# A regional water quality management plan for southeastern Wisconsin: an update and status report.

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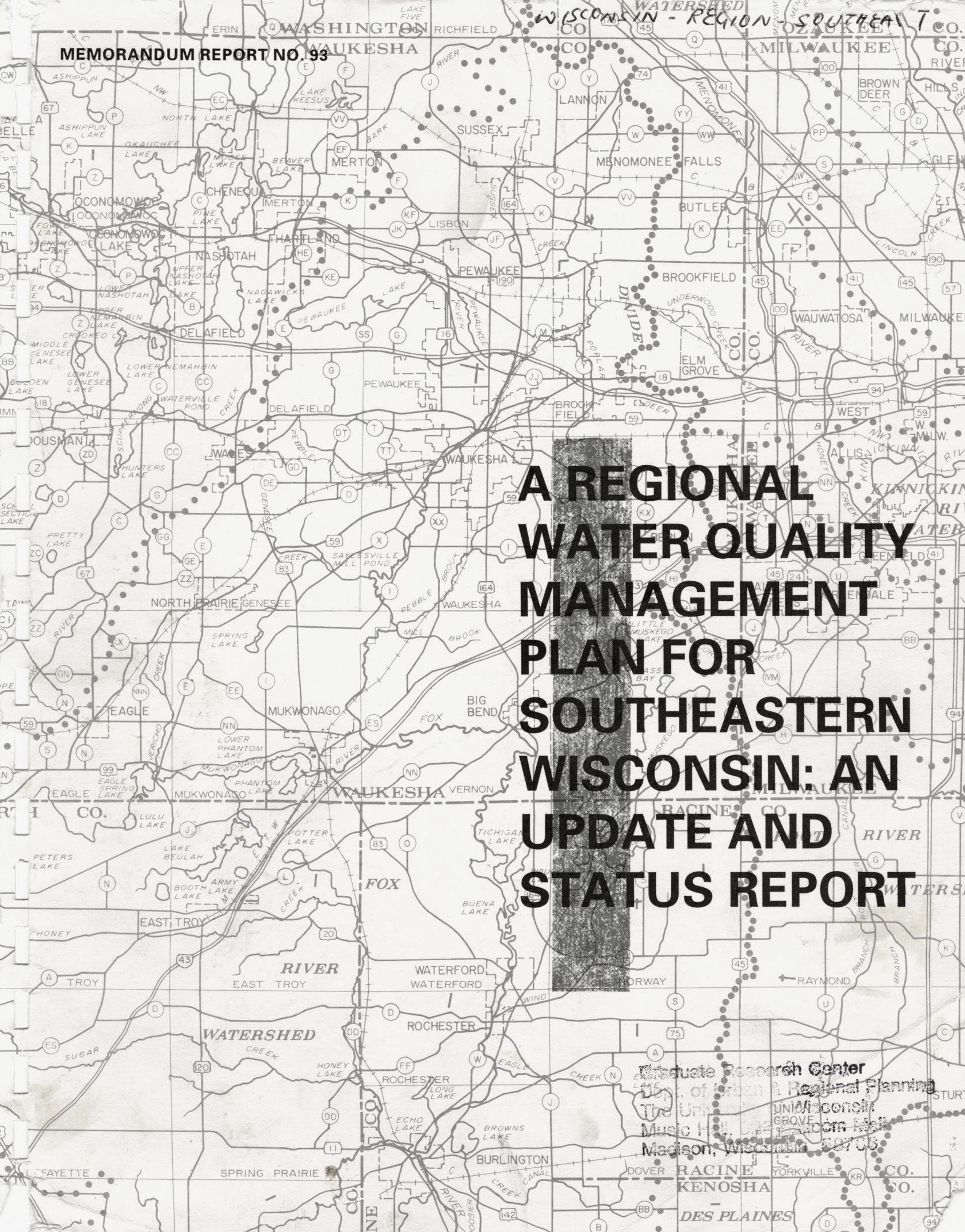
WISCONSIN - REGION - SOUTHEAST

**MEMORANDUM REPORT NO. 93**




# A REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN: AN UPDATE AND STATUS REPORT



SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Special acknowledgement is due Dr. Jeffrey A. Thornton, SEWRPC Principal Planner, Ms. Tiffany G. Lyden, SEWRPC Research Analyst, and Messrs. Edward J. Schmidt, and Theodore C. Hikade, SEWRPC Research Aides for their contributions to the conduct of this study and the preparation of this report.

MEMORANDUM REPORT
NUMBER 93

# A REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN: AN UPDATE AND STATUS REPORT

Prepared by the

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SEWRPC Memorandum Report No. 93

# REGIONAL WATER QUALITY MANAGEMENT PLANNING IN SOUTHEASTERN WISCONSIN: A PLAN UPDATE AND STATUS REPORT

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# Chapter I

# INTRODUCTION

## BACKGROUND

In 1979, the Commission completed and adopted a regional water quality management plan. The plan, designed in part to meet the Congressional mandate that the waters of the United States be made to the extent practicable "fishable and swimmable," is set forth in SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, Volume One, Inventory Findings, September 1978; Volume Two, Alternative Plans, February 1979; and Volume Three, Recommended Plan, June 1979. The plan provides recommendations for the control of water pollution from such point sources as sewage treatment plants, separate and combined sewer overflows, and industrial waste outfalls; and from such nonpoint sources as urban and rural stormwater runoff. The plan was subsequently endorsed by the Wisconsin Natural Resources Board and approved by the U. S. Environmental Protection Agency.

The regional water quality management plan is one of the more important plan elements adopted by the Commission since, in addition to providing clear and concise recommendations for the control of water pollution, it provides the basis for the continued eligibility of local units of government for Federal and State financial aids in partial support of sewerage system development and redevelopment; for the issuance of waste discharge permits by the Wisconsin Department of Natural Resources; for the review and approval of public sanitary sewer extensions by that Department; for the review and approval of private sanitary sewer extensions and large onsite sewage disposal systems and holding tanks by the Wisconsin Department of Industry, Labor and Human Relations; and for Federal and State financial assistance in support of local nonpoint source water pollution control projects.

Since adoption of the plan in 1979, the Commission has carried on a continuing regional water quality management planning program. That program is intended, to the extent that available fiscal resources permit, to meet the planning requirements set forth in Chapter NR 121 of the Wisconsin Administrative Code. Those rules envision periodic amendment, revision, and updating of the original plan as may be found necessary and desirable. This document is intended to help meet those planning requirements by providing for a restatement of the plan as updated over time through the amendment and revision process, by reporting on the extent to which the plan as amended has been implemented since its adoption, by identifying--to the extent that data are available--progress toward meeting the surface water quality objectives and supporting standards, and by identifying those issues which need to be addressed in the continuing planning process and which, therefore, may lead to further amendments, revisions, and updates of the plan.

PLAN REFINEMENT AND DETAILING EFFORTS SINCE PLAN ADOPTION

The adopted regional water quality management plan is a systems level plan intended to be refined, detailed, and, as necessary, amended through the following types of subregional planning and plan implementation efforts:

1. <u>Sewer Service Area Plans</u>
   The plan explicitly calls for the Commission to work with the designated management agencies to refine and detail the general sanitary sewer service areas identified in the original plan. These service areas are particularly important because they provide the basis for State regulatory approval of sanitary sewer extensions, and incorporate provisions attendant to the protection of environmentally sensitive lands. Since adoption of the original plan in 1979, such detailed sewer service area plans have been completed and adopted for 67 of the 85 initially identified sewer service areas.

2. <u>Detailed Sewerage Facilities Plans</u>
   The plan calls for the preparation on a case-by-case basis of detailed sewerage facility plans implementing the sewage treatment plant and trunk sewer improvements identified in the system plan. Responsibility for the preparation of these detailed plans lies with the designated management agency or agencies concerned. At times, these detailed facility planning efforts require reevaluation of system level recommendations and, therefore, may result in amendments to the system plan owing to changed circumstances.

3. <u>Detailed Nonpoint Source Pollution Abatement Plans</u>
   The plan recommends that the designated management agencies concerned prepare detailed nonpoint source pollution abatement plans to identify precisely how the quantitative nonpoint source pollution reduction goals set forth at the system level of planning can best be achieved. Since adoption of the original plan, the State of Wisconsin created a nonpoint source pollution abatement program that has served as the basis for carrying out this system plan recommendation. That program is overseen by the Wisconsin Department of Natural Resources and involves both detailed "second level" planning and funding of plan implementation efforts. In carrying out this program, the Department works closely with the designated nonpoint source pollution management agencies identified in the system plan, focusing its efforts in particular through the seven county land conservation committees.

4. <u>Comprehensive Inland Lake Water Quality Management Plans</u>
   The plan recommends that detailed inland land water quality management plans be prepared for the major lakes within the Region; that is, for those lakes having a surface water area of 50 acres or more. There are 101 such major lakes within the Region. Primary responsibility for carrying out this detailed planning lies with the designated management agencies concerned, primarily inland lake protection and rehabilitation districts.

5. <u>Special Studies</u>
   The plan also envisions that from time-to-time special in-depth studies would be undertaken to address unique water quality problems. One such major study has been completed since adoption of the original plan, that

being a comprehensive study of the Milwaukee Harbor estuary. This study had particularly important implications for the definition of the level of protection to be provided by abatement of combined sewer overflows in Milwaukee, and resulted in a recommendation to provide as well certain in-stream treatment measures.

Many of the foregoing plan refinement and detailing efforts have led over the years since adoption of the original plan to formal amendments of that plan by the Regional Planning Commission and the Wisconsin Department of Natural Resources. A list of those plan amendments, which were adopted only after public hearings and designated management agency approval, is set forth in Table I-1.

In addition to these subregional planning efforts which are intended to refine and detail and, as necessary, amend and revise the regional water quality management plan, the Commission carries on an important related regional planning effort. This effort is the regional land use planning program, which results from time-to-time in an updated and revised regional land use plan. The original regional water quality management plan directly incorporated the second generation regional land use plan that had been adopted by the Commission in 1978. Under the continuing regional planning program, the Commission prepared and adopted in 1991 a third generation regional land use plan. That plan also stands as an amendment to the systems level regional water quality management plan, and is being incorporated into the detailed sanitary sewer area plans as those plans are prepared initially and revised from time-to-time.

## SCHEME OF PRESENTATION

As noted above, this report has as its basic purpose restating the regional water quality management plan as updated over time through the amendment and revision process, and identifying issues which remain to be addressed in the continuing planning process. Toward this end, the remainder of this report has been organized as follows:

1. Chapter II--Surface Water Resources, Water Use Objectives and Standards, and Data Sources and Analytical Procedures
   Chapter II provides an overview of the surface water resources in the Region and includes a discussion of the water use objectives and standards that apply to those resources. In addition, the chapter describes the procedures and data sources used to evaluate, to the extent possible given available data, the degree to which the water use objectives in the Region have been met since adoption of the original plan.

2. Chapter III--Land Use Plan Element
   Chapter III provides a brief description of the land use element of the regional water quality management plan, that element being the third generation regional land use plan.

3. Chapters IV Through XV--Regional Water Quality Management Plan Status Report and Update for Each to the Twelve Watersheds in Southeastern Wisconsin
   These 12 chapters provide, for each of the 12 major watersheds of the Region, the following information:

## Table I-1

### AMENDMENTS TO THE REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN: 1979-1993

| Plan Element | Plan Document | SEWRPC Date of Adoption | WDNR Date of Adoption |
|---|---|---|---|
| Regional Water Quality Management Plan | Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin, Volume One, Inventory Findings; Volume Two, Alternative Plans; Volume Three, Recommended Plan | July 12, 1979 | August 2, 1979 |
| Amendment—Root River Watershed | Community Assistance Planning Report No. 37, A Nonpoint Source Water Pollution Control Plan for the Root River Watershed | March 6, 1980 | March 5, 1980 |
| Amendment—Walworth County Metropolitan Sewerage District | Community Assistance Planning Report No. 56 (2nd Edition), Sanitary Sewer Service Areas for the Walworth County Metropolitan Sewerage District, Walworth County, Wisconsin | December 4, 1991 | -- |
| Amendment—Cities of Brookfield and Waukesha | Amendment to the Regional Water Quality Management Plan—2000, Cities of Brookfield and Waukesha | December 3, 1981 | February 2, 1982 |
| Amendment—City of Muskego | Community Assistance Planning Report No. 64 (2nd Edition), Sanitary Sewer Service Area for the City of Muskego | March 3, 1986 | March 20, 1987 |
| Amendment—Ashippun Lake, Waukesha County | Community Assistance Planning Report No. 48, A Water Quality Management Plan for Ashippun Lake, Waukesha County, Wisconsin | September 9, 1982 | February 3, 1983 |
| Amendment—Okauchee Lake, Waukesha County | Community Assistance Planning Report No. 53, A Water Quality Management Plan for Okauchee Lake, Waukesha County, Wisconsin | September 9, 1982 | February 3, 1983 |
| Amendment—Lac La Belle, Waukesha County | Community Assistance Planning Report No. 47, A Water Quality Management Plan for Lac La Belle, Waukesha County, Wisconsin | September 9, 1982 | February 3, 1983 |
| Amendment—North Lake, Waukesha County | Community Assistance Planning Report No. 54, A Water Quality Management Plan for North Lake, Waukesha County, Wisconsin | December 2, 1982 | February 3, 1983 |
| Amendment—City of West Bend | Community Assistance Planning Report No. 35, Sanitary Sewer Service Area for the City of West Bend, Washington County, Wisconsin | December 2, 1982 | June 5, 1984 |
| Amendment—Village of Grafton | Amendment to the Regional Water Quality Management Plan—2000, Village of Grafton | December 2, 1982 | February 7, 1983 |
| Amendment—City of Brookfield | Amendment to the Regional Water Quality Management Plan—2000, City of Brookfield | December 2, 1982 | September 13, 1984 |
| Amendment—Village of Sussex | Community Assistance Planning Report No. 84, Sanitary Sewer Service Area for the Village of Sussex, Waukesha County, Wisconsin | June 16, 1983 | March 12, 1984 |
| Amendment—Village of Germantown | Community Assistance Planning Report No. 70, Sanitary Sewer Service Area for the Village of Germantown, Washington County, Wisconsin | September 8, 1983 | March 19, 1984 |
| Amendment—Village of Saukville | Community Assistance Planning Report No. 90, Sanitary Sewer Service Area for the Village of Saukville, Ozaukee County, Wisconsin | December 1, 1983 | May 23, 1984 |
| Amendment—City of Port Washington | Community Assistance Planning Report No. 95, Sanitary Sewer Service Area for the City of Port Washington, Ozaukee County, Wisconsin | December 1, 1983 | June 7, 1984 |
| Amendment—Belgium Area | Amendment to the Regional Water Quality Management Plan—2000, Onion River Priority Watershed Plan | December 1, 1983 | January 18, 1984 |
| Amendment—Geneva Lake Area | Amendment to the Regional Water Quality Management Plan—2000, Geneva Lake Area Communities | December 1, 1983 | October 5, 1987 |
| Amendment—Village of Butler | Community Assistance Planning Report No. 99, Sanitary Sewer Service Area for the Village of Butler, Waukesha County, Wisconsin | March 1, 1984 | April 30, 1984 |
| Amendment—City of Hartford | Community Assistance Planning Report No. 92, Sanitary Sewer Service Area for the City of Hartford, Washington County, Wisconsin | June 21, 1984 | October 26, 1984 |
| Amendment—Mukwonago Area | Amendment to the Regional Water Quality Management Plan—2000, Village of Mukwonago, Towns of East Troy and Mukwonago | June 21, 1984 | August 30, 1984 |

Table 1 (continued)

| Plan Element | Plan Document | SEWRPC Date of Adoption | WDNR Date of Adoption |
|---|---|---|---|
| Amendment—Village of Fredonia | Community Assistance Planning Report No. 96, Sanitary Sewer Service Area for the Village of Fredonia, Ozaukee County, Wisconsin | September 13, 1984 | October 11, 1984 |
| Amendment—Village of East Troy | Community Assistance Planning Report No. 112 (2nd Edition), Sanitary Sewer Service Area for the Village of East Troy and Environs, Walworth County, Wisconsin | June 16, 1993 | October 20, 1993 |
| Amendment—City of Milwaukee | Amendment to the Regional Water Quality Management Plan—2000, City of Milwaukee | September 13, 1984 | December 19, 1984 |
| Amendment—Town of Pleasant Prairie | Community Assistance Planning Report No. 88, A Land Use Management Plan for the Chiwaukee Prairie-Carol Beach Area of the Town of Pleasant Prairie, Kenosha County, Wisconsin | March 11, 1985 | October 21, 1985 |
| Amendment—Village of Belgium | Community Assistance Planning Report No. 97 (3rd Edition), Sanitary Sewer Service Area for the Village of Belgium, Ozaukee County, Wisconsin | September 15, 1993 | October 15, 1993 |
| Amendment—Town of Addison | Community Assistance Planning Report No. 103, Sanitary Sewer Service Area for the Allenton Area, Washington County, Wisconsin | March 11, 1985 | August 8, 1985 |
| Amendment—Town of Yorkville | Amendment to the Regional Water Quality Management Plan—2000, Town of Yorkville | March 11, 1985 | August 8, 1985 |
| Amendment—Village of Williams Bay | Amendment to the Regional Water Quality Management Plan—2000, Village of Williams Bay/Walworth County Metropolitan Sewerage District | March 11, 1985 | September 30, 1985 |
| Amendment—Town of Trenton City of West Bend | Amendment to the Regional Water Quality Management Plan—2000, City of West Bend/ Town of Trenton | March 11, 1985 | July 10, 1985 |
| Amendment—Village of Hartland | Community Assistance Planning Report No. 93, Sanitary Sewer Service Area for the Village of Hartland, Waukesha County, Wisconsin | June 17, 1985 | July 11, 1986 |
| Amendment—Village of Jackson | Community Assistance Planning Report No. 124, Sanitary Sewer Service Area for the Village of Jackson, Washington County, Wisconsin | June 17, 1985 | July 11, 1986 |
| Amendment—Pewaukee Area | Community Assistance Planning Report No. 113, Sanitary Sewer Service Area for the Town of Pewaukee Sanitary District No. 3, Lake Pewaukee Sanitary District, and Village of Pewaukee, Waukesha County, Wisconsin | June 17, 1985 | July 11, 1986 |
| Amendment—City of Waukesha | Community Assistance Planning Report No. 100, Sanitary Sewer Service Area for the City of Waukesha and Environs, Waukesha County, Wisconsin | December 2, 1985 | November 20, 1987 |
| Amendment—Village of Slinger | Community Assistance Planning Report No. 128 (2nd Edition), Sanitary Sewer Service Area for the Village of Slinger, Washington County, Wisconsin | September 15, 1993 | April 26, 1994 |
| Amendment—Kenosha Area | Community Assistance Planning Report No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin | December 2, 1985 | August 31, 1987 |
| Amendment—Town of Eagle | Amendment to the Regional Water Quality Management Plan—2000, Eagle Spring Lake Sanitary District | December 2, 1985 | November 2, 1987 |
| Amendment—Town of Salem | Community Assistance Planning Report No. 143, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin | March 3, 1986 | December 11, 1986 |
| Amendment—Friess Lake, Washington County | Community Assistance Planning Report No. 98, A Water Quality Management Plan for Friess Lake, Washington County, Wisconsin | March 3, 1986 | October 5, 1987 |
| Amendment—Geneva Lake, Walworth County | Community Assistance Planning Report No. 60, A Water Quality Management Plan for Geneva Lake, Walworth County, Wisconsin | March 3, 1986 | October 5, 1987 |
| Amendment—Pewaukee Lake, Waukesha County | Community Assistance Planning Report No. 58, A Water Quality Management Plan for Pewaukee Lake, Waukesha County, Wisconsin | March 3, 1986 | October 5, 1987 |

