacts on terrestrial wildlife habitats.

The New Berlin Southeast plant would be constructed on 55 acres of old fields and young woods, destroying these wildlife habitats. However, this land is zoned for residential use, and it is unlikely that it would remain undisturbed in any case.

The new site of the Muskego treatment facility is a few hundred feet south of the existing WWTP, bordering a small stand of old trees that has been set aside as a park by the City of Muskego. These trees should be avoided during construction. The wildlife in that area could be temporarily disrupted by the noise and activity of construction.

Because the CSSA is an urban area, the construction of any CSO Abatement Alternative would have little impact on wildlife habitat. Most of the construction for any CSO alternative would take place on paved surfaces. Some vegetation might be removed for the construction of pump stations, dropshafts, or storage facilities. However, few of these facilities would be located in a designated wildlife area and the vegetation would be restored upon completion of the construction. When construction occurs in public parks, some wildlife habitat could be disrupted. Some mitigation should be provided by replanting in these areas.

As part of the primary environmental corridor concept set forth in the SEWRPC Regional Land Use Plan, wildlife habitat should be protected from future development. The Local Alternative would not induce development in these areas if the Plan is implemented.

5.1.8.3 Regional or Mosaic Alternatives

Either of these alternatives would have similar impacts on wildlife habitats. The potential impacts of different methods of expanding the South Shore WWTP and for CSO abatement are described with the Local Alternative.

Other wildlife habitat that could be disturbed by construction includes the wooded floodplain of Tess Corners Creek in Muskego and Franklin and the north branch of Oak Creek near the south end of the Oak Creek Interceptor. The construction would require cutting a number of trees, thus disrupting wildlife. These impacts would be temporary, and they could be lessened by preserving as many trees as possible.

Because the wildlife habitat of the planning area is designated by SEWRPC as primary environmental corridor, it is unlikely that alternatives would cause development in these areas.

5.1.9 Prime Agricultural Land

As urban services, such as sewers, are extended to areas bordering farmland, the market value of the agricultural land tends to increase. As the farmland becomes more valuable for development, property taxes increase. The farmer is often encouraged to sell his property. This conversion of land from agricultural to urban use is an irreversible commitment of a resource. This EIS analyzes whether the final alternatives would encourage encroachment on prime agricultural land.

5.1.9.1 No Action Alternative

The No Action Alternative could affect prime agricultural land in three areas: Muskego, Franklin, and the Caddy Vista subdivision of Caledonia. The Caddy Vista subdivision is bordered on the north by a floodplain and on the east, west, and south by prime agricultural land. The Caddy Vista wastewater treatment plant is already hydraulically overloaded and it would not be able to meet future effluent standards. Large areas of Franklin and Muskego are presently unsewered. With the No Action Alternative, little new development would be allowed to connect to the public sewer system. Therefore, pressure could increase to develop the area on lots with septic tanks.

The Caddy Vista Subdivision is surrounded by prime farmland. In addition, southwest Muskego contains 3,800 acres (1,537.9 ha) and Franklin 5,000 acres (2,024 ha) of prime agricultural land. In all these areas, most of the soils are unsuitable for septic tank development on lots less than one acre (95% of Caddy Vista area and Franklin, 90% of Muskego). However, much of their land could be developed with septic tanks on lots greater than one acre (0.4 ha); 50% of Caddy Vista and Franklin, 55% of Muskego. Nonetheless, enforcement of local land use controls in conformance with the Year 2000 Regional Plan would limit development on prime agricultural land.

If any of these alternatives are implemented, the capacity of sewerage facilities in Muskego and Caddy Vista would be expanded, and sewer service would be extended further into Mequon, Franklin, and Germantown. All of these communities contain prime agricultural land which would be threatened by increased development. Enforcement of land use controls, such as local zoning for the implementation of the Regional Year 2000 Land Use Plan, would restrain this development. In addition, the Wisconsin Farmland Preservation Act (1977) provides tax relief to some farmers and it could be used to encourage the preservation of prime agricultural land (WSP 1979). This Act was established to ensure the continued maintenance of productive and potentially productive agricultural land. It was designed to promote cohesive state, county, and local planning for protection of a vital Wisconsin resource.

Through exclusive agricultural zoning or individual initiative, those persons meeting the necessary legal criteria (i.e., possessing at least 35 acres (14 ha) of land engaged in agricultural pursuits that have earned a minimum of $6,000 for the year previous to application or a net income of $18,000 over the previous three years) who wish to qualify under the program are eligible for an income tax credit

based on a complicated schedule that considers one's assessed property tax and earned income. Implicit in the agreement (contract) is the understanding that the land placed under the Wisconsin Farlmand Preservation Act will not be developed by the owner without review by the proper officials and a repayment of deferred taxes. For further details, the reader should consult Wisconsin State Statutes 91 and 71.

Prime agricultural land might be selected as sites for sewage sludge landfills or for storage facilities for sewage sludge. The estimated maximum total acreage required for any action alternative would be 410 acres for landfills and 60 acres for sludge storage. The use of prime agricultural land for landfill sites would be an irreversible committment of this resource because the future uses of the landfill sites would be restricted.

The application of sewage sludge containing metals to agricultural land could contaminate crops, soils, and groundwater. However, the sludge application would be regulated by the DNR, and the amounts would be limited by regulations. A detailed discussion of the impacts of land application of sewage sludge is presented in Appendix IV, Solids Management, and its Addendum. The Site Specific Analysis, now being prepared, will evaluate the impacts to the specific sites under consideration.

5.2 MANMADE ENVIRONMENT

5.2.1 Future Development and Land Use

The analysis of impacts of the Master Facilities Plan (MFP) on future development involves the examination of the Southeastern Wisconsin Regional Planning Commission (SEWRPC) population and housing unit forecasts and EIS-developed population and housing unit projections for interceptor areas. The SEWRPC forecasts were developed in its Planning Report No. 25, A Regional Land Use Plan and a Regional Transportation Plan for Southeastern Wisconsin - 2000. The EIS projections were short-term (through 1990) analyses of the housing market demand in proposed interceptor service areas based on recent trends.

The EIS-generated projections and SEWRPC forecasts should not be interpreted as two competing studies but, rather, as an independent analysis of the perceived demand to live in interceptor areas (EIS projections), and as a normative plan (SEWRPC) that is based on a set of guidelines, adopted principles, and overall county-level population forecasts.

These normative population allocations are the projected numbers of people and households that appear under the heading SEWRPC Plan in the tables in this section. The population and household numbers that appear in columns labeled Action and No Action are EIS projections based on market analysis of the amount of development that is likely to occur in the interceptor service areas. This type of analysis examines the relative strength of the housing market in the interceptor areas or, alternately, it assesses the demand of people and builders to develop the defined areas. These interceptor area analyses have, in general, confirmed the existence of a strong demand to develop in most of the areas.

If the overall county and regional population forecasts are accurate, the interceptors will have provided sewer service for new net growth in the Standard Metropolitan Statistical Area (SMSA). If, however, the future population level falls short of the forecast level (for the counties), the interceptor service areas will continue to remain high demand areas. The difference will be that, instead of accommodating new growth in the planning area, they would serve to disrupt the balance between the normative forecasts for the City of Milwaukee and the newly-served areas.

The impacts of the No Action and Action alternatives on Future Development are described below. These impacts are discussed in detail in Appendix IX, Secondary Growth Impacts.

5.2.1.1 No Action Alternative

SEWRPC has projected population and housing growth for the Southeastern Wisconsin Region through the year 2000. However, taking no action to upgrade sewerage facilities would alter the amount and location of growth that could occur. Table 5.20 illustrates these impacts.

The No Action Alternative involves no new construction of sewerage facilities other than two small projects which are already funded (two new interceptors presently under construction in the planning area). As a result of No Action, future housing growth that is planned (SEWRPC 2000 Land Use Plan) in the proposed interceptor service areas could not occur. By the year 1990, 6,300 new housing units that might have been accommodated in the interceptor service areas would have to develop elsewhere. This displaced development could shift to areas within the existing sewer service area, such as the Northwest Side of Milwaukee, Menomonee Falls, the Wildcat Creek area of New Berlin, parts of Greenfield, central Franklin, and much of Oak Creek. SEWRPC projects a growth of 13,000 units in these areas between the years 1990

TABLE 5.20

DEVELOPMENT EFFECTS, NO ACTION ALTERNATIVE

	Mequon		Germantown		Underwood Creek		New Berlin		Muskego		Franklin (within Franklin-Muskego Interceptor Area)		Oak Creek Service Area		Total in Interceptor Areas		
	No ACTION	SEWRPC PLAN	NO ACTION	SEWRPC PLAN	NO ACTION	SEWRPC PLAN	NO ACTION	SEWRPC PLAN	NO ACTION	SEWRPC PLAN	NO ACTION	SEWRPC PLAN	NO ACTION	SEWRPC PLAN	NO ACTION	SEWRPC PLAN	DIFFERENCE BETWEEN NO ACTION AND SEWRPC PLAN
Base-1979																	
Households	5,210	NA	3,419	NA	6,976	NA	9,286	NA	4,686	NA	2,297	NA	1,173	NA	NA	NA	NA
Population	17,141	NA	10,257	NA	25,428	NA	34,172	NA	16,401	NA	8,108	NA	3,343	NA	NA	NA	NA
Increment 1979-1985																	
Households	200	NA	253	NA	400	NA	1,224	NA	200	NA	400	NA	90	NA	NA	NA	NA
Population	2,335	NA	759	NA	1,458	NA	3,979	NA	(522)**	NA	657	NA	257	NA	NA	NA	NA
1985																	
Households	5,410	7,268	3,672	4,656	7,376	6,546	10,510	10,805	4,886	4,423	2,697	1,962	1,263	1,323	35,814	36,983	1,169
Population	19,476	26,800	11,016	17,400	26,886	24,522	38,151	40,900	15,879*	16,500	8,765	7,181	3,600	4,090	***	***	***
Increment 1985-1990																	
Households	0	1,285	0	1,305	0	567	800	1,487	250	505	125	457	0	679	1,175	6,285	5,110
Population	0	4,000	0	4,267	0	2,137	2,904	5,167	813	1,667	406	1,450	0	1,888	***	***	***
1990																	
Households	5,410	8,553*	3,672	5,961*	7,376	7,113	11,310	12,292*	5,136	4,928*	2,822	2,419*	1,263	2,002*	36,989	43,268	6,279
Population	19,476	30,800*	11,016	21,667*	26,886	26,659	41,055	46,067*	16,692	18,167*	9,171	8,631*	3,600	5,978*	***	***	***
2000																	
Households		11,120		8,572		7,113		15,265		5,938		3,333		3,359	-	54,700	NA
Population		38,800		30,200		26,659		56,400		21,500		11,532		9,754	-	194,845	NA

* Interpolation from 1985 to 2000.
** Muskego's population is expected to decline between 1979 and 1985 under No Action due to the projected decline in household size from 3.53 to 3.25.
*** Population differences cannot be meaningfully stated due to use of different family sizes used in "No Action" and SEWRPC Population Figures.

Note: Yearly dates are as of January 1.
NA: Not Applicable

Source: Real Estate Research Corporation projections; SEWRPC Plan.

and 2000, assuming no expansion of existing facilities. Thus, these presently sewered areas could be developed between 1980 and 1990 to the Year 2000 levels without overtaxing the existing sewerage facilities. The 6,300 units that could not occur in the proposed interceptor service areas from the present to 1990 could be accommodated in the presently sewered areas in addition to their planned 1990 development. Much of this growth would have to occur on small, infill parcels of land. Between 1990 and 2000 an additional 11,000 housing units would be displaced from their planned locations. By that time the housing growth would have to shift out of the planning area.

It is unlikely that much of the development that would be blocked from the proposed service areas could take place on lots with septic tank systems. Over the last two years, Wisconsin has strengthened and improved enforcement of regulations for soil percolation tests for on-site systems.

Most of the soils in the planning area are unsuitable for septic development on lots less than one acre in size. Thus, interest in sewered lots has increased and the No Action Alternative would probably not result in much septic system development.

Enough sewerage capacity currently exists in the planning area to accommodate the 4,000 new units of growth projected by SEWRPC for each year through 1990. Thus, the No Action Alternative would not significantly affect the level of growth up until that time. The Dane County Circuit Court has approved a "Waste Load Restriction and Apportionment" which allows the MMSD to increase annual wastewater flows to the Jones Island and South Shore WWTPs by only 2.1 MGD per year from 1977 to 1985. The 4,000 units that would be built each year during those years would add only 1.02 MGD of wastewater flow per year, which is well within the allocation (User Charge and Industrial Cost Recovery Program, Technical Memo No. 4A).

Beginning in 1983, if effluent violations should occur at either the Jones Island or South Shore WWTPs, the allocated increments of flow and pollutant loadings to the treatment facilities would be reduced. Table 5.21 outlines these reductions. Even if there were no new commercial or industrial connections, the pollutant load allotments would limit development to 3,764 housing units in 1983. In 1984 and 1985, only 1,880 additional residential units would be allowed, assuming no commercial connections. After 1986, no new development would be allowed in the MMSD service area if there were violations at the South Shore or Jones Island WWTPs.

TABLE 5.21

ANNUAL ADDITONAL INCREMENT OF WASTEWATER
FLOW AND POLLUTANT LOADING
ALLOWED IN THE MMSD
IF EFFLUENT VIOLATIONS OCCUR

Year	Flow	5-Day Biochemical Oxygen Demand (BOD_5) (Lbs. per Day)*	Housing Units	Total Suspended Solids (TSS) (Lbs. per Day)	Actual Allowable Increases
1983	1.0	2,000	3,764	2,000	1983: .96 mgd
1984	1.0	1,000	1,882	1,000	1984: .48 mgd
1985	1.0	1,000	1,882	1,000	1985: .48 mgd
1986 + beyond	0	0	0	0	1986 + beyond: 0 mgd

* Domestic wastewater has a strength of approximately 200 mg/l of BOD_5 and 240 mg/l of suspended solids. For example, 2000 lbs. of suspended solids is reached at 960,000 gallons of flow. Because the amount of suspended solids is the limiting factor, it is unlikely that wastewater flow would be allowed to increase by 1.0 mgd per year.

Since the two WWTPs are presently overloaded during wet weather, the No Action Alternative would probably result in the planning area not achieving its planned growth. If the increment by which MMSD wastewater flows can be increased each year is severely reduced after 1983, the allocations to contract communities would be reduced by the same ratio.

5.2.1.1.1 Franklin: With the No Action Alternative, the same amount of development would occur in Franklin as with an Action Alternative. The difference between Action and No Action would be the location of the future development. A large amount of sewered, vacant land exists in central Franklin. Under the No Action Alternative, a greater proportion of the future development would take place in central Franklin (about 2,800 units between 1979 and 1990). Growth would continue in the Franklin portions of the service areas of the two proposed interceptors. Between 1979 and 1990, this growth would consist of approximately 500 units in the Franklin-Muskego area and another 500 in the Franklin-Northeast area.

5.2.1.1.2 Germantown: In Germantown, the wastewater treatment facilities have almost reached their capacity. With the No Action Alternative, development would be limited to subdivisions in southern Germantown that are already platted (mapped). Once WWTP capacity is reached, no new development would be allowed. Therefore, only 255 new units would be constructed between 1979 and 1990, increasing the population by 760 people.

5.2.1.1.3 Mequon: In Mequon, the capacity of the sewer facilities has already been reached, and there have been problems with discharges, bypasses, and the availability of water. The No Action Alternative would result in very little new growth in the area. Only 200 new units could be accommodated and these would probably be built by the end of 1980.

5.2.1.1.4 Muskego: With the No Action Alternative, very little development would be possible in Muskego because the public wastewater treatment plants are already at capacity. Any new development would be scattered, taking place on large lots with septic systems. It is estimated that 450 new housing units would be constructed by 1990. Most of the development would take place in the far northwest corner of Muskego, since that is the only area with soil suitable for septic tanks. A small amount of development could also occur in southern Muskego served by the Town of Norway's sewer system.

5.2.1.1.5 New Berlin: Although development would be limited with the No Action Alternative, New Berlin would be able to accommodate much more development than most of the previously mentioned communities. There is capacity for 610 additional housing units at the Regal Manors WWTP in southern New Berlin, and capacity in the Wildcat Creek service area in eastern New Berlin and in the Poplar Creek service area in western New Berlin. Thus, between 1979 and 1990, it is likely that 2,025 housing units would be built in New Berlin, increasing the population by 6,885 to a total of 41,055.

5.2.1.1.6 Oak Creek: There is ample capacity throughout Oak Creek for the forecast increases in population and housing. However, with No Action little of this development would occur within the Oak Creek Interceptor area because there is very little capacity left in the Wildwood lift station. Only 90 new units could be accommodated in this area.

5.2.1.2 Local, Regional, and Mosaic Alternatives

The Local, Regional, and Mosaic Alternatives were all designed to provide sewer service for the same area. For this reason, the effects of these alternatives on future development and land use would be identical. In most of the communities of the planning area, these alternatives would encourage growth consistent with the Year 2000 Regional Land Use Plan. However, the provision of this additional sewerage capacity could have some "secondary" impacts; some communities might grow more rapidly than planned and others might not reach their recommended level of growth.

The implementation of any of these alternatives would affect land use in many communities in the planning area. In some areas, including Muskego, Mequon, Franklin, New Berlin, and Germantown, the provision of sewer service could result in the conversion of rural land use to urban use. In these communities, this conversion would be consistent with the recommendations of the Regional Plan as long as measures are taken to prevent encroachment on prime agricultural land.

5.2.1.2.1 Franklin: With an action alternative, the level of development in Franklin would be identical to the No Action level. However, the location of some of this future growth would change. Approximately 500 units (1979 to 1990) would shift out of the central Franklin area to the Franklin-Muskego Interceptor area (100 units) and to the Franklin-Northeast Interceptor area (400 units). The development is illustrated in Table 5.22.

TABLE 5.22
FUTURE DEVELOPMENT:
FRANKLIN, 1990

	Action Alternative	No Action
Franklin Portion of Franklin-Muskego Interceptor Area		
1979-1985	400	400
1985-1990	250	125
1979-1990	650	525
Franklin Portion of Franklin-Northeast Interceptor Area		
1979-1985	125	125
1985-1990	785	400
1979-1990	910	525
Central Franklin Area		
1979-1985	675	675
1985-1990	1,590	2,100
1979-1990	2,265	2,775
City of Franklin Total		
1979-1985	1,200	1,200
1985-1990	2,625	2,625
1979-1990	3,825	3,825

In Franklin and the Caddy Vista subdivision, the implementation of an action alternative would allow development to occur on sewered lots, with less septic tank development than would occur with the No Action Alternative. The construction of the interceptor would open up parcels of land adjacent to existing development encouraging a compact type of development.

5.2.1.2.2 Germantown and Milwaukee's Northwest Side: The EIS analysis revealed that Germantown and the Northwest Side of Milwaukee share the same housing market to some degree. When development in Germantown was limited by inadequate sewer capacity, the development on the Northwest Side increased. Provision of expanded sewer service in Germantown could encourage development there and slow growth on the Northwest Side (see Table 5.23). It might be necessary to enact growth controls to mitigate this impact.

With an action alternative it is estimated that 2,770 new housing units would be built in Germantown between 1979 and 1990. This growth is 2,520 more than the 250 units that could be added with the No Action Alternative. With this increase in housing development, population is expected to increase by 8,320 people.

The level of population and housing growth projected in Germantown with the implementation of the Local, Regional, or Mosaic Alternatives would be consistent with the Regional Land Use Plan. If no new sewer capacity were provided for Germantown, much of the development that would have occurred there would instead take place on the Northwest Side of Milwaukee, where there is a great deal of vacant sewered land.

5.2.1.2.3 Oak Creek: The City of Oak Creek has a large amount of vacant land and is encouraging development. Although construction of the Oak Creek Interceptor would have little effect on the amount of growth that would occur in Oak Creek, it could affect the location of future development within Oak Creek (see Table 5.24).

Oak Creek is expected to grow at a rate of 225 units per year between 1979 and 1990. At this rate of growth, 2,475 new housing units would be constructed during this period. By 1990, the Oak Creek Interceptor would lead to the construction of 390 units in the interceptor service area. Without construction of the interceptor, only 90 units could be built in that area by 1990. Thus, an action alternative would induce the construction of approximately 300 units in the interceptor service area between 1979 and 1990. Most of the existing development in Oak Creek has occurred in the

TABLE 5.23

FUTURE DEVELOPMENT: MENOMONEE FALLS
GERMANTOWN INTERCEPTOR,
1990

	Germantown			Northwest Side			
	Action**	No Action	SEWRPC Plan	Action**	No Action	SEWRPC Plan	City of Milwaukee Forecasts
Base 1979							
Households	3,419	3,419	NA	23,900	23,900	NA	23,900
Population	10,257	10,257	NA	73,300	73,300	NA	73,300
Increment 1979-1985							
Households	973	253	NA	4,187	4,507	NA	4,998
Population	2,919	759	NA	8,152	9,080	NA	10,488
1985							
Households	4,392	3,672	4,656	28,087	28,407	24,483	28,898
Population	13,176	11,016	17,400	81,452	82,380	71,002	83,788
Increment 1985-1990							
Households	1,800	0	1,305	2,500	3,300	2,960	4,165
Population	5,400	0	4,267	4,192	6,400	5,914	8,737
1990							
Households	6,192	3,672	5,961*	30,587	31,707	27,433*	33,063*
Population	18,576	11,016	21,667*	85,644	88,780	76,916*	92,525*
2000							
Households			8,572			33,363	41,400
Population			30,200			88,745	110,000-115,000

*Interpolation from 1985 to 2000.
**Provision of additional sewer service.
Note: Yearly dates are as of January 1.

Source: RERC projections; SEWRPC Plan; City of Milwaukee Projections.
NA - Not applicable. 1979 estimates are not available from SEWRPC.

TABLE 5.24

FUTURE DEVELOPMENT
OAK CREEK INTERCEPTOR, 1990

	Action**	No Action	SEWRPC Plan
Base 1979			
Households	1,173	1,173	NA
Population	3,343	3,343	NA
Increment 1979-1985			
Households	140	90	NA
Population	399	257	NA
1985			
Households	1,313	1,263	1,323
Population	3,742	3,600	4,090
Increment 1985-1990			
Households	250	0	679
Population	713	0	1,888
1990			
Households	1,563	1,263	2,002*
Population	4,455	3,600	5,978*
2000			
Households			3,359
Population			9,754

* Interpolation from 1985 to 2000.
**Provision of additional sewer service.

Note: Yearly dates are as of January 1.
Source: RERC projections; SEWRPC Plan.
NA - Not Applicable. 1979 estimates are not available from SEWRPC.

northern sections of the City. Construction of the interceptor could encourage development in southern portions of the City. Although the interceptor is not expected to increase the overall level of growth, it would open up new portions of the City for development. Thus, development may disperse over a larger area.

5.2.1.2.4 Mequon: The Northeast Side Relief Sewer System would serve Mequon, Thiensville, and a number of communities in northern Milwaukee County. Most of the municipalities in this area are fully developed. However, Mequon has a large amount of vacant land available, and its location makes it especially desirable for development. The Northeast Side Relief Sewer System could induce additional development in Mequon.

Construction of the Northeast Side Relief Sewer System will be completed in mid-1983. Until that time, 675 housing units are likely to be built in Mequon (150 units per year for 4.5 years). After 1983, new sewer capacity would allow development to accelerate. Mequon's growth management system is currently being formulated, and it will probably limit new development to between 225 and 250 units per year. Development from 1983 to 1990 could increase to those limits, approximately 250 units per year. The total increase by the year 1990 could then be 2,425 units (675 plus 250 units per year for seven years). The No Action Alternative would limit growth to 200 units by 1990. Thus, the Local, Regional, or Mosaic Alternative would result in an induced growth of 2,425 households.

Even with the construction of the Northeast Side Relief System, development in the City of Mequon would probably not reach SEWRPC forecasts. If growth controls are enacted, development by the year 1990 could be 1,000 units less than forecast by SEWRPC. The EIS analysis indicates that without the enactment of growth controls, development would still be within forecast levels.

5.2.1.2.5 New Berlin: New Berlin is physically attractive, is accessible by major highway, offers local employment possibilities, and contains large parcels of developable land. With the provision of increased sewer capacity, New Berlin would attract a larger share of the suburban Milwaukee housing market than it has in the past.

A range of forecasts have been determined for population and housing growth in the New Berlin area. The lower numbers were derived from an evaluation of the regional development that New Berlin is likely to attract, if easily developable land in Greenfield, West Allis, and Hales Corners is filled first. The higher estimates are based on the assumption

that New Berlin would attract development from Greenfield, West Allis, and Hales Corners in addition to its share of the regional development.

Between 1979 and 1990, an action alternative would allow between 3,970 and 5,220 new units to be constructed in New Berlin, compared to only 2,000 units with the No Action Alternative. Thus, induced growth would be between 1,950 and 3,200 housing units. New Berlin's population would increase by 13,960 to 18,470 people by 1990. This growth exceeds the level expected with the No Action Alternative by 7,080 to 11,590 people (see Table 5.25). Most of the development would occur in the southern half of New Berlin which contains vacant land.

5.2.1.2.6 Muskego: With the Local, Regional, or Mosaic Alternatives, Muskego could experience development of 1,860 new housing units by 1990, 1,410 more than the 450 units that could be constructed with the No Action Alternative. The population would increase by 4,870 people, which is 4,580 more than the increase of 290 people that would occur without additional sewer capacity. The SEWRPC 1985 housing and population projections have already been exceeded, and it is likely that the year 2000 figures will be reached by 1990 (see Table 5.26).

5.2.2 Indirect Fiscal Impacts

An indirect fiscal impact analysis was performed to determine the net costs or revenues that would result from secondary impacts. The costs associated with the future population would include municipal services such as general administration, public safety, parks, recreational facilities, and primary and secondary public education. Revenues would result from the increased tax base. Since future development would probably be similar in type to the existing development, it was assumed for the analysis that the relationships in state and federal aids would remain the same.

5.2.2.1 No Action Alternative

Indirect fiscal impacts are the revenues and costs to a community associated with future growth. Since the No Action Alternative would not greatly affect growth in the planning area, the indirect fiscal impacts of the alternative would be negligible.

5.2.2.2 Local, Regional or Mosaic Alternatives

Because the Local, Regional, and Mosaic Alternatives would have the same effects on future growth in the planning area, their indirect fiscal impacts would also be the same. As a

TABLE 5.25

FUTURE DEVELOPMENT:
NEW BERLIN
1990

	Action Alternative (Regional or Local Alternative)	No Action	SEWRPC Plan
Base			
1979			
Households	9,286	9,286	9,286
Population	34,172	34,172	34,172
Increment			
1979-1985			
Households	1,649-2,136	1,224	1,519
Population	5,522-7,290	3,979	6,728
1985			
Households	10,935-11,422	10,510	10,805
Population	39,694-41,462	38,151	40,900
Increment			
1985-1990			
Households	2,325-3,080	800	1,487
Population	8,440-11,180	2,904	5,167
1990			
Households	13,260-14,502	11,310	12,292*
Population	48,134-52,642	41,055	46,067*
2000			
Households			15,265
Population			56,400

* Interpolation from 1985 to 1990.

Note: Yearly figures are as of January 1.
Source: RERC projections; SEWRPC Plan.
NA: Not Applicable. 1979 estimates are not available from SEWRPC.

TABLE 5.26

FUTURE DEVELOPMENT:
MUSKEGO 1990

	Action Alternative	No Action	SEWRPC Plan
Base			
1979			
Households	4,686	4,686	NA
Population	16,401	16,401	NA
Increment			
1975-1985			
Households	935	200	NA
Population	1,867	(522)*	NA
1985			
Households	5,621	4,886	4,423
Population	18,268	15,879*	16,500
Increment			
1985-1990			
Households	925	250	505
Population	3,007	813	1,667
1990			
Households	6,546	5,136	4,928**
Population	21,275	16,692	18,167**
2000			
Households			5,938
Population			21,500

* Muskego's population is projected to decline between 1979 and 1985 under No Action due to the projected decline in household size from 3.53 to 3.25.

**Interpolation from 1985 to 2000.

Note: Yearly dates are as of January 1.
Source: RERC projections; SEWRPC Plan.
NA - Not Applicable. 1979 estimates are not available from SEWRPC.

community grows, its revenues from taxes increase; but at the same time, the cost to the communities for providing educational and municipal services also increases. In most of the communities in the planning area, these alternatives would allow growth to occur at a level, rate, and pattern consistent with the Regional Plan. However, the implementation of any of these alternatives could encourage growth in several areas at a level or pattern inconsistent with the Regional Plan. These areas include the Oak Creek Interceptor service area, the Menomonee Falls-Germantown Interceptor service area (Germantown and Milwaukee's Northwest Side), the Hales Corners Interceptor service area (southeastern New Berlin), and the Franklin Northeast Interceptor service area.

A quantitative indirect fiscal impact analysis was performed for Germantown, the Northwest Side of Milwaukee, and New Berlin (see Table 5.27). In Oak Creek and Franklin, an action alternative would not increase growth, but it could cause a more dispersed pattern of growth. A qualitative approach was used to examine the indirect fiscal impacts of this pattern of development.

5.2.2.2.1 Germantown and Milwaukee's Northwest Side: All of the alternatives would result in a surplus of revenue in Germantown of about $56,400 over municipal costs, compared with a $319,000 surplus with the No Action Alternative. A lower surplus would occur with the Local, Regional, or Mosaic Alternatives because of the increased municipal costs to serve the future populations. These costs would be minimal with the No Action Alternative.

The housing markets for Germantown and the Northwest Side of Milwaukee overlap, as discussed previously. The provision of increased sewer capacity in Germantown would draw some development away from the Northwest Side. Conversely, the No Action Alternative would result in greater development in the Northwest Side. With the No Action Alternative, the net indirect fiscal impact would be a revenue surplus of $23,436,000 for Milwaukee. If increased sewer capacity were provided for Germantown, the result would be a revenue surplus of $19,960,000. The Northwest Side already has an excess of municipal services and school facilities, so the population increase here would have less cost than revenue associated with it.

By combining the net fiscal impacts on Germantown and Milwaukee's Northwest Side, one can see that the construction of the Menomonee Falls-Germantown Interceptor would result in a total revenue surplus of $20,017,000. With the No Action Alternative, the surplus would be $23,755,000.

TABLE 5.27

INDIRECT FISCAL IMPACTS

Community	Population Increase	Revenues in 1990: Property Tax Revenue	Revenues in 1990: Other Revenue	Revenues in 1990: TOTAL REVENUE	Costs in 1990: School Costs	Costs in 1990: Municipal Costs	Costs in 1990: TOTAL COSTS	NET IMPACT
Germantown								
No Action	759	376,744	869,921	1,246,655	699,647	227,700	927,347	$ 319,318
Construct Interceptor	8,319	4,128,550	7,348,313	11,476,863	7,676,926	3,743,550	11,420,476	$ 56,387
SEWRPC	11,410	3,784,422	7,398,846	11,183,268	7,038,229	5,134,500	12,170,729	$ - 987,461
Northwest Milwaukee								
No Action	15,480	12,153,565	14,842,674	26,996,330	0	3,560,400	3,560,400	$23,435,930
Construct Interceptor	12,344	10,410,096	12,389,426	22,799,522	0	2,839,120	2,839,120	$19,960,402
SEWRPC	19,225	*	*	*	*	*	*	*
New Berlin								
No Action	6,883	2,637,083	1,324,953	3,962,036	3,139,298	1,103,142	4,242,440	$ - 280,404
Local	16,551	6,108,113	3,108,940	9,217,053	7,546,228	2,658,229	10,204,457	$ - 987,404
Regional + Mosaic	15,606	5,768,601	2,952,163	8,720,765	7,193,726	2,506,765	9,700,491	$ - 979,726
SEWRPC	11,895	3,916,113	2,133,069	6,049,182	4,619,047	1,905,841	6,524,888	$ - 475,706

*SEWRPC estimates were not made

5.2.3 Cost[1]

5.2.3.1 No Action Alternative

Although the No Action Alternative would not require capital expenditures for construction and improvements, significant costs would likely result. The MMSD is presently under order from the U.S. District Court and the Dane County Circuit Court to eliminate wet weather bypasses from separated sewer systems, to abate CSO discharges, and to upgrade the operations of its treatment facilities. Failure to comply with these orders could result in further court action, fines, and penalties. WWTPs must meet the effluent limitations set forth in their discharge permits. In cases where WWTPs would not consistently meet future effluent limits, fines and legal action would also be possible.

5.2.3.2 Local Alternative

The costs in 1980 dollars of implementing the Local Alternative have been calculated for: construction costs of new facilities (costs of materials and labor); annual operation and maintenance costs; sewer rehabilitation costs; and total present worth. Net (or total) present worth equals the total of initial construction costs plus the present value of annual operation and maintenance costs and future expenditures minus the present value of future salvage values. All costs are computed over the 20-year planning period and assume no inflation.

The total cost of the Local Alternative would include the cost for local plant construction and improvement, MMSD treatment plant improvements, interceptor construction, improvements to the MIS system, control of peak flows from separated sewer areas and abatement of combined sewer overflows. Costs associated with local treatment and conveyance are detailed in Table 5.28.
Costs for MMSD treatment plants and for rehabilitation, reinforcement, and expansion of the MIS system are detailed in Table 5.29. In addition to these costs, there are also costs for CSO abatement and peak flow attenuation. The

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[1]All cost estimates for storage components are based upon the assumption of 48% I/I removal. Should conditions arise which cause the storage volumes to change as outlined in Chapter 3, Section 3.9, the cost for the required storage volume would have to be adjusted. The costs for I/I removal would also have to be adjusted, which would partially offset the cost adjustment for a changed storage volume.

TABLE 5.28

COSTS FOR LOCAL ALTERNATIVE

LOCAL TREATMENT COSTS

Community	Action	Capital (10^6)	O&M (10^6)	Rehab. (10^6)	Net Present Worth (10^6)
Thiensville	Expand in Kind	3.89	0.128	0.15	5.17
Germantown	Land App.	8.77	0.422	0.40	13.17
New Berlin	S.E. Land App.	32.18	0.754	1.24	39.43
Muskego	N.E. Land App.	10.14	0.435	0.32	14.57
Caddy Vista	Expand in Kind	1.90	0.076	0.04	2.64
S. Milwaukee	Upgrade	2.38	0.414	----	7.01
Mequon	Extend MIS	2.51	0.001	----	2.22
LOCAL PLANT SUBTOTAL		61.77	2.230	2.15	84.21

LOCAL ALTERNATIVE SYSTEM COSTS

Component	Capital	O&M	Net Present Worth
Local Alternative Constants			
Local Plants	61.77	2.230	84.21
MMSD Treatment Plants	465.42	23.544	740.51
MIS Relief	186.31	0.010	169.86
Interceptors	81.16	0.225	77.27
Subtotal	794.65	26.009	1071.85
Complete Separation Subtotal	927.65	2.295	946.62
Total System Cost	1722.31	28.304	2018.47
Inline Storage Subtotal	897.73	2.474	878.26
Total System Costs	1692.39	28.483	1950.11
Modified CST/Inline Subtotal	904.18	3.435	909.90
Total System Cost	1698.84	29.444	1981.76
Modified Total Storage Subtotal	921.76	3.945	934.84
Total System Cost	1716.42	29.954	2006.69

TABLE 5.29

MMSD TREATMENT PLANT AND MIS SYSTEM COSTS
($ x 10^6)

MIS System

Component	Capital	Annual O&M	N.P.W.
Jones Island	337.87	13.817	504.59
South Shore	127.55	9.727	235.92
Treatment Plant Subtotal	465.42	23.544	740.51
Honey Creek Branch	0.26	--	0.23
S. 6th Street Branch	4.84	0.001	4.42
Hampton Avenue Branch	10.06	0.001	9.19
Menomonee/Burleigh Overflow	0.11	0.001	0.11
Menomonee/Keefe Diversion	0.16	0.004	0.19
81st & Grant Street Branch	0.54	0.001	0.48
84th & Becher Street Overflow	0.12	--	0.10
Upper Lincoln Creek Segment	4.80	0.002	4.39
MIS Rehabilitation	52.00	--	47.44
Local Sewer Programs	89.22	--	79.11
SSES Program	24.20	--	24.20
MIS Relief Subtotal	186.31	0.010	169.86

Interceptors

Franklin-Muskego (Franklin only)	0.85	0.021	1.08
Franklin Northeast	0.81	0.115	2.19
Mitchell Field South	1.58	0.002	1.41
Northeast Side Relief	58.26	0.033	53.64
Northridge	0.47	0.017	0.63
Oak Creek North Branch	3.74	0.003	3.45
Root River	9.76	0.001	9.08
Underwood Creek	5.69	0.033	5.79
Interceptor Subtotal	81.16	0.225	77.27
MMSD/MIS Subtotal	732.89	23.779	989.51

total costs of the Local Alternative are summarized in Table 5.29.

5.2.3.3 Regional Alternative

The Regional Alternative has many components common to the Local Alternative. With the Regional Alternative, costs for MMSD treatment plants and MIS improvements, as well as costs for CSO abatement and peak flow storage, would be identical to those costs detailed in the preceeding discussion of local costs. Under the Regional Alternative, costs to connect local plants to the MIS system would replace costs for local treatment plants. Due to requirements for certain local connecting sewers, the alignments and costs for some proposed interceptors would also change. Costs for connecting local communities presently served by independent plants as well as costs for the interceptors are detailed in Table 5.30. A summary of the costs of the Regional Alternative assuming implementation of each of the four CSO abatement and peak flow attenuation alternatives is shown in Table 5.31.

5.2.3.4 Mosaic Alternative

The Mosaic Alternative is identical to the Regional Alternative except in the case of South Milwaukee. The South Milwaukee WWTP would remain in operation as under the local system. Local costs are detailed in Table 5.30. Total costs for the Mosaic Alternative assuming implementation of each of the four CSO abatement alternatives is included in Table 5.32.

5.2.3.5 Local Sewer Repair and Rehabilitation

The MMSD's clear water program involves three sequential parts: an infiltration/inflow (I/I) analysis which was completed in November of 1978; a sewer system evaluation survey (SSES) which is currently in progress and to be completed in April of 1981; and a program for the repair and rehabilitation of local sewers (the ultimate objective of the clear water program).

Table 5.33 shows the cost estimates by community for a specified cost effective level of I/I removal, which was recommended by the I/I Analysis.

5.2.4 Fiscal Impacts

5.2.4.1 Introduction

Once the cost of each final alternative was estimated, a second analysis was performed to determine how the alternative

TABLE 5-30
SUMMARY OF LOCAL COSTS
REGIONAL AND MOSAIC ALTERNATIVES

Local Costs

Community	Action	Capital (10^6)	O&M (10^6)	Rehab. (10^6)	Net Present Worth (10^6)
Thiensville/Mequon	Connect to MMSD	3.50	0.002	0.15	3.37
Germantown	Connect To MMSD	3.40	0.085	0.40	6.35
New Berlin	Connect to MMSD	3.05	0.002	1.24	4.04
Muskego	Connect To MMSD	3.26	0.048	0.32	3.91
Caddy Vista	Connect To MMSD	0.40	0.018	0.04	0.59
Regional	Connect to MMSD	2.69	0.032	--	3.21
Mosaic	Upgrade to MMSD	2.38	0.414	--	7.01
SUBTOTAL					
Regional		18.30	0.187	2.15	21.47
Mosaic		17.99	0.569	2.15	25.27

Interceptors

Franklin-Muskego	2.51	0.041	--	2.68
Franklin-Northeast	0.81	0.115	--	2.19
Hales Corners	2.28	--	--	2.08
Mitchell Field South	1.58	0.002	--	1.41
Northeast Side Relief	58.26	0.033	--	53.64
Northridge	0.47	0.017	--	0.63
Oak Creek North Branch	3.74	0.003	--	3.45
Root River	13.37	0.027	--	13.17
Underwood Creek	5.69	0.033	--	5.79
Interceptor Subtotal	88.71	0.271		85.04

Source: MWPAP and ESEI

TABLE 5.31

SUMMARY OF REGIONAL TREATMENT SYSTEM COSTS

($ X 106)

Components	Capital	Annual O&M	Net Present Worth
Regional Alternative Constants			
MMSD Treatment Plants *	465.42	23.687	742.04
MIS Relief	188.68	0.010	169.25
Interceptors*	88.71	0.271	85.04
Local Connections	18.30	0.187	21.47
Subtotal	761.11	24.155	1017.80
Complete Separation Subtotal	927.65	2.295	946.62
Total System Cost	1688.76	26.450	1964.42
Inline Storage Subtotal	897.73	2.474	878.26
Total System Cost	1658.84	26.629	1896.06
Modified CST/Inline Subtotal	904.18	3.435	909.90
Total System Cost	1665.29	27.590	1927.70
Modified Total Storage Subtotal	921.76	3.945	934.84
Total System Cost	1682.87	28.100	1952.64

* See Table 5.30 for a breakdown of costs.

Source: MMSD

TABLE 5.32

SUMMARY OF MOSAIC TREATMENT SYSTEM COSTS

Components	Capital	Annual O&M	NPW
Mosaic Alternative Constants			
MMSD Treatment Plants *	465.42	23.687	742.04
MIS Relief	188.68	0.010	169.25
Interceptors*	88.71	0.271	85.04
Local Costs	17.99	0.569	25.27
Subtotal	760.80	24.537	1021.60
Complete Separation Subtotal	927.65	2.295	946.62
Total System Cost	1688.45	26.832	1968.22
Inline Storage Subtotal	897.73	2.474	878.26
Total System Cost	1658.53	27.011	1899.86
Modified CST/Inline Subtotal	904.18	3.435	909.80
Total System Cost	1664.98	27.972	1931.50
Modified Total Storage Subtotal	921.76	3.945	934.84
Total System Cost	1682.56	28.482	1956.44

* See Table 5.30 for a breakdown of costs.

Source: MMSD

TABLE 5.33

COSTS FOR REPAIR AND REHABILITATION OF LACAL SEWERS AND FOR LOCAL RELIEF SEWERS
($ X 1000)

Community	Local Repair and Rehabilitation		Local Relief Sewer	Total Public Costs	Project Costs
	Private	Public			
Bayside	$ 457	$ 119	$ --	$ 119	$ 576
Brown Deer	695	138	--	138	833
Cudahy	2,050	580	391	971	3,021
Fox Point	1,361	226	917	1,143	2,504
Franklin	372	166	--	166	538
Glendale	526	335	--	335	861
Greendale	40	368	--	368	408
Greenfield	7	780	450	1,230	1,237
Hales Corners	57	320	45	365	422
Milwaukee	42,695	7,288	434	7,722	50,417
Oak Creek	406	308	--	308	714
River Hills	298	190	--	190	488
St. Francis	778	300	36	336	1,114
Shorewood	361	76	451	527	888
Wauwatosa	4,687	1,016	1,027	2,043	6,730
West Allis	12,489	984	1,479	2,463	14,952
West Milwaukee	510	104	--	104	614
Whitefish Bay	34	413	1,713	2,126	2,160
SUBTOTAL	$67,823	$13,711	$6,943	$20,654	$88,477
Brookfield	313	205	--	205	518
Butler	13	52	--	52	65
Elm Grove	28	363	--	363	391
Germantown	44	141	--	141	185
Menomonee Falls	286	314	--	314	600
Mequon	169	205	--	205	374
Muskego	78	94	--	94	172
New Berlin	85	416	--	416	501
Thiensville	21	69	217	286	307
TOTAL	$68,860	$15,570	$7,160	$22,730	$91,590

*Six Gallons per Minute Removal Rate

Source: I/I Analysis, MWPAP November 1978.

could be funded and how its financing would burden the communities and households in the planning area. In discussing these fiscal impacts, the analysis will proceed from consideration of the overall cost of the alternative to the individual household tax burden. The analysis includes funding sources, methods of financing the project, debt requirements, costs to communities in and out of Milwaukee County, and costs to the average household. A description of the funding mechanisms for MMSD projects is included in Section 4.2.1.7.

5.2.4.1.1 MFP Funding: It has been estimated that Wisconsin will receive about $66 million of federal funds in 1980, of which a maximum of nearly $40 million will be available for allocation to MFP projects. The Wisconsin Fund will have approximately $60 million of available funds in 1980. Of these funds, a maximum of $20 million will be available for MFP projects. This brings 1980 funding expectations for the MFP to approximately $60 million. This $60 million ceiling assumes an unchanging level of available federal funds. However, recent trends and political opinion indicate that available federal funding may decline in future years.

With a $60 million annual ceiling on federal and state funding of the MFP, one approach to implementing the program would be for the MMSD to spend $80 million per year for as many years as necessary to complete the project. This method of meeting the project costs would allow the project to be 75% funded ($60 million is 75% of $80 million) which is the maximum allowable level of funding.

However, due to the construction schedule imposed on the MMSD by the U.S. District Court Order, the construction necessary to implement the MFP must be completed by the end of 1989. Averaged over a ten-year period, the cost to implement the Mosaic Alternative would be more than $150 million per year. Since the maximum funding that could be expected from the Federal government and the Wisconsin Fund would be $60 million, the majority (64%) of the cost of implementing the MFP would be borne locally.

5.2.4.1.2 Financing the Local Portion of the MFP Costs: There are several methods that could be used to finance the local portion of the MFP costs. Taxes could be levied to raise the money to pay construction costs on a "pay-as-you go" basis or bonds could be issued to spread the costs of the project over a longer period of time. Theoretically, by taxing all the taxable property in Milwaukee County in proportion to its equalized value (ad valorem), sufficient revenue could be collected to make cash outlays for MFP improvements as they fall due. The advantage of this type of "pay-as-you-go" system is that money need not be spent on interest or financing costs.

The disadvantage of this type of financing is that the magnitude of cash outlay would vary greatly from year to year. The MFP must be implemented by 1989, but the costs of the project would not be distributed evenly over those ten years. Almost two-thirds of the locally funded share would be expended within four years. To pay for these costs directly, tax rates in the County would average $6 per $1,000 of equalized property value, but in some years the rates would climb to more than $10 per $1,000 of property value.* This rate of taxation would result in severe hardship to businesses and residents.

The other method for financing the local portion of the project costs would be to raise the necessary money by issuing either general obligation (G.O.) or revenue bonds. G.O. bonds are backed by the "full faith and credit" and the taxing powers of Milwaukee County, the issuing body, thereby providing a low-risk investment for the bond purchaser. Because of this high level of security for the investor and because of the tax exempt status of the bonds, investors are willing to accept a lower interest rate on the G.O. bonds.

In Wisconsin, the amount of debt that a municipality such as a county, city, town, or village may incur is limited to 5% of the equalized valuation of its taxable property. Since G.O. bonds are backed by the full faith and credit of Milwaukee County, they contribute to the County's debt. In addition, G.O. bonds issued for MMSD improvements are currently restricted by the Wisconsin Constitution to a maturity of twenty years from the date of issue.

Revenue bonds differ from G.O. bonds in that they are backed by the future revenues of the issuing body, in this case either Milwaukee County or the MMSD. The obligations from this type of bond would be payable only from future revenues, and so they do not contribute to the debt of the community.

Revenue bonds would be considered by investors as a higher risk than G.O. bonds because revenue bonds are backed only by future revenues. For this reason, the interest rate paid on revenue bonds might be slightly higher than the rate paid on G.O. bonds. Also, revenue bonds solicit a closer examination by prospective buyers. Since neither the County nor the

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*Current tax rates in Milwaukee County range from $15.33 per $1,000 of equalized taxable property value (West Milwaukee) to $23.86 per $1,000 of equalized taxable property value (Milwaukee). Included in these total net tax rates is the $0.86 per $1,000 (equalized) for the 1980 MMSD debt service.

MMSD has issued this type of bond in the past, there is no record for investors to examine and the bonds might be difficult to market.

Under current Wisconsin law, G.O. bonds for financing capital improvements to the Metropolitan Sewerage System can only be issued by Milwaukee County. To change this law would require legislative action. Assuming such action is taken, any combination of the mentioned methods or an innovative financing scheme could be implemented to finance the local portion of costs.

5.2.4.1.3 Bond Rating: Implementation of the MFP could affect bond ratings of municipalities in Milwaukee County. Municipal bonds are rated to measure the risk of municipal default by two major rating agencies: Moody's and Standard and Poors. The greater the risk, the lower the credit rating and the higher the interest rate that must be paid by the municipality to attract investors. Numerous factors such as accounting practices, financial statements,and past budget and audit reports are used by the rating agencies to assess the "credit worthiness" of a municipality.

Another consideration of the credit rating agencies is the overlapping per capita debt of the residents within a municipality. Although the annual debt service and corresponding tax rate for one bond issue may be slight, it must be evaluated in the context of all the other tax rates which apply to property in the municipality.

Milwaukee County has had a history of sound debt and financial practices and, until recently, had a triple A (Aaa) rating from both major credit agencies (the highest rating available). However, on June 16, 1980, Moody's Investors Services lowered the ratings of the County, City, and MMSD bonds issued by the County from Aaa to Aa. The June 16th issue of Moody's Bond Survey characterized the ratings revision: "Although (the) current financial position and underlying economic resources remain strong, (the) magnitude of County funding required for compliance with stringent environmental regulations detracts from overall bond security." The article concluded by stating, "inherent risks of a sewerage program of this scale are recognized, as are the potential problems of managing this program by a district that, as now constituted, has neither direct taxing nor bonding authority."

The MMSD estimated that Milwaukee County's debt limit would be reached by 1986 if there is no borrowing for any other County purposes and all funds for capital improvements are raised by bonding. These projections assume that the "non-fundable" portion of the project costs would be financed by

issuing 20-year G.O. bonds at 6% interest, 0% inflation, and a 0.4% real annual growth rate in Milwaukee County property valuation. Once the debt limit is reached, future projects could only be financed by means other than G.O. bond issues. As the legal debt limit is approached, the County's bond rating might decline.

Even if the Wisconsin statutes are amended to allow the MMSD, rather than the County, to issue general obligation bonds and to levy the necessary taxes, the County's bond rating could be affected. MMSD bonds would not contribute to the County's debt, but they would increase the overlapping per capita debt of Milwaukee County as well as all municipalities within the County. Assuming Milwaukee County implements its 1981-1985 Recommended Capital Program and implements the MFP (by G.O. bonding), the County debt limit would be reached in 1985.

5.2.4.1.4 Cost Distribution: If bonds are issued to meet MFP costs rather than using direct taxation, the payment schedule for these costs would be spread over a longer period of time, but the project costs would be increased by interest payments. The local portion of the project cost would be distributed to citizens living in the MMSD service area by one of several methods of apportionment: property tax, flat rate, use-based charge, or income tax surcharge.

Wisconsin statutes now require that if Milwaukee County elects to provide funds to MMSD by issuing G.O. bonds, it must levy an ad valorem property tax on all taxable property within its boundaries to provide a direct cash flow to finance the debt service on the bond issues. The traditional argument supporting the property tax as a means of distributing annual revenue requirements is that all property in Milwaukee County benefits from the sewer service, so all property should share the burden of raising the needed capital. Advocates of the property tax point out that even property that may not receive sewer service would be enhanced in value because of its location in a sewered area. Another advantage of the property tax is that it is deductible on income tax returns.

There are also arguments opposing property taxes to support sewerage improvements. With such a system, farmers might have to pay sewer taxes on agricultural land. Residences in Milwaukee County with septic systems would have to pay for the rehabilitation of their septic systems, and they would be taxed for sewer service they would not receive. However, Federal Guideline (PRM 79-8) allows for the establishment of Septic Tank Management Plans, which could result in federal funding of septic tank upgrading. Also, a program of the

Wisconsin Fund makes grants available for the rehabilitation of septic systems.

The property tax would not charge users in proportion to their use of the system, but instead according to their property value. For example, a valuable property such as a shopping mall would have to pay a proportionately high amount of property tax even though it might not be a heavy user of the sewer system. On the other hand, some industries may be heavy contributors to the sewer system, but may have property of relatively low value and thus pay low taxes.

An alternative method of distributing the debt service from municipal bonds would be a flat rate system. Using such a system, the annual costs would be distributed based on the number of building connections to the sewerage system. Residents in the MMSD service area would be charged a set fee per connection. Many of the suburban communities surrounding Milwaukee County use this system to distribute annual capital costs.

A use-based system could also be employed to distribute the capital costs of the MFP. Such a system would charge each user of the sewerage system a fee based on the benefits the user receives. A payment formula would be developed to consider the volume and quality (suspended solids and BOD concentration, for instance) of the wastewater the user discharges to the sewer system.

A much greater proportion of the project costs would be borne by industry with a use-based system than with the current property tax system. Industry contributes about 30% of the total flow to the MMSD. Thus, under a use-based system industry would pay at least 30% of the MFP costs (as opposed to 10% under the current property tax based system). Certain wet industries (those that discharge the highest volumes of wastewater) including breweries, food processors, tanneries, and paper producers, would have to pay high capital charges in addition to the high user charges they now pay for the operation and maintenance of the MMSD. For example, industry paid about 31% of the MMSD's 1980 operation and maintenance budget. With a use-based system, location in Milwaukee County could place these industries at a competitive disadvantage to similar industries located outside the County. Also, since property value would not be considered with a use-based system, lower income households would pay relatively higher bills than they would pay with a property tax system.

Another method of distributing the MFP costs would be an income tax surcharge. Non-profit organizations that are exempt from State income tax would not pay the surcharge. Like the State income tax, the surcharge would be "progressive" (lower income residents would pay a smaller percentage of their income than higher income residents). As with the ad valorem property tax, an income tax surcharge would be unrelated to the benefits received from the sewerage system.

Since current Wisconsin law only authorizes a Milwaukee County ad valorem property tax for raising capital for sewerage improvements, any other system of cost distribution would require legislative action.

5.2.4.2 No Action Alternative

It is impossible to measure the severity of fiscal impacts that the No Action Alternative would have on communities in the planning area. Capital recovery costs and user charges would not change dramatically from the present. However, penalties and fines could be imposed on these communities if they did not comply with court orders, or if their treatment facilities violated WPDES effluent standards.

Projections of the future costs of the final alternatives were made by the MMSD using a computer model and were audited by EPA, DNR, and the EIS consultant. The model that was used for these projections is described more fully in the Fiscal/Economic Appendix to this EIS.

Tables 5.34 and 5.35 summarize the output of the model for the No Action Alternative. In Table 5.34, future charges to communities that now contract with the MMSD for waste disposal are shown as average yearly charges to each community during the period from 1985-2005. Table 5.35 indicates the average annual tax rate per $1,000 of equalized property value which is required to finance the MMSD debt service during the same period as the No Action Alternative.

TABLE 5.34

MMSD ANNUAL CHARGES* TO EACH COMMUNITY ($x1000)

- No Action Alternative -

Community	1980	1985-2005 Avg.
Contract Communities		
Brookfield	$434	$508
Butler	124	117
Elm Grove	244	226
Menomonee Falls	8	787
Mequon	434	562
New Berlin	566	1168
MMSD		
Bayside	209	165
Brown Deer	484	429
Cudahy	1135	1002
Fox Point	381	312
Franklin	462	457
Glendale	857	724
Greendale	645	548
Greenfield	1011	881
Hales Corners	277	233
Milwaukee	25765	23166
Oak Creek	2031	1962
River Hills	102	83
St. Francis	335	320
Shorewood	513	423
Wauwatosa	2479	2049
West Allis	2611	2199
West Milwaukee	961	834
Whitefish Bay	638	513

*Includes O&M as well as Capital Charges.