## Table 1 (continued)

| Plan Element | Plan Document | SEWRPC Date of Adoption | WDNR Date of Adoption |
|---|---|---|---|
| Amendment—Waterford/ Rochester Area | Community Assistance Planning Report No. 141, Sanitary Sewer Service Area for the Waterford/ Rochester Area, Racine County, Wisconsin | June 16, 1986 | December 9, 1986 |
| Amendment—City of Burlington | Community Assistance Planning Report No. 78, Sanitary Sewer Service Area for the City of Burlington, Racine County, Wisconsin | June 16, 1986 | July 13, 1987 |
| Amendment—City of Waukesha/Town of Pewaukee | Amendment to the Regional Water Quality Management Plan—2000, City of Waukesha/ Town of Pewaukee | December 1, 1986 | November 20, 1987 |
| Amendment—Salem/Paddock Lake/Bristol Area | Community Assistance Planning Report No. 145, Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin | December 1, 1986 | January 13, 1988 |
| Amendment—Racine Area | Community Assistance Planning Report No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin | December 1, 1986 | January 13, 1988 |
| Amendment—Town of Lyons | Amendment to the Regional Water Quality Management Plan—2000, Country Estates Sanitary District/Town of Lyons | March 2, 1987 | August 25, 1987 |
| Amendment—Village of Silver Lake | Community Assistance Planning Report No. 119, Sanitary Sewer Service Area, Village of Silver Lake, Kenosha County, Wisconsin | June 15, 1987 | January 13, 1988 |
| Amendment—Village of Twin Lakes | Community Assistance Planning Report No. 149, Sanitary Sewer Service Area, Village of Twin Lakes, Kenosha County, Wisconsin | June 15, 1987 | March 23, 1988 |
| Amendment—Cedarburg/ Grafton Area | Community Assistance Planning Report No. 91, Sanitary Sewer Service Area for the City of Cedarburg and the Village of Grafton, Ozaukee County, Wisconsin | June 15, 1987 | December 23, 1987 |
| Amendment—Town of Walworth | Amendment to the Regional Water Quality Management Plan—2000, Town of Walworth Utility District No. 1/Walworth County Metropolitan Sewerage District | June 15, 1987 | November 2, 1987 |
| Amendment—City of West Bend | Amendment to the Regional Water Quality Management Plan—2000, City of West Bend | June 15, 1987 | January 13, 1988 |
| Amendment—City of Whitewater | Community Assistance Planning Report No. 94, Sanitary Sewer Service Area for the City of Whitewater, Walworth County, Wisconsin | September 14, 1987 | March 23, 1988 |
| Amendment—Town of Lyons | Community Assistance Planning Report No. 158 (2nd Edition), Sanitary Sewer Service Area for the Town of Lyons Sanitary District No. 2, Walworth County, Wisconsin | September 15, 1993 | April 28, 1994 |
| Amendment—City of Hartford | Amendment to the Regional Water Quality Management Plan—2000, City of Hartford | September 14, 1987 | January 29, 1988 |
| Amendment—Milwaukee Harbor Estuary Plan | Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, Volume One, Inventory Findings; Volume Two, Alternative and Recommended Plans | December 7, 1987 | June 4, 1990 |
| Amendment—City of New Berlin | Community Assistance Planning Report No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin | December 7, 1987 | May 2, 1988 |
| Amendment—Village of Sussex | Amendment to the Regional Water Quality Management Plan—2000, Village of Sussex | December 7, 1987 | August 9, 1988 |
| Amendment—Kenosha Area | Amendment to the Regional Water Quality Management Plan—2000, City of Kenosha and Environs | December 7, 1987 | December 7, 1989 |
| Amendment—Village of Kewaskum | Community Assistance Planning Report No. 161, Sanitary Sewer Service Area for the Village of Kewaskum, Washington County, Wisconsin | March 7, 1988 | October 24, 1988 |
| Amendment—Town of Darien | Amendment to the Regional Water Quality Management Plan—2000, Town of Darien/ Walworth County Metropolitan Sewerage District | June 20, 1988 | October 24, 1988 |
| Amendment—Village of Sussex | Amendment to the Regional Water Quality Management Plan—2000, Village of Sussex | June 20, 1988 | January 14, 1993 |

## Table 1 (continued)

| Plan Element | Plan Document | SEWRPC Date of Adoption | WDNR Date of Adoption |
|---|---|---|---|
| Amendment–Village of Darien | Community Assistance Planning Report No. 123 (2nd Edition), Sanitary Sewer Service Area for the Village of Darien, Walworth County, Wisconsin | September 23, 1992 | January 14, 1993 |
| Amendment–West Bend Area | Amendment to the Regional Water Quality Management Plan–2000, City of West Bend/Town of West Bend | September 12, 1988 | November 17, 1988 |
| Amendment–Hartford Area | Amendment to the Regional Water Quality Management Plan–2000, City of Hartford | September 12, 1988 | January 9, 1989 |
| Amendment–Town of Waterford | Amendment to the Regional Water Quality Management Plan–2000, Western Racine County Sewerage District | September 12, 1988 | December 16, 1988 |
| Amendment–Hartford Area | Amendment to the Regional Water Quality Management Plan–2000, City of Hartford | December 5, 1988 | April 18, 1989 |
| Amendment–City of Waukesha | Amendment to the Regional Water Quality Management Plan–2000, City of Waukesha | December 5, 1988 | April 5, 1989 |
| Amendment–Oconomowoc Area | Community Assistance Planning Report No. 172, Sanitary Sewer Service Area for the City of Oconomowoc and Environs, Waukesha County, Wisconsin | March 6, 1989 | October 17, 1989 |
| Amendment–Village of Genoa City | Community Assistance Planning Report No. 175, Sanitary Sewer Service Area for the Village of Genoa City, Kenosha and Walworth Counties, Wisconsin | March 6, 1989 | August 14, 1989 |
| Amendment–Village of Germantown | Amendment to the Regional Water Quality Management Plan–2000, Village of Germantown | March 6, 1989 | June 5, 1989 |
| Amendment–Racine Area | Amendment to the Regional Water Quality Management Plan–2000, City of Racine and Environs | March 6, 1989 | June 5, 1989 |
| Amendment–Upper Fox River Watershed | Amendment to the Regional Water Quality Management Plan–2000, Upper Fox River Watershed–Brookfield and Sussex Sewage Treatment Plants | May 15, 1989 | September 1989 |
| Amendment–Racine Area | Amendment to the Regional Water Quality Management Plan–2000, City of Racine and Environs | June 19, 1989 | August 14, 1989 |
| Amendment–Lake Geneva Area | Amendment to the Regional Water Quality Management Plan–2000, City of Lake Geneva and Environs | June 19, 1989 | July 19, 1989 |
| Amendment–Town of Geneva | Amendment to the Regional Water Quality Management Plan–2000, Town of Geneva, Walworth County Metropolitan Sewerage District | November 6, 1989 | August 9, 1991 |
| Amendment–Town of Waterford | Amendment to the Regional Water Quality Management Plan–2000, Western Racine County Sewerage District | December 4, 1989 | February 20, 1990 |
| Amendment–Delavan Lake Area | Amendment to the Regional Water Quality Management Plan–2000, Delavan Lake Sanitary District/Walworth County Metropolitan Sewerage District | December 4, 1989 | February 20, 1990 |
| Amendment–East Troy Area | Amendment to the Regional Water Quality Management Plan–2000, Towns of East Troy, LaFayette, and Spring Prairie, and Village of East Troy | December 4, 1989 | March 26, 1990 |
| Amendment–Waukesha Area | Amendment to the Regional Water Quality Management Plan–2000, City of Waukesha and Town of Waukesha | June 20, 1990 | October 12, 1990 |
| Amendment–Village of Silver Lake | Amendment to the Regional Water Quality Management Plan–2000, Village of Silver Lake and Salem Utility District No. 2 | June 20, 1990 | October 12, 1990 |
| Amendment–Village of Union Grove | Community Assistance Planning Report No. 180, Sanitary Sewer Service Area for the Village of Union Grove and Environs, Racine County, Wisconsin | September 12, 1990 | August 19, 1991 |
| Amendment–Town of Somers | Amendment to the Regional Water Quality Management Plan–2000, Kenosha and Racine Sanitary Sewer Service Areas | September 12, 1990 | January 15, 1991 |

Table 1 (continued)

| Plan Element | Plan Document | SEWRPC Date of Adoption | WDNR Date of Adoption |
|---|---|---|---|
| Amendment—City of Franklin | Community Assistance Planning Report No. 176, Sanitary Sewer Service Area for the City of Franklin, Milwaukee County, Wisconsin | December 5, 1990 | July 31, 1991 |
| Amendment—Village of Mukwonago | Community Assistance Planning Report No. 191, Sanitary Sewer Service Area for the Village of Mukwonago, Waukesha County, Wisconsin | December 5, 1990 | August 19, 1991 |
| Amendment—Village of Dousman | Community Assistance Planning Report No. 192, Sanitary Sewer Service Area for the Village of Dousman, Waukesha County, Wisconsin | December 5, 1990 | July 31, 1991 |
| Amendment—Towns of Yorkville and Mt. Pleasant | Amendment to the Regional Water Quality Management Plan—2000, Towns of Yorkville and Mt. Pleasant | December 5, 1990 | February 15, 1991 |
| Amendment—Town of Bristol | Amendment to the Regional Water Quality Management Plan—2000, Town of Bristol | March 6, 1991 | July 22, 1991 |
| Amendment—Village of Pewaukee | Amendment to the Regional Water Quality Management Plan—2000, Village of Pewaukee | March 6, 1991 | July 22, 1991 |
| Amendment—Town of Brookfield | Amendment to the Regional Water Quality Management Plan—2000, Brookfield and Waukesha Sanitary Sewer Service Areas | March 6, 1991 | July 22, 1991 |
| Amendment—Delavan Area | Amendment to the Regional Water Quality Management Plan—2000, Walworth County Metropolitan Sewerage District/Delavan-Delavan Lake Sanitary Sewer Service Area | March 6, 1991 | July 22, 1991 |
| Amendment—Oconomowoc Lake, Waukesha County | Community Assistance Planning Report No. 181, A Water Quality Management Plan for Oconomowoc Lake, Waukesha County, Wisconsin | June 19, 1991 | -- |
| Amendment—Town of Salem | Amendment to the Regional Water Quality Management Plan—2000, Town of Salem | June 19, 1991 | September 30, 1991 |
| Amendment—Town of Caledonia | Amendment to the Regional Water Quality Management Plan—2000, Town of Caledonia | June 19, 1991 | -- |
| Amendment—Village of Hartland | Amendment to the Regional Water Quality Management Plan—2000, Village of Hartland | June 19, 1991 | September 30, 1991 |
| Amendment—Town of Caledonia | Amendment to the Regional Water Quality Management Plan—2000, Town of Caledonia | September 11, 1991 | December 11, 1991 |
| Amendment—Town of Norway | Amendment to the Regional Water Quality Management Plan—2000, Town of Norway | September 11, 1991 | December 11, 1991 |
| Amendment—Town of Rochester | Amendment to the Regional Water Quality Management Plan—2000, Town of Rochester | September 11, 1991 | November 26, 1991 |
| Amendment—Town of Norway | Amendment to the Regional Water Quality Management Plan—2000, Town of Norway | September 11, 1991 | -- |
| Amendment—Brookfield/Elm Grove Area | Community Assistance Planning Report No. 109, Sanitary Sewer Service Area for the City and Town of Brookfield and the Village of Elm Grove, Waukesha County, Wisconsin | December 4, 1991 | July 20, 1992 |
| Amendment—Racine Area | Amendment to the Regional Water Quality Management Plan—2000, City of Racine and Environs | December 4, 1991 | December 26, 1991 |
| Amendment—Pewaukee Lake Area | Amendment to the Regional Water Quality Management Plan: 2000, Lake Pewaukee Sanitary District | December 4, 1991 | April 7, 1992 |
| Amendment—West Bend Area | Amendment to the Regional Water Quality Management Plan: 2000, City of West Bend/Town of West Bend | December 4, 1991 | February 5, 1992 |
| Amendment—Town of Salem | Amendment to the Regional Water Quality Management Plan: 2000, Town of Salem | December 4, 1991 | March 27, 1992 |
| Amendment—City of Mequon and Village of Thiensville | Community Assistance Planning Report No. 188, Sanitary Sewer Service Area for the City of Mequon and the Village of Thiensville, Ozaukee County, Wisconsin | January 15, 1992 | September 23, 1992 |
| Amendment—City of West Bend/Town of West Bend/Silver Lake Sanitary District | Amendment to the Regional Water Quality Management Plan—2000, City of West Bend/Town of West Bend/Silver Lake Sanitary District | March 4, 1992 | September 11, 1992 |
| Amendment—Town of Somers | Amendment to the Regional Water Quality Management Plan—2000, Town of Somers | June 17, 1992 | September 11, 1992 |

Table 1 (continued)

| Plan Element | Plan Document | SEWRPC Date of Adoption | WDNR Date of Adoption |
|---|---|---|---|
| Amendment—Delafield-Nashotah Area | Community Assistance Planning Report No. 127, Sanitary Sewer Service Area for the City of Delafield and the Village of Nashotah and Environs, Waukesha County, Wisconsin | January 18, 1993 | April 29, 1993 |
| Amendment—City of Lake Geneva and Environs | Community Assistance Planning Report No. 203, Sanitary Sewer Service Area for the City of Lake Geneva and Environs, Walworth County, Wisconsin | January 18, 1993 | April 29, 1993 |
| Amendment—Eagle Lake Sewer Utility District | Community Assistance Planning Report No. 206, Sanitary Sewer Service Area for the Eagle Lake Sewer Utility District, Racine County, Wisconsin | January 18, 1993 | April 29, 1993 |
| Amendment—Village of Hartland | Amendment to the Regional Water Quality Management Plan: 2000, Village of Hartland | January 18, 1993 | May 14, 1993 |
| Amendment—Village of Newburg | Community Assistance Planning Report No. 205, Sanitary Sewer Service Area for the Village of Newburg, Ozaukee and Washington Counties, Wisconsin | March 3, 1993 | June 21, 1993 |
| Amendment—Village of Twin Lakes | Amendment to the Regional Water Quality Management Plan—2000, Village of Twin Lakes | March 3, 1993 | May 14, 1993 |
| Amendment—City of Muskego | Amendment to the Regional Water Quality Management Plan: 2000, City of Muskego | March 3, 1993 | April 29, 1993 |
| Amendment—Villages of Lannon and Menomonee Falls | Community Assistance Planning Report No. 208, Sanitary Sewer Service Areas for the Villages of Lannon and Menomonee Falls, Waukesha County, Wisconsin | June 16, 1993 | September 10, 1993 |
| Amendment—City of New Berlin | Amendment to the Regional Water Quality Management Plan—2000, City of New Berlin | June 16, 1993 | -- |
| Amendment—Racine Area | Amendment to the Regional Water Quality Management Plan—2000, City of Racine and Environs | June 16, 1993 | August 24, 1993 |
| Amendment—Powers Lake, Kenosha and Walworth Counties | Community Assistance Planning Report No. 196, A Management Plan for Powers Lake, Kenosha and Walworth Counties, Wisconsin | September 15, 1993 | -- |
| Amendment—Wind Lake, Racine County | Community Assistance Planning Report No. 198, A Management Plan for Wind Lake, Racine County, Wisconsin | September 15, 1993 | -- |
| Amendment—Walworth County Metropolitan Sewerage District | Amendment to the Regional Water Quality Management Plan—2000, Town of Geneva, Walworth County Metropolitan Sewerage District | December 1, 1993 | February 15, 1994 |

a. A description of the various elements of the regional water quality management plan as amended and as applied to the particular watershed concerned.

b. A description of the extent to which the key elements of the regional water quality management plan have been implemented since adoption of the original plan.

c. A description, based on the best available data, of the existing water quality conditions and of the extent to which the water quality objectives and standards in the watershed have been met.

d. A description of the substantive water quality management issues within the watershed that remain to be addressed in the continuing planning process.

4. Chapter XVI--Status of Groundwater Quality Management Plan Element
This chapter describes the status of the preparation of a proposed new element of a regional water quality management plan; namely, a groundwater management element.

5. Chapter XVII--Designated Management Agencies and Responsibilities
This chapter identifies, by plan element, all of the designated management agencies given responsibility for implementation of the regional water quality management plan.

6. Chapter XVIII--Summary and Recommendations
This chapter provides a summary of the information presented in the report, focusing in particular on the restatement of the regional water quality management plan as amended and updated; on the extent to which the water use objectives and supporting water quality standards have been met; and on the remaining water quality management issues to be addressed in the continuing planning effort.

# Chapter II

## SURFACE WATER RESOURCES--WATER USE OBJECTIVES AND STANDARDS, DATA SOURCES, AND ANALYTICAL PROCEDURES

This regional water quality management plan includes a collection of current data on which an assessment of the existing water quality conditions in the streams and lakes of the planning area, and an analysis of the ability of those conditions to support proposed water uses, has been made. In addition, such data are compared to historic data in order to assess the changes which have occurred in surface water quality since the preparation of the initial regional water quality management plan.

The initial water quality management plan presented a description of the existing surface water system along with existing and planned water use objectives and water quality data available through 1976. This chapter includes a general description of the existing surface water system; presents updated information on water use objectives and standards; and includes a general description of the data available and the procedures used to present the current state of surface water quality. Chapters IV through XV present for each of the 12 watersheds in the Region: available data on water quality and other surface water conditions for stream reaches and lakes; an assessment of the degree to which the water use objectives are currently being met; and, to the extent the data permit, an assessment of the changes which have occurred in water quality conditions since the initial regional water quality management planning effort was completed, thus providing a measure of the effect of plan implementation to date.

### SURFACE WATER RESOURCE DESCRIPTION

Lakes and streams constitute an extremely valuable part of the natural resource base of Southeastern Wisconsin. Inasmuch as they are focal points for water-related recreational activities popular with the inhabitants of the Region, lakes and streams provide extremely attractive sites for properly planned residential development; and, when viewed in the context of open space areas, greatly enhance the aesthetic aspects of the environment. While highly valued by the urban and rural populations of the Region, lakes and streams are extremely susceptible to deterioration through the activities of those very populations. Water quality can degenerate as a result of pollutant loadings from malfunctioning or improperly placed septic tank systems, inadequate sewage treatment facilities, runoff from rural, urban, and urbanizing lands. Lakes and streams are also adversely affected by the excessive development of lacustrine and riverine areas in combination with the filling of peripheral wetlands, which removes valuable nutrient and sediment traps while adding nutrient and sediment sources. The regional surface water resources must be properly managed and land uses carefully located and designed to achieve a reasonable balance between public and private use and enjoyment of those surface water resources.

## Streams

As shown on Map II-1, the surface drainage system of Southeastern Wisconsin may be viewed as existing within 11 individual watersheds. Five of these, the Root River, Menomonee River, Kinnickinnic River, Oak Creek, and Pike River watersheds, are contained entirely within the Region. In addition to the 11 watersheds, numerous small catchment areas immediately adjacent to the Lake Michigan shoreline drain directly to the Lake via local natural streams or artificial drainageways; these tributary areas together may be considered to comprise a twelfth watershed. The Region contains only a very small part of the Des Plaines and Fox River watersheds and of the Wisconsin portion of the large Rock River watershed. The streams of the Rock River watershed within the Region are limited to the headwater portions of such tributaries to the Rock River as the Bark and Oconomowoc Rivers and Turtle Creek.

Three of the 12 watersheds contained wholly or partly in Southeastern Wisconsin, the Fox, Rock, and Des Plaines River watersheds, with a combined area of 1,681 square miles, or 63 percent of the area of the Region, lie west of the subcontinental divide. As a result, the rivers and streams within these catchment areas flow in a generally southerly and southwesterly direction and are part of the Mississippi River drainage system. The rivers and streams in the nine watersheds comprising the remainder of Southeastern Wisconsin, with a combined area of 1,008 square miles, or 37 percent of the area of the Region, flow in a generally southerly and easterly direction and discharge into Lake Michigan and are a part of the Great Lakes-St. Lawrence River drainage system. A summary of the relative sizes of the watersheds within Southeastern Wisconsin is presented in Table II-1 and a graphical representation of the range of watershed sizes is shown in Figure II-1.

One of the most interesting, variable, and occasionally unpredictable features of each watershed is the ever changing, sometimes widely fluctuating, discharges and stages of its stream system. The stream systems of the Region generally receive a relatively uniform flow of groundwater from the shallow aquifers underlying the Region. This groundwater discharge constitutes the base flow of the streams. The streams also periodically intercept surface water runoff from rainfall and snowmelt which is superimposed on the base flow and sometimes causes the streams to leave their channels and occupy the adjacent floodlands. The volume of water drained annually from Southeastern Wisconsin by the stream system is equivalent to seven to eight inches of water spread over the seven-county Region, and amounts to about one-fourth of the average annual precipitation.

Major streams are defined herein as perennial streams which maintain, at a minimum, a small, continuous flow throughout the year except under unusual drought conditions. Within the Region, there are approximately 1,148 miles of such major streams, as summarized by county in Table II-2. The length of major streams per county ranges from a low of 101 linear miles in Racine County to a high of 333 linear miles in Waukesha County. The latter county also has the largest number of major lakes, and is therefore particularly well endowed with surface water resources.

## Lakes

Major inland lakes are defined herein as those having 50 acres or more of surface water area, a size capable of supporting reasonable recreational use with relatively little degradation of the resource. There are 101 such major inland lakes within the Region, the location and relative sizes of which are

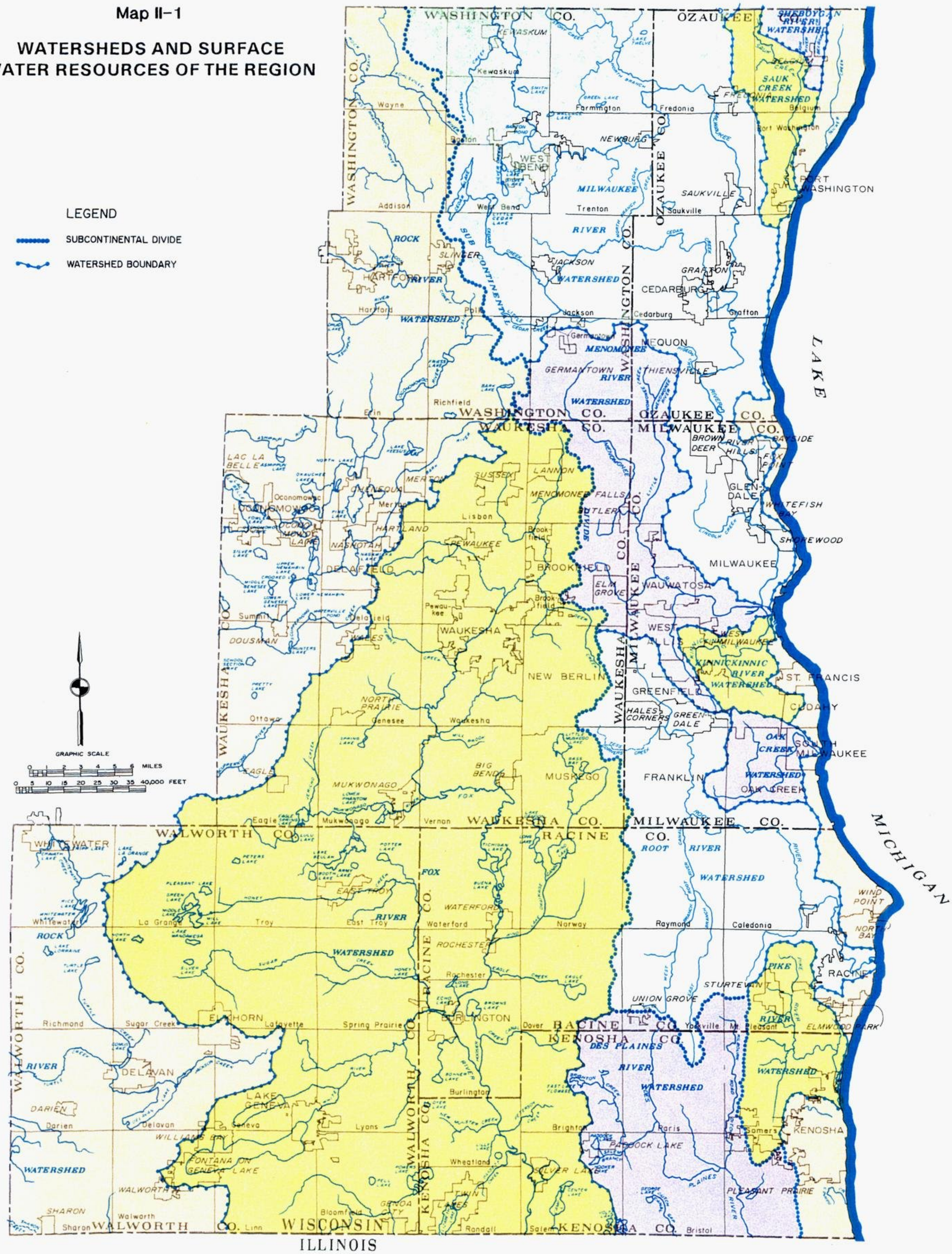
Map II-1

## WATERSHEDS AND SURFACE WATER RESOURCES OF THE REGION

LEGEND

SUBCONTINENTAL DIVIDE

WATERSHED BOUNDARY




Source: SEWRPC.

## Table II-1

## WATERSHEDS IN THE REGION BY COUNTY

| Watershed[a,b] | Kenosha Area (square miles) | Kenosha Percent of Watershed | Milwaukee Area (square miles) | Milwaukee Percent of Watershed | Ozaukee Area (square miles) | Ozaukee Percent of Watershed | Racine Area (square miles) | Racine Percent of Watershed | Walworth Area (square miles) | Walworth Percent of Watershed | Washington Area (square miles) | Washington Percent of Watershed | Waukesha Area (square miles) | Waukesha Percent of Watershed | Total Watershed Area Within Region (square miles) | Percent of Region |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fox River[d,f] | 96.06 | 10.28 | 0.26 | 0.03 | -- | -- | 164.78 | 17.63 | 337.06 | 36.06 | 0.25 | 0.02 | 336.30 | 35.98 | 934.71 | 34.76 |
| Rock River[d] | -- | -- | -- | -- | -- | -- | -- | -- | 239.43 | 39.21 | 177.65 | 29.10 | 193.51 | 31.69 | 610.59 | 22.71 |
| Milwaukee River[e,f] | -- | -- | 57.90 | 13.31 | 151.25 | 34.78 | -- | -- | -- | -- | 225.80 | 51.91 | -- | -- | 434.95 | 16.17 |
| Root River[c,e,f] | 1.99 | 1.02 | 57.75 | 29.47 | -- | -- | 123.16 | 62.85 | -- | -- | -- | -- | 13.06 | 6.66 | 195.96 | 7.29 |
| Menomonee River[c,e,f] | -- | -- | 56.34 | 40.92 | 11.63 | 8.45 | -- | -- | -- | -- | 31.98 | 23.22 | 37.74 | 27.41 | 137.69 | 5.12 |
| Des Plaines River[d] | 123.53 | 91.82 | -- | -- | -- | -- | 11.00 | 8.18 | -- | -- | -- | -- | -- | -- | 134.53 | 5.00 |
| Minor Tributaries to Lake Michigan[c,e] | 27.23 | 29.42 | 18.32 | 19.79 | 27.28 | 29.48 | 19.72 | 21.31 | -- | -- | -- | -- | -- | -- | 92.55 | 3.44 |
| Pike River[c,e,f] | 29.59 | 57.55 | -- | -- | -- | -- | 21.83 | 42.45 | -- | -- | -- | -- | -- | -- | 51.42 | 1.91 |
| Sauk Creek[e] | -- | -- | -- | -- | 34.09 | 100.00 | -- | -- | -- | -- | -- | -- | -- | -- | 34.09 | 1.27 |
| Oak Creek[c,e,f] | -- | -- | 27.74 | 100.00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 27.74 | 1.03 |
| Kinnickinnic River[c,e,f] | -- | -- | 24.17 | 100.00 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 24.17 | 0.90 |
| Sheboygan River[e] | -- | -- | -- | -- | 10.84 | 100.00 | -- | -- | -- | -- | -- | -- | -- | -- | 10.84 | 0.40 |
| Total | 278.40 | 10.35 | 242.48 | 9.02 | 235.09 | 8.74 | 340.49 | 12.66 | 576.49 | 21.44 | 435.68 | 16.20 | 580.61 | 21.59 | 2,689.24 | 100.00 |

NOTE: Watershed areas are approximations based upon aggregations of U. S. Public Land Survey quarter sections.

[a] *Includes only that area of each watershed that lies within the Southeastern Wisconsin Region.*

[b] *Watersheds are listed in order of decreasing size within the Region.*

[c] *Indicates watershed wholly contained within the Region.*

[d] *Indicates watershed west of the subcontinental divide that is tributary to the Mississippi River basin. Three watersheds having a combined area of about 1,680 square miles, or about 62 percent of the Region, are in this category.*

[e] *Indicates watershed east of the subcontinental divide that is tributary to the Great Lakes-St. Lawrence River basin. Nine watersheds having a combined area of about 1,009 square miles, or about 38 percent of the Region are in this category.*

[f] *Indicates watershed for which comprehensive watershed plan has been prepared and adopted by the Regional Planning Commission.*

*Source: SEWRPC.*

## Table II-2

## MAJOR LAKES IN THE REGION BY COUNTY

| County | Major Lakes[a] Number[b] | Major Lakes[a] Surface Area Acres | Major Lakes[a] Surface Area Percent of Region |
|---|---|---|---|
| Kenosha | 17 | 3,414 | 9.4 |
| Milwaukee | -- | -- | -- |
| Ozaukee | 3 | 358 | 1.0 |
| Racine | 11 | 3,516 | 9.6 |
| Walworth | 27 | 12,597 | 34.5 |
| Washington | 14 | 2,634 | 7.2 |
| Waukesha | 33 | 13,998 | 38.3 |
| Region | 101 | 36,517 | 100.0 |

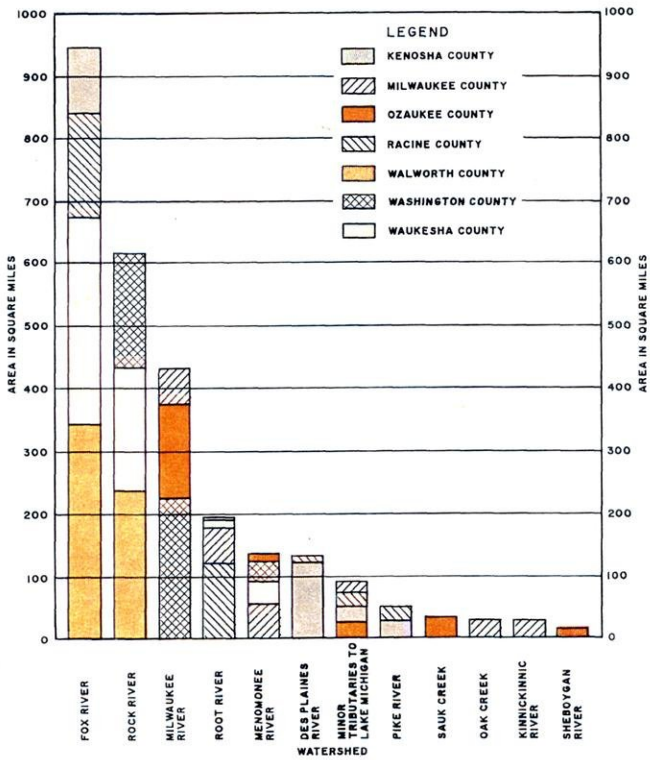
[a] *A major lake is defined as one having 50 acres or more of surface water.*

[b] *There are 101 major lakes in the Region. Four of these lakes lie in more than one county in the Region, including Benedict Lake and Powers Lake, which lie in Kenosha and Walworth Counties; Lake Denoon, which lies in Racine and Waukesha Counties; and Lake Five, which lies in Washington and Waukesha Counties. The number of lakes as reported by county in this table, therefore, adds up to more than 101.*

*Source: Wisconsin Department of Natural Resources and SEWRPC.*

## Figure II-1

## SIZE AND DISTRIBUTION OF WATERSHEDS IN THE REGION BY COUNTY




*Source: SEWRPC.*

shown on Map II-1.[1] Tabular summaries of selected physical characteristics of the major lakes of Southeastern Wisconsin are presented by watershed in the following chapters. The major lakes in the Region have a combined surface water area of about 36,500 acres, or about 2 percent of the total area of the Region. The number of major inland lakes per county ranges from none in Milwaukee County to 33 in Waukesha County; the combined surface water areas of the major lakes per county ranges from none in Milwaukee County to about 14,000 acres in Waukesha County. Lake Geneva is by far the largest inland lake in Southeastern Wisconsin, with an area of 5,262 acres, more than twice as large as Pewaukee Lake, which, with an area of 2,493 acres, is the second largest inland lake in the Region.

In addition to the major lakes, there are numerous "minor" lakes and ponds in the Region encompassing less than 50 acres of surface water area. These minor lakes have a combined surface area of about four square miles, or about 0.15 percent of the Region. These smaller lakes generally have few riparian owners and, in many cases, have marginal fisheries. In most cases, the primary values of the minor lakes are aesthetic. However, these lakes do provide a valuable resource and serve to provide an important ecological and recreational function. In some cases, these smaller lakes are located in highly urban areas, thus providing a readily available resource to large numbers of people. Minor lakes can be a fragile but important resource, and their ecological and aesthetic values may be lost unless properly managed.

The inland lakes of Southeastern Wisconsin are almost exclusively of glacial origin, formed by depressions in outwash deposits, terminal and interlobate moraines, and ground moraines. Some lakes, such as Green Lake in northeastern Washington County or Browns Lake in southwestern Racine County, owe their origins to kettles, that is, depressions formed in the glacial drift as a result of the melting of ice blocks that became separated from the melting continental ice sheet, and of the subsequent subsidence of sand and gravel contained on and within those blocks. By virtue of their origin, glacially formed lakes are fairly regular in shape, with their deepest points located predictably near the center of the basin, or near the center of each of several connected basins. The beaches are characteristically gravel or sand on the windswept north, east, and south shores, while fine sediments and encroaching vegetation are common on the protected west shores and in bays.