Source: MWPAP

TABLE 5.35

PROPERTY TAX RATES* FOR SEWER SERVICE WITH NO ACTION 1980-2005

Community	Average Year	Peak Year
Milwaukee County	$0.62	$1.18
Butler	0.65	0.85
Elm Grove	0.45	0.59
New Berlin	0.41	0.48
Menomonee Falls	0.39	0.54
Mequon	0.39	0.54

*Rates are per $1,000 of equalized property valuation.

Source: System Plan EA Volume 2-B.

5.2.4.3 Local Alternative

The fiscal analysis for the Local Alternative was made using the assumptions outlined in Table 5.36. The MMSD would construct all components of the Local Alternative except in the Caddy Vista Sanitary District, Germantown, Muskego, New Berlin, South Milwaukee, and Thiensville. This construction would total $1,633,194,000 from 1978 to 1992. Of these costs, $591,425,000 (36%) would be funded by state and federal grants, and $1,041,769,000 (64%) would be financed locally. Figure 5-4 shows the yearly costs of the project. The annual distribution of these costs for communities and households is shown in Table 5.37. In Milwaukee County, the average annual tax rate would be $4.33 per $1,000 of equalized property value. These taxes are in addition to the property tax rate for municipal services.

The Caddy Vista Sanitary District, Germantown, Muskego, New Berlin, South Milwaukee, and Thiensville would finance the improvements to their local treatment facilities. These improvements would total $67,808,000. Table 5.38 indicates the annual construction costs to each of those communities through 1999, assuming no federal or state funding.

If the 208 Plan is amended, there is a possibility that some of these communities could receive federal or state funding (or both). Table 5.39 illustrates the annual community and household costs assuming 0%, 60% (the state limit), and 75% (federal limit) funding. The State of Wisconsin limits the debt that a municipality can incur to 5% of its equalized

TABLE 5.36

ASSUMPTION OF THE FISCAL ANALYSIS
LOCAL ALTERNATIVE

- The MMSD would operate the Jones Island and South Shore WWTPs.
- The MMSD would construct all elements of the Local alternative except in Caddy Vista Sanitary District, Germantown, Thiensville, New Berlin, Muskego, and South Milwaukee. All facilities in these six communities would be constructed and financed locally.
- The local municipalities would issue 20-year general obligation bonds at 7% interest for capital improvements.
- Milwaukee County would issue 20-year general obligation bonds at 6% interest for capital improvements.
- All projected design flows would be achieved.
- The existing contract formula would continue for communities outside Milwaukee County.
- The methods now used by communities outside Milwaukee County (whether connected to the MMSD or independent) to distribute costs to households would continue.
- The net annual MMSD debt service after subtracting payments from contract communities, would be recovered by ad valorem taxation of property in Milwaukee County.
- Grant eligible projects would be 75% funded to an annual maximum of $60 million.
- County equalized property value would rise at a real growth rate of .4% per year.
- No inflation is assumed. Costs are in 1980 dollars.

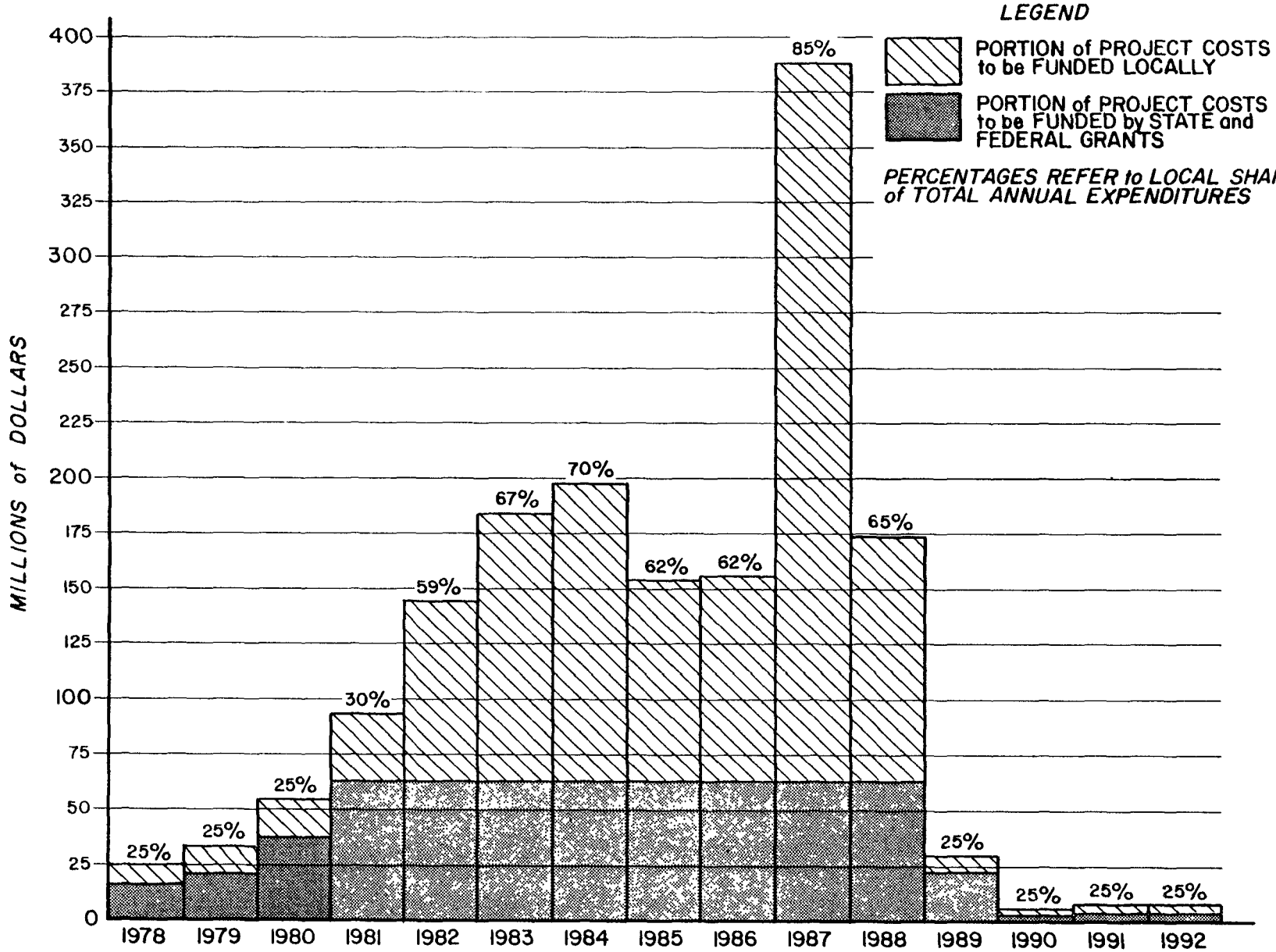

FIGURE 5-4

DATE APRIL 1981

ANNUAL EXPENDITURES

LOCAL ALTERNATIVE

SOURCE MWPAP MODEL 70A

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

TABLE 5.37

AVERAGE DISTRIBUTION OF COSTS (x $1,000)

- Local Alternative -

Community	1985-2005 Average Annual Community Charges** O&M	Capital	1985-2005 Average Annual Household Charges O&M	Capital	% of Average Income
Bayside	$ 99	$ 725	61	498	1.1
Brookfield*	438	789	61	138	0.5
Brown Deer	366	1,491	61	268	1.5
Butler*	93	190	61	41	0.4
Caddy Vista*	76	166	204	445	3.2
Cudahy	1,002	1,910	61	223	1.5
Elm Grove	150	358	61	143	0.4
Fox Point	207	1,204	61	474	1.0
Franklin	608	1,664	61	296	1.5
Germantown*	422	815	59	114	0.7
Glendale	541	3,016	61	325	1.4
Greendale	393	2,022	61	342	1.6
Greenfield	703	3,127	61	266	1.3
Hales Corners	179	778	61	292	1.2
Menomonee Falls*	919	1,664	61	132	0.7
Mequon*	626	1,173	61	129	0.5
Milwaukee	22,871	41,313	61	173	1.5
Muskego*	435	933	79	169	1.0
New Berlin*	754	2,958	49	191	0.9
Oak Creek	2,518	2,674	61	251	1.4
River Hills	50	403	61	688	0.8
St. Francis	305	780	61	206	1.5
Shorewood	303	1,480	61	370	2.1
South Milwaukee	414	250	51	33	0.4
Thiensville*	129	356	78	215	1.0
Wauwatosa	1,584	6,655	61	303	1.5
West Allis	1,829	6,153	61	264	1.9
West Milwaukee	893	1,064	61	219	2.3
Whitefish Bay	355	1,861	61	390	1.3

*Outside Milwaukee County

Source: MWPAP Model 70A

TABLE 5.38

CASH FLOWS FOR LOCAL ALTERNATIVES (0% FUNDING)

	Muskego NE To Land	South Milwaukee	Germantown Land Application
1980	$ 131	$ 30	$ 115
81	241	55	211
82	837	191	735
83	4,797	1,091	4,210
84	4,116	936	3,612
1994	858	225	584
95	10	3	7
1998	482	1,275	580
99	5	14	7
	$ 11,477	$ 3,820	$ 10,061

	New Berlin SE To Land	Caddy Vista	Thiensville
1980	$ 417	$ 24	$ 50
81	770	44	93
82	2,676	155	323
83	15,332	886	1,850
84	13,156	760	1,588
1994	2,581	43	119
95	29	0	1
1998	1,026	0	420
99	12	90	5
	$35,999	$2,002	$4,449

All costs x 10^3

Source: WPAP Models AL101, 901, 201, 401, 601, 801

TABLE 5.39

1985-2005 AVERAGE ANNUAL COSTS TO COMMUNITIES [1]

ASSUMING DIFFERENT LEVELS OF FUNDING

	Funding Assumption Percentage	Community Costs (x 1000) Capital	Community Costs (x 1000) O&M	Household Capital	Household O&M	Total as % of Income	1980-84 Initial Construction Capital (X 1000)	1979 Capacity for Future Indebtedness (X 1000)
Caddy Vista*	0	$166	$76	$445	$204	3.2%	1,869	
Caddy Vista	60	75	76	200	204	2.0	850	$13,575
Caddy Vista	75	52	76	138	204	1.7	597	
Germantown	0	815	422	114	59	.7	8,883	
Germantown	60	326	422	46	59	.4	3,553	7,394
Germantown	75	203	422	28	59	.3	2,222	
Muskego	0	933	435	169	79	1.0	10,122	
Muskego	60	373	435	68	79	.6	4,050	7,519
Muskego	75	233	435	42	79	.5	2,530	
New Berlin	0	2,958	754	191	49	.9	32,351	
New Berlin	60	1,183	754	76	49	.5	12,941	28,619
New Berlin	75	778	754	48	49	.4	8,088	
Thiensville	0	356	129	215	78	1.0	3,904	
Thiensville	60	142	129	86	78	.6	1,561	3,788
Thiensville	75	89	129	54	78	.5	975	
South Milwaukee	0	250	414	33	51	.4	2,303	
South Milwaukee	60	100	414	13	51	.3	921	14,175
South Milwaukee	75	62	414	8	51	.3	576	

*Town of Caledonia

[1] These are the only communities with local WWTPs.

property value, so Table 5.39 also compares the initial capital required during the first five years of construction to the 1979 remaining debt margin of the community (debt limit less existing debt). These figures can be compared because inflation would be roughly similar for construction costs and property values.

As Table 5.39 indicates, without funding most of the communities would exceed their debt limits very quickly. This problem could be avoided if communities could issue revenue bonds (which are not included in the debt level) rather than G.O. bonds. However, the interest rates would increase with revenue bonds, and there could be difficulties in marketing the bonds.

5.2.4.4 Regional Alternative

With the Regional Alternative, the MMSD would operate two WWTPs to treat all wastewater flows in the planning area: Jones Island and South Shore. Since South Milwaukee would join the MMSD, its residents would pay MMSD user charges, and they would be assessed at the same property tax rate as the rest of Milwaukee County to finance the MMSD debt service. The assumptions used to analyze the fiscal impacts of the Regional Alternative are outlined in Table 5.40.

Between 1978 and 1992, $1,658,511,000 would have to be expended to design and construct the Regional Alternative. Of these costs, only $492,227,000 (36%) would be grant funded. The remaining 64%, $1,066,284,000, would have to be financed locally. Figure 5-5 shows the yearly cash expenditures that would be required for design and construction of the Regional Alternative.

Because most of these expenditures would have to be financed locally, additional interest costs would have to be included. The total MMSD debt service with the Regional Alternative would be $1,970,574,000. The average annual debt service between 1985 and 2005 would be $86,331,000 of which $7,036,000 would be paid by contract communities. The remainder of the average annual debt service, $79,295,000, would be distributed by ad valorem property taxation in Milwaukee County. The average annual tax rate, during those years, would be $4.29 per $1,000 of equalized property value. Table 5.41 shows the average annual allocation of the costs of the program and interest payments to the communities of the planning area. The table also indicates the average annual cost per household in each community.

TABLE 5.40
ASSUMPTION USED IN FISCAL IMPACTS ANALYSIS
FOR THE REGIONAL ALTERNATIVE

- The MMSD would operate two WWTPs: Jones Island, and South Shore.
- The MMSD would finance the construction of all elements of the alternative, including sewer rehabilitation and relief work both inside and outside Milwaukee County, as well as local connector sewers required beyond Milwaukee County.
- Milwaukee County would issue 20-year general obligation bonds at 6% interest for MMSD capital improvements.
- All projected design year flows would be achieved.
- The existing contract formula would continue for communities outside Milwaukee County.
- The methods now used by communities outside Milwaukee County to distribute costs to households would be continued.
- After subtracting contract community payments, the net amount of annual MMSD debt service would be recovered by the ad valorem taxation of Milwaukee County property.
- Grant eligible expenditures would be 75% funded, to a maximum of $60 million per year.
- Milwaukee County property value would rise at a real growth rate of .4% per year.
- No inflation is assumed. Costs are expressed in 1980 dollars.

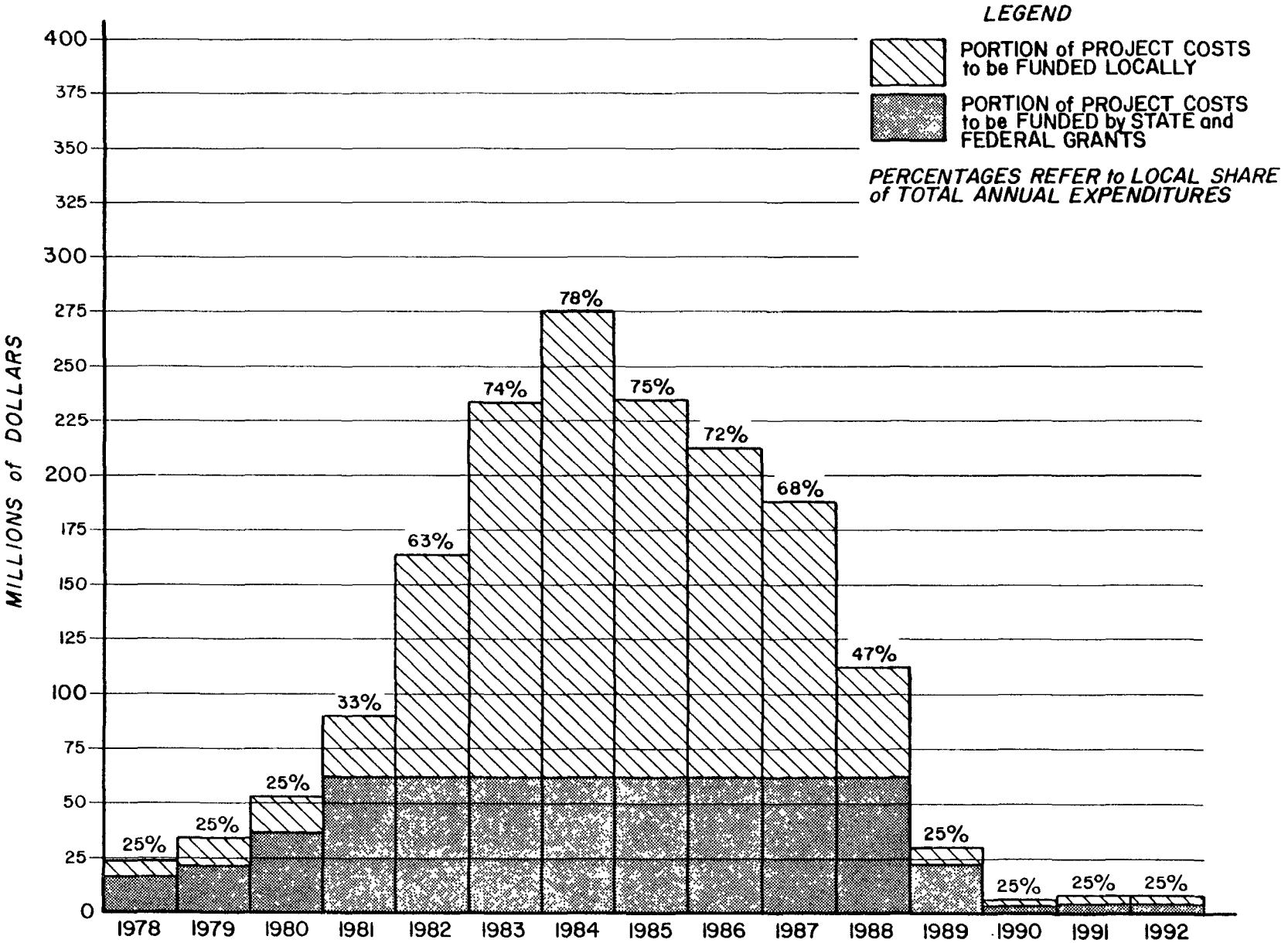

FIGURE 5-5

DATE APRIL 1981

ANNUAL EXPENDITURES

REGIONAL ALTERNATIVE

SOURCE MWPAP Model 6SM

PREPARED BY EcolSciences

TABLE 5.41

AVERAGE ANNUAL COMMUNITY AND HOUSEHOLD COSTS

- Regional Alternative -

Community	1985-2005 Average Annual Community Charges** O&M	Capital	1985-2005 Average Annual Household Charges O&M	Capital	% of Average Income
Bayside	$ 93	$ 717	57	493	1.1
Brookfield*	411	742	57	131	0.5
Brown Deer	344	1,472	57	266	1.4
Butler*	88	179	57	39	0.4
Caddy Vista*	22	36	57	95	0.8
Cudahy	946	1,888	57	221	1.5
Elm Grove*	140	337	57	135	0.4
Fox Point	194	1,192	57	470	1.0
Franklin	570	1,642	57	294	1.5
Germantown*	391	676	57	94	0.6
Glendale	509	2,972	57	322	1.4
Greendale	369	1,999	57	339	1.5
Greenfield	660	3,087	57	264	1.2
Hales Corners	168	770	57	290	1.2
Menomonee Falls*	862	1,561	57	124	0.7
Mequon*	588	1,100	57	121	0.5
Milwaukee	21,566	40,870	57	172	1.4
Muskego*	293	576	57	104	0.7
New Berlin*	948	1,626	57	105	0.6
Oak Creek	2,381	2,632	57	249	1.3
River Hills	47	398	57	682	0.8
St. Francis	287	770	57	204	1.5
Shorewood	284	1,466	57	367	2.1
South Milwaukee	406	1,841	50	238	1.4
Thiensville*	77	190	57	115	0.6
Wauwatosa	1,489	6,588	57	300	1.5
West Allis	1,720	6,093	57	262	1.8
West Milwaukee	846	1,504	57	217	2.3
Whitefish Bay	333	1,843	57	386	1.3

* Outside Milwaukee County
**X 1000

See Tables 3.19 and 3.20 for a comparison of the Community and Household costs of Local, Regional and Mosaic Alternatives.

Source: MWPAP and ESEI

5.2.4.5 Mosaic Alternative

The Mosaic Alternative is very similar to the Regional Alternative except that with the Mosaic Alternative the City of South Milwaukee would manage and operate its own WWTP. The Jones Island and South Shore WWTPs would be the only other public WWTPs in operation in the planning area. The MMSD would finance and construct all aspects of the MFP both in and out of Milwaukee County. The other assumptions used in determining the fiscal impacts of the Mosaic Alternative are described in Table 5.42.

With the Mosaic Alternative, $1,656,208,000 would be expended between 1978 and 1992. Of this cost, $592,204,000, or 36%, would be fundable from state and federal sources. The remaining $1,064,005,000 (64%) would have to be financed locally. Figure 5.6 illustrates the annual capital expenditures that would be required to implement the Mosaic Alternative.

With the Mosaic Alternative, the total MMSD debt service from 1980 to 2009 would be $1,966,223,000. The average annual debt service payments from 1985 to 2005 would be $86,137,000, of which $7,121,000 would be paid by contract communities. The remaining portion of the annual average debt service, $79,016,000 would be distributed by an ad valorem taxation of property in Milwaukee County. For this property, the average annual tax rate (1985 to 2005) would be $4.37 per $1,000 equalized property value. Table 5.43 shows the average annual community and household allocations of capital costs.

5.2.4.6 Bond Interest Rate Sensitivity

The fiscal analysis has assumed that Milwaukee County would issue 20-year, general obligation bonds at an interest rate of 6%. However, it is possible that future economic conditions could require the County to market the bonds at a higher interest rate. For this reason, the MMSD performed an analysis to determine the impacts associated with higher interest rates. The average annual debt services were calculated for 6%, 7%, 8%, and 9% interest rates. This analysis used the MMSD Recommended Plan as an example, but the findings would be applicable to any of the final alternatives.

This analysis revealed a fairly constant relationship between the interest rate and the debt service. Every one percentage point increase in the interest rate paid on the bonds would be reflected in an 8% increase in annual debt service. Table 5.44 shows how increases in interest rates would affect annual debt payments of the MMSD Recommended Plan.

TABLE 5.42

ASSUMPTIONS USED IN THE FISCAL IMPACTS ANALYSIS
MOSAIC ALTERNATIVE

- The MMSD would operate two WWTPs: Jones Island, and South Shore. The South Milwaukee WWTP would be locally owned and operated.
- The MMSD would finance the construction of all elements of the MWPAP, including sewer rehabilitation and relief work both in and out of Milwaukee County for MMSD capital improvements.
- Milwaukee County would issue 20-year general obligation bonds at a 6% interest rate for MMSD capital improvements.
- South Milwaukee would issue 20-year general obligation bonds at a 7% interest rate for capital improvements.
- All projected design year flows would be achieved.
- The existing contract formula for communities outside Milwaukee County would continue.
- The current methods for distributing costs to communities outside Milwaukee County would be continued.
- The City of South Milwaukee would distribute costs by an ad valorem property tax.
- After subtracting contract community payments, the net amount of annual MMSD debt service would be recovered by ad valorem taxation of Milwaukee County property.
- Grant eligible expenditures would be 75% funded to a maximum of $60 million per year.
- Equalized property value within Milwaukee County would rise at a real growth rate of .4% per year.
- No inflation is assumed. All costs are expressed in 1980 dollars.

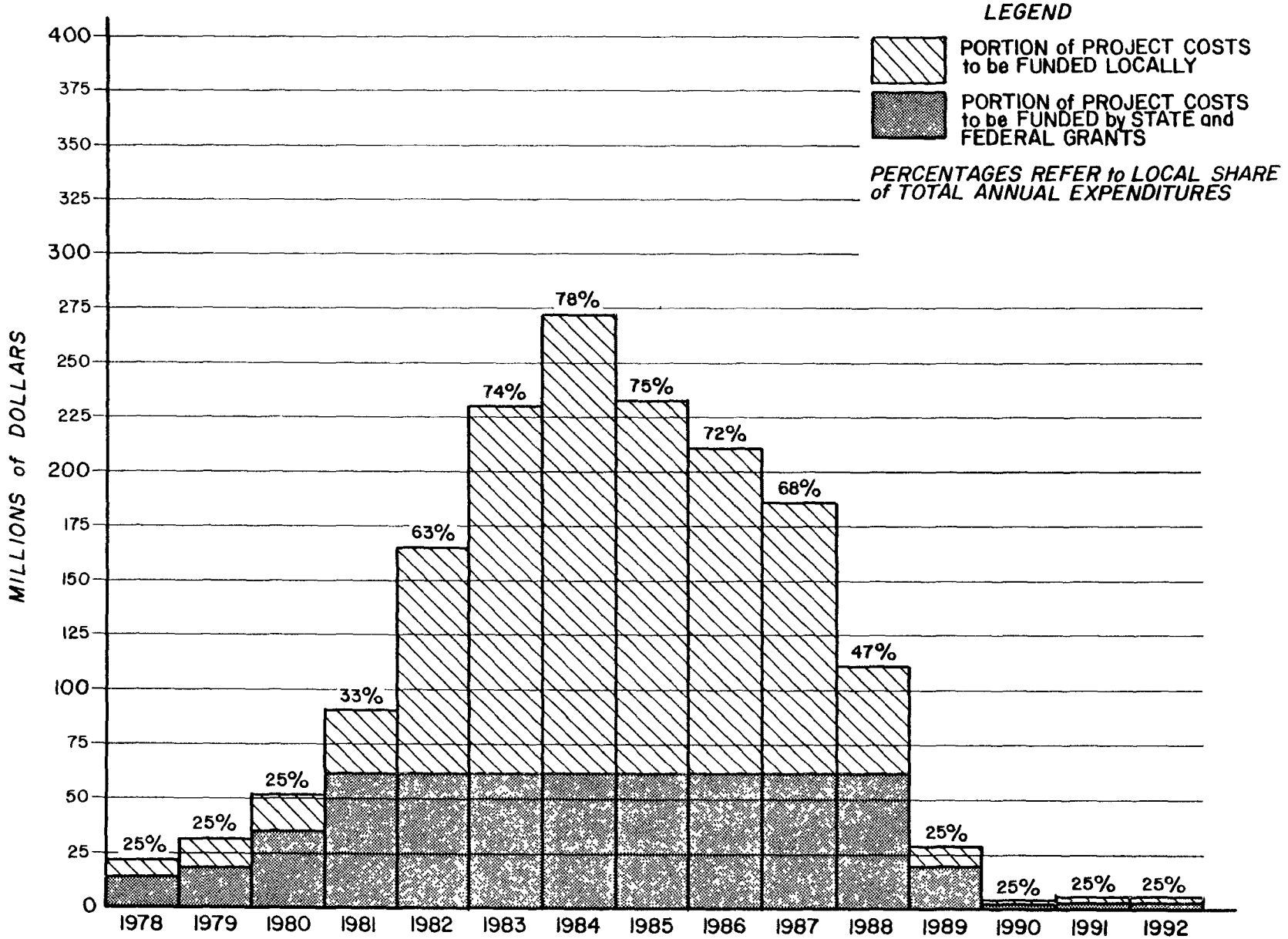

FIGURE 5-6

DATE APRIL 1981

ANNUAL EXPENDITURES

MOSAIC ALTERNATIVE

SOURCE WPAP MODEL 60A

PREPARED BY ESEI EcolSciences ENVIRONMENTAL GROUP

TABLE 5.43

AVERAGE ANNUAL COMMUNITY AND HOUSEHOLD COSTS

- Mosaic Alternative -

Community	1985-2005 Average Annual Community Charges** O&M	Capital	1985-2005 Average Annual Household Charges O&M	Capital	% of Average Income
Bayside	$ 94	$ 732	57	503	1.1
Brookfield*	416	750	57	131	0.5
Brown Deer	348	1,502	57	271	1.5
Butler*	89	181	57	39	0.4
Caddy Vista*	22	36	57	96	0.8
Cudahy	956	1,926	57	225	1.5
Elm Grove*	142	341	57	137	0.4
Fox Point	196	1,216	57	478	1.0
Franklin	576	1,675	57	299	1.5
Germantown*	396	684	57	95	0.6
Glendale	515	3,032	57	328	1.4
Greendale	373	2,039	57	345	1.5
Greenfield	668	3,149	57	269	1.3
Hales Corners	170	786	57	295	1.2
Menomonee Falls*	872	1,580	57	126	0.7
Mequon*	594	1,114	57	122	0.5
Milwaukee	21,804	41,694	57	175	1.5
Muskego*	297	583	57	105	0.7
New Berlin*	959	1,646	57	106	0.6
Oak Creek	2,405	2,685	57	253	1.3
Piver Hills	47	406	57	695	0.8
St. Francis	290	786	57	208	1.5
Shorewood	288	1,495	57	374	2.1
South Milwaukee	414	250	51	33	0.4
Thiensville*	78	192	57	116	0.6
Wauwatosa	1,507	6,721	57	306	1.5
West Allis	1,739	6,216	57	267	1.9
West Milwaukee	855	1,075	57	221	2.3
Whitefish Bay	337	1,880	57	393	1.3

* Outside Milwaukee County

** In Thousands

See Tables 3.19 and 3.20 for a comparison of the Community and Household Costs of the Local, Regional and Mosaic Alternatives.

Source: MMSD and ESEI

TABLE 5.44

THE EFFECTS OF INCREASED INTEREST RATES

G.O. Bond Maturity	Interest Rate	Average Tax Rate Per $1,000 Equalized Property Value	Total MMSD Debt Service
20 year	6%	$ 4.37	$1,966,319,000
20 year	7%	$ 4.73	$2,117,550,000
20 year	8%	$ 5.12	$2,273,957,000
20 year	9%	$ 5.53	$2,435,315,000

5.2.4.7 Bond Maturity Sensitivity

Although the Wisconsin Constitution now limits the repayment period of municipal bonds to twenty years, the effects of extending this period would decrease annual debt service payments. However, since the payments would continue for a longer period of time, the total interest paid on the bond would increase. This analysis evaluates the reduction in annual payments in relation to the increase in total interest payments.

Issuing approximately $1.1 billion in 20-year general obligation bonds during the 1980s would result in an average debt service of $86,137,000* between 1985 and 2005 and a total debt service of $1,966,223,000.* In other words, it would ultimately cost about $1.9 billion to pay for a $1.1 billion capital expenditure. By the time the last payment is made, interest on the bonds would total $870 million.*

If the Wisconsin Constitution is amended, the legislature could authorize Milwaukee County or the MMSD to issue bonds with a longer maturity. Table 5.45 shows the degree to which extending the maturity on $1.1 billion of G.O. bonds for sewer improvements would decrease the annual debt service payments and would increase the total amount of interest paid by the County. This analysis was performed for the Mosaic Alternative (the MMSD Recommended Plan). However, the percentages of increase and decrease would remain the same for any of the final alternatives.

*These figures include a small amount of existing debt service.

TABLE 5.45

BOND MATURITY SENSITIVITY

Recommended Plan Local Capital Cost	Bond Length	*Ave Annual MMSD Debt Service	% Change From 20 yr Bonds	Total MMSD Debt Service	% Change From 20 yr. Bonds
$1,064,005,000	20 yr (6%)	$86,137,000 (1985-2005)	0%	$1,966,223,000 (1980-2012)	0%
$1,064,005,000	30 yr (6%)	$75,387,000 (1985-2015)	-12%	$2,404,790,000 (1980-2023)	+20%
$1,064,005,000	40 yr (6%)	$68,737,000 (1985-2025)	-20%	$2,886,737,000 (1980-2033)	+47%

*Numbers in this column include a small amount of existing MMSD debt independent of the MWPAP.

All figures are in 1980 dollars.

Source: MWPAP MODELS FM60A, 62A, 63A

As the table shows, increasing the bond maturity to 30 years would decrease annual payments by 12%, but it would increase the total debt service by almost $440 million (20%). With 40-year bonds, the average annual debt service would be reduced by 20%, but total debt service would increase by 47%, or more than $920 million.

5.2.4.8 A Worst Case Analysis

The accuracy of the MFP cost estimates, the level of grant funding ultimately obtained, and the prevailing interest rates at the time of bond issues, all have the potential of altering the forecast fiscal impact of the MFP. As Table 5.46 indicates, the assumptions of the Mosaic Alternative (MMSD Recommended Plan) include: 1) a $1.66 billion program: 2) 36% grant funding: and 3) all bonds sold (to raise the non-grant-funded portion) at 6% interest. This worst case analysis examines the impact of three different deviations from the assumptions upon which the Mosaic Alternative is founded. All worst case scenarios assume district-wide financing.

5.2.4.8.1 Worst Case "A": The sequence of expenditures needed to implement the $1.6 billion MFP is technically referred to as the Project Delivery Analysis (PDA). The PDA is used to establish the annual budget for implementing the Mosaic Alternative and as a basis for estimating project design costs. The PDA would be modified during the design phase as more refined cost estimates become available.

This PDA has an accuracy range of -15% to +30%. In other words, the cost range of the MFP is $1.4 billion to $2.16 billion. The worst case "A" in Table 5.46 assumes that the MFP would end up costing 15% more than the PDA estimate of $1.6 billion. The total cost would, in this case, increase by $249 million to $1.9 billion.

At the time the Draft EIS was released, the MMSD had anticipated an overall grant funding level of 36%. However, information that has since become available suggests that 36% may be an overly optimistic estimate. Therefore, the worst case "A" assumes that the $1.9 billion would be only 25% grant funded.

Recently, interest rates on G. O. municipal bonds have exceeded the 6% rate assumed for the Mosaic Alternative. Therefore, this worst case analysis assumes that the $1.42 billion of needed capital (75% of 1.9 billion) would be raised with G.O. bonds paying 7.5% interest. This higher interest rate assumption increases the equalized tax rate by 12%.

TABLE 5.46

WORST CASE ANALYSES

	Cost Estimate Level of Accuracy	Grant Funding Availability	Interest Rate on Bond Issues	MWPAP Tax Rate in Milwaukee County[1]
Assumptions of MMSD Recommended Plan	Cost of $1.66 billion. Accuracy range of -15% to +30%. All costs are assumed accurate.	75% Funding, with annual maximum of $60 million. 36% funded overall. $1.07 billion not grant funded.	All MMSD bond issues pay 6%.	$4.37 average annual equalized property tax rate per $1000 from 1985-2005.
Worst Case "A" Assumptions	Cost of $1.9 billion. A $249 million increase; 15% higher than $1.66 billion.	25% (or $.48 billion) grant funded. $1.42 billion, or 75% not grant funded. Tax rate increases from $4.37 to $5.80.	All MMSD bond issues pay 7.5%. Tax rate increases from $5.80 to $6.50.	$6.50 average annual equalized property tax rate per $1000 from 1985-2005.
Worst Case "B" Assumptions	Cost of 2.16 billion. 30% higher than MWPAP estimate; a $498 million increase over $1.66 billion.	15% (or $.36 billion) grant funded. $1.80 billion, or 85% non grant funded. Tax rate increases from $4.37 to $7.35.	All MMSD bond issues pay 8% Tax rate increases from $7.35 to $8.57	$8.57 average annual equalized property tax rate per $1000 from 1985-2005.
Worst Case "C" Assumptions	Cost of $2.5 billion. 50% higher than MWPAP estimate of $1.66 billion. An $840 million increase.	0% funded. $2.5 billion not grant funded. Tax rate increases from $4.37 to $10.21.	All MMSD bond issues pay 9%. Tax rate increases from $10.21 to $12.86.	$12.86 average annual equalized property tax rate per $1000 from 1985-2005.

[1] This Table assumes District-wide financing.

The estimated cumulative effect of the above assumptions is a 49% increase in the Milwaukee County tax rate. That is, while the assumptions in the Mosaic Alternative lead to an average annual equalized tax rate of $4.37 for district-wide financing, the assumptions outlined in the worst case "A" lead to $6.50 per $1,000.

5.2.4.8.2 Worst Case "B": The worst case "B" assumes that the $1.6 billion estimate is 30% lower than what the final cost would be (in 1980 dollars). This assumption causes the $1.66 billion to increase by $498 million to $2.16 billion. In addition, grant funding is assumed to be 15%.

With these two assumptions, the entire $1.8 billion would have to be raised locally. Bonding $1.8 billion at 6% would result in an average annual tax rate of $7.35/$1,000. However, if bond issues are assumed to average 8%, the tax rate would increase an additional 16% to $8.57/$1,000.

In summary, the worst case "B" analysis, including a project cost increase of 30%, 15% grant funding, and 8% interest on MMSD bonds, would cause the Milwaukee County property tax rate for the MFP to increase 96% over the tax rate associated with the Mosaic Alternative, from $4.37 to $8.57/$1,000.

5.2.4.8.3 Worst Case "C": Worst case "C" assumes that the capital cost of the MFP would be 50% higher than the estimated $1.66 billion and that no grant funding would be available during implementation of the program. If the $2.5 billion would be debt financed with 20-year G.O. bonds at 9% by Milwaukee County, the average annual equalized County tax rate would be $12.86 per $1,000.

With implementation of the MFP, the 1985-2005 average annual equalized Milwaukee County property tax rate would likely be between $4.37 and $12.86 per $1,000, depending upon which of the possible combinations of cost estimates, funding levels, and interest rates ultimately occur.

5.2.4.9 Fiscal Impacts of CSO

The MMSD Recommended Plan assumes that all capital costs of the MFP would be spread district-wide, and that all operation and maintenance costs would be distributed through the User Charge Program. Since the CSO program is part of the MFP, all CSO-related capital and O&M costs are assumed to be shared district-wide.

However, the costs of some MFP projects have more priority on the Wisconsin Project Priority List than CSO abatement,

and the cost of implementing the MFP would exceed the $60 million per year ceiling for federal and state grants during most years. Therefore, grant funds would not be available for CSO abatement. The effect on the property tax rate produced by different CSO solutions can be predicted by applying the percentage differences in cost among alternatives to the tax rate. For example, given that a $1,064 billion alternative (Mosaic) would result in a $4.37 per $1,000 tax rate, then a $1.098 billion solution, which is a 3.2% increase, would result in a $4.51/$1,000 tax rate (see Table 5.47).

Assuming the continuation of the current contract formula, costs to communities outside of Milwaukee County would also increase, but not as much as in-County costs. The contract formula is not as sensitive to changes in MMSD capital expenditures as the property tax system, because the charges to contract communities are based on a 2% depreciation of MMSD assets in place. The contract formula distributes costs based on a 50-year payback period as opposed to 20-year bonds in Milwaukee County.

5.2.4.10 Individual Community Financing

On June 5th, 1980, the Milwaukee Metropolitan Sewerage Commission approved the district-wide financing of all components of the MFP. However in the past, all communities in the MMSD planning area have financed their own local sewer rehabilitation and relief, CSO abatement, and trunk sewer connections to the Milwaukee County line. Historically, the MMSD has financed Metropolitan Intercepting Sewer (MIS) construction and treatment plant construction or improvement.

District-wide financing of the entire MFP has been controversial. A lawsuit has been filed against the MMSD by 15 suburbs to challenge the legality of district-wide financing. Due to the uncertain outcome of this lawsuit, the EIS provides a parallel fiscal impact analysis that assumes the CSO abatement, local sewer rehabilitation, and trunk sewer connections to the Milwaukee County line are financed by the individual communities that own, or would own, the sewers. This financial arrangement is referred to as the Individual Community Financing Alternative.

The following assumptions underlie this analysis. These assumptions are used because they enable the results under the Individual Community Financing Alternative to be compared to the District-Wide Financing Alternative.

TABLE 5.47

FISCAL IMPACTS OF CSO ALTERNATIVES

Alternative	Total Initial MWPAP Capital: Local Share*	Percent Increase	Average Annual Tax Rate	Annual Burden to a $50,000 Home in Milwaukee
1. Inline	$1,064,005	Base	$ 4.37	$ 218
2. CST/Inline	1,074,535	1%	4.41	220
3. Modified Total Storage	1,088,085	2.3%	4.47	223
4. Complete Separation	1,097,925	3.2%	4.51	225

*Costs in thousands
Source: ESEI

1.) Each community would finance its own sewer rehabilitation and relief with 20-year G.O. bonds at 7% interest.

2.) Each community joining the MMSD would finance its own connecting trunk sewer with 20-year bonds at 7% interest.

3.) Both the City of Milwaukee and Shorewood would finance their own costs for CSO abatement with 20-year bonds at 7% interest. CSO costs include only CSO components, not interceptor and relief components.

4.) All program elements not identified in 1, 2, or 3 above would be financed district-wide with 20-year G.O. bonds issued by Milwaukee County at 6% interest. The debt service would be recovered by the existing contract formula and the Milwaukee County ad valorem property tax.

5.) Grant funding would be distributed proportionally among all program elements (e.g., CSO abatement, interceptors, or WWTP upgrading and expansion), regardless of which municipality assumes the financing.

Table 5.48 compares the average annual debt service of individual community financing with district-wide financing. Table 5.49 compares average tax rates. Major differences observed between the two methods of financing are discussed below:

1.) Average annual costs to the City of Milwaukee and the Village of Shorewood would be lower under the District-Wide Financing Alternative. Costs of the City of Milwaukee would decrease 30%; Shorewood's by 24%. This decrease would occur because, with district-wide financing, about $400 million for CSO abatement in these two municipalities would be distributed to all planning area communities.

2.) The average annual costs to each of the remaining MMSD communities within Milwaukee County would increase under the District-Wide Financing Alternative (relative to the Individual Community Financing Alternative). This increase would occur because these communities would share the costs of CSO abatement in the City Milwaukee and Shorewood.

3.) However, when all the average annual costs for Milwaukee County communities from 1985-2005 are totaled, the sum for the District-Wide Financing Alternative would be less than the sum for the Individual Community Financing Alternative. The bond interest rate for the District-Wide Financing Alternative is assumed to be 6%, whereas

TABLE 5.48

INDIVIDUAL COMMUNITY FINANCING VS. DISTRICT-WIDE FINANCING[1]
1985 - 2005 AVERAGE ANNUAL DEBT SERVICE

MILWAUKEE COUNTY COMMUNITIES	1 INDIVIDUAL COMMUNITY FINANCING[2]	2 DISTRICT-WIDE FINANCING[3]	3 PERCENTAGE CHANGE FROM 1 TO 2
Bayside	$ 467	$ 732	57%
Brown Deer	905	1,502	66
Cudahy	1,281	1,926	50
Fox Point	922	1,216	32
Franklin	985	1,675	70
Glendale	1,773	3,032	71
Greendale	1,188	2,039	72
Greenfield	1,871	3,149	68
Hales Corners	474	786	66
Milwaukee	59,578	41,694	-30
Oak Creek	1,563	2,685	72
River Hills	259	406	57
St. Francis	513	786	53
Shorewood	1,965	1,495	-24
Wauwatosa	4,256	6,721	58
West Allis	4,460	6,216	39
West Milwaukee	652	1,075	65
Whitefish Bay	1,214	1,880	55
Subtotal	$ 84,326	$ 79,015	-6%
CONTRACT COMMUNITIES			
Brookfield	$ 487	$ 750	54%
Butler	113	181	60
Caddy Vista	47	36	-23
Elm Grove	230	341	48
Germantown	761	684	-10
Menomonee Falls	989	1,580	60
Mequon	769	1,114	28
Muskego	574	583	2
New Berlin	1,223	1,646	35
Thiensville	164	192	17
Subtotal	$ 5,431	$ 7,107	31%

[1]All costs in thousands.

[2]Column 1 is derived from Table 4, Column 5.

[3]Column 2 is derived from Table 51, Appendix X.

Source: MMSD and ESEI

TABLE 5.49

INDIVIDUAL COMMUNITY FINANCING VS. DISTRICT-WIDE FINANCING:
1985 - 2005 AVERAGE ANNUAL EQUALIZED TAX RATES[1]

	1	+ 2	+ 3	+ 4	= 5	v. 6
MILWAUKEE COUNTY COMMUNITIES	SEWER REHABILITATION[3]	TRUNK SEWER CONNECTORS	CSO ABATEMENT[3,4]	MMSD CHARGES	COMMUNITY FINANCING ALTERNATIVE TOTAL	DISTRICT-WIDE FINANCING ALTERNATIVE TOTAL
Bayside	.24/$1000	/$1000	/$1000	2.50/$1000	2.74/$1000	4.37/$1000
Brown Deer	.15			2.50	2.65	4.37
Cudahy	.42			2.50	2.92	4.37
Fox Point	.55			2.50	3.05	4.37
Franklin	.08			2.50	2.58	4.37
Glendale	.08			2.50	2.58	4.37
Greendale	.05			2.50	2.55	4.37
Greenfield	.10			2.50	2.60	4.37
Hales Corners	.13			2.50	2.63	4.37
Milwaukee	.31		3.42	2.50	6.23	4.37
Oak Creek	.07			2.50	2.57	4.37
River Hills	.03			2.50	2.83	4.37
St. Francis	.37			2.50	2.87	4.37
Shorewood	.16		3.08	2.50	5.74	4.37
Wauwatosa	.26			2.50	2.76	4.37
West Allis	.63			2.50	3.13	4.37
West Milwaukee	.14			2.50	2.64	4.37
Whitefish Bay	.32			2.50	2.82	4.37
CONTRACT COMMUNITIES						
Brookfield[2]	.03			.36	.39	.59
Butler	.05			1.39	1.44	2.28
Caddy Vista[5]		1.63		1.32	2.95	2.26
Elm Grove	.08			.77	.85	1.27
Germantown	.04	1.13		1.35	2.52	2.22
Menomonee Falls	.04			1.14	1.18	1.86
Mequon	.04	.30		1.05	1.39	1.73
Muskego	.03	.57		.98	1.58	1.62
New Berlin	.03	.20		1.04	1.27	1.72
Thiensville	.20	.30		1.24	1.74	2.03

[1] All values are expressed in dollars per $1000 of equalized value.

[2] The tax rates for the contract communities (Brookfield through Thiensville) are based on all taxable property within the communities (e.g., only 40% of Brookfield's property is in the contract area). For commparison purposes only, this table assumes contract communities would use the property tax to pay the contract charges.

[3] These rates are subject to change depending on the results of the ongoing Sewer System Evaluation Survey.

[4] These rates are based upon the Inline Storage Alternative.

[5] Property value estimated.

Source: MMSD and ESEI

the local bond issues (for the Community Financing Alternative) are assumed to be 7%. As a result, the average annual debt service (from 1985-2005) with the Individual Community Financing Alternative would be $84 million as opposed to an average $79 million annually for the District-Wide Financing Alternative.

4.) Average annual costs for all MMSD contract communities (i.e. outside Milwaukee County), except Germantown and Caddy Vista, would be higher with the District-Wide Financing Alternative than with the Individual Community Financing Alternative. The cost increase would occur because these communities would share the cost of CSO abatement in Milwaukee and Shorewood.

5.) The tax rates for the City of Milwaukee and Shorewood would decrease with the District-Wide Financing Alternative from $6.23 and $5.74, respectively, to $4.37.

6.) Except for Germantown and Caddy Vista (discussed above), tax rates would increase for non-Milwaukee County communities with the District-Wide Financing Alternative.

Table 5.50 compares the average annual household charges by community for Milwaukee County communities with the District-Wide and Individual Community Financing Alternatives. These household costs are calculated by multiplying either the assessed tax rate times the average assessed home value or the equalized tax rate times the average equalized home value. (Both methods produce the same tax payment.) The contract communities' cost distribution methods were simulated to determine the household costs in this table.

The greatest difference between the Individual Community Financing Alternative and the District-Wide Financing Alternative is the shifting of CSO abatement costs. Assuming Milwaukee and Shorewood would finance their own CSO abatement, peak year (1990) tax rates would be $7.20 per $1,000 (equalized) for the City of Milwaukee and $6.65 (equalized) for Shorewood. These rates incorporate the proportionate funding assumption discussed above for CSO abatement. If CSO abatement received no grant funding, these peak tax rates would be $11.25 and $10.40, respectively. For a more detailed comparison of these two financing methods, the reader is referred to Section 2.0 of the Addendum to Appendix X, Fiscal/Economic Impacts.

5.2.4.11 Other Methods of Distributing Project Costs

As mentioned previously, there are other methods that could be used to distribute project costs. A use-based system

TABLE 5.50

INDIVIDUAL COMMUNITY FINANCING AND DISTRICT-WIDE FINANCING COMPARED TO NET PROPERTY TAXES: 1985 - 2005 AVERAGE ANNUAL HOUSEHOLD CHARGES

MILWAUKEE COUNTY COMMUNITIES	COMMUNITY FINANCING ALTERNATIVE	DISTRICT-WIDE FINANCING ALTERNATIVE	1981 AVERAGE NET PROPERTY TAX[1]
Bayside	$315	$503	$2,347
Brown Deer	164	271	1,457
Cudahy	150	225	1,172
Fox Point	334	478	2,376
Franklin	177	299	1,505
Glendale	194	328	1,457
Greendale	201	354	1,872
Greenfield	160	269	1,351
Hales Corners	178	295	1,553
Milwaukee	249	175	1,103
Oak Creek	149	253	1,032
River Hills	450	695	3,870
St. Francis	136	208	1,234
Shorewood	491	374	2,217
Wauwatosa	193	306	1,568
West Allis	191	267	1,558
West Milwaukee	133	221	1,179
Whitefish Bay	254	393	2,138
CONTRACT COMMUNITIES[2]			
Brookfield	86	131	1,716
Butler	25	39	1,056
Caddy Vista	126	96	N/A
Elm Grove	92	137	2,200[3]
Germantown	106	95	1,382
Menomonee Falls	79	126	1,443
Mequon	95	122	1,853
Muskego	104	105	1,132
New Berlin	79	106	1,360
Thiensville	99	116	1,517

[1]This figure is derived from the 1981 Net Tax Rates in the Citizens Government Research Bureau, Bulletin, March 7, 1981 and updated property values in Table 20 of Appendix X.

[2]This table assumes the contract communities would use their present methods of cost apportionment.

[3]1980 Average Net Property Tax

N/A: Not Available.

Source: MMSD and ESEI

could be implemented, by which each community would pay according to the percentage of the total flow they contribute to the MMSD. Another form of cost apportionment would be the ad valorem taxation of all property served by the sewer system, regardless of jurisdictional boundaries. The costs to the communities in the planning area under the use-based or service area tax systems are compared to present distribution methods in Table 5.51. The assumptions used to determine these costs are listed in Table 5.52.

A use-based distribution of MFP costs would result in an average increase of charges to contract communities of 8% over the charges associated with the Mosaic Alternative. In addition, the charges to some Milwaukee County communities would increase even more dramatically: Cudahy by 45%; Milwaukee by 20%; Oak Creek by 44%; St. Francis by 19%; and West Milwaukee by 113%. Although these communities have relatively low property values, they contribute large amounts of wastewater, which accounts for their increased costs.

The costs to the 13 remaining Milwaukee County communities would be reduced from the costs associated with the Mosaic Alternative. This reduction would range from 16% to 66%. These communities have relatively higher property values and would pay more if costs are distributed by ad valorem property taxation.

If the MFP costs are distributed by an ad valorem tax of all property in the entire MMSD sewer service area, the costs to suburbs outside Milwaukee County would increase an average of 94% over the charges imposed by the current MMSD Contract Formula. At the same time, charges to communities in Milwaukee County would decrease an average of 8%.

5.2.4.12 The EPA Preferred Alternative

Should the U.S. Supreme Court decide that the CSO abatement facilities need not be designed for the worst storm on record (a 40-year recurrence interval), the MMSD would have to comply with the DNR Stipulation (see Chapter 2). The DNR Stipulation states that if Federal and/or State financial assistance is not available, the Sewerage Commission must spend $13 million annually in 1976 dollars ($20.3 million in 1980 dollars) between 1983 and 1996 toward the CSO abatement project. After 1996, the Sewerage Commission must continue to spend the 1996 dollar equivalent of $13 million in 1976 dollars. This amount would not have to be adjusted for inflation after 1996. Because of the very low position of the CSO project on the State priority list, it is very likely that the CSO abatement would have to be financed entirely with local funds.

TABLE 5.51

ALTERNATIVE METHODS OF COST APPORTIONMENT

	(1) MMSD Recommended Plan x 1000	% of Total	(2) Flow Based	% of Total	% Change From (1)	(3) Sewer Service Area Property Tax	% of Total	% Change from (1)
Bayside	731.7	.85	258.4	.3	-65	676.3	.78	- 8
*Brookfield	750.5	.87	792.5	.92	+ 6	1,744.3	2.02	+132
Brown Deer	1,501.6	1.74	826.9	.96	-45	1,387.4	1.61	- 8
*Butler	180.9	.21	189.5	.22	+ 5	320.7	.37	+77
*Caddy Vista	35.9	.04	43.1	.05	+20	48.4	.06	+35
Cudahy	1,925.7	2.23	2,799.4	3.25	+45	1,779.7	2.1	- 8
*Elm Grove	341.5	.4	361.8	.42	+ 6	1,091.7	1.27	+220
Fox Point	1,216.4	1.41	534.0	.62	-56	1,124.5	1.3	- 8
Franklin	1,674.9	1.94	1,076.7	1.25	-36	1,547.8	1.8	- 8
*Germantown	684.1	.79	740.7	.86	+ 8	622.3	.72	- 9
Glendale	3,032.0	3.52	1,016.4	1.18	-66	2,801.3	3.25	- 8
Greendale	2,039.3	2.37	938.9	1.09	-55	1,884.7	2.19	- 8
Greenfield	3,148.9	3.66	1,610.6	1.87	-49	2,909.8	3.38	- 8
Hales Corners	785.8	.91	301.5	.35	-62	726.4	.84	- 8
*Menomonee Falls	1,580.1	1.83	1,714.1	1.99	+ 8	3,067.5	3.56	+94
*Mequon	1,113.6	1.29	1,205.9	1.4	+ 8	1,821.4	2.11	+63
Milwaukee	41,694.0	48.4	49,916.2	57.95	+20	38,534.6	44.74	- 3
*Muskego	583.0	.68	628.8	.73	+ 8	1,140.8	1.32	+96
*New Berlin	1,645.6	1.91	1,783.0	2.07	+ 8	2,899.0	3.37	+76
Oak Creek	2,684.9	3.12	3,876.2	4.5	+44	2,480.4	2.88	- 8
River Hills	406.0	.47	215.3	.25	-47	375.3	.44	- 8
St. Francis	786.0	.91	938.9	1.09	+19	726.3	.84	- 8
Shorewood	1,495.2	1.74	1,119.8	1.3	-25	1,382.1	1.6	- 8
South Milwaukee	Local		Local		Local	Local	Local	Local
*Thiensville	192.2	.22	206.7	.24	+ 7	381.7	.44	+99
Wauwatosa	6,721.3	7.80	4,668.6	5.42	-30	6,212.3	7.21	- 8
West Allis	6,216.0	7.23	5,202.7	6.04	-16	5,745.3	6.67	- 8
West Milwaukee	1,075.3	1.25	2,291.2	2.66	+113	-93.9	1.15	- 8
Whitefish Bay	1,880.4	2.18	887.2	1.03	-53	1,738.2	2.02	- 8
	86,136.7	99.99	86,145.5	100.01		86,185.8	100.06	

* Outside Milwaukee County

Source: MWPAP and ESEI

TABLE 5.52

ASSUMPTIONS FOR ALTERNATIVE FUNDING ANALYSIS

Assumptions of Mosaic Alternative (MMSD Recommended Plan)

- Existing contract formula for non-Milwaukee County Suburbs
- MMSD annual debt service (after reduced by contract communities' payments) is recovered by ad valorem taxation of Milwaukee County property.
- County equalized property valuation is assumed to rise at a real growth rate of .4% per year.