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[1]It should be noted that SEWRPC Planning Report No 30, A Regional Water Quality Management Plan for Southeastern Wisconsin--2000, reported the existence of 100 major lakes in the Region. Since the previous inventory, East Lake Flowage has been created as a major lake through an impoundment effort in the Bong State Recreation Area in the Town of Brighton, and an unnamed major lake has been created from an abandoned quarry in the Village of Pleasant Prairie. West Bend Pond in Washington County, classified as a major lake in previous inventory, is no longer a major lake due to the removal in 1987 of the dam which formed the pond. In addition, the classification of two other lakes has been changed on the basis of revised inventory data. Previously classified as a minor lake, Lac du Cours in Ozaukee County is now classified as a major lake on the basis of a revised area measurement of 56 acres. Previously classified as a major lake, Saylesville Mill Pond in Waukesha County is no longer classified as a major lake on the basis of a revised area measurement of 45 acres.

## WATER USE OBJECTIVES AND SUPPORTING WATER QUALITY STANDARDS

The Wisconsin Department of Natural Resources (DNR) is required, under Section 144.025(2)(b) of the Wisconsin Statutes and the State Water Resources Act of 1965, to establish a set of water use objectives and supporting water quality standards applicable to all surface waters of the State. Under the Federal Water Pollution Control Act of 1965, the establishment of such objectives and standards is required for all navigable waters in the United States. The Federal Water Pollution Control Act further requires that these objectives and standards be periodically reviewed and revised as appropriate. Under the Wisconsin Resource Development Board, predecessor to the Wisconsin Natural Resources Board, a set of water use objectives and standards for Wisconsin surface waters was initially adopted for interstate waters on June 1, 1967, and for intrastate waters on September 1, 1968. These objectives and standards were then revised by the Wisconsin Natural Resources Board in 1977.

The initial regional water quality management plan included consideration of a set of water use objectives which were considered to be applicable for Southeastern Wisconsin and which were consistent with the water use objectives and standards for the State as they were revised by the Wisconsin Department of Natural Resources in 1977. In the initial regional plan, the following five combinations of water use objectives were formulated for application in Southeastern Wisconsin:

1. Salmon spawning fishery and aquatic life, recreational use, and minimum aesthetic standards

2. Trout fishery and aquatic life, recreational use, and minimum standards

3. Warmwater fishery and aquatic life, recreational use, and minimum standards

4. Warmwater fishery and aquatic life, limited recreational use, and minimum standards

5. Limited fishery and aquatic life, limited recreational use, and minimum standards

Of the five water use objective combinations, only the first three, providing for a full warmwater fishery and full body contact recreational use, are fully compatible with the national goal of "fishable and swimmable" waters, as set forth in Public Law 92-500.

The current Wisconsin Department of Natural Resources water use objectives and supporting standards, as of December 1992, are set forth in Chapters NR 102, 104, and 105 of the Wisconsin Administrative Code. In addition, Chapter NR 103, which became effective on August 1, 1991, establishes water quality-related rules for wetlands. The rules set forth in Chapter NR 103 consist of two parts: 1) a set of standards intended to protect water quality-related functions of wetlands including sediment and pollution control, stormwater and floodwater storage, hydrologic cycle maintenance, shoreline erosion protection, habitat protection for aquatic organisms and other wildlife species, and recreational uses; and 2) implementation procedures for application of the water quality standards. Because the application of the rules set forth in Chapter NR 103 are site specific and require consideration of the specific activity proposed within or adjacent to a wetland, wetland water quality objectives and standards are not specifically addressed in this report. Rather, it is assumed that the procedures documented in Chapter NR 103 will be applied by the Wisconsin Department of Natural Resources on a site-specific, case-by-case basis.

"Fishable" Waters

The revisions which have been made by the Wisconsin Department of Natural Resources to the surface water use objectives since the preparation of the regional water quality management plan consist primarily of combining the salmon and trout fishery categories into one coldwater fishery category, adding a new Great Lakes community category, and further subdividing the warmwater fishery and limited fishery biological use categories based upon the type of biological community which can be supported. Six biological use objectives have been developed by the Wisconsin Department of Natural Resources for application to all of the State surface waters, including both streams and lakes. These objectives are set forth in Chapter NR 102.04 (3) of the Wisconsin Administrative Code, and are based upon the type of aquatic life uses a particular water body should be able to safely and consistently support. Sub-section NR 102.04 (4) sets forth the applicable standards relating to these use objectives. Standards for recreational use, public health and welfare, and wild and domestic animals are set forth in Sub-sections NR 102.04 (5), (6) and (7), respectively, of the Wisconsin Administrative Code.

Each biological use objective represents the type of aquatic community a particular lake or stream reach is expected to be able to sustain. Because the existence of a particular aquatic community is dictated in large part by the level of water quality present in a particular water body, the assigned biological use serves as a measure of the water quality conditions, which are either currently being met or which could potentially be achieved under prescribed types and levels of management. The biological use objectives are detailed as follows:

Great Lakes Communities - Streams classified under this category are those waters which drain to Lake Michigan, and its bays, arms, and inlets, which serve as spawning areas for anadromous fishes.

Cold Water Communities - Streams classified under this category are capable of supporting a community of coldwater fish and other aquatic life, or serve as spawning areas for coldwater sport fish species. This category includes, but is not restricted to, surface waters identified as trout waters by the Wisconsin Department of Natural Resources. Also included in this classification are coldwater streams which, too small to support sport fish, are capable of supporting an abundant and diverse population of forage fish and macroinvertebrates which are intolerant of pollution.

Warmwater Sport Fish Communities - Under this classification, streams are capable of supporting a warmwater sport fishery or serve as spawning areas for warmwater sport fish species such as walleye, bluegill, largemouth bass, and smallmouth bass. Also present are aquatic macroinvertebrates which are relatively intolerant of pollution.

Warmwater Forage Fish Communities - This category includes surface waters with natural water quality and habitat capable of supporting an abundant, usually diverse, community of forage fish (shiners, minnows) and/or aquatic macroinvertebrates (insects, clams, crayfish) which are relatively intolerant of pollution. These streams are generally too small to support sport fish species. Streams capable of supporting valuable populations of pollution-tolerant forage fish are also included in this classification.

Limited Forage Fish Communities (Intermediate Surface Waters) - Streams within this classification are of limited capacity, naturally poor water quality and deficient habitat. These intermediate surface waters are capable of supporting only a limited community of pollution-tolerant forage fish and aquatic macroinvertebrates.

Limited Aquatic Life (Marginal Surface Waters) - Streams with this classification have a severely limited capacity, naturally poor water quality and deficient habitat. These marginal surface waters are only capable of supporting a limited community of aquatic life.

Those surface waters assigned a biological use objective as a Great Lakes community, coldwater community, warmwater sportfish community, or warmwater forage fish community, are characterized as surface waters which are considered in the Federal Water Pollution Control Act Amendment of 1972, Public Law 92-500, to be suitable for the protection and propagation of a balanced fish and other aquatic life community. These waters typically exhibit the highest degree of water quality and can be expected to meet the "fishable" criterion specified in Public Law 92-500. The remaining two biological use objectives are assigned when a particular surface water is unable to maintain the afore-described water quality conditions and resultant aquatic communities, or have been the subject of irretrievable physical alterations which limit uses. These water use objectives are described as supporting limited forage fish communities (intermediate surface waters) and limited aquatic life (marginal surface waters), respectively, in Sub-section NR 104.02 (3) of the Wisconsin Administrative Code.

"Swimmable" Waters

Two recreational use objectives considered applicable to surface waters in Southeastern Wisconsin for planning purposes in the initial regional plan were used in this updated report as a means of classifying surface waters according to varying degrees of human recreational use. For this purpose, the surface waters are divided into two categories: those waters that have a water quality which is considered safe and acceptable for full recreational use and those waters considered safe and acceptable for only limited recreational use. Surface waters classified as safe for full recreational use include those which have expected water quality conditions considered safe for human recreation where immersion of the head is expected and frequent. Recreational activities in this classification include swimming, waterskiing, windsurfing, and similar activities where significant contact with water is likely to occur. Limited recreational use waters include those used for human recreational use where immersion of the head is not frequent and contact is accidental or incidental and therefore less frequent, such as boating and sailing. As was done in preparing the initial water quality management plan, the Commission staff, when establishing the recreational use objectives for a particular water body or watercourse within the Region, in addition to giving consideration to potential bacterial contamination levels, gave consideration to both the degree of channelization and physical alteration, and physical attributes of the water body or watercourse, and to the nutrient levels within the waters, where known. Those streams and lakes which had excessive nutrient levels, which could not as a practical matter be sufficiently reduced, were placed in a limited recreational use category on the basis that the biological response to these conditions would result in a condition that would place limitations on the recreational uses.

Additionally, those streams which were found to have bacterial levels which could not be practically reduced to meet the standards described in the subsequent section, or which had physical characteristics which limited their use, were also placed in the limited recreation use category.

As was done in the initial regional water quality management plan, an attempt was made to assign all surface waters in the Region to an appropriate combination of those use objectives which would fully meet the national goal of "fishable and swimmable" waters. Consideration was given to the potential of each stream reach and of each major lake to meet objectives consistent with the national goal of "fishable and swimmable" waters. This consideration took into account the results of available inventories of the physical characteristics and conditions of the lakes and streams, existing water quality, sources of pollution in tributary drainage areas, characteristics of land uses in tributary drainage areas, and the locations and extent of in-place pollutants. This assessment was also based, in part, upon review of the analyses conducted under the initial regional water quality management planning program and subsequent field inspections and analyses conducted by the Wisconsin Department of Natural Resources staff, supplemented by inventory data collected by the U.S. Geological Survey, the Regional Planning Commission, and local agencies.

Water Use Objectives

In updating the initial regional water quality management plan, consistent with the objectives set forth in the initial regional water quality management plan refined to reflect the foregoing amended requirements of the Wisconsin Administrative Code and other considerations as set forth above, eight combinations of water use objectives were established by Commission staff for application to surface waters in the Region. These combinations of water use objectives are as follows:

- Coldwater biological community and full recreational use
- Warmwater sport fish community and full recreational use
- Warmwater sport fish community and limited recreational use
- Warmwater forage fish community and full recreational use
- Warmwater forage fish and limited recreational use
- Limited forage fish community and limited recreational use
- Limited aquatic life and limited recreational use

Waters supporting a limited forage fish community or limited aquatic life were deemed, by definition, to be incapable of supporting full recreational use, given that the conditions which impaired the survival of aquatic organisms would also be likely to impair human use of the system.

In addition to the above combinations of classifications, the Wisconsin Department of Natural Resources has two other special classifications used for the highest-quality lakes and streams. These classifications are Outstanding Resource Waters and Exceptional Resource Waters, as defined in Chapter NR 102 of the Wisconsin Administrative Code:

> Outstanding Resource Waters have the highest value as a resource, excellent water quality and high-quality fisheries. They do not receive wastewater discharges and point source discharges will not be allowed in the future unless the quality of such a discharge meets or exceeds the quality of the receiving water. This classification includes national and State wild and scenic rivers and the highest quality, Class I trout streams in the State.

Exceptional Resource Waters have excellent water quality and valued fisheries but already receive wastewater discharges or may receive future discharges necessary to correct environmental or public health problems. This classification includes trout stream segments not classified as Outstanding Resource Waters.

The results of the application of the analysis of water use objectives for selected streams and for major lakes in the Region are graphically summarized on Map II-2 and are summarized below.

Streams: Of the seven water use objective combinations, only the three providing for the three highest biological uses, combined with the full recreational use, are fully compatible with the national goal of "fishable and swimmable" waters. Of the 1,223 stream miles analyzed in the updated planning program, 1,066 miles, or 87 percent, fall into one of these three categories: including 86 miles, or 7 percent, in the coldwater fishery, full recreational use category; 868 miles, or 71 percent, in the warmwater sport fishery, full recreational use category; and 112 miles, or 9 percent, in the warmwater forage fishery, full recreational use category. The remaining 157 stream miles, or about 13 percent, would not meet the national goal of "fishable and swimmable waters". These stream miles generally have excessive bacterial or nutrient levels which cannot as a practical matter be sufficiently reduced; or which have been significantly and permanently altered through concrete channelization; or have other physical alterations which limit their potential recreational use. Of these 157 stream miles, 59 miles, or 5 percent, have been placed into the warmwater sport fish and limited recreational use category; 27 stream miles, or 2 percent, have been placed into the warmwater forage fish and limited recreational use category; 35 stream miles, or 3 percent, have been placed into the limited forage fish and limited recreational use category; and 34 stream miles, or 3 percent, have been placed into the limited aquatic life and limited recreational use category.

The 1,223-mile stream network identified above does not include the Lake Michigan estuary portions of any of the regional streams that drain to Lake Michigan, except for the Milwaukee Harbor estuary which was included in the regional water quality management plan by means of a special estuary study completed in 1987.[2] No specific water use objectives for the remaining estuary reaches were assigned under the areawide water quality management planning program. Because of the complexity of the estuaries, it is envisioned that supplemental estuary studies will have to be undertaken to fully assess the water quality related problems of these estuaries and to intelligently assign appropriate water use objectives to all the estuaries.

Within Southeastern Wisconsin, Bluff, Potawatomi, and Van Slyke Creeks, all in Walworth County, totaling 5.0 stream miles, or 0.4 percent of all the perennial stream miles within the Region, are currently classified as Outstanding Resource Waters. The East Branch of the Milwaukee River from the Long Lake outlet to STH 28 in Washington County; and, Genesee Creek above STH 59, the Mukwonago River from Eagle Springs Lake to Upper Phantom Lake, and the Oconomowoc River below North Lake to Okauchee Lake, all in Waukesha County, totaling 21.4 miles, or

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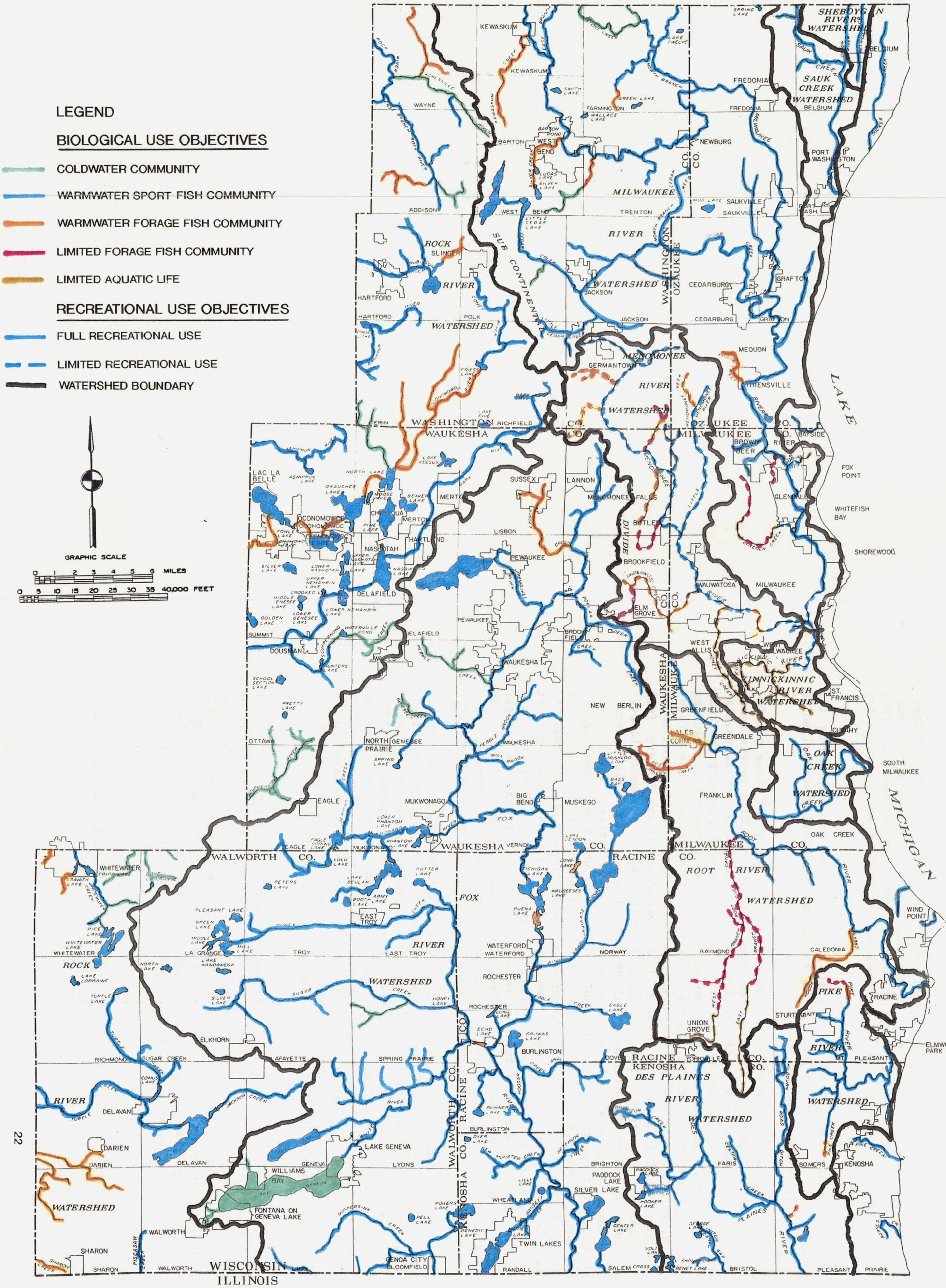
[2]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary; Volume One, Inventory Findings; Volume Two, Alternative and Recommended Plans; December 1987.

## Map II-2

## RECOMMENDED WATER USE OBJECTIVES FOR LAKES AND STREAMS IN SOUTHEASTERN WISCONSIN: 2010




Source: SEWRPC.

1.8 percent of streams in the Region, are currently classified as Exceptional Resource Waters.