Assumptions of Flow Based Analysis

- Flows used to determine the percent of total are 1995 estimates (Base flow + I/I). The estimates are averages between 1985 and 2005 design year flows.
- Community percentages are calculated by dividing each community's 1995 flow by the total 1995 flow.
- Each community's percentage is multiplied times the MMSD average annual (1985-2005) debt service, which is about $86 million.
- No assumption is made on how the communities would distribute the cost to the household level.
- County boundaries are ignored.

Assumptions of Service Area Property Tax

- Only the property in each community that is served by the sewerage system is considered in the analysis.
- 1985-2005 average annual tax rate is $4.06 per $1000. of equalized property value.
- The tax rate is applied equally to all served property in the sewer service area regardless of jurisdictional boundaries.

Assuming that the U.S. District Court Order is overturned, the Preferred CSO abatement facilities would be designed for a 2- to 5-year storm recurrence interval (meaning that the system's capacity would be exceeded only once during the average 2- to 5-year period).

The capital cost of this alternative would range between $350 and $520 million. If between $350 and $520 million is spent at the rate of $20 million per year, $203 million would be spent by 1992 and $284 million by 1996 (in 1980 dollars). If approximately $20 million (in 1980 dollars) would be spent annually on the CSO project after 1996, a total of $350 million would be spent by 1999, $467 million by 2005, and $520 million by 2008.

The fiscal impacts of the EPA Preferred Alternative are discussed below for a district-wide as well as an individual community financing scheme and summarized in Table 5.53.

5.2.4.12.1 District-Wide Financing: With a district-wide financing arrangement, the MMSD would spend about $203 million on CSO abatement and about $1.1 billion on the balance of the EPA Preferred Alternative for a total of about $1.3 billion by 1992. Beyond 1992, the MMSD would continue to spend $20 million a year (1980 dollars) for 7 to 15 more years until between $350 and $520 million had been spent on the CSO project. The total cost for the EPA Preferred Alternative would be between $1.47 and $1.64 billion.

Assuming that the $1.3 billion is expended by 1992, that $20 million per year is spent on CSO thereafter, that the expenditures are 36% grant funded, and that G.O. bonds are issued at a 6% interest rate, the 1985-2005 average annual equalized property tax rate for Milwaukee County would be about $3.50 per $1,000 to finance the local portion.

Assuming that the $1.3 billion (and $20 million per year after 1992) would be 0% grant funded and that interest rates on the bonds would average 9%, the 1985-2005 average annual equalized tax rate would be about $6.80 per $1,000.

Thus under a district-wide financed scheme, the average annual equalized Milwaukee County tax rate (1985-2005) to finance the EPA Preferred Alternative would range from $3.50 to $6.80 per $1,000 depending upon available grant funds and prevailing interest rates on G.O. bonds.

TABLE 5.53

1985-2005 ESTIMATED AVERAGE ANNUAL EQUALIZED PROPERTY TAX RATES
TO FINANCE THE DEBT SERVICE FOR THE EPA PREFERRED ALTERNATIVE

ASSUMPTIONS	1985-2005 AVERAGE ANNUAL EQUALIZED TAX RATES PER $1000.		ANNUAL TAX ON A $50,000. HOME	
District-Wide Financed	City of Milwaukee	Milwaukee County Suburbs	City	Suburbs
36% Grant Funded 6% Interest Rate on G.O. Bonds	$3.50	$3.50	$175	$175
0% Grant Funded 9% Interest Rate on G.O. Bonds	$6.80	$6.80	$340	$340
INDIVIDUAL COMMUNITY FINANCING				
Assume 36% Grant Funded, and 6% Interest on G.O. Bonds				
Then				
CSO Project	$1.80	$0.0	$ 90	$ 0
Balance of EPA Preferred Alternative	2.80	2.80	140	140
TOTAL TAX RATE	$4.60	$2.80	$230	$140
Assume 0% Grant Funded, and 9% Interest on G.O. Bonds				
Then				
CSO Project	$3.50	$0.0	$175	$ 0
Balance of EPA Preferred Alternative	5.50	5.50	275	275
TOTAL TAX RATE	$9.00	$5.50	$450	$275

Source: ESEI

5.2.4.12.2 Individual Community Financing: If the City of Milwaukee finances the EPA Preferred CSO alternative with 36% grant funding and issues $20.3 million worth of bonds each year at 6% interest, the 1985-2005 average annual equalized tax rate would be about $1.80. The balance of the MFP would cost City of Milwaukee taxpayers another $2.80 per $1,000 equalized, increasing the total to $4.60. The rest of Milwaukee County would be taxed at a rate of about $2.80 per $1,000 equalized.

Assuming 0% grant funding and 9% interest on the bonds for both the City and the County, the City of Milwaukee would be taxed at the rate of about $9.00 per $1,000 equalized ($3.50 for CSO plus $5.50 for the balance of the EPA Preferred Alternative). The rest of Milwaukee County would be taxed at about $5.50 per $1,000 equalized.

Thus, under an Individual Community Financing arrangement, the 1985-2005 average annual equalized City of Milwaukee property tax rate to finance the EPA Preferred Alternative would range from $4.60 to $9.00, depending upon available grant funding and prevailing interest rates. The costs to the rest of Milwaukee County would range from $2.80 to $5.50 per $1,000.

With either District-Wide or Individual Community Financing, households in the contract communities would be charged about one-half as much as households in Milwaukee County suburbs (assuming the current contract formula).

5.2.5 Economic Impacts

5.2.5.1 Introduction

Any of the MFP final alternatives, except No Action, would have both positive and negative impacts on the economy of the Milwaukee area. The massive amount of money spent in the Milwaukee area to implement the MFP would have positive impacts by stimulating the economy, creating jobs, and increasing income levels. However, negative impacts would also occur because 64% of this money would come from the taxation of citizens in the Milwaukee area, thus reducing the amount of money that these taxpayers could otherwise save or spend within or outside of the region.

Any change in the region's economy affects all aspects of the area's economy. For example, contracting a construction firm to build a treatment plant could cause that firm to hire more employees in addition to purchasing the materials needed for the job. This is called a direct effect. Also, the firms that do business with the firms supplying the

construction company would be stimulated. These many levels of economic interactions, coupled with the effects of the increased consumer spending due to increased income, are called indirect or induced effects. At the same time, a reduction in spendable income due to increases in the tax rate could reduce the money being spent locally, thus having a negative indirect effect on local businesses.

The Regional Industrial Mutiplier System (RIMS) model, developed by the United States Department of Commerce, Bureau of Economic Analysis, was used by the MMSD to estimate specific economic impacts of the program. The EPA, DNR, and EIS consultant evaluated the RIMS model and determined that it was an acceptable method of evaluating potential economic impacts.

The RIMS model is a method of quantitatively estimating the total effect of a major project like the MFP on the local economy by tracking the many levels of economic effects it sets off. The RIMS model was used to measure how the MFP would affect gross output (regional economic production), earnings (income), and employment in the study area. The results of the RIMS analyses for all final alternatives were similar, so the Mosaic Alternative is used as the basis for the discussion in this chapter. For a detailed description of the RIMS model and its application to this project, the reader is referred to Appendix X, Fiscal/Economic Impacts.

Because 64% of the project costs are projected to be locally funded, both the positive and negative impacts of the project must be considered. The positive and negative impacts of the Mosaic Alternative are discussed separately and then are combined to determine the program's net impact on the local economy.

5.2.5.2 Positive Economic Impacts

The total dollar amounts of gross output, earnings, and employment stimulated by the direct and indirect effects of the Mosaic Alternative are listed below.

Gross Output = $4,544,452,000
Earnings = $1,173,626,000
Employment = 55,097 man-years

Thus, although the MFP would cost $1.6 billion, it would stimulate the local economy to increase its output by $4.5 billion. The MFP would directly and indirectly create 55,097 man-years of work increasing local earnings by $1.2 billion.

5.2.5.3 Negative Economic Impacts

The negative economic impacts of the MFP are more difficult to assess. Quantification of the negative impacts of the project requires analysis of how consumers (the taxpayers) would have spent the tax money used to support the MFP.

There are two extremes to measure the range of negative economic impacts. The "least case" assumes that none of the tax money raised to support the debt service would have been spent within the region. Therefore, there would be no ripple effect on the local economy from the lost consumer income. The negative impacts of the MFP under this "least case" assumption are shown below.

"Least Case:"

Gross Output = -$1,966,319,000
Earnings = -$ 333,584,000
Employment = -23,707 man-years

The second way that the negative impacts could be generated is termed a "worst case", which assumes that all of the money taken out of the private sector to support the debt service would have been spent in the local economy. This spending shortfall would, therefore, have repercussions throughout the local economy. Just as the $1.6 billion program expenditure multiplies into a total of $4.5 billion, the $1.97 billion spent on debt service must also be represented in its multiplied form. The $1.97 billion would ripple through the economy by way of direct and indirect effects and create a multiplied total of $5.5 billion. The same procedure was carried out for earnings and employment, listed below.

"Worst Case:"

Gross Output = -$5,525,758,000
Earnings = -$1,137,313,000
Employment = -72,197 man-years

In other words, if the negative effects of the MFP, i.e. the local burden in terms of gross output, earnings, and employment, are subjected to the same "multiplier," or ripple effect, as the positive effects, the resulting "worst case" negative effects could potentially cost $5.5 billion in gross output, $1.1 billion in earnings, and 72,197 in man-years.

The actual negative impacts of the MFP would probably fall somewhere between the "least case" and "worst case" scenarios.

5.2.5.4 Net Impacts

To measure the net impacts to the local economy of the MFP, the negative impacts are subtracted from the positive. Table 5.54 summarizes the net impact of the MFP, assuming the least and worst case scenarios. The economic impact of the MFP may be characterized as having an initial positive effect, quickly followed by a period of negative effects in the form of debt service payments.

5.2.5.5 Impacts of CSO Alternatives on Area Employment

The RIMS model was not used for the final CSO alternatives. Therefore, no method exists for quantitatively assessing and comparing the direct and indirect impacts of each final CSO alternative on the Milwaukee area economy. However, certain manpower requirements for CSO alternatives can be estimated, and statements regarding the requirements of local labor can be made.

The EIS assumes that the implementation of a CSO alternative which utilizes the local labor and materials market would have a greater positive impact on the area economy than an alternative which relies to a greater extent on non-local labor and materials. Generally, much of the sophisticated equipment and specialized labor required for cavern and deep tunnel construction is not available in the local area (this specialized labor and equipment represents only a small portion of the labor and equipment required for any alternative). Therefore, the positive employment impacts of a sewer separation alternative, which relies on more local labor, will probably be greater than the positive employment impacts of a storage alternative. The employment impacts of the Complete Sewer Separation Alternative are compated below to those of the MMSD Recommended CSO Alternative (Inline Storage) since they represent two extremes in terms of employment impacts.

According to Appendix 6D of the MMSD CSO Facility Plan, complete sewer separation would require an average of 190 construction workers per year for ten years to complete the main line sanitary sewer construction. In addition, a minimum average of 150 workers per year for ten years would be required for separating residential, commercial, and industrial buildings. The Complete Sewer Separation Alternative would require 340 (190+150) man-years per year for ten years, for a total of 3,400 (340 x 10) man-years (a man-year is employment for one person for one year; thus, this does not necessarily mean 3,400 new jobs would be created).

TABLE 5.54

NET ECONOMIC IMPACT ASSUMING LEAST CASE NEGATIVE

	Positive	- Negative	= Net Impact
Gross Output (x 1000)	$4,544,452	$1,966,319	$2,578,133
Earnings (x 1000)	$1,173,626	$ 333,584	$ 840,042
Employment (man-years)	55,097	23,707	31,390

NET ECONOMIC IMPACT ASSUMING WORST CASE NEGATIVE

	Positive	- Negative	= Net Impact
Gross Output (x 1000)	$ 544,452	$5,525,758	-$ 981,306
Earnings (x 1000)	$1,173,626	$1,137,313	$ 36,313
Employment (man-years)	55,097	72,192	17,100

Source: MMSD and ESEI

According to Chapter 8 of the MMSD CSO Facility Plan, the MMSD Recommended CSO Abatement Alternative would require an average of 310 construction-related personnel per year, for 9 years, for a total of 2,790 man-years.

The comparison would be 3,400 man-years for complete sewer separation as opposed to 2,790 man-years for the construction of new storm sewers and storage facilities (MMSD Recommended Plan). However, if it is assumed that 10% of the work force for the recommended alternative would be imported, then the comparison would be: 3,400 man-years required for complete sewer separation vs. 2,511 man-years for the MMSD Recommended CSO Alternative.

Although the Complete Sewer Separation Alternative has the potential to employ a greater number of local construction-related workers, the rather intense disruption to CSSA businesses caused by the Complete Sewer Separation Alternative could offset the positive impact of greater local employment.

It would be difficult to differentiate between the negative economic impacts of the Inline, Complete Sewer Separation, Modified CST/Inline, and Modified Total Storage Alternatives for CSO and I/I abatement because the amount of local tax dollars raised to finance construction of any of these alternatives would be nearly equal. Table 5.55 summarizes the employment impacts of the final CSO alternatives.

5.2.5.6 Tax Climate

Historically, Milwaukee and Wisconsin have had reputations as high tax areas. However, two important changes have recently been made in the state tax policy: the property tax exemption for manufacturing machinery and equipment and the exemption of inventories and livestock. These tax exemptions should affect the manufacturing sector because their taxable property will be reduced substantially. Businessmen in the manufacturing sector who were interviewed by the MMSD indicated that the machinery and equipment exemptions have changed their attitudes about Wisconsin's tax climate. The inventory exemption would have similar effects on retail and wholesale businesses.

Another factor would be the increases in property taxes that could be deducted on federal and state income tax forms. Due to recent State law changes, residential property taxes can no longer be an itemized deduction on state income tax forms. Since 1979, property taxes have been treated as a tax credit which can be claimed by all persons filing a Wisconsin State income tax return.

TABLE 5.55

CSO ALTERNATIVES: ECONOMIC IMPACTS

Inline: The 11% complete separation and 89% partial separation required could almost totally draw from the local labor supply. A small amount of non-local labor could be supplemented with local labor to satisfy the deep tunnel, dropshaft, and cavern construction.

Complete Separation: Although this alternative involves 100% separation, it would require 440 miles of sanitary sewers, as opposed to 460 miles of storm sewers, with the Inline alternative. The positive economic impacts may be slightly less than with the Inline alternative.

The local labor required for separation is nearly identical to Inline, but there would be less local labor required for near-surface facilities, soft-ground tunnels, screening structures, and access shafts (the "all other" category).

If current financing practices were applied to the analysis of the complete separation alternative, homeowners in the CSSA could be severely burdened with additional costs. Specifically, current MMSD practices require that homeowners pay for the costs of connections and repairs made from the street to the home. Under the complete separation alternative, there could be this additional fiscal burden to CSSA homeowners, unless the opinion of the MMSD Legal Staff is confirmed, that the entire MMSD would pay the costs of street-to-house connections in the CSSA.

CST/Inline: This alternative involves 120 miles of construction, with 11% complete separation, 21% partial separation, and 68% complete storage. This may have fewer positive economic impacts than Inline, but no comparison with complete separation is possible.

Total Storage: With no sewer separation, the local labor needs would be more intensified in the tunnel and storage facility construction. Positive economic impacts will be limited to the "all other" category, yielding much less of an economic benefit than Inline or CST/Inline.

5.2.5.7 Business Relocation

Taxes are often an important factor when businesses choose to locate or remain within the planning area. To study how tax increases might affect specific industries in the Milwaukee area, the EIS has relied on a MMSD survey of 47 firms and on interviews by the EIS consultant with trade associations. The businesses sampled represented each major industrial sector throughout the region. Interviews were conducted with senior executives of each participating firm.

The objectives of the MMSD survey were to provide information on the project, to discuss estimates of the firms' sewer related tax increases due to the project, and to elicit the companies reactions to the future changes.

Few of the firms surveyed indicated that the tax increases would put them at a competitive disadvantage to similar companies outside the planning area. No firm stated a desire to move outside the planning area to avoid MFP costs. This response may partly be explained by the large exemption to property valuation granted to the industrial sector.

5.2.5.8 Impacts on Selected Industries

Table 5.56 compares projected 1985 sewerage costs for selected industries with their 1979 costs. These sewerage costs include user charges for O&M and property taxes for capital debt service. For this comparison, the 31 major industrial firms were grouped into three categories: heavy machinery; breweries and dairy products; and manufacturing. For these three categories of industries, sewerage costs would increase by 24% on the average, with the highest increase (67%) in the heavy machinery industry.

In all these industries, sewerage costs are now and will continue to be only a small portion of the cost of doing business. Table 5.57 illustrates the small percentage of present and projected value added (the value of a firm's finished product less the cost of materials) attributable to sewerage costs. Only in the chemical industry are sewerage costs a significant portion of value added, and the percentage of operating cost attributable to sewer costs would not change drastically if the MFP is implemented. The effects on other industries and households are summarized below.

5.2.5.8.1 Brewing: The project would probably not have any adverse effect on the brewing industry because capital costs are recovered by property taxes and not by user charges. The brewing industry is a heavy water user, but its taxable property values are not especially high.

TABLE 5.5 6

1979 AND 1985 SEWERAGE COSTS FOR 31 INDUSTRIAL FIRMS

Description	1979 Sewerage Costs[1] (Thousands of 1980 Dollars) User Charge	Property Tax	Total	Projected 1985 Sewerage Costs[2] (Thousands of 1980 Dollars) User Charge	% Increase	Property Tax	% Increase	Total	% Increase
Costs in thousands at 1980 price levels									
Group A	$ 716.7	$506.6	$1,223.1	$ 770.5	7.5%	$1,275.1	151.7%	$2,045.6	67.2%
Group B	3,038.0	120.2	3,158.2	3,393.6	11.7%	464.1	286.1%	3,857.6	22.1%
Group C	3,572.1	23.7	3,595.8	3,920.8	9.8%	70.5	197.5%	3,991.4	11.0%
Total	$7,326.8	$650.5	$7,977.1	$8,084.9	10.3%	$1,809.6	178.2%	$9,894.6	24.0%
Cost distribution between Capital and O&M									
Group A	59%	41%	100%	38%		62%		100%	
Group B	96%	4%	100%	88%		12%		100%	
Group C	99%	1%	100%	98%		2%		100%	
Total	92%	8%	100%	82%		18%		100%	

[1]Manufacturers' and merchants' stock 50% tax exempt.
[2]Manufacturers' and merchants' stock 100% tax exempt.

Group A - Heavy Machinery
Group B - Breweries and Dairy Products
Group C - Manufacturing

Source: MMSD Wastewater System plan, EA,7-11.

TABLE 5.57

SEWERAGE COSTS AS A PERCENTAGE OF VALUE ADDED

Description	Sewerage Cost as a Percent of Estimated 1976 Value Added: 1979 Sewerage Cost[1]	Projected 1985 Sewerage Cost[2]
Heavy Machinery		
Paints and Allied Products	0.2%	0.5%
Primary Metals	0.2	0.3
Fabricated Metals	*	0.1
Machinery Except Electrical	0.1	0.1
Electric and Electronic Equipment	0.1	0.1
Transportation Equipment	*	0.1
Total	0.1%	0.2%
Beverages and Dairy Products		
Malt Beverages	0.8%	1.1%
Dairy Products	0.2	0.2
Total	0.7%	0.9%
Other Manufacturing		
Food Processing Excluding Beverages and Dairy Products	2.2%	2.5%
Paperboard Products	N/A	N/A
Misc. Chemicals	16.2	18.2
Leather Tanning	3.2	3.6
Total	4.0%	4.5%
All Groups, Total	0.3%	0.4%

*Less than 0.05%
N/A - Not Available

[1]Manufacturers' and merchants' stocks 50% tax exempt.

[2]Manufacturers' and merchants' stocks 100% tax exempt.

Source: Table 7-12
WSP: Environmental Assessment.

5.2.5.8.2 Leather Tanners: The leather tanning industry faces severe foreign competition and consequently has had great difficulty passing price increases to its customers. Interviews revealed that the projected increases in property taxes would not adversely affect this industry.

5.2.5.8.3 Construction: The MFP could create a temporary upsurge in the construction industry in Milwaukee. In 1984, employment in construction is expected to rise to a high of 3,000 man-years. The annual average through 1990 would be 1,800 man-years. This average figure would represent an increase of about 10% over average annual construction employment in the Milwaukee area over the past decade.

Representatives of the U.S. Department of Labor's Office of Construction Services, several of its branch offices, and construction experts at the U.S. EPA all concurred that the surge in employment created by the MFP is not a critical issue. The construction industry tends to have employment swings as projects are completed or new projects start up.

5.2.5.9 Impacts on Households

Household property would be the most seriously affected by increases in property taxes. This property does not have some of the benefits (e.g., inventory exemptions) which lessen the burden to industries.

Milwaukee should receive some additional state property tax credits due to the increase in property taxes associated with the MFP, which would lower the net tax levy. Homeowners who itemize their income tax deductions (usually in the middle or upper income brackets) would be able to itemize their increased property tax levy on their federal income tax forms and claim a portion of their property taxes as an income tax credit on their State income tax form. For detailed information on the fiscal impacts to households, see Appendix X, Fiscal/Economic Impacts.

5.2.5.10 Construction Impacts on Local Businesses

The construction of various components of the MFP would reduce available parking spaces and disrupt traffic patterns and access to some businesses. The MMSD has estimated that the MFP construction projects would have durations lasting from two weeks to two months per block. The disruption of traffic and access could also disturb businesses in the vicinity. Businesses which rely on impulse buying (e.g., record or book stores) would be more severely affected than those that sell necessities. Also severely affected would

be businesses that have a high business threshold (require greater numbers of daily receipts to remain solvent).

Retailers outside the central business district could also be affected by MFP construction because they must rely heavily on customers using private automobiles. The central business district has a large customer market readily available from retail, financial, and other businesses. Pedestrian access would be less disrupted than vehicular traffic.

Further discussion of impacts to traffic and access can be found in Section 5.2.12 of this volume and in the CSO Appendix.

5.2.6 Noise

5.2.6.1 No Action Alternative

The operation of wastewater treatment facilities does not significantly affect the noise levels in the planning area. Most of the WWTPs are located in residential areas, but there have been no complaints that noise levels are increased by WWTP operations. The Jones Island treatment plant is located near residential development, but it is surrounded by heavy industry; and thus noise from the WWTP is not considered a hazard.

5.2.6.2 Local, Regional and Mosaic Alternatives

The Local Alternative includes the construction of six interceptors of relief systems and three new wastewater treatment facilities as well as the rehabilitation and expansion of the Jones Island and South Shore treatment plants. In addition, five public and two private WWTPs would be upgraded or expanded. The Regional and Mosaic Alternatives include eight interceptors and the rehabilitation and expansion of the Jones Island and South Shore treatment plants. All this construction would require heavy machinery. This equipment should have internal noise muffling equipment. Construction noise would be temporary, although some construction periods could be several years; the South Shore WWTP would require three and one half years for expansion.

The MMSD has estimated that construction of sewers, dropshafts, cavern access shafts, and near-surface conveyance and storage facilities for the abatement of CSO and attenuation of peak flows would result in outdoor noise levels of approximately 55 decibels (dBA) in the A-weighted scale at a distance of 570 feet (174 m), approximately one and one-half blocks. This 55 dBA noise level has been identified by EPA as requisite to protect public health and welfare with an adequate margin of safety (U.S. EPA, MCD-20, 1976). Some blasting might be

required for tunnels and storage caverns. The durations of construction activities to abate CSO are outlined in Table 5.58.

Most sewer construction would occur in streets 50 to 90 feet (15 to 27m) from residences. Outdoor noise levels from this construction have been estimated to be in the range of 75 to 87 dBA (CSO FP). Indoor noise levels would be less (by approximately 15 dBA) due to the typical noise attenuation qualities of residential buildings. Exposure to peak sewer construction noise levels would generally be limited to a period of one to two days per residence.

The noise associated with the construction of dropshafts, cavern access shafts, and near-surface conveyance and storage silos would be in the same range as those expected for sewer construction. Noise from the construction of screening facilities for the Modified CST/Inline and Modified Total Storage Alternatives would be substantially higher due to the need for pile driving operations. The distance from residential areas to dropshafts construction sites would be greater than 600 feet (183 m) for all but four dropshafts. Of those four, one is located 100 feet (30 m) from residences, two are 200 feet (61 m) from residences, and one is 300 feet (91 m) from residences. Construction at these sensitive sites should employ the best available noise control methods. The duration of construction at these sites would be approximately one year.

In general, the CSO alternatives that involve sewer construction would cause the greatest noise disruption throughout the CSSA. However, specific locations would only be affected on a short-term basis. Conversely, facilities requiring long duration construction at specific sites could have major long-term noise impacts in sensitive residential areas. Operating noise from the treatment facilities could potentially have long-term impacts on the surrounding environment, since most of the facilities are located near residential land. However, these operations have not in the past disrupted the surrounding communities.

Noise generated during operation and maintenance of any CSO abatement component would be minimal. Most facilities would be underground, thus preventing the transmission of operation and maintenance noise to the human environment. Some minor intermittent noise would be generated by maintenance vehicles and personnel entering and leaving a particular facility. Ventilation equipment would be operated prior to entry of sewers, deep tunnels, and caverns. The noise produced by ventilation equipment could be minimized by proper vent location, baffling, and vegetative screens.

TABLE 5.58

DURATION OF CSO CONSTRUCTION ACTIVITIES

Alternative	Extent	Duration
Complete Sewer Separation	Entire CSSA affected by sewer construction within 50 feet to 90 feet of buildings.	10 years total, 1 to 2 weeks per residential block.
	15 lift stations.	6 months each
Inline Storage	Entire CSSA affected by sewer construction within 50 feet to 90 feet of buildings.	10 years total, 1 to 2 weeks per residential block.
	9 miles of near surface collector sewers.	1 to 2 weeks per residential block.
	6.5 miles of shallow tunnels w/access shaft every 1000 feet.	2-6 months per access shaft.
	14 dropshafts (no screening facilities).	1 year at each site.
	4 near surface storage facilities (without screening).	3 years each site.
	1 cavern access shaft.	3½ years at this site.
Modified CST/ Inline Storage	21% of CSSA affected by sewer construction within 50 feet to 90 feet of buildings.	1 to 2 weeks per residential block.
	9 miles of near surface collector sewers.	1-2 weeks per residential block.
	6.5 miles of shallow tunnels with access shafts every 1000 feet.	2-6 months per access shaft.
	14 dropshafts (with screening).	1 year each.
Modified CST/ Inline Storage (cont.)	4 near surface storage facilities (with screening).	3 years each.
	2 cavern access shafts.	3½ years each.
Modified Total Storage	9 miles of near surface collector sewers.	1-2 weeks per residential block.
	6.5 miles of shallow tunnels with access shafts every 1000 feet.	2-6 months per access shaft.
	14 dropshafts (with screening).	1 year each.
	4 near surface storage facilities (with screening)	3 years each
	2 cavern access shafts	3½ years each

1 Mile = 1.609 Kilometers
1 Foot = 0.3048 Meters

Source: ESEI, 1980.

Pump stations and screening facilities would present the greatest potential for producing long-term noise impacts. Proper acoustical treatment of the structures housing these facilities would limit objectionable noise to the confines of the buildings. Additional protection could be achieved by providing buffer zones with vegetative screening around the facilities.

5.2.7 Public Health

Public health concerns associated with the MFP are related to the exposure to disease-producing organisms or toxic substances. Potential risks to public health affected by the MFP include the following issues:

1. Sewerage system or treatment plant discharges of disease-producing organisms,

2. The use of chlorination for WWTP effluent disinfection,

3. Priority pollutants discharged from WWTPs,

4. Aerosal emissions from WWTPs, and

5. Groundwater quality impacts of the deep tunnel CSO abatement system.

All of these issues are discussed below.

5.2.7.1 No Action Alternative

With the No Action Alternative, untreated or inadequately treated sewage would continue to be discharged to surface waters from combined sewer overflow outfalls, dry weather and wet weather bypasses from the separate sewer systems, overloaded wastewater treatment plants, and malfunctioning septic systems.