Lakes: Of the 101 major lakes in the Region, 98 lakes fall into water use objective categories that are deemed to be fully compatible with the national goal of "fishable and swimmable" waters. Of these 98 lakes, one--Geneva Lake--has been recommended for the maintenance of a coldwater biological community and full recreational use. The lake is the largest inland lake in the Region, with a surface area of 5,262 acres, or 14.5 percent of the total lake surface area of the Region. Within the Region, 97 lakes have been placed into the warmwater sport fish and full recreational use category, occupying a total area of 30,746 acres, or 84 percent of the lake area in Southeastern Wisconsin. The remaining three lakes--Echo Lake, Kee Nong Go Mong Lake, and the Buena Lake portion of the Waterford Impoundment in Racine County, together totaling 400 acres, or 1.1 percent of the lake surface area in the Region--have been placed into the warm-water forage fish and limited recreational use category because of estimated excessive nutrient loadings to the lakes which cannot, as a practical matter, be sufficiently reduced, resulting in accelerating rates of lake fertilization and attendant aquatic plant growth. Two lakes, Lulu Lake in Walworth County and Spring Lake in Waukesha County, are also classified as Outstanding Resource Waters, occupying 189 acres in surface area, or 0.5 percent of the combined surface area of all major lakes in the Region.

Water Quality Standards

In conjunction with the above stated water-use objectives, specific chemical and biological standards were developed for use in the plan updating process in order to quantitatively evaluate the water quality of specific surface waters. The standards are defined as characteristics of a water body which must be maintained to warrant it suitable for specific uses. When applied to specific waters, the standards serve to determine if, and to what extent, the water body is meeting its current water-use objectives. Additionally, standards are established and followed as a means for governing water management decisions.

The currently adopted standards were developed for planning purposes based upon consideration of those set forth in the initial areawide water quality management plan and the Wisconsin Administrative Code--Chapters NR 102, 104, and 105--as well as from additional sources, including U.S. Environmental Protection Agency (EPA) water quality criteria. These standards, as they apply to specific biological use objectives and recreational use objectives for the Southeastern Wisconsin Region, are set forth in Tables II-3 and II-4.

Historically, water quality standards were applied based upon the belief that water pollution was essentially a dry-weather, low-streamflow problem. This practice was based on analyses of stream water quality conditions affected by sewage treatment plant discharges. Such plants normally discharge sewage effluent at a relatively constant rate and quality, thereby causing the most severe water quality problems when receiving streamflows--and hence, dilution--are low. The Wisconsin Department of Natural Resources currently requires that all instream water quality standards be met during all but the very lowest flow conditions, such conditions being defined as flows less than the 7-day average, 1-in-10-year recurrence interval low flow.

Under the Commission's regional water quality management planning programs, however, it was determined that a probabilistic approach to the application of certain water quality standards, whereby the percent of time a given standard

Table II-3

APPLICABLE WATER USE OBJECTIVES AND WATER QUALITY STANDARDS FOR LAKES AND STREAMS WITHIN THE SOUTHEASTERN WISCONSIN REGION[a]

| Water Quality Parameters | Combinations of Water Use Objectives Adopted for Southeastern Wisconsin Inland Lakes and Streams[b,c] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Coldwater Community and Full Body Recreational Use | Warmwater Sport fish Community and Full Recreational Use | Warmwater Sport fish Community and Limited Recreational Use | Warmwater Forage Fish Community and Full Recreational Use | Warmwater Forage Fish Community and Limited Recreational Use | Limited Forage Fish Community and Limited Recreational Use[d] | Limited Aquatic Life and Limited Recreational Use |
| Temperature[e,f,g] (°F) | Background | 89.0 maximum | 89.0 maximum | 89.0 maximum | 89.0 maximum | -- | -- |
| Dissolved Oxygen[g] (mg/l) | 6.0 and 7.0[h] minimum | 5.0 minimum[i] | 5.0 minimum[i] | 5.0 minimum[i] | 5.0 minimum[i] | 3.0 minimum[j] | 3.0 minimum[j] |
| pH Range[k] (S.U.) | 6.0 - 9.0 | 6.0 - 9.0 | 6.0 - 9.0 | 6.0 - 9.0 | 6.0 - 9.0 | 6.0 - 9.0 | 6.0 - 9.0 |
| Total Phosphorous[l] (mg/l) | 0.1, 0.02 maximum | 0.1, 0.02 maximum | -- | 0.1, 0.02 maximum | -- | -- | -- |
| Un-ionized Ammonia Nitrogen (mg/l) | 0.02 maximum | 0.04 maximum | 0.04 maximum | 0.04 maximum | 0.04 maximum | 3.0, 6.0 maximum[m] | -- |
| Chloride[n] (mg/l) | 1,000 maximum | 1,000 maximum | 1,000 maximum | 1,000 maximum | 1,000 maximum | 1,000 maximum | -- |
| Fecal Coliform (MFFCC) | 200, 400 maximum[o] | 200, 400 maximum[o] | 1,000, 2,000 maximum[p] | 200, 400 maximum[o] | 1,000; 2,000 maximum[p] | 1,000; 2,000 maximum[p] | 1,000; 2,000 maximum[p] |

[a] Includes SEWRPC interpretations of all basic water use categories established by the Wisconsin Department of Natural Resources and additional categories established under the areawide water quality management planning program, plus those combinations of water use categories applicable to the Southeastern Wisconsin Region. It is recognized that under both extremely high and extremely low flow conditions, instream water quality levels can be expected to violate the established water quality standards for short periods of time without damaging the overall health of the stream. It is important to note the critical differences between the official State and federally adopted water quality standards--composed of "use designations" and "water quality criteria"--and the water use objectives and supporting standards of the Regional Planning Commission described here. The U.S. Environmental Protection Agency and the Wisconsin Department of Natural Resources, being regulatory agencies, utilize water quality standards as a basis for enforcement actions and compliance monitoring. This requires that the standards have a rigid basis in research findings and in field experience. The Commission, by contrast,must forecast regulations and technology far into the future, documenting the assumptions used to analyze conditions and problems which may not currently exist anywhere, much less in or near Southeastern Wisconsin. As a result, more recent--and sometimes more controversial--study findings must sometimes be applied. This results from the Commission's use of the water quality standards as criteria to measure the relative merits of alternative plans.

[b] All waters shall meet the following minimum standards at all times and under all flow conditions: substances that will cause objectionable deposits on the shore or in the bed of a body of water, floating or submerged debris, oil, scum, or other material, and material producing color, odor, taste or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the State. Substances in concentrations or combinations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts which are acutely harmful to animal, plant or aquatic life.

Footnotes continue.

Footnotes to Table II-3

[c] Standards presented in the table have been applied for planning purposes to lakes over 50 acres in surface area and to major streams of the Region.

[d] No un-ionized ammonia nitrogen standard has been established for streams or lakes classified as supporting limited forage fish communities. The maximum standard for total ammonia, as set forth in Chapter NR 104 of the Wisconsin Administrative Code, is included in the table.

[e] There shall be no temperature changes that may adversely affect aquatic life. Natural daily and seasonal temperature fluctuations shall be maintained. The maximum temperature rise at the edge of the mixing zone above the natural temperature shall not exceed 5°F for streams.

[f] There shall be no significant artificial increases in temperature where natural trout reproduction is to be maintained.

[g] Dissolved oxygen and temperature standards apply to continuous streams and the leeches of stratified lakes and to the unstratified lakes; the dissolved oxygen standard does not apply to the hypolimnion of stratified inland lakes. However, trends in the period of anaerobic conditions in the hypolimnion of deep inland lakes should be considered important to the maintenance of their natural water quality.

[h] Dissolved oxygen in classified trout streams shall not be artificially lowered to less than 6.0 mg/l at any time, nor shall the dissolved oxygen be lowered to less than 7.0 mg/l during the spawning season.

[i] Standard noted is applied using a probabilistic analyses approach as defined in this chapter; absolute minimum standard of 3.0 mg/l of dissolved oxygen also applies.

[j] Standard noted is applied using a probabilistic analyses approach as defined in this chapter; absolute minimum standard of 1.5 mg/l of dissolved oxygen also applies.

[k] The pH shall be within the stated range with no change greater than 0.5 units outside the estimated natural seasonal maximum and minimum.

[l] In streams classified for full recreational use, the total phosphorus concentration shall not exceed 0.1 mg/l. In lakes classified for full recreational use, the total phosphorus concentration shall not exceed 0.02 mg/l during spring when maximum mixing is underway. A phosphorus standard does not apply to streams and lakes classified for limited recreational use. Total phosphorus standards were developed by the Commission for use in the initial water quality management plan from U.S. Environmental Protection Agency recommendations set forth in Quality Criteria for Water, 1976.

[m] Standard is for total ammonia. Ammonia Nitrogen, expressed as N, at all points in the receiving water of Limited Forage Fish Communities should not be greater than 3 mg/l during warm temperature conditions (May - October), and 6 mg/l during cold temperatures (November - April), to minimize the zone of toxicity and to reduce dissolved oxygen depletion caused by oxidation of the ammonia.

[n] Threshold concentration for the propagation of freshwater fish above which the effects on aquatic life may become significant as determined by the California State Water Pollution Control Board, 1952.

[o] The fecal coliform count (MFFCC) should not exceed 200 per 100 ml as a geometric mean based on no less than 5 samples per month, nor exceed 400 per 100 ml in more than 10% of all samples during any month.

[p] The fecal coliform count (MFFCC) should not exceed 1000 per 100 ml as a geometric mean based on no less than 5 samples per month, nor exceed 2000 per 100 ml in more than 10% of all samples during any month.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table II-4

ACUTE AND CHRONIC TOXICITY CRITERIA[a]

| Water Quality Parameters | Acute Toxicity ($\mu g/l$) | | | | | | Chronic Toxicity ($\mu g/l$) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Water Use Objective | | | | | | Water Use Objective | | |
| | Coldwater | | | Others | | | All Water Use | | |
| | Hardness ($mgCaCO_3/l$) | | | Hardness ($mgCaCO_3/l$) | | | Hardness ($mgCaCO_3/l$) | | |
| | 50 | 100 | 200 | 50 | 100 | 200 | 50 | 100 | 200 |
| Cadmium | 1.8 | 3.9 | 8.6 | 13.3 | 29.0 | 63.3 | 0.2 | 0.5 | 1.0 |
| Copper | 8.6 | 16.6 | 31.8 | 8.6 | 16.6 | 31.9 | 6.0 | 11.2 | 22.1 |
| Lead | 70.0 | 169.1 | 408.6 | 70.0 | 169.1 | 408.6 | 4.2 | 10.1 | 24.4 |
| Zinc | 57.4 | 103.3 | 185.8 | 62.7 | 112.8 | 202.9 | 27.6 | 49.6 | 89.2 |

[a]Values set forth in Chapter NR 105 of the Wisconsin Administrative Code.

Source: Wisconsin Department of Natural Resources.

should be allowed to be violated would be specified, would allow the assessment and resolution of water quality problems during high-flow as well as low-flow conditions. This approach is considered appropriate for planning, as opposed to regulatory, purposes as it allows the use of standards as criteria to measure the relative merits of alternative plans. Accordingly, analyses were conducted, under the initial regional water quality management plan, to determine the percentage of the time certain standards should be allowed to be violated except under specified conditions. A 95 percent compliance level was selected as the criterion for meeting the water quality standards for some parameters which directly affect desirable forms of aquatic life; namely, dissolved oxygen, temperature, un-ionized ammonia nitrogen, and pH. A 90 percent compliance level was selected as the criterion for parameters which do not directly affect desirable forms of aquatic life; namely, phosphorus, fecal coliform organisms, and chlorides. The analyses indicated that if these compliance levels were always met other than during periods of extreme low-flow conditions, the duration of the violation could be expected to be relatively short and the intensity of the violation to be relatively low, so that desirable uses and forms of aquatic life should not be adversely affected. Furthermore, the analyses indicated that even those surface waters which currently support full recreational uses and healthy fish and aquatic life communities often did not meet applicable water quality standards at all times. Thus, some level of violation of the standards was considered acceptable.

This probabilistic approach to water quality standards application was also used where applicable in the preparation of the regional water quality management plan update as a supplement to the current exemption in the standards for flow conditions lower than the 7-day average, 1-in-10-year recurrence interval low flow. This approach was generally used in considering the achievement of the water use objectives based upon modeling data developed in the initial plan for conditions arising from pollutant control levels which approximate current conditions. The probabilistic compliance level approach was not applied to those parameters for which seasonal standards--or standards based on acute and chronic toxicity criteria--were developed. For dissolved oxygen, an absolute minimum standard is also considered, as noted in Table II-3. For metals, values based on acute toxicity are presented and the application of such standards and criteria is specific and no probabilistic compliance level procedure is used. Chronic toxicity levels are also presented for metals and were considered based upon the 90 percent compliance level noted above.

Sediment Quality Standards

In addition to dissolved contaminants, contaminants also accumulate in lake and stream sediments. The Federal Water Resources Development Act of 1992 recognized the widespread existence of contaminated sediments and required that existing information on such sediments be compiled in a register. In response to this directive, the Wisconsin Department of Natural Resources (DNR) undertook a review of the existing data available in the State with a view toward developing statewide criteria for the identification and prioritization of contaminated sediment sites. The Department's draft report was published in mid-1994.[3] The criteria set forth in this report supersede previously published EPA criteria and, hence, have been adopted for use as an assessment tool in this plan.

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[3]Wisconsin Department of Natural Resources, Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System, June 1994.

The assessment criteria proposed in the draft DNR report are based on the potential for the contaminants present in the sediments at a particular site to create biological impacts. Two levels of potential impact are proposed: the lowest effect level (LEL) and the severe effect level (SEL) which represented the 5th and 95th percentiles, respectively, of a database compiled and analyzed in a comprehensive reference study prepared by the Ontario Ministry of the Environment. These values were considered by the DNR to be applicable within the State of Wisconsin. The lowest and severe effect levels for a selected set of parameters are shown in Table II-5.

Available data on the sediment quality were assembled for use in assessing the potential contamination of sediments within the Region. These data are presented in Chapters IV through XV for the major watersheds in the Region.

## CURRENT SURFACE WATER QUALITY EVALUATION, DATA SOURCES AND PROCEDURES

Water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964-65 Commission benchmark stream water quality study, the 1965-75 Commission stream water quality monitoring effort, the 1976 Commission sampling program for the regional water quality management plan, and the Wisconsin Department of Natural Resources sampling programs in 1973 and 1976.

The water quality biological condition and sediment quality data have been collected since the initial regional plan by sampling programs operated by other agencies and local units of government, including the Wisconsin Department of Natural Resources, the Milwaukee Metropolitan Sewerage District, the U. S. Geological Survey, the U. S. Environmental Protection Agency, and local lake organizations. In many cases, data have been collected for local or subregional purposes and thus do not represent a uniform data base comparable to that which was available for the initial regional plan, which included the results of modeling of the stream system. Therefore, the assessment of the probability of achieving the established water use objectives has relied in part upon the uniform areawide characterization of surface water conditions developed under the initial plan and expanded for the Milwaukee Harbor estuary study.[4] Simulation modeling conducted during the earlier planning programs,[5] in most cases, remains valid. Simulation of water quality conditions was carried out under various levels of point source and nonpoint source pollution control, and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. While these modeling data cannot be used to precisely quantify the current 1990 water quality conditions, review of those data and a knowledge of the current status of the pollution control recommendations provides insight into the current water quality conditions and the potential for achieving the established water use objectives under current conditions.

### Streams

Where data were available, various biotic and water quality indices were calculated for stream reaches within the Region. A water quality index value was

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[4]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, December 1987.

[5]SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin--2000, Volume Two, Alternative Plans, February 1979.

Table II-5

LOWEST AND SEVERE EFFECT LEVELS OF CONTAMINANTS
PRESENT IN SEDIMENTS IN WISCONSIN

| Chemicals | Lowest Effect Level[a] | Severe Effect Level[a] |
|---|---|---|
| As (Arsenic) | 6 | 85 |
| Cd (Cadmium) | 1.1 | 9 |
| Cr (Chromium) | 31 | 145 |
| Cu (Copper) | 25 | 390 |
| Hg (Mercury) | 0.15 | 1.3 |
| Ni (Nickel) | 31 | 75 |
| Pb (Lead) | 31 | 250 |
| Zn (Zinc) | 120 | 820 |
| Total PAH (Polycyclic Aromatic Hydrocarbons) | 4 | 500 |
| Total PCB (Polychlorinated Bi-phenyls) | 0.07 | 26.4 |
| Aldrin | 0.002 | 0.4 |
| Chlordane | 0.007 | 0.3 |
| Total DDT | 0.007 | 0.6 |
| op + pp DDT | 0.008 | 3.6 |
| pp DDD | 0.008 | 0.3 |
| pp DDE | 0.005 | 1 |
| Mirex | 0.007 | -- |
| TCDD (dioxin) $\mu$g/kg | 0.0003 | -- |
| $NH_3$-N | 75 | -- |
| Oils and Grease | 1,000 | -- |
| CN (Cyanide) | 0.1 | -- |

[a] Concentrations are in mg/kg dry sediment, with the exception of TCDD, which is in $\mu$g/kg.

Source: Wisconsin Department of Natural Resources and SEWRPC.

calculated for selected reaches. This index value was based upon six water quality parameters: fecal coliform counts, pH, and dissolved oxygen, chloride, nitrate-nitrogen, and total phosphorus concentrations. The same index was used in the initial regional water quality management plan.[6] For each water quality station where current data were available, the observed levels of each of the six selected parameters were assigned a score in the range of from 0 to 100. The parameter scores were then combined, through the use of selected weighing values, to prepare a general water quality index classification for each sampling station. Where the available data permit, the resulting ratings, based upon data obtained since the completion of the initial plan, are presented and compared to the 1964 and 1975 indices, along with descriptions of existing water quality conditions and trends, for each of the 12 major watersheds in the Region. These data are presented in Chapters IV through XV. Available water quality data collected since the completion of the initial plan are also summarized graphically in Chapters IV through XV.

Two biotic indices were also calculated where data were available. The Hilsenhoff Biotic Index (HBI) is the ratio of pollution-tolerant species or genera of arthropods--benthic animals--present in a stream sample population. Each species or genus is assigned a pollution tolerance value of between 0 and 5, with 0 representing the least tolerant species and 5 the most tolerant species. At each stream station, and for each species or genus present, the number of individual animals present is multiplied by the tolerance coefficient value for that species or genus, and a total score determined. The total score is divided by the total number of individuals present in the sample to derive the index value. HBI values of less than 2.75 were considered indicative of good water quality, while values in excess of 4.0 were considered indicative of poor water quality.[7] The resulting index values, based upon data obtained since the completion of the initial plan together with selected sampling data, are presented, along with descriptions of existing water quality conditions and trends, for each of the 12 major watersheds in the Region. These data are also presented in Chapters IV through XV.