Pathogens discharged in sewage can contaminate water and infect humans and other animals through water consumption or direct body contact. Water-borne diseases include cholera, hepatitis-A, typhoid fever, salmomellosis, and gastroenteritis. Fecal coliform bacteria are used as indicator organisms for the presence of viral, bacterial, protozoan, and fungal pathogens. The number of fecal coliform organisms in the water is an indication of the bacteriological safety of the water and the public health hazard associated with its use.

With the No Action Alternative, all major streams in the planning area, the Inner Harbor, and the Outer Harbor would continue to violate the fecal coliform standards established

by the DNR and recommended in the 208 Plan. The direct relationship between fecal coliform organisms and the actual occurance of water-borne diseases is difficult to determine. Nonetheless, the excessive fecal coliform levels expected under the No Action Alternative could pose a substantial risk to public health if these waters were consumed or used for body-contact recreational activities. Milwaukee area beaches would probably continue to be closed due to high fecal coliform levels in Lake Michigan.

Wastewater effluent is now disinfected by chlorination and this process would continue with the No Action Alternative. Chlorination produces by-products which are carcinogens or suspected carcinogens. With the No Action Alternative, the concentrations of residual chlorine in the receiving waters would be very similar to existing concentrations. Based on the limited data available, concentrations of chlorination by-products are currently well below the EPA proposed drinking water criteria.

The chlorination process does, however, pose another risk to human health due to possible accidents associated with the storage, handling, and transportation of the chlorine gas. Proper precautionary measures would minimize this risk.

There are numerous other substances that would be discharged from wastewater treatment plants which, if present in high enough concentrations, can be toxic to humans. These priority pollutants are discussed in Section 4.3 of Appendix VII, Water Quality. Concentrations of priority pollutants in the Inner Harbor, Outer Harbor, near-shore Lake Michigan, and at the Lake Michigan water supply intakes were measured in 1980. Because of the scarcity of data available, it is not possible to quantitatively predict concentrations of these priority pollutants in the future.

However, the existing data and EPA water quality criteria were used to assess the impacts of discharges from the Jones Island and South Shore WWTPs on near-shore Lake Michigan water quality. No pollutant concentrations measured exceeded the EPA criteria established to protect human health. Phthalate esters, a group of organic compounds, were detected at levels which could have chronic toxic effects on aquatic life. However, these concentrations were less than 0.2% of the concentrations determined to be toxic to humans.

Public concern has also been expressed about health hazards posed by aerosol emissions from wastewater treatment plants. Under the No Action Alternative, aerosol emissions from treatment plants would be expected to continue at approximately the existing levels. The following studies have

addressed the risks to public health associated with aerosol emissions from wastewater treatment plants:

"Health Effects of Aerosols Emitted from an Activated Sludge Plant," EPA-600/1-79-019,

"Health Implications of Sewage Treatment Facilities," EPA-600/1-78-032,

"Health Effects of a Wastewater Treatment System," EPA-700/1-78-062,

"Assessment of Disease Rates among Sewer Workers in Copenhagen, Denmark," EPA-600/1-78-007,

"Environmental Monitoring of a Wastewater Treatment Plant," EPA. In publication,

"The Evaluation of Microbiological Aerosols Associated With the Application of Wastewater to Land: Pleasonton, CA.," Department of the Army, and

"Health Risk of Human Exposure to Wastewater," EPA, in publication.

Some of the studies concluded that some wastewater treatment plants produce aerosol emissions which contain fecal coliforms, pathogens, enteroviruses, mercury, and other toxic substances. However, the studies did not indicate that the wastewater treatment plants contributed to a higher incidence of disease near the plants. Nevertheless, the presence of these organisms and substances at higher levels than would otherwise occur indicates an increased risk to public health.

5.2.7.2 Local, Regional and Mosaic Alternatives

All of the action alternatives would include abatement of CSO. These alternatives would eliminate the discharge of untreated or inadequately treated sewage to surface waters from combined sewer overflows, dry weather and wet weather bypassing from separated sewer systems, malfunctioning septic systems, and overloaded wastewater treatment plants. Thus, these alternatives would reduce the risk to public health from the discharge of pathogens. The implementation of these alternatives, together with implementation of the 208 Plan, would allow all streams in the planning area to meet both the existing DNR and 208 recommended fecal coliform standards.

Risks to public health resulting from chlorination of WWTP

effluent would be less with an action alternative than with the No Action Alternative because smaller amounts of residual chlorine would be discharged to inland streams. If the EPA recommendations (Section 3.13.6.1) are acted upon, dechlorination processes would be implemented at the Jones Island and South Shore WWTPs, further reducing inputs of chlorine to Lake Michigan.

With any action alternative, the discharge of priority pollutants to Lake Michigan would be similar to the No Action Alternative. If priority pollutants are contained within effluent discharges to inland streams, these pollutant discharges would cease when these WWTPs are abandoned.

Aerosol emissions from the Jones Island and South Shore WWTPs with the action alternatives would also be similar to the No Action Alternative. Aerosol emissions would cease from WWTPs which are abandoned. However, aersol emissions would continue from those WWTPs that would utilize land application of sewage effluent. The infiltration-percolation ponds, which would not be covered, could emit some pollutants into the atmosphere.

Public concerns have been raised about the possibility that the proposed construction of approximately 17 miles of 20- to 30-foot diameter tunnels beneath Milwaukee County may pollute groundwater. This issue is addressed in detail in an attachment to the Addendum to Appendix V, Combined Sewer Overflow which includes a study by Converse Ward Davis Dixon, Inc. The study concludes that that the escape of pollutants from the tunnels into the groundwater could be mitigated in final design. However, such mitigating measures may not be cost-effective. The study recommends a series of followup studies and procedures to minimize the impacts of the tunnels. In addition, an extensive groundwater monitoring system is recommended. If implemented, these measures should adequately protect the groundwater resources in the planning area.

5.2.8 Safety

5.2.8.1 No Action Alternative

Other than risks to the public health, safety is primarily a concern during new construction activities. Because the No Action Alternative calls for no new development, safety is not a significant issue.

5.2.8.2 Local, Regional and Mosaic Alternatives

Any major construction project poses a potential threat to

the safety of workers and the public. For the construction necessary to implement the MFP, the MMSD requires the contractor to adhere to laws and local ordinances governing safety and be responsible for the construction sites. Generally, the hazards associated with construction are temporary and they would end when work is completed. Measures to reduce safety hazards during construction are listed in Table 5.59.

There are also hazards associated with the operation of treatment facilities. Workmen or the public could be exposed to dangerous chemical or biological substances including toxic chemicals, corrosives, dust, fumes, smoke, noise, biological infective agents, and gases. Physical hazards also exist, including fire, electrical shock, falls, explosions and equipment related accidents. However, precautions are taken at existing WWTPs to minimize these dangers, and it is assumed that adequate precautions would be taken in the future.

5.2.9 Traffic and Access

5.2.9.1 No Action Alternative

Because the No Action Alternative requires no construction other than for projects now underway or projects that have received "Findings of No Significant Impact" designations, no major affect on transportation patterns or pedestrian access to residential, commercial, or industrial establishments is expected.

5.2.9.2 Local Alternative

Most of the construction activities required to implement this alternative would take place in the existing public right-of-way, mainly in streets with some use of easements and other public lands. Construction projects of this nature tend to disrupt traffic patterns, increase traffic congestion in both arterial and non-arterial streets near the construction site, decrease parking availability, and limit accessibility to residences and local commercial establishments. Table 5.60 summarizes the impacts of the program elements on traffic and access.

The Local Alternative would create impacts of both short and moderate duration. Construction activities at the Jones Island, South Shore, South Milwaukee, Caddy Vista, Muskego Northeast, New Berlin Southeast, Germantown, and Thiensville WWTPs would range from minor upgrading to complete reconstruction. It has been estimated by the MMSD that construction activities at the Jones Island WWTP would require approximately five years to complete. South Shore WWTP construction duration

TABLE 5.59

MEASURES TO REDUCE SAFETY HAZARDS
AT CONSTRUCTION SITES

1. Confer with local utilities to obtain locations and routes of all utility facilities that might interfere with the chosen route. Utilities might include water, storm and sanitary sewer, fuel, gas, steam and electricity both aerial and underground.

2. Hold traffic interference from construction activities to a minimum. This can be done by use of warning signs, obstruction lights and detouring.

3. Begin trenching and tunneling at lower end of route to help protect against flooding. Keep water out of trenches by pumping or well points.

4. Check that adequate shoring and sheeting is used at excavations.

5. Be sure that methods and equipment used for construction are the safest alternatives. (Example: Loads should not be swung over workmen's head as they work in the excavations.)

6. Sites must have a system of security to protect the public from unknowingly coming onto the site. This could be done with placement of equipment and barriers both during construction activities and off-hours.

TABLE 5.60

CONSTRUCTION IMPACTS ON TRAFFIC AND ACCESS

FACILITY	WORK INVOLVED	SEVERITY AND TYPE OF IMPACT	DURATION
CSO FACILITIES:			
A. Complete Separation	Open-cut sewer construction, public and private	Entire CSSA affected, Separation in most buildings	1 to 2 weeks per residential block, 10 yrs. total
	15 Lift stations	Minimal traffic impact Localized access impact	6 months each, 10 yr. total
B. Inline Storage	Open-cut sewer construction on public property	Entire CSSA affected within 50 to 90 feet of buildings	1 to 2 weeks per residential block, 10 yrs. total
	9 miles of near surface collector sewers	Complete disruption to the 9 mile area	1 to 2 weeks per residential block
	6.5 mi. of shallow tunnels with access shaft every 1000 ft.	Localized disruption at dropshaft sites	2-6 months per access shaft
	14 dropshafts (no screening facilities)	Localized disruption, increased truck traffic	1 year at each site
	4 near surface storage facilities (without screening)	Localized disruption, increased truck traffic	3 years each site
	4 access shafts for deep tunnel construction	10 acres of complete disruption per access shaft	3 1/2 years per access shaft
C. Modified CST/Inline Storage	Open-cut sewer construction on public property	21% of CSSA affected within 50 to 90 ft. of buildings	1 to 2 weeks per residential block
	9 mi. of near surface collector sewers	Complete disruption to the 9 mile area	1 to 2 weeks per residential block
	6.5 mi. of shallow tunnels with access shaft every 1000 ft.	Localized disruption at dropshaft sites	2-6 months per access shaft
	14 dropshafts with screening	Localized disruption, Increased truck traffic	18 months at each site
	4 near surface storage facilities with screening	Localized disruption, Increased truck traffic	3 yrs. each site
	4 cavern access shafts	10 acres of complete disruption per access shaft	3 1/2 years per access shaft
D. Modified Total Storage	9 miles of near surface collector sewers	Complete disruption to the 9 mile area	1 to 2 weeks per residential block
	6.5 mi. of shallow tunnels with access shafts every 1000 ft.	Localized disruption at access shafts	2-6 months per ac shaft
	14 dropshafts with screening	Localized disruption, Increased truck traffic	1 year each
	4 near surface storage facilities with screening	Localized disruption, Increased truck traffic	3 years each
	4 cavern acess shafts	10 acres of complete disruption per access shaft	3 1/2 years each

TABLE 5.60 (continued)

CONSTRUCTION IMPACTS ON TRAFFIC AND ACCESS

FACILITY	WORK INVOLVED	SEVERITY AND TYPE OF IMPACT	DURATION
INTERCEPTORS			
A. Open-cut	Open-cut at depths of 0 to 25 feet. Often along right-of-ways	Moderate to severe traffic disruption. Much less disruption if not constructed along a right-of-way.	About two weeks per city block. Two years total.
B. Tunnel	Tunnels with surface construction limited to shaft and storage sites	Minimal traffic impacts, but heavier equipment can be expected. Minor access problems.	Long duration at shaft sites. Two years total.
WASTEWATER TREATMENT PLANTS			
A. Jones Island WWTP	Upgrading and expansion of facility, demolition of equipment to be replaced	Slight impact caused by on-site work. WWTP is in an industrial area which is removed from major arterials	Majority of work would occur during 1982-1983, Although some work could start in mid 1981 and run through 1986
	Transportation of new equipment and construction waste in and out of WWTP	Moderate to severe over a short term period, localized near the WWTP	1981-1986 construction period
	Lakefill	Could affect Outer Harbor shipping and boating	Mid 1982 - mid 1984
	Relocation of Jones Street	Port of Milwaukee would be affected by all work involved, including street location	1981-1986 construction period
	Disposal of demolition material and construction byproducts	510,000 cubic yards would have to be disposed of	1981-1986 construction period
	Normal plant operation	This could be affected, e.g. transportation of pickle liquor, chlorine and could be a safety problem	1981-1986 construction period
B. South Shore WWTP	Upgrading and expansion of facility	Localized impact caused by transportation of new equipment into plant. Nearby residents along major tranportation routes could be impacted. Approximately 33,000 cubic yards of concrete and 36,000 cubic yards of stone and gravel would be hauled in (Alt. No. 1.)	Most construction occurs during 1982 through 1983, although some starts in mid 1981 and some ends in mid 1984
	Lakefill	Up to 510,000 cubic yards of net fill would be required. This could be a severe impact during the hauling period	Mid 1981 - mid 1982
	Normal Plant Operation	This could be impacted by bringing in construction materials	Mid 1981 - mid 1984

TABLE 5.60 (continued)

CONSTRUCTION IMPACTS ON TRAFFIC AND ACCESS

FACILITY	WORK INVOLVED	SEVERITY AND TYPE OF IMPACT	DURATION
LOCAL TREATMENT PLANTS (Caddy Vista, Germantown, Muskego, New Berlin, Thiensville, South Milwaukee)	Upgrading and expansion of facility, demolition of equipment to be replaced. Transportation of new equipment and construction waste in and out of WWTP	Increased truck traffic in and near residential areas. Noise and dust	1 to 2 years each

has been estimated to be approximately three years. The upgrading or new construction at the other local WWTPs would require one to two years. Heavy machinery and truck traffic would be the primary impacts of these construction activities.

Short-term disruption would also occur along the routes chosen to connect the Germantown, New Berlin Southeast, and Muskego WWTPs to their proposed land application sites, as well as to connect outlying portions of New Berlin to the new treatment plant site. Much of the construction of these connector sewers would be open-cut. Many routes would follow roads with average to wide right-of-ways. Traffic might be impaired, but detours would be unnecessary. Many of these connection sewers would be routed through rural and undeveloped areas and would have little impact on traffic or access.

Also included in the Local Alternative are six interceptors which would extend the MIS system within Milwaukee County (see section 3.13.2.2). The Franklin portion of the Franklin-Muskego Interceptor, Oak Creek North Branch, Underwood Creek, Root River Interceptor, the Northeast Side Relief System, and the Franklin Northeast pump station would be constructed early in the planning period. Large portions of these interceptors would be tunnelled, but some would also use open-cut construction methods.

Interceptor construction would take approximately two years. Open-cut sewers would cause moderate to severe disruptions to traffic. Portions in the Franklin-Muskego and Oak Creek North Branch would be routed through rural areas. Their impacts would be similar to those for connection to land application sites. The impacts from tunnel construction would not be as severe because surface construction would be limited to access shaft and storage sites. Heavier traffic can be expected in the area due to the large amounts of soil and concrete that must be transported for such projects. Access problems associated with tunneling would be minor. Impacts near access shafts would be of longer duration than for open-cut methods.

Construction for the Northeast Side, Underwood Creek, and Root River Interceptors would have more severe impacts because they are routed through moderately developed areas, which would increase the likelihood and severity of interruptions of access to business and residential units.

5.2.9.3 Regional and Mosaic Alternatives

Traffic and access impacts under the Regional and Mosaic Alternatives are similar to those identified under the Local

Alternative. The Jones Island and South Shore WWTPs would have the same construction durations and impacts identified above. All other WWTPs in the planning area would be abandoned under the Regional and Mosaic Alternative. Instead, connecting sewers would be constructed to transport flows from existing local plants to the MIS system. The methods for this construction would be similar to those used for interceptor construction, and thus they would have the impacts discussed for the Local Alternative. The construction of sewers would take place mainly in rural areas except for the South Milwaukee connector. This sewer would be constructed in South 5th Street in a medium residential area. This sewer would not be built under the Mosaic Alternative because the South Milwaukee WWTP would be upgraded and would continue to operate throughout the planning period.

Six MIS extension interceptors are proposed under the Local Alternative. Under both the Regional and Mosaic Alternatives, three additional interceptors would be built: Menomonee Falls-Germantown, Hales Corners, and the Muskego portion of Franklin-Muskego. The construction of Menomonee Falls-Germantown and Hales Corners Interceptors would not severely disrupt traffic and access because both interceptors would be constructed by tunneling methods. In addition, the Menomonee Falls-Germantown Interceptor would be located in a rural area. The Franklin-Muskego Interceptor portion which would serve Muskego would be constructed by open-cut methods along Forest Home Avenue and open fields in Franklin. Although the construction would disrupt traffic flow on Forest Home Avenue, it is not expected that detouring of traffic would be necessary.

Under the MMSD Recommended Plan, the Franklin-Northeast Interceptor would be constructed instead of upgrading the pump stations. If constructed, the interceptor would pass through open fields for most of its route and accordingly would not cause major traffic or access problems.

5.2.9.4 CSO/Peak Flow Alternatives

Facilities for the abatement of CSO and the attenuation of peak flows would be constructed under the Local, Regional and Mosaic Alternatives. Because these facilities would be located in areas which contain much of the major industrial and commercial activities and most of the high density residential areas in the planning area, the potential for major disruption of traffic and reduction in access exists.

The disruption to traffic, mass transit, and access to industry, commercial centers, and residential areas is discussed in detail in section 5.12 of Appendix V, Combined

Sewer Overflow. Table 5.58 outlines the duration for specific components of the different alternatives for CSO abatement and peak flow attenuation.

The Complete Sewer Separation Alternative would create the most access problems because sewer construction (most of it open-cut) would take place in 92% of the combined sewer service area (CSSA). The construction of sanitary sewers and laterals from buildings would affect access to major transportation corridors and affected properties and parking availability. About 440 miles of new sanitary sewer would be placed in street right-of-way. There are more than 500 miles of street in the CSSA. Sewer construction would necessitate the closing of some residential streets to through traffic for a minimum of two weeks. Residences with alleys would continue to have direct access to their houses during the construction period. In those areas without alleys, inhabitants would have to park their vehicles on nearby streets.

Traffic would be maintained in commercial areas; however, some lanes would be closed and on-street parking would be prohibited. The central business district would be the area most susceptable to severe traffic impacts. Mitigative measures, such as suspension of construction work during peak traffic hours and the proper sequencing of work projects, would be needed to prevent severe restrictions to traffic in this area.

The Inline Storage Alternative would cause disruption similar to the Complete Sewer Separation Alternative because the same amount of area would be affected by sewer separation. The effects would be slightly lessened because no private property work would be required.

The Modified CST/Inline Storage System would require sewer construction in only 24% of the combined area; 21% would require partial separation with no private property work, and the remaining 3% would be separated with only minor localized modifications to the existing system. Although some commercial areas would be affected, the bulk of the separation activities would take place in residential areas, minimizing short-term access problems.

The Modified Total Storage System would require only minor modifications of the existing system to complete any planned sewer separation. Impacts on access would be minimal. Sewer construction would occur in small areas in discrete corners of the service area so that only small areas would be affected at any one time.

Storage facility construction would require three to four years of construction activity. Traffic problems would be local and would be limited to the immediate vicinity of the construction site (near-surface storage site or dropshaft site). The major impact would be construction traffic.

Because construction of CSO facilities would cause congestion in the central business district and the urban areas, public transportation would be interrupted. The amount of disruption to public transit would depend on the area affected by sewer separation. Table 5.61 lists the number of bus routes affected by various CSO alternatives. The degree of severity is based on the number of total routes and importance of the routes affected.

5.2.10 Archaeological and Historical Sites

5.2.10.1 No Action Alternative

The No Action Alternative would have no impact on archaeological or historical sites in the planning area. No new construction would take place, therefore, no archaeological or historical sites would be destroyed or disturbed.

5.2.10.2 Local, Regional and Mosaic Alternatives

The planning area is rich in historic and cultural resources. Numerous historic structures reflecting a variety of architectural styles and a number of archaeological sites have been identified. Any new construction in the planning area could uncover previously unknown archaeological sites.

Cultural Field investigations along the construction corridors of the interceptor alignments have identified historical and archaeological sites which are listed in Table 5.62.

As was discussed in Chapter 4, Affected Environment, the Jones Island WWTP has been determined to be eligible for inclusion in the National Register of Historic Places. A Memorandum of Agreement (MOA) has been prepared by the MMSD, EPA, DNR, State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation in order to outline the specific actions necessary to avoid or mitigate adverse impacts to the plant during rehabilitation and expansion activities. The MOA is included in the Final EIS as Attachment A.

Based on preliminary surveys at the Jones Island site, the SHPO and the MMSD's consulting archaeologist have concurred that previous dredge, fill, and construction activities may have destroyed some significant prehistoric or historic

TABLE 5.61

BUS ROUTES AFFECTED BY CSO ALTERNATIVES

Alternatives	Routes Affected	Severity
Complete Separation	44	Extreme
Inline Storage	44	Extreme
Modified CST/Inline	17	Minor
Modified Total Storage	1	Minimal

TABLE 5.62

HISTORICAL AND ARCHAEOLOGICAL SITES IN INTERCEPTOR ROUTES

Interceptor	Type(s)	Location	Materials Recovered
Franklin-Muskego	Archaeological Site	Near Tess Corners Creek in the Construction Corridor	Prehistoric and Historic Artifacts
Underwood Creek	Prehistoric Aboriginal Sites and Historic Site	Near the Construction Corridor	
Root River	Archaeological Site	In Service Area - Site is far from the Construction Corridor Area	
	Prehistoric Aboriginal Site	In the Construction Corridor	
Oak Creek North	2 Archaeological Sites	In Service Area	Aboriginal Campsites and Worksites
Franklin-Northeast	Prehistorical Aboriginal Site	In Service Area	Prehistoric Aboriginal Occupation
	Historically Significant Structure	In Service Area	

Source: MMSD

archaeological deposits. However, as stated in the Jones Island: West Plant Preliminary Case Report, "it is not possible to demonstrate that such sites do not exist in the proposed expansion area". Controlled test excavations were, therefore, recommended. These excavations were performed in the summer of 1980 and recovered only a small amount of historic material. In view of the expense and technical problems involved, the investigating archaeologist and the SHPO recommended that no further work be done. Additional information may be found in Appendix II, Jones Island.

It is possible to generally discuss the impacts that could occur in the CSSA. It is anticipated that no standing structures would be destroyed or relocated as a result of sewer or storage facility construction. Dropshaft facilities would, however, be visible from some landmarks listed on the National Register of Historic Places. Due to the uncertainty of the impact, the SHPO should be consulted to determine the severity of these visual impacts. New gravity storm sewers would generally be placed under pavement at the same level or above the existing combined sewers. Thus, they would be located in previously disturbed material.

The proposed dropshaft sites are along the Milwaukee and Menomonee Rivers, which are also areas of relatively dense concentrations of archaeological sites. Construction activities on three to five acres for each dropshaft could disturb an unknown number of archaeological sites. Many of these dropshaft locations are in park-like open areas which may not have been disrupted by previous construction. Therefore, additional field inventories should be performed and reviewed by the SHPO prior to final design of dropshaft and storage facilities. Additional information concerning the location of the archaeological and historical sites in the CSSA may be found in Appendix V, Combined Sewer Overflow .

During construction, previously unidentified property which could be eligible for inclusion on the National Register of Historic Places may be encountered. At that time, in accordance with section 800.7 of the regulations for the Protection of Historical and Cultural Properties (36 CFR Part 800), construction would have to cease until it could be determined by the SHPO whether the site would be eligible for the National Register of Historic Places. Eligible sites must be recovered in compliance with the current Advisory Council procedures or else avoided altogether.

It is in the purview of the SHPO to be consulted during all phases of the facilities plan/environmental impact statement process. By reviewing preliminary plans for all projects, the SHPO can determine impacts on identified historical/

archaeological sites in the early stages of the project and assist in mitigating any adverse impacts. By reviewing final design specifications, the SHPO can assure compliance with federal regulations when unidentified properties are discovered during construction.

5.2.11 Recreation and Aesthetics

5.2.11.1 No Action Alternative

A decision not to take action to upgrade the sewerage system could affect recreational opportunities in the planning area. Increased flows to the WWTPs would increase the frequency of sewer overflows and bypasses, adversely affecting water quality. With a continued decline in water quality, beaches on Lake Michigan would still have to be closed occasionally to protect public health. Continued nutrient loads to the Outer Harbor, Whitnall Park Pond, Big Muskego Lake, and the near-shore portions of Lake Michigan could increase algal growth in these surface waters thereby reducing their general recreational and aesthetic value and that of adjoining parks and parkways. Floating debris in these waters as a result of sewage overflows and bypasses would also reduce their recreational and aesthetic value.

5.2.11.2 Local, Regional and Mosaic Alternatives

With implementation of any action alternative, all bypasses and overflows of inadequately treated sewage would end. Therefore, Lake Michigan beaches could be closed less frequently for sewage-related problems. Also, the abandonment of public and private WWTPs could slightly improve the appearance and recreational value of Big Muskego Lake and Whitnall Park Pond.

Nutrient loads to the area surface waters would be reduced under each alternative. Algae would continue to be present, but would be reduced in comparison to the No Action Alternative.

The abatement of CSO would reduce the amount of debris in the lower reaches of the Milwaukee and Kinnickinnic Rivers. However, debris would still be visible in these rivers from runoff and discharges outside the planning area.

With any of the action alternatives, some sewerage facilities, such as dropshafts, would have to be constructed in parks or residential areas. These facilities would be incompatible with their surroundings. In order to mitigate these potential impacts to parkland, the U.S. Department of the Interior has recommended the following actions (Minor to McGuire, 1/12/81):

"1. Vehicular and pedestrian access should be maintained. The potential for temporary entrances at new locations should be discussed with local park and recreation officials.

2. Barriers and/or buffers which minimize adverse noise impacts from construction equipment should be provided.

3. Disruption of utilities should be avoided. For example, the loss of water service might cause the closing of a swimming pool. Loss of gas or electricity could cause the closing of an entire recreational complex.

4. Vegetation in the area of construction should be protected from damage by heavy equipment. Trunks of trees should be protectively wrapped (2 by 4 lumber may be wired together and wrapped around trees for protection). Low branches which become damaged should be properly pruned. Small shrubs which might be lost should be temporarily transplanted and returned to their original location after construction.

5. All areas should be restored to the preconstruction condition. Areas left bare by construction should be reseeded of sodded. All trees and shrubs lost or damaged should be replaced with landscaping material of at least equal size, value, and utility.

6. Soil compacted as a result of heavy machinery should be scarified or otherwise loosened to promote healthy plant growth.

7. All debris and surplus materials from construction should be removed from the area as construction progresses and not as a last minute cleanup effort. All possible precautions should be taken to prevent soil poisoning by spills of toxic materials such as oils, fuels, and solvents."

There is the potential for using abandoned wastewater treatment facilities for recreational purposes. EPA encourages recreational use of wastewater treatment and conveyance facilities which are being planned, designed, and constructed. This concept of dual use has been recently emphasized to encourage community participation in the planning of wastewater treatment facilities and to provide an opportunity for the fullest utilization of every public dollar spent. There are many opportunities for dual use through the coordination and incorporation of recreation facilities and open space in the development of new wastewater treatment and conveyance systems and the modification of existing systems, particularly

in urban areas where land is at a premium.

The MMSD has recommended that the South Shore WWTP be expanded by enclosing 30 acres and filling in 12 acres of Lake Michigan to the north of the existing site. Since the expansion would take place at lake level, it should not greatly increase the visibility of the facility except to lakefront property directly adjacent to the South Shore WWTP. The MMSD plans to landscape their property thereby reducing the plant's visibility and providing a more aesthetically pleasing view. The MMSD is also investigating the possibility of integrating recreational facilities into the lakefill. This issue is discussed further in the Addendum to Appendix III, South Shore.

5.2.12 Energy Consumption

5.2.12.1 No Action Alternative

The wastewater treatment facilities in the planning area require energy to operate. Most of the energy they use is purchased as fuel oil, electricity, or natural gas, although the South Shore WWTP also produces electricity with on-site generators fueled by methane gas, a by-product of anaerobic digestion. The No Action Alternative would not significantly affect energy consumption at the WWTPs because there would be no new construction or improvements to existing facilities. It is assumed that energy consumption would increase at a rate proportional to increases in wastewater flow. Table 5.63 presents the year 2005 energy consumption of the Jones Island, South Shore, and local WWTPs, and the MMSD conveyance system. Of the estimated 2949 billion BTU (3,111 billion kJ) per year required by this alternative, natural gas would supply 78%, electricity 10.6%, and digester gas (used at the South Shore WWTP) 8.5%. The remaining 2.9% would be supplied by fuel oil and diesel fuel.

Because of the unpredictable rises of energy prices in the future, an energy cost sensitivity analysis has been prepared. This analysis evaluates how the cost of operating the sewerage facilities in the planning area would change if the cost of one energy source doubled. The analysis was conducted for each type of fuel used by the sewerage facilities. Increases in the price of natural gas were found to have the most serious consequences for the costs of operating sewerage facilities in the planning area with the No Action Alternative. A doubling of the price of natural gas would increase the cost of the energy used by these sewerage facilities by 80.3%.

TABLE 5.63
NO ACTION ALTERNATIVE
YEAR 2005 ENERGY USE
(Billion BTU)

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total
Jones Island	152.01	2196.68	0.0	76.19	0.0	2424.58
South Shore	50.06	52.88	0.0	0.0	249.83	352.77
Local WWTPs	105.80	0.0	6.0	0.78	0.0	112.58
MMSD Conveyance	17.32	0.0	0.0	0.0	0.0	17.32
Total	325.19	2249.56	6.0	76.97	249.83	2907.55

NO ACTION ALTERNATIVE
YEAR 2005 ENERGY COST
($ x 1000)

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total
Jones Island	501.5	4942.5	0.0	214.1	0.0	5658.2
South Shore	165.2	119.0	0.0	0.0	0.0	284.2
Local WWTPs	349.2	0.0	17.2	2.2	0.0	368.6
MMSD Conveyance	57.2	0.0	0.0	0.0	0.0	57.2
Total	1073.2	5061.5	17.2	216.3	0.0	6368.2

Electricity: 1 kwh = 10,500 BTU
Natural Gas: 1 Therm = 100 ft^3 = 100,000 BTU
Fuel Oil: 1 gallon = 142,500 BTU
Diesel Fuel: 1 gallon = 140,000 BTU
Digester Gas: 1 Therm = 167 ft^3 = 100,000 BTU

1 BTU = 1.06 kilojoule (kJ)

5.2.12.2 Local Alternative

The energy requirements of the Local Alternative would be less than those of the No Action Alternative. The reduction of 23.9% to 26.4% (depending on the chosen CSO alternative) would be due primarily to changes in the processes at the Jones Island WWTP. The facility now uses 2196 billion BTU of natural gas. Approximately 260 billion BTU of this amount is lost as waste heat from the sludge drying operation. The rehabilitation and expansion of the WWTP would eliminate the Milorganite process as well as the wasted energy associated with the process. In addition, anaerobic digesters would be added for sludge processing. The methane that is a by-product of this process would be converted to energy, significant ly reducing the need for natural gas.

Table 5.64 compares the energy required for the Local and No Action Alternatives. Of the estimated 2094 billion BTU (2209 billion kJ) that would be used each year by the WWTPs and the MIS system with the Local Alternative, electricity would supply 58.9% and digester gas (used whenever possible to operate treatment plants) 34.7%. The remaining 6.4% of the energy requirement would be supplied by natural gas and diesel fuel.

A sensitivity analysis was also performed for the Local Alternative. For this analysis, it was assumed that the Inline Storage Alternative would be implemented for CSO abatement and peak wastewater flow control. Energy costs with the Local Alternative would be most sensitive to variations in the cost of electricity.

5.2.12.3 Regional Alternative

With the Regional Alternative, energy consumption in the year 2005 would be reduced between 33.1% and 35.7% (depending on the chosen CSO alternative) from the requirements with the No Action Alternative. The reduction in energy use would result from the elimination of Milorganite production and the abandonment of local WWTPs. The future energy requirements are shown in Table 5.65 Of the 1825 billion BTU (1925 billion kJ) that would be used each year by the Jones Island and South Shore WWTPs and the MIS system, electricity would supply 53.5% and digester gas 39.5%. The remaining 7% would be supplied by natural gas, diesel fuel, and fuel oil.

A sensitivity analysis, assuming the implementation of the Inline Storage Alternative was performed for the Regional Alternative. This analysis determined that these energy costs would be most sensitive to variations in the price of

TABLE 5.64

LOCAL ALTERNATIVE
YEAR 2005 ENERGY USE (BILLION BTU)
COMPARED TO NO ACTION ALTERNATIVE

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total	Total No Action Alt.
Jones Island	735.63	0.0	29.61	0.0	274.15	1039.39	2424.88
South Shore	192.57	47.50	49.42	0.81	447.18	737.48	352.77
Local WWTPs	262.36	0.0	0.45	0.0	4.47	267.28	112.58
MMSD Conveyance	49.98	0.0	0.0	0.0	0.0	49.98	17.32
CSO/Peak Flow Facilities(1)	46.90	0.0	0.0	0.0	0.0	46.90	0.0
Total	1287.44	47.50	79.48	0.81	725.80	2141.03	2907.55

LOCAL ALTERNATIVE
YEAR 2005 ENERGY COST
COMPARED TO NO ACTION ALTERNATIVE
($ x 100)

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total	Total No Action Alt.
Jones Island	$2,427.6	$ 0	$ 84.7	$ 0	$ 0	$2,512.3	$5,658.2
South Shore	635.5	106.9	141.3	2.3	0	886.0	284.2
Local WWTPs	865.8	0	1.3	0	0	867.1	368.6
MMSD Conveyance	164.9	0	0	0	0	164.9	57.2
CSO/Peak Flow Facilities	154.8	0	0	0	0	154.8	0.0
Total	4,248.6	106.9	227.3	2.3	0	4,585.1	6,368.2

Electricity: 1KWH = 10,500 BTU
Fuel Oil: 1 gallon = 142,500 BTU
Digester Gas: 1 Therm = 167 ft^3 100,000 BTU
Natural Gas: 1 Therm = 100 ft^3 = 100,000 BTU
Diesel Fuel: 1 gallon = 140,000 BTU
1 BTU = 1.06 kilojoule(kJ)

(1) Assumes Inline Storage as the CSO/Peak Flow Facilities Alternative. For Comparative purposes see Table 5.63.

Source: MWPAP and ESEI

TABLE 5.65
REGIONAL ALTERNATIVE
YEAR 2005 ENERGY USE (IN BILLION BTU)
COMPARED TO THE NO ACTION ALTERNATIVE

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total	Total No Action Alt
Jones Island	735.63	0.0	29.61	0.0	274.15	1039.39	2424.58
South Shore	192.57	47.50	49.42	0.81	447.18	737.48	352.77
Conveyance	48.20	0.0	0.0	0.00	0.0	48.20	17.32
CSO/Peak Flow Facilities(1)	46.90	0.0	0.0	0.0	0.0	46.90	0.0
Total	1023.30	47.50	79.03	0.81	721.33	1871.98	2907.55*

REGIONAL ALTERNATIVE
YEAR 2005 ENERGY COST
COMPARED TO NO ACTION ALTERNATIVE
($ x 1000)

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total	Total No Action Alt
Jones Island	$2,427.6	$ 0	$ 84.7	$ 0	$ 0	$2,512.3	$5,658.2
South Shore	635.5	106.9	141.3	2.3	0	886.0	285.2
Conveyance	159.1	0	0	0	0	151.9	365.6
CSO/Peak Flow Facilities	154.8	0	0	0	0	154.8	57.2
Total	3377.0	106.9	226.0	2.3	0	3712.2	6368.2

Electricity: 1 KWH = 10,500 BTU
Natural Gas: 1 Therm = 100 ft^3 = 100,000 BTU
Fuel Oil: 1 gallon = 142,500 BTU
Diesel Fuel: 1 gallon = 140,000 BTU
Digester gas: 1 Therm = 157 ft^3 = 100,000 BTU

1 BTU = 1.06 kilojoule (kJ)

*Total includes 112.58 BTU for local plants

(1) Inline storage is assumed as the CSO/ Peak Flow Facilities Alternative. For Comparison see Table 5.63

Source: MWPAP and ESEI

electricity.

5.2.12.4 Mosaic Alternative

The Mosaic Alternative would have energy requirements very similar to the Regional Alternative. The only difference would be that the South Milwaukee WWTP would require 22.68 billion BTU (23.93 billion kJ) for operation (82% of which would be electricity), compared to 3.8 billion BTU (4.0 billion kJ) for connection to the MMSD system. Table 5.66 outlines the detailed energy requirements of the Mosaic Alternative.

The energy requirements outlined above for the Local, Regional, and Mosaic Alternatives have all assumed implementation of the Inline Storage Alternative. If another of the final four CSO abatement/peak wastewater flow control alternatives were selected, the total energy requirements of each system-level would change. Table 5.67 shows the annual energy requirements of each of the four alternatives and how their energy requirements affect the total system-level requirements of the Local, Regional,and Mosaic Alternatives.

A detailed discussion of energy requirements for the various components of the Local, Regional, and Mosaic Alternatives may be found in Appendix II, Jones Island; Appendix III. South Shore; Appendix V, Combined Sewer Overflow; Appendix VI, Local Alternatives; and Appendix VIII, Interceptor Alignment.

5.2.13 Resource Consumption

None of the Final Alternatives would affect mineral resources in the planning area.

5.2.13.1 No Action Alternative

Wastewater treatment plants consume the major portion of all resources used by sewerage facilities in the planning area, including chemicals for phosphorus control, sludge thickening, and disinfection. The resources consumed in the conveyance system are negligible. The resource consumption of the No Action Alternative was calculated by adjusting exisitng consumption by the expected future wastewater flows. Quantities required are detailed in Table 5.68.

5.2.13.2 Local Alterantive

Resource requirements for the operation of 8 public and 2 private treatment plants included in the Local Alternative are detailed in Table 5.69. It is assumed that conveyance

TABLE 5.66
MOSIAC ALTERNATIVE
YEAR 2005 ENERGY USE (BILLION BTU)
COMPARED TO THE NO ACTION ALTERNATIVE

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total	No Action Total
Jones Island	735.63	0.00	29.61	0.00	274.15	1039.39	2424.58
South Shore	192.57	47.50	49.42	0.81	447.18	737.48	352.77
South Milwaukee	18.69	0.00	0.39	0.00	3.60	22.68	112.58
Conveyance	44.00	0.00	0.00	0.00	0.00	44.00	17.58
CSO/Peak Flow Facilities (1)	46.90	0.00	0.00	0.00	0.00	46.90	0.0
Total	1037.79	47.50	76.42	0.81	724.93	1890.45	2907.55

MOSIAC ALTERNATIVE
YEAR 2005 ENERGY COSTS
COMPARED TO NO ACTION ALTERNATIVE
($ x 1000)

Facility	Electricity	Natural Gas	Diesel Fuel	Fuel Oil	Digester Gas	Total	No Action Total
Jones Island	$2,427.6	$ 0.0	$ 84.7	$0.0	$0	$2,512.3	$5,658.2
South Shore	635.5	106.9	141.3	2.3	0	886.0	284.2
South Milwaukee	61.7	0.0	1.1	0.0	0	62.8	368.6
Conveyance	145.2	0.0	0.0	0.0	0	145.2	57.2
CSO/Peak Flow Facilities	154.8	0.0	0.0	0.0	0	154.8	0.0
Total	3,424.8	106.9	227.1	2.3	0	3,761.1	6,368.2

Electricity: 1 KWH = 10,500 BTU
Natural Gas: 1 Therm = 100 ft_3 = 100,000 BTU
Fuel Oil: 1 gallon = 142,500 BTU
Diesel Fuel: 1 gallon = 140,000 BTU
Digester Gas: 1 Therm = 167 ft^3- 100,000 BTU

1 BTU = 1.06 kilojoule (kJ)

1) Inline storage is assumed as the CSO/Peak Flow Alternative. For comparison see Table 5.63.

Source: MWPAP and ESEI

TABLE 5.67

ANNUAL ENERGY REQUIREMENT

CSO/PEAK FLOW STORAGE ALTERNATIVES

	Complete Sewer Separation	Inline Storage	Modified CST/ Inline Storage	Modified Total Storage
Electricity (106 KWH)	4.30	4.47	9.29	11.30
Diesel Fuel (Gallon)	--	--	1350.00	1700.00
Equivalent Energy (109 BTU)	45.05	46.90	97.73	118.91
Local Total (109 BTU)	2139.18	2141.03	2191.86	2213.04
Regional Total (109 BTU)	1870.12	1871.97	1922.80	1943.98
Mosaic Total (109 BTU)	1888.60	1890.45	1941.28	1962.46

1 BTU= 1.06 Kilojoule (KJ)

Source: MMSD

TABLE 5.68

TREATMENT PLANT RESOURCE CONSUMPTION
NO ACTION - YEAR 2005

	Alum T/yr	Polymer T/yr	Ferric Chloride T/yr	Pickle Liquor T/yr as Fe	Chlorine T/yr
Caddy Vista	NA	NA	NA	NA	NA
Muskego NE	--	--	--	52.0	3.3
Muskego NW	--	--	--	49.2	3.2
N.B. Regal Manors	--	--	--	--	11.2
Germantown	--	--	--	94.7	6.9
Thiensville	49	0.8	--	--	2.3
School Sisters of Notre Dame	--	--	00	--	0.2
WEPCO	--	--	--	00	0.6
South Milwaukee	NA	NA	NA	NA	NA
Jones Island	--	--	1825.0	1825.0	912.5
South Shore	--	1771.5	--	1478.3	522.8
TOTAL	49	1771.5	1825.0	3499.2	1463.0

T = Tons

and CSO facilities would expend no significant resources.

Materials required for construction cannot be quantified because the plans are not specific enough at this time. Massive amounts of concrete and reinforcing steel would be required to construct the proposed facilities.

5.2.13.3 Regional Alternative

With the Regional Alternative, the Jones Island and South Shore WWTPs would treat all wastewater flows in the planning area. As a result, the annual consumption of alum, ferric chloride and polymer would be reduced. The consumption of pickle liquor and chlorine would increase from the No Action Alternative. Table 5.70 compares the resource consumption of the final alternatives.

5.2.13.4 Mosaic Alternative

The Mosiac Alternative is also similar to the Local Alternative except that only the Jones Island, South Shore, South Milwaukee, WEPCO, and School Sisters of Notre Dame WWTPs would be in operation.

A comparison of resource consumption with the Local, Regional, and Mosaic Alternatives can be found in Table 5.70.

5.2.14 Engineering Feasibility

5.2.14.1 No Action Alternative

The MMSD projected the flows that would be conveyed to each WWTP in the planning area in the year 2005, assuming that the growth forecasted by SEWRPC would occur. Analysis of each public wastewater treatment facility in the planning area was performed to determine its ability to treat these projected wastewater flows. The WWTPs were evaluated for hydraulic capability and ability to meet the tentative WPDES effluent limits set by DNR.

To determine hydraulic capacity, average daily base flows (ADBF) and maximum flows to each WWTP were reviewed. For each WWTP, the current average hydraulic capacity of each WWTP was compared to the ADBF projected over the planning period. It was determined by this evaluation that only four public treatment facilities would have the capacity to adequately treat year 2005 projected daily flows. These are the Jones Island, South Shore, South Milwaukee, and Caddy Vista WWTPs.

TABLE 5.68

RESOURCE CONSUMPTION YEAR 2005

Local System Level Alternative	Alum T/yr	Polymer T/yr	Ferric Chloride T/yr	Pickle Liquor T/yr as Fe	Act. Carbon lb/yr	Lime T/yr	Fly Ash T/yr	Chlorine T/yr	Sulfur Dioxide T/yr
Caddy Vista								1.4	
Muskego NE								24.1	
New Berlin SE								65.6	
Germantown								30.9	
Thiensville	143	0.358						5.7	
Sisters of Notre Dame								0.5	
WEPCO								1.2	
South Milwaukee		4.4	338					36.5	
Jones Island		290	2400	1697	2860	9500	6700	1055	352
South Shore		510		3030	2860			700	350
Conveyance Systems (includes MMSD collection system)									
CSO System									
TOTALS	143	800	2738	4727	5720	9500	6700	1900	702
Regional System Level Alternative									
Jones Island		290	2400	1697	2860	9500	6700	1055	352
South Shore		510		3030	2860			700	350
Conveyance Systems (includes MMSD collection system)									
CSO System									
TOTALS	0	800	2400	4727	5720	9500	6700	1755	702
Preferred System Level Alternative									
Sisters of Notre Dame								0.50	
WEPCO								1.20	
South Milwaukee		4.4	338					36.5	
Jones Island		290	2400	1697	2860	9500	6700	1055	352
South Shore		510		3030	2860			700	350
Conveyance System (includes MMSD collection system)									
CSO System									
TOTALS	0	804	2738	4727	5720	9500	6700	1793	702

The analysis of ADBF of a WWTP does not reflect the overloading that can occur during wet weather. The second analysis compared present and year 2005 maximum daily flow to each plant's peak hydraulic design capacity. This evaluation indicated that the South Milwaukee WWTP would be the only treatment facility in the planning area that would be able to adequately treat year 2005 maximum daily wastewater flows.

The DNR has set tentative effluent limits for the planning period. The future limits are equal to, or more stringent than current limits, and the only existing WWTPs that have the equipment necessary to meet them are the South Shore, Jones Island, South Milwaukee, and Thiensville WWTPs. However, Jones Island, South Shore, and Thiensville would have overloading problems during wet weather that would lead to inadequate sewage treatment and effluent violations. The South Milwaukee plant has the hydraulic capacity to treat year 2005 maximum flows, but problems in facility operation could result in occasional violations.

In addition, portions of the MMSD conveyance system are in disrepair. The failures of this system greatly contribute to the MMSD's infiltration and inflow problems. With the No Action Alternative, these sewers would continue to deteriorate throughout the planning period, thereby increasing the total volume of wastewater in the system and further taxing treatment facilities.

The eight private WWTPs that would operate under the No Action Alternative were also evaluated. Five of the WWTPs would not have the equipment to meet tentative future standards: the Cleveland Heights Grade School in New Berlin, New Berlin Memorial Hospital, the Chalet-on-the-Lake Restaurant in Mequon, the Highway 100 Drive-In Theater, and St. Martins Road Truck Stop in Franklin. Only three private treatment facilities; Wisconsin Electric Power Company (WEPCO) in Oak Creek, the School Sisters of Notre Dame in Mequon, and the Muskego Rendering Company, are meeting their current limits. Although the WWTP at the Muskego Rendering Company has recently expanded its hydraulic capacity to 83,000 gallons (314 m^3) per day, the plant discharges its effluent to absorption ponds that have a capacity of only 25,000 gallons (95 m^3) per day. The ponds are adequate for present discharge rates, but flows to the WWTP are expected to double during the planning period. With the No Action Alternative, the absorption ponds would be hydraulically overloaded. Effluent limits could also be violated due to high influent BOD. Only the WEPCO and School Sisters of Notre Dame treatment facilities would be able to treat future wastewater loadings adequately to meet the stringent year 2005 effluent limits.

5.2.14.2 Local Alternative

Although the first phase of facilities planning does not include actual design of sewerage facilities, a preliminary evaluation was made of the technical feasibility of the alternatives. This evaluation included an investigation of whether the techniques included in the alternative had been used successfully in other cities and what the consequences of a system breakdown would be. Basically, all the alternatives that survived preliminary screening could be implemented successfully. In evaluating the technical feasibility of an alternative, several assumptions had to be made. These assumptions are listed below.

1. All critical components would be provided with backup equipment for use during maintenance procedures and in the event of the component's failure.

2. All facilities would be equipped with a secondary power supply that could be used if a power failure occurred.

3. Critical components would be equipped with protective mechanisms that would relieve them in case flows increase beyond peak capacity.

4. Maintenance procedures and schedules would be developed and followed for all equipment. These procudures would include periodic inspections of all equipment and structures.

The Local Alternative would include the operation of the Jones Island and South Shore WWTPs and six smaller WWTPs. The Jones Island and South Shore WWTPs would continue to treat the majority of the wastewater flows in the planning area. The basic treatment processes at these WWTPs have been proven feasible.

The other treatment plants in the planning area would be much smaller in capacity, most less than 10 MGD (0.44 m^3/sec). These facilities would use either the activated sludge process or land application of effluent by infiltration-percolation. The activated sludge process has been widely used and is a proven wastewater treatment technique. If the facilities are properly designed and constructed, the process could be used successfully. Because activated sludge treatment uses biological organisms, flows should be fairly constant. Dramatic increases or decreases in flows could destroy the biological communities.

Land application has been proposed at the Muskego Northeast, New Berlin Southeast, and Germantown WWTPs. The infiltration-percolation technique has been used successfully for many years in climates similar to Wisconsin's. The sites for these ponds should be carefully selected based on soil quality and the depth to groundwater.

The conveyance system required by the Local Alternative would include gravity sewers and force mains. Gravity sewers do not require pumps for conveyance of wastewater flows. They are the most reliable means of conveying wastewater. If properly designed and constructed, gravity sewers would require little maintenance and would have a long service life. No difficult or innovative construction techniques would be required to install gravity sewers.

Force mains would also be constructed to implement the Local Alternative. This type of sewer requires pump stations and pressure resistant force mains. Pump stations should be equipped with multiple pumps for use during maintenance procedures, for emergency back up, and for peak flow demand. The pump stations and force mains would require more maintenance than gravity sewers.

The Complete Sewer Separation Alternative for abatement of CSO would require separation of building plumbing systems. The separation could cost up to $4,000 per house, and this cost might have to be borne by the property owner (pending a ruling on a MMSD legal staff opinion that this cost would be borne by MMSD). Property owners may be reluctant to spend that amount of money. Also, the inspection of all buildings to ensure that they are adequately separated would be difficult. Many of the buildings in the CSSA are older structures, and care should be taken to preserve their structural integrity.

All the other proposed CSO and peak flow storage alternatives would require tunnelling in both deep rock formations and in the softer, surficial glacial deposits. Deep rock deposits are generally dolomite, a limestone-like substance. While the dolomite is impervious, fissures in the rock structure can convey large amounts of groundwater. Lining of tunnels would be required but may prove unnecessary depending on the structural quality of the bedrock. Generally, the dolomite is a good construction medium with minimal need for structural bracing during construction.

Soft ground tunnels would involve more risk; tunnelling could degrade the structural quality and bearing capacities of upper layers of the geologic strata which could lead to the settling of buildings, the disruption of utilities, cracking of pavement, and, in extreme cases, the collapse of

buildings and streets. Extreme caution would be necessary for this type of construction, especially in highly urban areas.

The proposed subsurface construction would create large volumes of spoil materials. Table 5.70 gives a comparative approximation of the amount of spoil that would be generated by different alternatives. Disposal of such large amounts of material would require a well designed disposal system. The MMSD has tentatively identified four options for spoil disposal and utilization: MMSD use, public projects, marketing, and disposal.

MMSD use of spoil material is limited by the court-ordered construction schedule of the various components of the MFP. Using spoil material for the initial lakefilling at the Jones Island and South Shore WWTPs is not feasible because any lakefill that might occur at these WWTPs would be necessary prior to the major deep rock tunnel and cavern construction that would supply most of the spoil material generated by the MFP. However, the MMSD has identified the additional 18 acres of lakefill which the MMSD has proposed for possible future plant expansion as the optimum alternative for spoil disposal. MMSD preference for this alternative is largely due to the size of its fill requirement (355,000 cubic yards), its freedom from scheduling constraints, and the fact that both crushed dolomite and overburden could be used. However, there is no guarantee that this additional 18 acre lakefill will be necessary or approved. Other potential MMSD uses for the crushed dolomite include bankfill material and a concrete aggregate. In order to use the excavated dolomite for these purposes, it would have to be processed by crushing and screening.

Potential public projects which could utilize MMSD spoil material include Milwaukee Department of City Development plans to expand the Summerfest grounds and Milwaukee County Park Commission plans for filling lakefront areas between Bender Park and South Shore Park. Schedules for these projects are compatible with MMSD excavation schedules. However, these projects are still in the planning stage. Required funds and permits have not been obtained at this time.

Sale of the mineral dolomite to local quarry companies would be possible if the dolomite could not be used by the MMSD or by public projects. After processing, the dolomite could be used as construction aggregate, roadstone, railroad ballast, fill, and agricultural lime. Local quarry companies have expressed interest in purchasing the dolomite.

TABLE 5.70

SPOIL MATERIAL GENERATED[1)]

($X10^6$ cubic yards)

Alternative	Rock[2)]	Overburden	Total
Complete Sewer Separation	1.534	6.920	8.454
Inline Storage	2.876	7.368	10.244
Modified CST/ Inline Storage	5.402	3.324	8.726
Modified Total Storage	5.402	4.977	10.379

1) Includes spoil material generated for CSO abatement and peak wastewater control alternative assuming a 48% level of I/I reduction. Should conditions arise which cause the storage volumes to change, as outlined in Chapter 3, Section 3.9, the volume of spoil material would change.

2) Assumes a 1.2 expansion factor from the in-situ to the excavated state.

Note: Where excavated material meets design specifications, it may be used as backfill material.

Source: MMSD Draft Inline Storage Facility Plan, 1981. and ESEI, 1981.

Transportation costs and the potential for oversupplying the local market are problems with this option. Quarry operators in Chicago have indicated during telephone conversations with the MMSD that the sale of dolomite from the Tunnel and Reservoir Project (TARP) has influenced quarry operations in the Chicago area. Much of the excavated dolomite from TARP has been bought by quarry companies, stockpiled, and filtered into the local market slowly to help maintain a stable market. Nevertheless, some reductions in quarry operations have occurred.

It is possible that an oversupply of mined rock could also reduce operations and employment in Milwaukee area quarries. However, stockpiling and the greater than normal demand for aggregate due to MMSD construction requirements should minimize these impacts. A possible benefit of marketing the crushed dolomite would be the extension of life of existing quarries.

If none of the above uses of the excavated dolomite or removal overburden are possible, direct disposal would be necessary. Chapter NR 180 of the Wisconsin Administrative Code governs solid waste management procedures in Wisconsin. Specifically, any disposal operations must be operated in a "nuisance-free and aesthetic manner" and must avoid areas within wetlands, critical habitat areas, and areas in which operation may be detrimental to surface water or groundwater quality. Several inactive quarries in the Milwaukee area have been identified as possible disposal sites. Any selected disposal site would have to be approved by the DNR.

Regardless of how the excavated spoil is ultimately used or disposed of, it is very likely that temporary stockpiles at worksites or central storage areas would be necessary. These stockpiles would have to meet the requirements of section NR 180.07, "Storage Facility Requirements."

The availability of some construction material may be severely limited. Concrete, for example, is in short supply. In 1979, the U.S. had to import 11% of the year's demand for concrete. The deterioration of concrete producing equipment will offset capacities created by new construction of production facilities. Present concrete production capacity in the U.S. is projected to be 80 million tons (73 million metric tons) annually (ENR - 6/19/80). Table 5.71 is a summary of the concrete required for construction of most of the components for CSO and peak flow storage. As can be seen, the concrete requirements of the MFP would in some cases be in excess of 1% of the national annual concrete production.