Similarly, where data were available, an Index of Biotic Integrity (IBI) value was calculated. This index is a numerical description of the stream fishery, being comprised of the summation of ten scores and two correction factors. These scores are derived from metrics which reflect species richness and composition--rankings are given on the basis of the total number of native fish species, the number of darter species, the number of sucker species, the number of sunfish species, the number of pollution-intolerant species, and the percentage of pollution-tolerant species, their trophic and reproductive function--rankings are given on the basis of the percentage of omnivores, the percentage of insectivores, the percentage of top carnivores, and the percentage of simple lithophilous spawners, and fish abundance and condition--rankings are given on the basis of the number of pollution-intolerant individuals per 300 meters sampled and the percentage of deformities, eroded fins, lesions or tumors (DELT). Fish abundance and condition rankings, or the correction factors, are used only in cases where the IBI scores have extreme values--for example, where there are

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[6]See also: SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1974, June 1978.

[7] Wisconsin Department of Natural Resources Technical Bulletin No. 132, Using A Biotic Index to Evaluate Water Quality in Streams, 1982.

very low numbers of fishes or a high percentage of DELT fishes. IBI values of close to 100 are considered indicative of good water quality, while values near zero are considered indicative of poor water quality.[8] Negative scores are rounded to zero. Scores differing by at least 25 points are considered to represent clear differences between sites. Where adequate data are available, the resulting index values, based upon data obtained since the completion of the initial plan, together with selected sampling data, are presented along with descriptions of existing water quality conditions and trends for each of the 12 major watersheds in the Region. These data are also presented in Chapters IV through XV.

Lakes

The 101 major lakes in the Region have been classified and are discussed according to trophic status where data exist. Trophic state classifications form a continuum from very nutrient poor lakes--classified as ultra-oligotrophic or oligotrophic--through mesotrophic to very nutrient rich lakes--classified as eutrophic or hypertrophic. The nutrient status of the lakes--generally assessed by means of their nitrogen and phosphorus concentrations and nitrogen to phosphorus ratios--is directly related to the nature and magnitude of plant growth that occurs in the lake. The relative proportions of nitrogen to phosphorus concentrations determines which of these essential plant nutrients controls plant growth--the "limiting nutrient"--as well as the type of algal growth that will occur--the lower the nitrogen to phosphorus ratio the more likely the lake is to be enriched and the more likely it is to have an algal flora dominated by nuisance, scum-forming blue-green algae. Eutrophic--or "well-fed"--lakes tend to have large numbers of few species of plants and animals, or unbalanced ecosystems dominated by the less desirable plants and animals; whereas, the oligotrophic--or nutrient poor--lakes tend to have small numbers of many species of plants and animals. The middle state--mesotrophy--contains moderate numbers of numerous species of plants and animals. Mesotrophy tends to be the most acceptable state for multiple use waterbodies and tends to be the natural state of most Southeastern Wisconsin waterbodies[9]--58 of the 101 major lakes in the Region have been assessed as mesotrophic using the trophic state classification described further below.

The trophic state classifications were assigned, where data were available, based on the phosphorus and chlorophyll concentrations and water clarity, with consideration being given to the levels of use impairment caused by algal and aquatic plant growth. The most commonly available data were water clarity data--determined as Secchi disc transparency--obtained through the Wisconsin Department of Natural Resources citizen-based Self-help Monitoring Program, the DNR Long-term Trends Monitoring Program, and specific lake studies conducted by the U. S. Geological Survey under the Chapter NR 119 Lake Management Planning Grant Program. These data were used to calculate the Carlson Trophic State Index

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[8] United States Department of Agriculture, Forest Service General Technical Report No. NC-149, Using The Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams of Wisconsin, April 1992.

[9] Lillie, R.A. and J.W. Mason, "Limnological Characteristics of Wisconsin Lakes," DNR Technical Bulletin No. 138, 1983.

(TSI) values and Wisconsin Trophic State Index (WTSI) values for these lakes.[10] These index values present numerical representations of water quality conditions in lakes based on a scale that ranges from 0 or ultra-oligotrophic to 100 or hypertrophic. Scores of about 50 are indicative of borderline eutrophy. The WTSI modifies the original Carlson TSI value to account for the greater humic--or tea-stained--coloration present in Wisconsin lake waters. Where data permit, both the Carlson and Wisconsin trophic state ratings are reported in the descriptions of water quality conditions in these lakes by watershed, as set forth in Chapters IV through XV.

The changes that have occurred in the water quality status of the lakes since 1975, as documented in the initial regional water quality management plan, are reported for the major lakes in each of the 12 major watersheds in the Region, as set forth in Chapters IV through XV, insofar as data exist. Assessment of change in water quality is based on a comparison of TSI values derived from 1981 survey based on satellite imagery and other available pre-1981 data sources, with index values calculated from post-1981 lake monitoring. The 1979-81 satellite imagery data[11], while tabulated, have limitations--the TSI was based only upon chlorophyll-a levels estimated from satellite imagery rather than upon chlorophyll-a and total phosphorus concentrations and water clarity observed in the lakes--which preclude their use in such assessments. The TSIs calculated from Wisconsin Department of Natural Resources Self-help monitoring data, while generally based solely on Secchi disc transparencies, in contrast, represent a readily available measured characterization of the status of the major lakes of Southeastern Wisconsin and likewise are presented in the following 12 chapters. However, because of these limitations in the data, as well as the inherently general nature of the Trophic State Index, the TSI values should be used with caution when comparing overall lake conditions. This is especially true when the variability inherent in the data is taken into account. For this reason, a change in TSI value of at least 10 units was required before a change in lake water quality was accepted as an assumed change. A change of 10 TSI units is equivalent to a change of approximately three to six feet in Secchi disc transparency in the mid-range mesotrophy. Even then, field data should be acquired before any lake management response, or alteration of existing lake management response, is contemplated. The WTSI values were not used in these assessments but are presented in order to facilitate future assessments when this refined index is brought into general use by the Wisconsin Department of Natural Resources.

## SUMMARY

The assessment of water quality conditions requires a comparison of observed conditions to desired conditions. Thus, this plan update presents available

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[10]The two trophic state index schemes are described in detail in R.E. Carlson, "A Trophic State Index for Lakes," Limnology and Oceanography, Volume 22, pp. 361-368, 1977; and R.A. Lillie, S. Graham, and P. Rasmussen, "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," DNR Research Management Findings, No. 35, May 1993. It should be noted that Wisconsin Trophic State Index values are currently being adopted by the DNR for future use in water quality assessments.

[11]Wisconsin Water Quality Assessment Report to Congress, 1992; and Wisconsin's Lakes-A Trophic Assessment, January 1983.

data upon which the assessment of current water quality and biological conditions can be made. Changes in water quality conditions which are apparent since preparation of the initial plan are also discussed where this data allow. In addition, a comparison of the water quality conditions of streams and lakes based upon available water quality sampling data obtained since 1975, or in some cases, estimated based upon modeling data developed in the initial plan, to the water use objectives and supporting standards described in this chapter. The resulting assessments are summarized by watershed in Chapters IV through XV. This approach was used to underpin the watershed-based approach to water quality management detailed in the following chapters.

Chapter III

# LAND USE PLAN ELEMENT

## INTRODUCTION

The most fundamental and basic element of the regional water quality management plan is the land use element. The future distribution of urban and rural land uses will determine to a large degree the character, magnitude, and distribution of point and nonpoint sources of pollution; the practicality of as well as the need for various lake, stream, and groundwater system management plans; and ultimately, the quality of the surface waters and the groundwater pollution potential of the Region. Accordingly, the selection and use of a regional land use plan is an essential element in synthesizing a regional water quality management plan.

The Southeastern Wisconsin Regional Planning Commission prepared and adopted on September 23, 1992, a new regional land use plan for the design year 2010. This plan is set forth in full in SEWRPC Planning Report No. 40, A Regional Land Use Plan for Southeastern Wisconsin - 2010. This land use plan was intended to update and revise as necessary the previously adopted SEWRPC regional land use plan for the year 2000, which was prepared and adopted by the Commission on December 19, 1977, and which served as the basis of the land use element of the 1979 regional water quality management plan. The year 2000 plan is documented in SEWRPC Planning Report No. 25, A Regional Land Use Plan and a Regional Transportation Plan for Southeastern Wisconsin: 2000. The design year 2010 plan is based upon the same basic concepts as the year 2000 plan, refining and detailing the previous plan as required with respect to changes in the levels and spatial distribution of population, households, and employment; land use patterns; and public facility and utility systems development.

## YEAR 2000 PLAN RECOMMENDATIONS

The year 2000 land use plan emphasized a compact, centralized regional settlement pattern, with the location, intensity, and character of urban development being largely controlled by the effects of the urban land market. However, the plan sought to influence the urban land market in three significant areas in an effort to achieve a more healthful, attractive, and more efficient regional settlement pattern.

First, the year 2000 plan recommended that intensive urban development occur only in those areas of the Region covered by soils suitable for such development; and not subject to special hazards, such as flooding and shoreline erosion; and furthermore, those areas which would be readily served by essential municipal facilities and services, including centralized public sanitary sewerage and water supply. The plan recommended that new residential development occur primarily in planned neighborhood units at medium densities. A total of 22 major industrial centers and 16 major commercial centers were envisioned to exist within existing or proposed urban areas by the plan year 2000.

Second, the plan recommended the protection of all of the remaining primary environmental corridors of the Region from intrusion by incompatible urban development. The preservation of the primary environmental corridors in essentially natural, open uses, was envisioned to contribute to an anticipated integrated system of park and related open spaces within the Region.

Third, the design year 2000 plan proposed the retention, in essentially rural use, of almost all the remaining prime agricultural lands. These prime agricultural lands consist of the most productive farm lands and farm units in the Region.

STATUS OF IMPLEMENTATION OF THE YEAR 2000 LAND USE PLAN

In many respects, actual growth and change within the Region between 1970, the base year of the year 2000 plan, and 1985, the base year of the year 2010 plan, occurred in close conformance with design year 2000 regional land use plan recommendations and forecasts. However, it should be noted that this period also experienced a continuation of certain trends which were at variance with the plan.

Between 1970 and 1985, residential development in the Region occurred at a rate somewhat higher than envisioned under the adopted regional land use plan. While more that 70 percent of all housing units were built at medium or high residential densities in accordance with plan recommendations, substantial development of residential land occurred at lower densities.

Additional land use development, with respect to major recreational, commercial, and industrial centers, proceeded in substantial conformance with regional land use plan recommendations. Between 1970 and 1985, continued development of the majority of the recommended major park sites occurred in accordance with specific recommendations. Two of five proposed commercial sites and three of five proposed industrial sites also achieved major regional commercial or industrial site status between 1970 and 1985.

Significant progress was made in the protection of primary environmental corridor lands in the Region between 1970 and 1985. In 1970, approximately 72 square miles of primary environmental corridor lands were protected through public ownership. By 1985, 147 square miles, or about 31 percent of primary corridor lands in the Region, were publicly owned and thereby permanently protected against inappropriate urban development. Urban development in other areas of the Region, however, was largely responsible for the loss of almost eight square miles, or approximately 2 percent of the total primary environmental corridor lands.

Substantial progress was also made in the protection of prime agricultural lands between 1970 and 1985 through the application of exclusive agricultural zoning. This zoning served to protect about 585 square miles of prime agricultural lands within the Region. While the regional land use plan recommended the preservation of most prime agricultural lands, the plan recognized that the loss of certain prime farmland would be necessary to accommodate continued urban growth and development within the Region. In total, about 160 square miles of prime farmland was lost to urban development in the Region between 1963 and 1985. About 27 square miles of this total was located in, or adjacent to, expanding urban areas, consistent with the year 2000 land use plan recommendations. The remaining 133 square miles were located in outlying rural areas generally recommended to remain in agricultural and related use under the year 2000 land use plan.

## YEAR 2010 PLAN--ALTERNATIVE FUTURES

During periods of major change in social and economic conditions, there is great uncertainty as to whether or not historic trends will continue. In order to deal with this uncertainty, the Southeastern Wisconsin Regional Planning Commission incorporated the use of "alternative futures" into the preparation of the new year 2010 land use plan. Under this approach, the development and evaluation of alternative land use plans is based not upon a single most probable forecast of future socio-economic conditions, but rather upon a number of alternative futures chosen to represent a range of conditions which may occur over the plan design period. The alternative futures are intended to supplement the recommended plan by indicating a range of possible future conditions with respect to the level and distribution of population, households, economic activity, and attendant land use patterns in the Region. The purpose of the approach is to allow the evaluation of the performance of alternative plans over a variety of possible future conditions in order to identify those alternatives that perform well under a wide range of such conditions.

Under the alternative futures approach, three alternative future growth scenarios were postulated for Southeastern Wisconsin. The sets of conditions postulated for each "future" were intended to represent consistent, reasonable scenarios of future changes in resident population and economic activity levels in the Region through the year 2010. Two scenarios, the "high-growth" scenario and the "low-growth" scenario, were intended to represent reasonable extremes, while the third scenario, the "intermediate-growth" scenario, was intended to represent the most-likely future.

From these three growth scenarios, four individual alternative futures land use plans plus the recommended land use plan were developed for the design year 2010. Each plan was based upon different potential growth rates and development patterns. Three of these plans envision a decentralized regional settlement pattern. The "high-growth decentralized" plan was designed to accommodate the future population and economic activity levels that could be anticipated under a high-growth scenario. The "intermediate-growth decentralized" plan and the "low-growth decentralized plan were designed to accommodate the population and economic activity levels that would be anticipated under the intermediate- and low-growth scenarios, respectively. The fourth plan, the "high-growth centralized" plan, was designed to accommodate population and economic activity levels anticipated under the high-growth scenario, emphasizing a centralized, rather than a decentralized development pattern for the Region as did the other three alternative futures. Together, these four alternative futures land use plans were intended to conceptually bracket the new recommended year 2010 regional land use plan, which was based upon an intermediate-growth centralized scenario. While many variations of the four alternative futures plans are possible, it is believed that the four alternative futures plans, in conjunction with the recommended plan, provide a good representation of the range of possible future conditions with respect to the overall scale and distribution of land use development in the Region through the year 2010.

As might be expected, population and employment levels anticipated under the three growth scenarios vary considerably. Under the high-growth scenario, the resident population of the Region would increase by about 551,000 persons, or 31 percent, from about 1,765,000 persons in 1980 to about 2,316,000 persons by the year 2010. The intermediate-growth scenario envisions a population increase of about 107,000 persons, or 6 percent, to a level of about 1,872,000 persons by the year 2010. Conversely, the low-growth scenario envisions a decrease in the regional population of about 248,000 persons, or 14 percent, to a level of about 1,517,000 persons by the year 2010.

Under the high-growth scenario, total regional employment would increase by about 368,000 jobs, or 42 percent, from about 884,000 jobs in 1980 to about 1,252,000 jobs by 2010. Under the intermediate-growth scenario, employment would increase by about 167,000 jobs, or 19 percent, to about 1,051,000 jobs by 2010. Under the low-growth scenario, total employment would approximate 871,000 jobs by 2010, about 13,000 jobs, or about 2 percent, less than the 1980 level.

As a practical matter, the design of a regional land use plan must be targeted toward a single set of population and employment forecasts. It was the collective judgment of the Advisory Committee guiding the preparation of the design year 2010 plan that future population and employment levels in the Region would be most closely approximated by the intermediate-growth scenario. Accordingly, the Committee directed that the new land use plan be prepared to accommodate the population and employment forecasts attendant to that scenario, with some adjustments to reflect 1990 benchmark population and employment data. It was thus determined that the new regional land use plan should accommodate a design year population of 1,911,000 persons, and a design year employment level of about 1,095,000 jobs. While the new year 2010 regional land use plan is based upon the intermediate-growth scenario, potential land use patterns associated with population and economic activity levels under the low-growth and high-growth scenarios were also explored under the current planning program.

The new year 2010 regional land use plan, as described in the following sections, has been scaled to a carefully selected set of population, household, and employment forecasts for the Region. Consideration of these alternative future conditions is particularly important in local plan implementation activities associated with the regional water quality management plan. It is recommended that the local, detailed facility planning for both point and nonpoint source pollution abatement projects give consideration to the range of possible future conditions. As an example, the design of certain facilities which can readily be expanded in stages may be based initially on the recommended intermediate-growth centralized plan, or even on the low-growth stage of that recommended plan,, recognizing that the expansion of such facilities can be readily accommodated if a higher-growth future occurs. Examples of such a facility would be treatment plants designed for modular expansion or detention basins in areas where adequate open land is reserved. Conversely, certain facilities which cannot be readily expanded may be designed initially using the higher growth future condition. Such facilities might include gravity flow trunk sewers being built in areas where development is taking place, making replacement or reinforcement costly. Facilities crossing wetlands or other environmentally sensitive areas may also warrant design based upon a higher growth future in order to avoid future disruption. By considering the range of future conditions, the most robust as well as cost-effective and environmentally sound alternative design can be selected. To this end, design year 2010 population data under the recommended plan and under a high-growth decentralized land use scenario are provided herein for each sewer service area in the Region in order to provide a reasonable range of conditions to be considered in subsequent facility planning.

## LAND USE PLAN ELEMENT

The adopted regional land use plan for design year 2010 for the Southeastern Wisconsin Region, as it was adopted on September 23, 1992, is shown in graphic summary on Map III-1. The regional land use plan recommends the promotion of compact, centralized land use development in the Region, with development generally occurring in concentric rings along the periphery of, and outward from, existing urban centers. While the plan continues to recognize the importance of market forces in determining the location, intensity, and character of urban development, it--like the two predecessor regional land use plans--seeks to influence the operation of the urban land market in order to promote a more orderly and economic settlement pattern. This settlement pattern would generally avoid further intensification of existing, and the creation of new, areawide developmental and environmental problems. In this regard, the plan recommends that new urban development occur either at densities consistent with the provision of public centralized sanitary sewer, water supply, and mass transit facilities and services, or in locations where such facilities and services can be readily and economically provided. Additionally, the plan seeks to encourage the location of new urban development primarily in those areas of the Region which are covered by soils suitable for such development and not subject to special hazards, such as flooding and erosion.

### Urban Development and Density

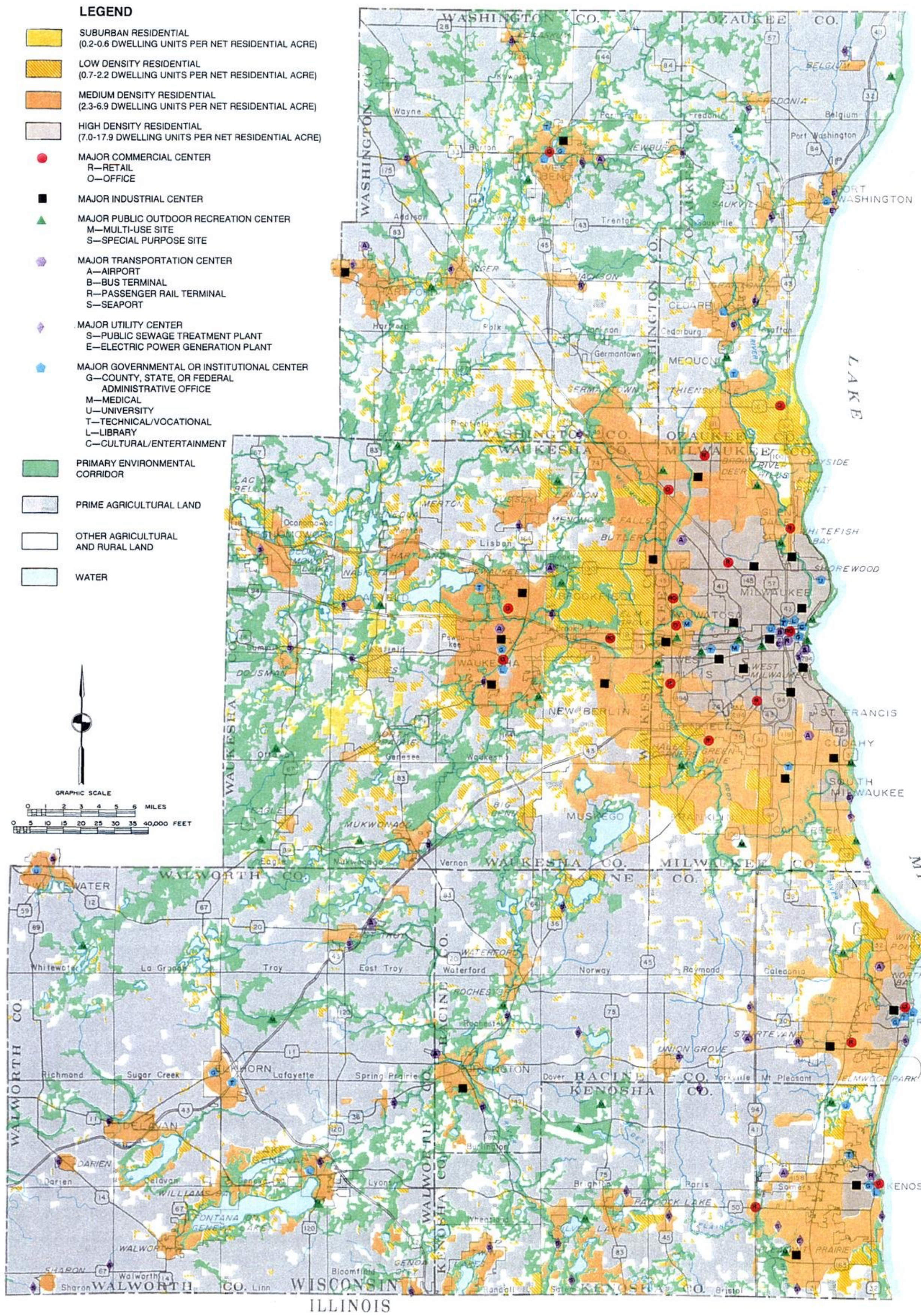
In order to accommodate the anticipated increases in population, households, and employment levels from 1985 to 2010, the year 2010 regional land use plan proposes to accommodate portions of this growth through the conversion of certain existing rural lands to urban land uses. In 1985, approximately 605 square miles, or about 22 percent of the Region, were devoted to urban land uses. The recommended land use plan anticipates a conversion of about 86 square miles of rural land to urban use by the year 2010, increasing the total stock of urban land to 691 square miles, or to about 26 percent of the total area of the Region.

The land use plan envisions that most new urban development would occur in planned neighborhood development units at medium density, with a typical single-family lot size of one-quarter acre and a typical multi-family development averaging about 10 dwelling units per net acre. Urban development would be provided with basic urban services and facilities, including, importantly, public sanitary sewer and water supply services. The plan envisions that by the year 2010 about 85 percent of all urban land and about 91 percent of the total population of the Region would be served with public sanitary sewer and water supply services.

The year 2010 land use plan seeks to discourage scattered, "leap frog" urban development--urban sprawl--in outlying areas of the Region, both through encouragement of higher density development in those areas of the Region that can be most readily served by essential urban services, and through the maintenance of rural development densities in these rural, outlying areas, that is, average lot sizes of at least five acres per dwelling unit. With proper attention to soil and other natural resource base limitations, such development can be sustained without public sanitary sewer, water supply, or urban storm drainage facilities; high-value woodland and wetland areas can be preserved; and wildlife can continue to sustain itself in the area.

## Map III-1

# RECOMMENDED LAND USE PLAN FOR THE SOUTHEASTERN WISCONSIN REGION: 2010




*Source: SEWRPC.*

Under the plan, the population density within the developed area of the Region would decline from a 1985 level of about 3,600 persons per square mile to a year 2010 level of about 2,800 persons per square mile, continuing the trend toward declining densities evident in the Region since 1920. The rate of decline would be significantly reduced, however, by implementation of plan proposals to develop the majority of new urban land within the Region at medium, rather than low, densities and to provide such development with public sanitary sewer and water supply services.

Major Regional Commercial and Industrial Centers

In the Southeastern Wisconsin Region in 1985, there were 14 existing major commercial centers, encompassing a total of almost 1,100 acres of commercial land uses. The recommended land use plan proposes retaining all 14 existing sites as major commercial centers through the year 2010 and also proposes the expansion of certain of these centers. It is anticipated that with the expansion of the centers, 300 acres, in addition to the existing 1,100 acres, of commercial land would be occupied.

In addition to the proposed expansion of the centers, the plan recommends the development of five new major commercial centers in the Region. Four of the five centers are proposed as office centers and would include Park Place in northwestern Milwaukee County, development of which is currently underway; a strip office development along IH 43 in the City of Mequon, which is also under development; a new research park to be located near the Milwaukee County Institutions grounds in the City of Wauwatosa; and a new office center located near the intersection of IH 94 and CTH J in the Town of Pewaukee. The fifth proposed commercial center is a retail center located near the intersection of IH 94 and STH 50 in Kenosha County, development of which is underway.

In 1985, there were 22 major industrial centers identified in the Region. The recommended regional land use plan proposes to retain all of these sites as major industrial centers and further proposes to add three new major industrial centers by the year 2010. The three proposed new centers would be located in or near the Cities of Burlington and Hartford and the Village of Pleasant Prairie. Consideration has been given to these new industrial centers as sewer service area plans are being prepared for the individual service areas in the Region.

Park and Outdoor Recreation Area

Under the recommended year 2010 land use plan, about 4,100 acres of land for intensive, public recreational land use would be added to the existing 26,000 acres currently designated as recreational lands. The additional recreational areas called for under the plan are based in part on neighborhood development standards, which seek to provide adequate neighborhood park land in developing areas. The recreational land use recommendations of the regional land use plan also reflect specific park site acquisition and development proposals set forth in the county park and open space plans prepared by the Commission for each of the seven counties in the Region.

The year 2010 regional land use plan proposes a system of 31 major parks of regional size and significance to serve the needs of the Region through the year 2010. Such parks have an area of at least 250 acres and provide opportunities for a variety of resource-oriented outdoor recreational activities. Twenty-nine of the 31 sites were recommended as major park sites under the year 2000 regional land use plan. Of the 29 previously recommended sites, only two--Sugar Creek in

Walworth County and Paradise Valley in Washington County--have yet to be publicly acquired.

The year 2010 plan recognizes the development of two major parks not identified in the year 2000 plan, namely, Mitchell Park, an approximately 800-acre site located in the City and Town of Brookfield, and an approximately 400-acre unnamed site surrounding a major lake recently created from an abandoned quarry in the Village of Pleasant Prairie. Facility development at these sites as envisioned in local site plans would qualify both sites as major parks.

The development of a water quality management plan in accordance with proposed land use objectives for the design year 2010 will be important to the full and beneficial use of both resource and non-resource related outdoor recreation facilities.

Environmentally Sensitive Lands

Environmental corridors are defined as linear areas in the landscape containing concentrations of natural resource and natural resource-related amenities. These corridors generally lie along the major stream valleys, around major lakes, and in the Kettle Moraine area of southeastern Wisconsin. Almost all of the remaining high-value wetlands, woodlands, wildlife habitat areas, major bodies of surface water, and delineated floodlands and shorelands are contained within these corridors. In addition, significant groundwater recharge and discharge areas, many of the most important recreational and scenic areas, and the best remaining potential park sites are located within the environmental corridors. Such environmental corridors are, in effect, a composite of the most important individual elements of the natural resource base in southeastern Wisconsin and have immeasurable environmental, ecological, and recreational value.

As part of the regional land use planning program, each of these natural resource and resource-related elements was mapped on 1 inch equals 400 feet scale, ratioed and rectified aerial photographs. A point system for value rating the various elements of the resource base was established, as summarized in Table III-1. The primary environmental corridors were delineated using this rating system. To qualify for inclusion in a primary environmental corridor, an area must exhibit a point value of 10 or more. In addition, a primary environmental corridor must be at least 400 acres in size, be at least two miles long, and have a minimum width of 200 feet. This environmental corridor refinement process is more fully described in SEWRPC Technical Record, Volume 4, No. 2, in an article entitled, "Refining the Delineation of Environmental Corridors in Southeastern Wisconsin."

The primary environmental corridors encompassed about 468 square miles, or 17 percent of the Region in 1985. Under the recommended regional land use plan for the year 2010, these corridors, as shown on Map III-1, would be protected and preserved in essentially natural, open uses. In addition to the proposed retention of existing corridors, the year 2010 land use plan proposes that 3,600 acres of adjacent floodland areas currently in agricultural or other open use, be restored to a wetland condition, and thereby incorporated into the environmental corridor network. In accordance with the regional land use plan and the county park and open space plans for each of the individual seven counties, these lands are recommended for county or State acquisition for open space preservation purposes, or for protection through joint State, county-local zoning.

Table III-1

**VALUES ASSIGNED TO NATURAL RESOURCE BASE AND RESOURCE BASE-RELATED ELEMENTS IN THE PROCESS OF DELINEATING PRIMARY AND SECONDARY ENVIRONMENTAL CORRIDORS**

| Resource Base or Related Element | Point Value |
|---|---|
| Natural Resource Base | |
| Lake | |
| Major (50 acres or more) | 20 |
| Minor (five to 49 acres) | 20 |
| Rivers or Streams (perennial) | 10 |
| Shoreland | |
| Lake or Perennial River or Stream | 10 |
| Intermittent Stream | 5 |
| Floodland (100-year recurrence interval) | 3 |
| Wetland | 10 |
| Wet, Poorly Drained, or Organic Soil | 5 |
| Woodland | 10 |
| Wildlife Habitat | |
| High-Value | 10 |
| Medium-Value | 7 |
| Low-Value | 5 |
| Steep Slope | |
| 20 Percent or More | 7 |
| 13-19 Percent | 5 |
| Prairie | 10 |
| Natural Resource Base-Related | |
| Existing Park or Open Space Site | |
| Rural Open Space Site | 5 |
| Other Park and Open Space Site | 2 |
| Potential Park Site | |
| High-Value | 3 |
| Medium-Value | 2 |
| Low-Value | 1 |
| Historic Site | |
| Structure | 1 |
| Other Cultural | 1 |
| Archaeological | 2 |
| Scenic Viewpoint | 5 |
| Scientific Area | |
| State Scientific Area | 15 |
| State Significance | 15 |
| County Significance | 10 |
| Local Significance | 5 |

*Source: SEWRPC.*

The preservation of primary environmental corridors is considered essential to the protection and wise use of the natural resource base of the rapidly urbanizing Region. Preservation of these corridors in natural, open uses provides significant areas of habitat for wildlife, maintains the existence of high quality woodlands and wetlands, significantly contributes to the prevention of new and the intensification of existing environmental problems such as flooding and water pollution, and contributes to the preservation of the Region's cultural heritage and natural beauty.

It is recommended that lands identified as primary environmental corridors not be developed for intensive urban use. Accordingly, the plan further recommends that sanitary sewers not be extended into such corridors for the purpose of accommodating urban development in the corridors. It was, however, recognized in the plan that it would be necessary in some cases to construct sanitary sewers across and through primary environmental corridors, and that certain land uses requiring sanitary sewer service could be properly located in the corridors, including park and outdoor recreation facilities and certain institutional uses. In some cases very low density single-family residential development on five-acre lots, compatible with the preservation of the corridors in essentially natural open uses, may also be permitted to occupy corridor lands and it may be desirable to extend sewers into the corridors to serve such uses. Basically, however, the plan element seeks to ensure that the primary environmental corridor lands are not destroyed through conversion to intensive urban uses.

Secondary environmental corridors are also identified in the year 2010 regional land use plan. The secondary environmental corridors, while not as significant as the primary environmental corridors in terms of the overall resource values, should be considered for preservation as the process of urban development proceeds, because such corridors often provide economical drainageways, as well as needed "green space," through developing residential neighborhoods. To qualify for inclusion in a secondary environmental corridor, an area must exhibit a point value of 10 or more, with such a corridor having a minimum area of 100 acres and a minimum length of one mile.

Isolated natural areas are also identified in the year 2010 regional land use plan. Isolated natural areas generally consist of those natural resource base elements that have "inherent natural" value such as wetlands, woodlands, wildlife habitat areas, and surface water areas, but that are separated physically from the primary and secondary environmental corridors by intensive urban and agricultural land uses. Since isolated natural areas may provide the only available wildlife habitat in an area, provide good locations for local parks and nature study areas, and lend aesthetic character and natural diversity to an area, these areas should also be protected and preserved in a natural state to the extent practicable. An isolated natural area must be at least five acres in size.

As service area plans are developed for the individual sewer service areas in the Region, the primary environmental corridors, secondary environmental corridors, and isolated natural areas are documented, quantified, and mapped in order to assist the designated management agencies in the protection of the primary environmental corridors and in considering protection of other environmentally sensitive lands.

Prime Agricultural Lands

In an urbanizing area such as southeastern Wisconsin, the demands of a growing urban population typically require certain conversion of rural land to urban land use. While general agricultural lands are subject to this conversion, the year 2010 plan seeks to minimize the development of new urban uses on lands which have been designated as prime agricultural lands. Those areas, as shown on Map III-1, totaled just over 1,047 square miles, or 39 percent of the Region, in 1985. The recommended year 2010 land use plan proposes to convert to urban use only those prime agricultural lands which were already committed to urban development due to proximity to existing and expanding concentrations of urban uses and the prior commitment of heavy capital investment in utility extensions. The recommended plan proposes to convert only about 16 square miles, or just over 1 percent of the remaining prime agricultural lands to urban use by the year 2010.

The preservation of prime agricultural lands has important implications for water quality management planning. Prime agricultural land preservation will assist in the implementation of sound soil and water conservation practices and nonpoint source water pollution abatement measures, such as conservation tillage, crop rotation, contour plowing, cover crops, terracing, diversion structures and dikes, water and grade control structures, and grassed waterways, and will facilitate implementation of appropriate wind erosion measures, streambank erosion measures, and pesticide, fertilizer, and animal controls. Well-managed agricultural land contributes less pollutants to surface waters than urban land uses. Accordingly, implementation of the prime agricultural land component of the year 2010 regional land use plan element will be important to the implementation of the nonpoint source pollution abatement plan element and to the achievement of the recommended water use objectives and supporting water quality standards.

## Chapter IV

## DES PLAINES RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

### INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto, and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Des Plaines River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Des Plaines River watershed as part of the continuing water quality planning process. The status of the initial adopted plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included. Designated management agencies for plan implementation are presented in Chapter XVII on a regional basis.

The Des Plaines River watershed is located in the southeasterly portion of the Region. That part of the watershed contained within the Region--about 134-square miles--is only a small part of a much larger watershed. The main stem of the Des Plaines River rises in Racine County south of the Village of Union Grove and flows approximately 22 miles southerly and easterly through Kenosha County before crossing the State line about 1.5 miles east of IH 94 into Illinois where it continues southerly to join the Kankakee River to form the Illinois River. Rivers and streams in the watershed are part of the Mississippi River drainage system as the watershed lies west of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Des Plaines River and its principal tributaries, are shown on Map IV-1.

There are six major lakes in the watershed having a surface area of 50 acres or more: Benet/Shangrila Lakes, East Lake Flowage, George Lake, Hooker Lake, Paddock Lake, and an unnamed lake formed by an abandoned quarry in the Village of Pleasant Prairie. Physical characteristics of the major lakes in the Des Plaines River watershed are set forth in Table IV-1. The data indicate that major lakes in the watershed have a combined surface area of about 667 acres, or less than 1 percent of the total area of the watershed.