TABLE 5.71

CONCRETE REQUIREMENTS

CSO/PEAK FLOW ALTERNATIVES **

Alternative	Concrete Required (1) Cubic Yards	Ton*
Complete Separation	261,538	529,615 (0.66%)
Inline Storage	402,589	815,242 (1.02%)
Modified CST/Inline	390,288	790,333 (0.99%)
Modified Total Storage	396,840	803,602 (0.71%)
1/2 yr. LOP Inline	282,442	571,946 (0.71%)

* Parenthetical numbers reflect percentage of U.S. Annual Concrete Production Capacity.

** Reflects requirements of sewer construction, deep tunnels, drop shafts, storage caverns, near-surface collection and storage silos. Control structures, screening facilities, drop shaft energy disapation chambers, connections to caverns, and outfall work are not included.

(1) Requirements based upon the assumption of 48% removal of I/I. Should conditions arise which cause the storage volume to change as outlined in Chapter 3, Section 3.9, these requirements would change accordingly.

Source: MMSD and ESEI

5.2.14.3 Regional Alternative

A preliminary analysis was also performed to evaluate the technical feasibility of the components of the Regional Alternative. The analysis of the technical feasibility of the Regional Alternative used the assumptions that were discussed for the Local Alternative: critical components would be provided with backup equipment, all facilities would be equipped with a secondary power supply in case of a power failure, critical components would be equipped with relief devices, and proper maintenance and inspection procedures would be followed.

With the Regional Alternative, all WWTPs in the planning area, except Jones Island and South Shore, would be abandoned. The wastewater flows that had been treated at the abandoned WWTPs would instead be conveyed to either the Jones Island or South Shore facilities. Since the flows from the abandoned WWTPs would increase flows to Jones Island and South Shore by only 5%, the processes proposed for the Local Alternative could successfully treat the increased capacity.

The wastewater flows from all abandoned WWTPs except Thiensville and Caddy Vista would be diverted to new or existing intercepting sewers. The sewers connecting the abandoned treatment facilties to the interceptors would either be gravity sewers or force mains. Both conveyance systems are feasible, although force mains would require more maintenance and backup power sources. Most interceptors would be gravity sewers.

The wastewater flows from the Thiensville WWTP would be conveyed to the Northwest Side Relief System. The sewers included in this proposed system would be designed to incorporate the flows from the Thiensville WWTP as well as the other flows in the system's service area.

The sewage flows from the abandoned Caddy Vista WWTP would be connected to a local sewer system in the southern part of the City of Oak Creek. The local sewer system could adequately handle these increased flows until late in the planning period.

5.2.14.4 Mosaic Alternative

Because the Mosaic Alternative is so similar to the Regional Alternative, the issues of technical feasibility are the same. The difference between the two alternatives would be the operation of the South Milwaukee, School Sisters of Notre Dame, and WEPCO wastewater treatment facilities. An

appraisal of these facilities (see Chapter III) indicated that they could meet future WPDES permit standards without bypassing. Therefore, these facilities are considered technically feasible.

5.2.15 Legality

The planning for the MFP has been guided by a number of legal requirements, the most significant of which are EPA and DNR regulations, the U.S. District Court Order, and the Dane County Court Stipulation. With the Local Alternative, several individual communities or sanitary districts--Thiensville, Germantown, New Berlin, Musekgo, Caddy Vista, and South Milwaukee -- would operate their own WWTPs. Accordingly, they would not be under the requirements of the U.S. District Court Order or the Dane County Stipulation, although the MMSD would still have to meet those requirements. Other legal issues affect all local system-level actions. These are discussed below for each designated management agency.

5.2.15.1 MMSD

With any final alternative, the MMSD would be responsible for four components of the MFP: the operation of the Jones Island and South Shore WWTPs, the construction of CSO and I/I abatement facilities, the construction of expansion and relief sewers, and the development of a solids disposal program. The MFP evaluated a variety of alternatives to select the final Local System-Level Alternative that would meet both the Dane County and U.S. District Court requirements and all other Federal, State, and local laws.

The key requirement of the U.S. District Court Order is the elimination of all dry and wet weather bypassing in the MMSD. All discharges of "human fecal waste from the combined sewer system must be eliminated with provision of storage for the largest storm on record since 1940." Any overflows caused by a storm of greater magnitude must receive primary treatment and disinfection before discharge. Bypassing must be eliminated at the WWTPs, and the treatment plant effluent must meet limitations stricter than EPA and DNR requirements.

MMSD appeals of this court order have lessened these requirements. On April 26, 1979, the Federal Court of Appeals in Chicago rejected the stringent effluent limits and substituted the DNR secondary effluent limits. On May 1, 1980, the U.S. Supreme Court issued a stay of the District Court and Court of Appeals rulings pending the final ruling on the case which will likely occur in 1981.

With the stay of the U.S. District Court Order, the Dane County Court Stipulation establishes the legal requirements for the MFP. The Dane County Stipulation essentially sets a schedule for actions required in order for MMSD to meet existing EPA and DNR regulations. There are four requirements the MFP must comply with: WPDES effluent limitations must be met at all WWTPs; dry and wet weather overflows from the separated sewer areas must be eliminated; a cost effective means of abating CSO and meeting applicable water quality standards must be determined; and a solids management program must be developed.

The components of the action alternatives have been developed to meet all of the requirements of both the U.S. District Court Order (as modified by the Court of Appeals) and the Dane County Court Stipulation. The recommended CSO Alternative would eliminate overflows up to the storm of record for the District Court Order and could be modified to a level to meet applicable water quality standards for the Dane County Court Stipulation, if the Supreme Court rules in favor of the MMSD. See Chapter 3, Section 3.9 for a discussion of alternatives to meet DNR water quality standards.

Two legal issues remain. The first is the District Court requirements for primary treatment and disinfection of any overflows that occur from a storm greater than the storm of record. The Inline Storage Alternative would separate combined sewers in the public right-of-way, thus reducing CSO volumes by 70% and limiting possible inflow from the remainder of the CSO system. The MMSD has recommended that screening and chlorination facilities not be built because the possibility of overflows is remote. If this portion of the District Court Order is upheld by the Supreme Court, the MMSD would have to approach the District Court for a ruling on the screening facilities.

A second question arises regarding the achievement of water quality standards required by the Dane County Court Stipulation. No MFP alternative alone would achieve these water quality standards (see Appendix VII, Water Quality). The DNR must determine whether the MMSD has to undertake further analysis of alternatives to achieve these standards or whether the issue of water quality standards could be delayed until completion of the planning stages of the MFP.

The remainder of the MMSD actions would meet EPA and DNR regulations and the two court requirements. Both Jones Island and South Shore would meet their WPDES permit effluent limits. Dry weather bypassing would be eliminated throughout the MMSD service area. Wet weather bypassing would be eliminated in the separated sewer area. Also, the

construction of facilities would proceed under the schedule imposed by the Courts.

Other executive orders and legislation establishing federal policies on wetlands, floodplains, and the protection of the cultural environment have also affected the development of the final alternatives. These issues have been addressed in separate sections of this Chapter.

5.2.15.2 Local Agencies

With the Local Alternative, Thiensville, Germantown, New Berlin, Muskego, and Caddy Vista would operate local WWTPs during the planning period. The Regional 208 Plan would have to be amended to incorporate these five communities as "designated management agencies" for treatment of sanitary sewage. Currently, only the MMSD and South Milwaukee have been so designated within the planning area.

As designated management agencies, each of the local communities would be required to prepare a facilities plan addressing specific issues of their proposed treatment facilities. Specific treatment alternatives would be developed and analyzed for cost effectiveness and possible impacts to the natural and man-made environments, as required by EPA and DNR regulations. The selected treatment alternative would have to meet WPDES effluent limits and conform to all other Federal, State, and local laws and regulations.

The treatment alternatives for the local communities analyzed as part of the MFP have been identified only as feasible concepts. If the concept is found to be part of the cost-effective, environmentally sound solution to the existing water pollution problems, it would undergo further legal analysis as part of a specific rigorous facilities plan and environmental assessment.

ATTACHMENT A

MEMORANDUM OF AGREEMENT

JONES ISLAND WWTP - WEST PLANT

Advisory Council On Historic Preservation

1522 K Street, NW
Washington, DC 20005

FEB 23 1981

Mr. Charles H. Sutfin
Director, Water Division
Environmental Protection Agency
Region V
230 South Dearborn Street
Chicago, IL 60604

Dear Mr. Sutfin:

Enclosed is the Memorandum of Agreement reflecting the agreement to mitigate the adverse effects of the Treatment Facilities Improvement Project in Milwaukee, Wisconsin, on the Jones Island West Plant reached by the consulting parties.

Please sign and date this agreement and forward it to Richard A. Erney, Wisconsin State Historic Preservation Officer, for his dated signature. Thereafter, it must be returned to the Council for ratification by the Chairman. The agreement will become final 30 days after receipt by the Chairman or earlier if ratified by the Chairman.

The ratified Memorandum of Agreement will constitute the Council's comments in accordance with Section 800.6(c)(3) and completes your responsibilities under Section 106 of the National Historic Preservation Act and the Council's regulations.

Thank you for your cooperation.

Sincerely,

Jordan E. Tannenbaum

Jordan E. Tannenbaum
Chief, Eastern Division
of Project Review

Enclosure

Advisory
Council On
Historic
Preservation

1522 K Street, NW
Washington, DC 20005

MEMORANDUM OF AGREEMENT

WHEREAS, the Environmental Protection Agency (EPA), proposes to provide funding for the improvement of sewage treatment facilities in Milwaukee, Wisconsin; and,

WHEREAS, EPA, in consultation with the Wisconsin State Historic Preservation Officer (SHPO), has determined that this undertaking as proposed would have an adverse effect upon the Jones Island West Plant, a property eligible for the National Register of Historic Places; and,

WHEREAS, pursuant to Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. Sec. 470f, as amended, 90 Stat. 1320), and Section 800.4(d) of the regulations of the Advisory Council on Historic Preservation (Council), "Protection of Historic and Cultural Properties" (36 CFR Part 800), EPA has requested the comments of the Council; and,

WHEREAS, pursuant to Section 800.6 of the Council's regulations, representatives of the Council, EPA, and the Wisconsin SHPO have consulted and reviewed the undertaking to consider feasible and prudent alternatives to avoid or satisfactorily mitigate the adverse effect;

NOW, THEREFORE, it is mutally agreed that implementation of the undertaking in accordance with the following stipulations will satisfactorily mitigate adverse effect on the above-mentioned property.

Stipulations

EPA will ensure that the following measures are carred out.

1. Prior to any demolition or alteration of the Jones Island West Plant, EPA will record the Jones Island West Plant so that there will be a permanent record of the history and present appearance of the Plant and sewage treatment process. EPA, in consultation with the Wisconsin SHPO, will first contact the National Architectural and Engineering Record (NAER) (Lake Central Region, Federal Building, Ann Arbor, Michigan 48107), to determine what documentation is required. All documentation must be accepted by NAER and the Council notified of its acceptance, prior to any demolition or alteration. EPA will also provide copies of this documentation to the Wisconsin SHPO, Milwaukee Metropolitan Sewerage District Archives, and the Milwaukee Historical Society.

2. In cooperation with the Wisconsin SHPO, EPA will prepare a brochure based on the information in the above referenced documentation. This brochure will document the significance of the Jones Island West Plant and will be made available to the general public.

3. Final plans for the proposed improvements will be developed in consultation with the Wisconsin SHPO to ensure that, to the fullest extent possible, portions of the Jones Island West Plant which can feasibly be retained will be retained and reused as part of the improved facilities.

4. Plans and specifications for any rehabilitation work needed for buildings to be retained will be developed in consultation with the Wisconsin SHPO and will be consistent with the recommended approaches in the Secretary of the Interior's "Standards for Rehabilitation."

5. Prior to any alteration or demolition of the Jones Island West Plant the Wisconsin SHPO, or his designee, the Milwaukee Historical Society will be given a reasonable opportunity to select architectural elements from the buildings or portions of buildings that will be lost through demolition or alteration for curation or use in other projects. EPA will be responsible for ensuring the careful removal of these elements and will deliver them without cost to the SHPO or the Milwaukee Historical Society. The Wisconsin SHPO will notify the Council when all selected architectural elements have been salvaged.

6. Within 90 days after completion of the project, EPA will notify the National Register of any changes in the Jones Island West Plant so that the records of this eligible property may be kept current.

7. Failure to carry out the terms of this Agreement requires that EPA again request the Council's comments in accordance with 36 CFR Part 800. If EPA cannot carry out the terms of the Agreement, it shall not take or sanction any action or make any irreversible commitment that would result in an adverse effect with respect to National Register or eligible properties covered by the Agreement or would foreclose the Council's consideration of modifications or alternatives to the proposed Treatment Facilities Improvement that could avoid or mitigate the adverse effect until the commenting process has been completed.

8. If any of the signatories to this Agreement determine that the terms of the Agreement cannot be met or believes a change is necessary, that signatory shall immediately request the consulting parties to consider an amendment or addendum to the Agreement. Such an amendment or addendum shall be executed in the same manner as the original Agreement.

9. Within 90 days after carrying out the terms of the Agreement, EPA shall provide a written report to all signatories to the Agreement on the actions taken to fulfill the terms of the Agreement.

Robert Bauer Feb 23, 1981
(Date)
Executive Director
Advisory Council on Historic Preservation

(date) 3/19/85
Environmental Protection Agency

(date)
Wisconsin State Historic Preservation Offi

(date)
Chairman
Advisory Council on Historic Preservation

GLOSSARY

GLOSSARY

Activated Sludge: Sludge floc produced in raw or settled wastewater by the growth of zoogleal bacteria and other organisms in the presence of dissolved oxygen and accumulated in sufficient concentration by returning floc previously formed.[1]

Acute Toxicity: Any toxic effect produced within a short period of time, usually up to 24-96 hours, resulting in severe biological harm and often death.[9]

Ad Valorem: A tax or duty levied in the form of percentage of value of property.[5]

ADBF: Average Daily Base Flow.

Aeration: The bringing about of intimate contact between air and a liquid by one or more of the following methods: (a) spraying the liquid in the air, (b) bubbling air through the liquid, (c) agitating the liquid to promote surface absorption of air.[1]

Aerated Lagoon: A natural or artificial wastewater treatment pond in which mechanical or diffused-air aeration is used to supplement the oxygen supply.[1]

Aerobic: Requiring, or not destroyed by, the presence of free elemental oxygen.[1]

Algae: A class of plants, including single cell plants and common sea weeds.[10]

Allocation System: Section of the Dane County stipulation requiring that the MMSD and the DNR, "establish rules and regulations to restrict the amount of wastewater discharged to the sewerage system of the District each year."[6]

Anaerobic: Requiring, or not destroyed by, the absence of air or free (elemental) oxygen.[1]

Annual Capital Expenditures: The dollar amount of bonds assumed to be issued annually to finance MMSD improvements.

Aquifer: A porous, water-bearing geologic formation, generally restricted to materials capable of yielding an appreciable supply of water.[1]

Basic Industry: Firms serving markets outside the area of their location (exporting products).

Benthos: The plant and animal life whose habitat is the bottom of a sea, lake or river.[9]

Biochemical Oxygen Demand (BOD): The quantity of oxygen used in the biochemical oxidation of organic matter in a specified time, at a specified temperature, and under specified conditions. (2) A Standard test used in assessing wastewater strength.

Biodegradable: The process of decomposing quickly as a result of the action of microorganisms.[9]

BOD: Biochemical Oxygen Demand.

Bypass: Diversion of untreated wastewater from a sewage facility into a body of water, or to the effluent channel of a wastewater treatment facility.

CFS: Cubic Feet per Second.

Chlorination: The application of chlorine to drinking water, sewage, or industrial waste for disinfection or oxidation of undesirable compounds.[9]

Chronic Toxicity: Any toxic effect which causes poisoning, death or damage to an organism by prolonged exposure which may range from several days to weeks, months, or years.[13]

Clarifiers: A unit of which the primary purpose is to reduce the concentration of suspended matter in a liquid. Usually applied to sedimentation tanks or basins.[1]

Combined Sewer: A sewer intended to receive both wastewater and storm or surface water.[1]

Construction Grants Program: Section 208 of Pl 92-500 creates a funding program for improvements to municipal wastewater treatment facilities.

CSO: Combined Sewer Overflow.

CSSA: Combined Sewer Service Area.

DATCP: Wisconsin Department of Agriculture, Trade and Consumer Protection.

DCD. Milwaukee Department of City Development.

Debt Limit: The maximum amount of debt that a governmental unit may incur under constitutional, statutory, or charter requirements. The limitation is usually a percentage of assessed valuation.[4]

Debt Service: Principal plus interest that a bond issuer pays the bond buyer over the maturity period of the bond(s).

DNR. Department of Natural Resources (Wisconsin).

DOA: Department of Administration (Wisconsin).

Draw Down Effect: A lowering of groundwater levels due to pumping.

Dry Industry: Industry that does not use or discharge large quantities of water.

Effluent: Wastewater or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or part thereof.[1]

EIS: Environmental Impact Statement.

Emergent Plants: Plants anchored below water level and growing above water level, such as a rush or cattail.

Equalized Property Value: The full market value of property as determined by the Wisconsin Department of Revenue, Bureau of Property Tax.

EPA: Environmental Protection Agency (U.S.).

Eutrophication: The normally slow aging process by which a lake evolves into a bog or marsh and utimately assumes a completely terrestrial state and disappears. During eutrophication, the lake becomes so rich in nutritive compounds, especially nitrogen and phosphorus, that algae and other microscopic plant life become super-abundant, thereby choking the lake.[9]

Exporting Industry: Firms serving markets outside the area of their location (exporting products).

Facilities Plan: Section 208 of PL 92-500 provides funding for the planning of municipal wastewater treatment. These planning documents (such as the MWPAP) are facilities plans.

Fauna: Animal life.

Fiscal Impact Analysis: An evaluation of the net public costs or revenues resulting from actual or planned growth.[2]

Flow Augmentation: The increase in stream flow by artificial means.

FNSI: Finding of No Significant Impact.

Forage Fish: Non-game fish such as the common shiner and fathead minnow.

General Obligation Bond (G.O. Bond): Validaly issued and legally binding evidence of indebtedness secured by the full faith, credit and taxing powers of the issuer.[7]

Glacial Drift: A general term for all types of glacial deposits.[3]

Grit Chamber: A dentention chamber or an enlargement of a sewer designed to reduce the velocity of flow of the liquid to permit the separation of mineral from organic solids by differential sedimentation.[1]

Groundwater: The supply of freshwater under the earth's surface in an aquifer or soil that forms the natural reservoir for Man's use.[9]

Hydraulic Head: (1) The height of a column of fluid necessary to develop a specific pressure. (2) The pressure of water at a given point in a pipe arising from the pressure in it.[11]

Hydrocarbon: Any of the class of compounds consisting solely of carbon and hydrogen.

Hydrology: The science dealing with the properties, distribution, and circulation of water and snow.[9]

I/I: Infiltration and Inflow.

Igneous Rocks: Rocks that crystallize from a melt within, Or at the surface of the earth.[3]

Indirect Fiscal Impacts: The revenues and costs to a community associated with growth inconsistent with the 208 plan.

Induced Growth: The magnitude, timing, location, and density of residential development has been projected for a proposed sewer service area, with and without the proposed sewerage facility. The difference between the two projections represents the induced growth attributable to the proposed facility.

Infill Development: Locating new development in existing urban aread, where most public services are already available.

Infiltration: (1) The flow or movement of water through the interstices or pores of a soil or other porous medium. (2) The quantity of groundwater that leaks into a pipe through joints, porous walls, or breaks.[1]

Inflow: Clearwater which enters a sewer system. Although generally rainwater entering through manholes covers and illegal drain connection, it also includes cooling water, sump pump water and other clearwater which would normally not need treatment.

Influent: Water, wastewater, or other liquid flowing into a reservoir, basin, or treatment plan, or any unit thereof.[1]

Inner Harbor: The Lake Michigan estuary-affected regions of the Milwaukee, Menomonee, and Kinnickinnic Rivers.

Interceptor Sewers: Sewers used to collect the flows from main and trunk sewers and carry them to a central point for treatment and discharge.[9]

Land Application: A process of wastewater treatment by which treated wastewater is sprayed or spread on agricultural land.

Leapfrog Development: A development pattern whereby vacant, developable areas adjacent to existing urban development are bypassed in favor of inexpensive, agricultural tracts.

Macroinvertebrates: Those animals lacking a backbone which are observable with the naked eye.

Mesotrophic: The condition of a water body which is characterized by moderate nutrient concentrations and aquatic plant growth, moderate water transparency, and occassional periods of low oxygen content.

Metamorphic Rock: Any change in the composition, texture, internal structure, etc., of a rock produced by temperature, pressure, or migrating fluids.[3]

MGD: Million Gallons per Day.

Mg/l: Milligrams per Litre.

Mixing Zone: An area contiguous to a point source pollution discharge where receiving water quality may not meet applicable water quality standards.

MMSD: Milwaukee Metropolitan Sewerage District.

MWPAP: Milwaukee Water Pollution Abatement Program.

NAAQS: National Ambient Air Quality Standards.

NEPA: National Environmental Policy Act.

Nitrification: The processes by which ammonia is oxidized to nitrite and nitrite is oxidized to nitrate.

Nitrifying Bacteria: Organisms which belong to the family Nitrobacteraceae and which are active in the processes of nitrification.

Nonpoint Source Pollution: Pollution originating from areas other than specific discrete sources. Nonpoint sources would include urban and rural storm water runoff, atmospheric deposition, livestock wastes, construction activities, and malfunctioning septic systems.

NPDES: National Pollution Discharge Elimination System.

Old Field Vegetation: An abandoned agricultural field which is undergoing succession to a grass, shrub, or forest environment.

Oligotrophic Lake: Lake or other contained water body poor in nutrient. Characterized by low quantity of planktonic algae, high water transparency with high dissolved oxygen in upper layer, adequate dissolved oxygen in deep layers, low organic deposits colored shades of brown, and absence of hydrogen sulfide in water and deposits.[1]

O&M: Operation and Maintenance.

Organic Matter: Referring to or derived from living organisms. In chemistry, any compound containing carbon.

Outer Harbor: The Lake Michigan area enclosed with the the Milwaukee breakwaters.

Overlapping Per Capita Debt: The consideration of debt from more than one municipal corporation. For example the same property may be taxed to support city debt service as well as county debt service. When the total debt from all government bodies of a local jurisdiction is divided by that jurisdiction's population, an overlapping per capita debt is obtained.

Palezoic: The second era of the geologic time scale. 230-600 million years ago.[3]

Particulates: Finely divided solid or liquid particles in the air or in an emission. Particulates include dust, smoke, fumes, mist, spray and fog.[9]

Pathogens: Disease-carrying microorganisms such as the typhus or polio viruses.

PCBs: Polychlorinated Biphenyls.

Per Capita Income: Total personal income received in an area during a year divided by the area's population.

pH: The reciprocal of the logarithm of the hydrogen-ion concentration. The concentration is the weight of hydrogen ions, in grams, per liter of solution. Neutral water, for example, has a pH value of 7 and a hydrogen-ion concentration of 10^{-7}.[1]

Phytoplankton: The floating plants of a body of water, often microscopic.

Piezometric Surface: The level to which water will rise in a tightly cased well. In an unconfined aquifer the water table represents the piezometric surface.

PPL: Project Priority List.

Precambrian: The oldest, major division in the geologic time scale; equivalent to about 90% of geologic time.[3]

Present Worth: Present worth analysis is a method of determining the present value of future money receipts and disbursements. Net Present worth equals the present worth of benefits minus the present worth of costs.

Primary Environmental Corridor: Wetlands, woodland, floodplain and wildlife habitat preserved from development by the 208 Plan.

Primary Treatment: The first stage in wastewater treatment in which substantially all floating and setteable solids are mechanically removed by screening and sedimentation.[9]

Pumpage: The withdrawal of water from an aquifer by wells or other mechanical means.

Re-aeration: The absorption of oxygen into water under conditions of oxygen deficit.[1]

Real Growth Rate: The net annual growth rate of property value after having been discounted by the inflation rate. A genuine increase in property value holding all other variables constant.

Residence Time: The time it would take for the full volume of a lake to be replaced by inflowing waters.

Residual Chlorine: The chlorine that remains following initial contact with the wastewater. Residual chlorine includes free chlorine and chloramines.

Revenue Bonds: A bond payable from charges made for services provided. The borrower obligates to operate the utility system to provide sufficient net revenues to meet the obligations of the bond issue.

RIMS: Regional Industrial Multiplier System; an input-output model developed by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). This model is used by the MWPAP to estimate the net (negative vs. positive) economic impacts of the project.

Secondary Impact: The significance of the projected induced growth is measured in relation to the growth outlined in the SEWRPC Year 2000 Land Use Plan. A secondary impact exists when the difference between the Land Use Plan and the induced growth is meaningful.

Secondary Wastewater Treatment: The treatment of wastewater by biological methods after primary treatment by sedimentation.[1]

Sewer Moratorium: A halt in the construction of sewer extensions, imposed on a community by the DNR.

SEWRPC: Southeastern Wisconsin Regional Planning Commission.

Sludge: (1) The accumulated solids separated from liquids, such as water or wastewater, during processing, or deposits on bottoms of streams or other bodies of water. (2) The precipitate resulting from chemical treatment, coagulation, or sedimentation of water or wastewater.

SMSA: Standard Metropolitan Statistical Area.

SSES: Sewer System Evaluation Study.

Suspended Solids: Solids that either float on the surface of or are in suspension in water, wastewater, or other liquids, and which are largely removable by laboratory filtering.[1]

TARP: (Tunnel And Reservoir Project) A combined sewer and flood control program under construction by the Metropolitan Sanitary District of Greater Chicago, consisting of 131 miles of tunnelled sewer and 3 aerated storage quarries.

Total Ammonia-Nitrogen: The total concentration or amount of nitrogen in the form of ammonia.

Total Nitrogen: The sum of the various forms of nitrogen compounds (e.g. nitrates, nitrites, ammonia, and organic).

Turbidity: The cloudy condition of water due to the suspension of silt or finely divided organic matter.[9]

Ultimate Biochemical Oxygen Demand (BOD ult): The measure of the total oxygen necessary to complete biologically degrade all organic matter in a water sample. The analysis procedure assumes that it is equal the BOD exerted over a 20 day period. Ultimate BOD is approximately 1.5 times as large as the BOD exerted over a 5 day period (BOD_5).

Un-ionized Ammonia: Expressed as NH_3, un-ionized ammonia has one less hydrogen ion than does the ionized ammonia, NH_4^+. The un-ionized form of ammonia is toxic to fish and aquatic life.

Urban Sprawal: The patter of low density residential development (and accompanying low population density) fostered by the availability of developable land which is easily served by public utilities and highways.

User Charge System: A system to distribute annual operation and maintenance costs of sewerage facilities to the users of the system. The MMSD's User Charge System was put into effect on January 1, 1980.

Value Added: The wholesale price of a good minus the cost of materials.

WAC: Wisconsin Administrative Code.

Water Quality Management Plan (208 Plan): General guide for water quality management in Southeastern Wisconsin, completed in 1979 by the Southeastern Wisconsin Regional Planning Commission, prepared under Section 208 of the Federal Water Pollution Control Act (PL 92-500).

WEPA: Wisconsin Environmental Policy Act.

WEPCO. Wisconsin Electric Power Company.

Wet Industry: An industry that uses and discharges large volumes of water during the manufacturing process. The discharge is referred to as process wastewater. Examples include brewing, leather tanning, and food processing.

WSP: Wastewater System Plan.

WWTP: Wastewater Treatment Plant.

Zooplankton: Planktonic animals that supply food for fish.[9]

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