# Map IV-1
# DES PLAINES RIVER WATERSHED

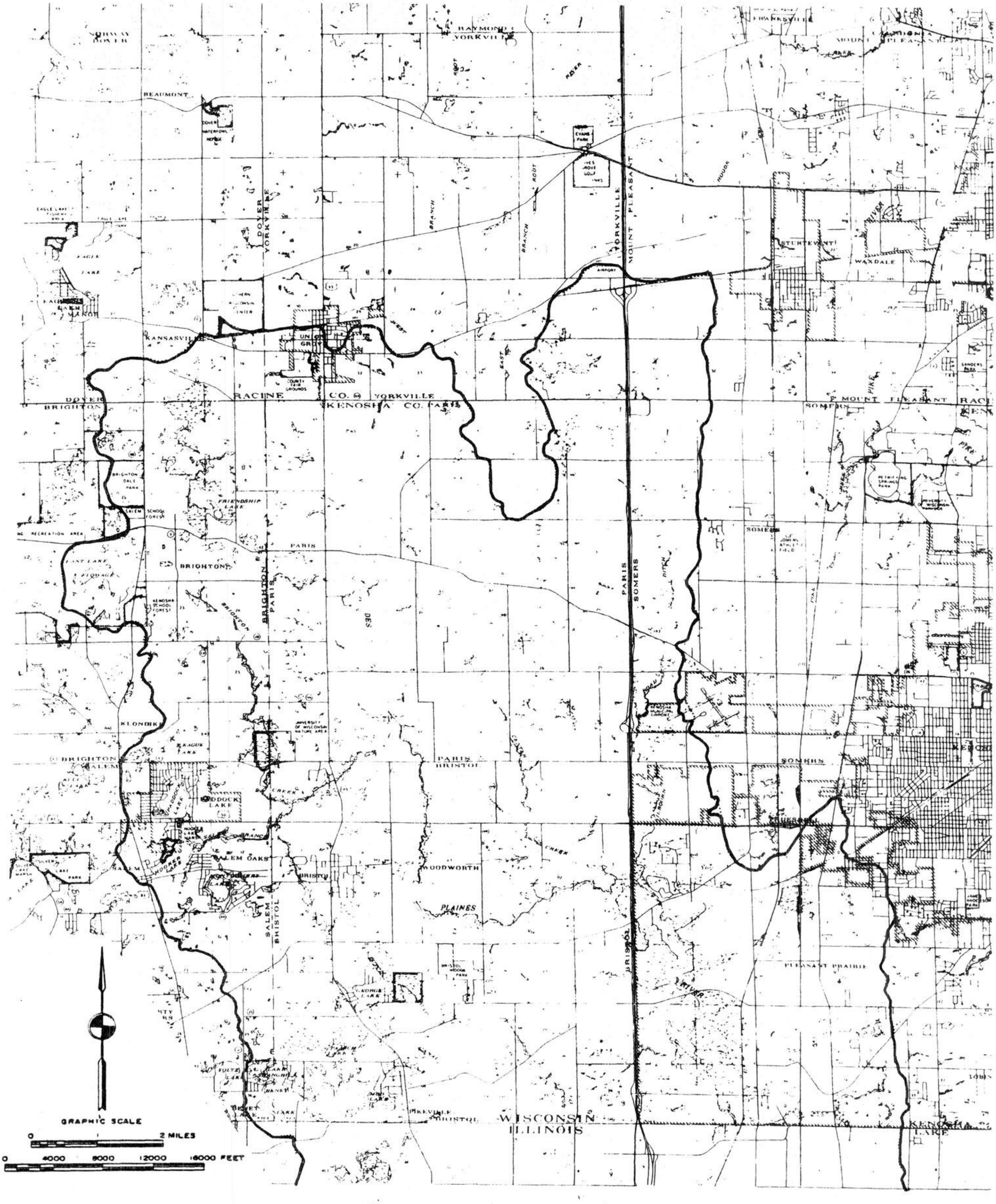


Table IV-1

**PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE DES PLAINES RIVER WATERSHED**

| **WATERSHED** Lake Name | Surface Area (acres) | Direct Tributary Drainage Area (acres) | Shoreline (miles) | Maximum Depth (feet) | Mean Depth (feet) | Volume (acre-feet) |
|---|---|---|---|---|---|---|
| **DES PLAINES RIVER** | | | | | | |
| Benet/Shangrila Lake | 186[a] | 407 | 6.20 | 24 | 4.7 | 874 |
| East Lake Flowage | 123 | 850 | 3.07 | N/A | N/A | N/A |
| George Lake | 59 | 2,187 | 1.18 | 16 | 6.4 | 389.4 |
| Hooker Lake | 87 | 1,244 | 1.90 | 24 | 11.3 | 983 |
| Paddock Lake | 112 | 291 | 3.42 | 32 | 11.4 | 1,277 |
| Unnamed Lake | 100 | 68 | 2.10 | N/A | N/A | N/A |
| Total | 667 | 5,047 | 17.87 | -- | -- | -- |

[a]Includes six acres in Illinois.

Source: SEWRPC

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendation, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes- the changes in land uses which have occurred within the Des Plaines River watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table IV-2 summarizes the existing land uses in the Des Plaines River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed is presently experiencing a relatively rapid conversion of land from rural to urban use in certain areas, about 88 percent of the watershed was still in rural and other open space land use in 1990. These uses included about 68 percent of the total watershed in agricultural and related rural uses, 6 percent in woodlands, about 9 percent in surface water and wetlands, and about 5 percent in other open lands. The remaining 12 percent of the total watershed was devoted to urban uses. Existing 1990 land uses within the watershed are shown on Map IV-2.

Within the Des Plaines River watershed, major concentrations of urban development have been rapidly taking place in the portion of the watershed east of IH 94 and just west of IH 94 at STH 50, the areas where public sanitary sewer service and water supply facilities are now available. Other urban-related land uses are located in the western portions of the watershed around Lakes Paddock, George, Hooker, Montgomery, and Benet/Shangrila; within the unincorporated Village of Bristol surrounding STH 45 south of STH 50; and within the corporate limits of Union Grove.

As shown in Table IV-2, from 1975 to 1990, urban land uses in the watershed increased from about 8,070 acres, or 12.6 square miles to about 10,030 acres, or 15.7 square miles, or by about 24 percent. Also, as shown in Table IV-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 3,970 acres, or about 6.2 square miles in 1975 to 4,700 acres, or about 7.3 square miles in 1990, an 18 percent increase. Commercial and industrial lands increased from about 200 acres, or about 0.31 square mile, to 440 acres, or 0.69 square mile, an increase of 118 percent.

The 15.7 square miles of urban land uses in the watershed as of 1990 exceeded the approximated 1990 planned level of about 14.9 square miles set forth in the adopted year 2000 land use plan. The current status of development in the Des Plaines River watershed and adjacent portions of Kenosha County was considered

Table IV-2

LAND USE IN THE DES PLAINES RIVER WATERSHED: 1975 AND 1990[a]

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 3,971 | 4.6 | 4,695 | 5.5 | 724 | 18.2 |
| Commercial | 97 | 0.1 | 185 | 0.1 | 88 | 90.7 |
| Industrial | 104 | 0.1 | 254 | 0.3 | 150 | 144.2 |
| Transportation, Communication, and Utilities[b] | 3,174 | 3.7 | 3,915 | 4.5 | 741 | 23.3 |
| Governmental and Institutional | 233 | 0.3 | 248 | 0.3 | 15 | 6.4 |
| Recreational | 492 | 0.6 | 737 | 0.9 | 245 | 50.8 |
| Subtotal | 8,071 | 9.4 | 10,034 | 11.6 | 1,963 | 24.3 |
| Rural | | | | | | |
| Agricultural and Related | 62,001 | 72.0 | 58,793 | 68.3 | -3,200 | - 5.2 |
| Lakes, Rivers, Streams, and Wetlands | 8,061 | 9.4 | 7,953 | 9.2 | - 108 | - 1.3 |
| Woodlands | 4,645 | 5.4 | 4,765 | 5.5 | 120 | 2.6 |
| Open Lands,[c] Landfills, and Extractive | 3,324 | 3.8 | 4,557 | 5.3 | 1,233 | 37.1 |
| Subtotal | 78,031 | 90.6 | 76,068 | 88.3 | -1,963 | - 2.5 |
| Total | 86,102 | 100.0 | 86,102 | 100.0 | -- | -- |

[a]As approximated by whole U.S. Public Land Survey one-quarter sections.

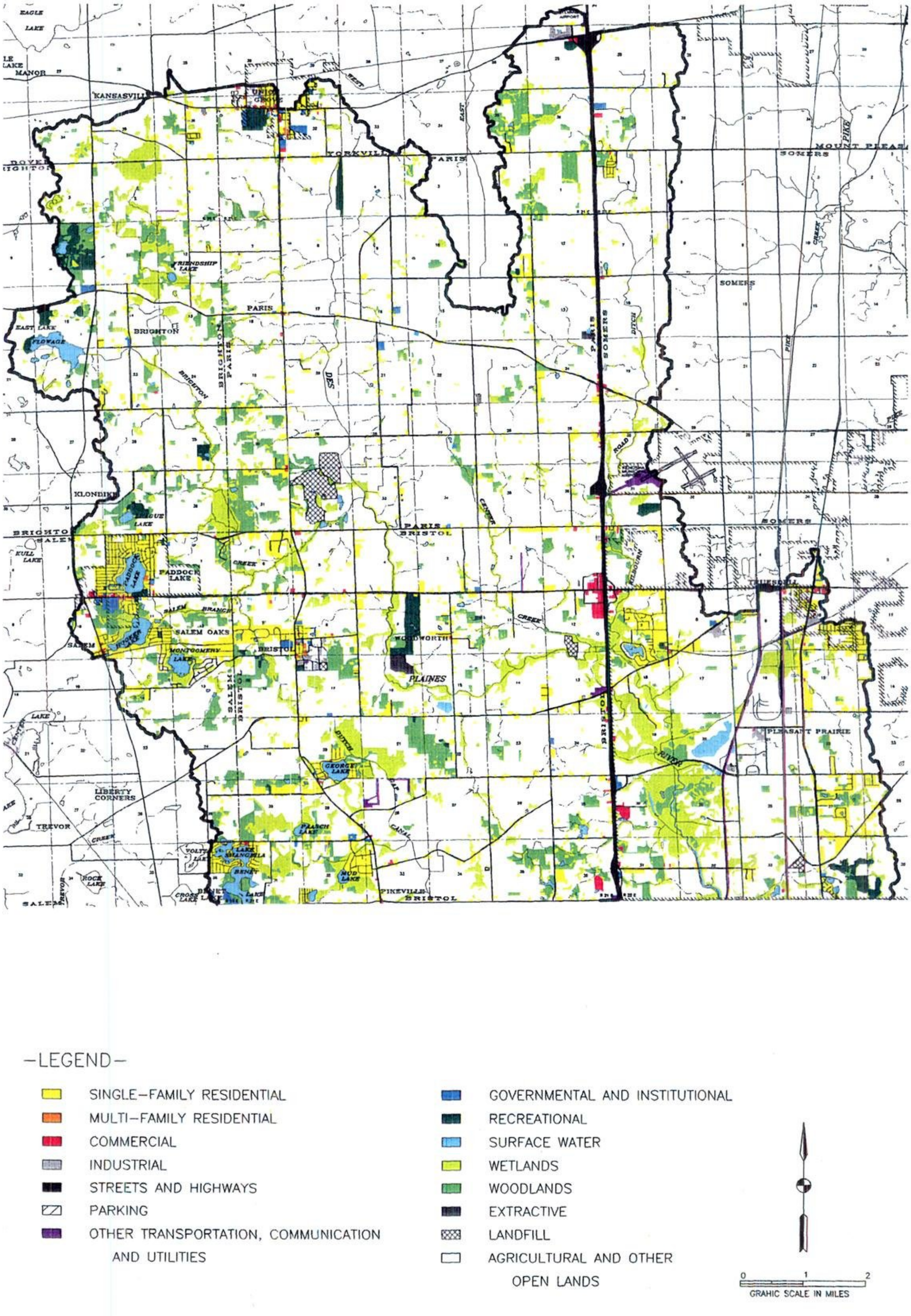
[b]Includes all off-street parking.

[c]Includes both rural and urban open lands.

Source: SEWRPC.

## MAP IV-2

## LAND USES IN THE DES PLAINES RIVER WATERSHED: 1990




The Des Plaines River watershed is about 134 square miles in areal extent, or about 5 percent of the total area of the Region. In 1990 about 16 square miles, or about 11 percent of the watershed, was in urban land uses.

Source: SEWRPC

in developing the new year 2010 land use plan element described in Chapter III for the Region.

Table IV-3 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Des Plaines River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban uses are expected to increase along the IH 94 corridor in the City of Kenosha, the Village of Pleasant Prairie, and the Towns of Bristol and Somers; the STH 50 corridor in the City of Kenosha, the Village of Pleasant Prairie, and the Towns of Salem and Bristol; in an around the Villages of Paddock Lake and Union Grove; and in the unincorporated Village of Bristol. The year 2010 plan also proposes the addition of a major retail commercial center located near the intersection of IH 94 and STH 50, development of which was underway by 1985, and also the addition of a major industrial center located in the southwestern portion of the Village of Pleasant Prairie which was under development by 1990.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Des Plaines River watershed, as indicated in Table IV-3, is projected to increase from the 1990 total of about 15.7 square miles, or about 12 percent of the total area of the watershed, to about 20.3 square miles, or about 15 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 22.5 square miles, or about 17 percent of the total watershed by the year 2010. It is important to note that the 83 to 85 percent of the watershed remaining in rural use would be comprised, in part, of primary environmental corridor lands consisting of the best remaining natural resource features and, as recommended in the year 2010 regional land use plan, is proposed to be largely preserved in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodlands outside the primary environmental corridor are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a large portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 119.0 square miles in 1990 to about 114.0 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 112.0 square miles under the high growth decentralized land use plan, decreases from about 4 to 6 percent between 1990 and 2010 for the two year-2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Des Plaines River watershed--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described

Table IV-3

EXISTING AND PLANNED LAND USE IN THE DES PLAINES RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010: Intermediate Growth-Centralized Land Use | | | | Year 2010: High Growth-Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 4,695 | 5.5 | 6,171 | 7.2 | 1,476 | 31.4 | 6,496 | 7.6 | 1,801 | 38.4 |
| Commercial | 185 | 0.2 | 317 | 0.4 | 132 | 71.4 | 424 | 0.5 | 239 | 129.2 |
| Industrial | 254 | 0.3 | 634 | 0.7 | 380 | 149.6 | 1,155 | 1.3 | 901 | 354.7 |
| Transportation, Communication, and Utilities[b] | 3,915 | 4.6 | 4,625 | 5.4 | 710 | 18.1 | 5,040 | 5.8 | 1,125 | 28.7 |
| Governmental and Institutional | 248 | 0.3 | 290 | 0.3 | 42 | 16.9 | 301 | 0.4 | 53 | 21.3 |
| Recreational | 737 | 0.9 | 966 | 1.1 | 229 | 31.1 | 998 | 1.2 | 261 | 35.4 |
| Subtotal | 10,034 | 11.8 | 13,003 | 15.1 | 2,969 | 29.1 | 14,414 | 16.8 | 4,380 | 43.0 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 58,793 | 68.2 | 57,810 | 67.1 | - 983 | - 1.7 | 56,516 | 65.6 | -2,277 | - 3.9 |
| Lakes, Rivers, Streams, and Wetlands | 7,953 | 9.2 | 7,736 | 9.0 | - 217 | - 2.7 | 7,736 | 9.0 | - 217 | - 2.7 |
| Woodlands | 4,765 | 5.5 | 4,663 | 5.4 | - 162 | - 2.1 | 4,658 | 5.4 | - 107 | - 2.3 |
| Open Lands,[c] Landfills, Dumps, and Extractive | 4,557 | 5.3 | 2,890 | 3.4 | -1,667 | -36.6 | 2,778 | 3.2 | -1,779 | - 39.0 |
| Subtotal | 76,068 | 88.2 | 73,099 | 84.9 | -2,969 | - 3.9 | 71,688 | 83.2 | -4,380 | - 5.8 |
| Total | 86,102 | 100.0 | 86,102 | 100.0 | 0 | -- | 86,102 | 100.0 | 0 | -- |

[a]As approximated by whole U.S. Public Land Survey one-quarter sections.

[b]Includes all off-street parking.

[c]Includes both rural and urban unused lands.

Source: SEWRPC.

in the initial plan. This section also includes a status report on the public sanitary sewer service areas in the watershed.

Public and Private Wastewater Treatment Systems and Sewer Services Areas Existing Conditions and Status of Plan Implementation: In 1975, there were five public sewage treatment facilities located in the Des Plaines River watershed, as shown on Map IV-3. The two plants which served the Town of Pleasant Prairie Sanitary District No. 73-1[1] and the Town of Pleasant Prairie Utility District "D"[1] discharged treated effluent directly to the main stem of the Des Plaines River via small tributaries; the two plants which served the Village of Paddock Lake and the Town of Salem Utility District No. 1 discharged to Brighton Creek and to the Salem Branch of Brighton Creek, respectively; and the plant which served the Town of Bristol Utility District No. 1 discharged treated effluent directly to a tributary of the Des Plaines River. No public sewage treatment plants have been abandoned since 1975. The status of implementation in regard to the abandonment, upgrading, and expansion of the public and private sewage treatment plants in the Des Plaines River watershed, as recommended in the initial regional water quality management plan, is summarized in Table IV-4.

As can be seen by review of Table IV-4, full implementation of the initial plan would provide for the upgrading and expansion of the Town of Bristol Utility District No. 1, the Village of Paddock Lake, and the Village of Pleasant Prairie Sewer Utility District "D" facilities. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the upgrading of the Village of Pleasant Prairie Sanitary District No. 73-1 plant and the abandonment of the Town of Salem Utility District No. 1 plant. The former recommendation has not yet been carried out. As recommended in an amendment to the initial plan, the Town of Salem Utility District No. 1 plant has been abandoned and connection of that service area to the Town of Salem Utility District No. 2 sewerage facilities has been completed. Three of the four public sewage treatment plants operating in the watershed have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluent to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site-specific phosphorus limitations on all public sewage treatment plants, and in 1993, by the adoption of rules to allow for placement of such limitations. To date, such procedures have not been implemented for plants in the Des Plaines River watershed with the exception of the Village of Pleasant Prairie Sanitary District No. 73-1 facility which does have facilities to provide a conventional level of phosphorus removal. As specific sewage treatment plant permits are issued for the remaining public sewage treatment plants, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. Selected characteristics of the public sewage treatment plants currently existing in the watershed are given in Table IV-5.

In addition to the publicly owned sewage treatment facilities, eight private sewage treatment plants were in existence in 1975 in the Des Plaines River

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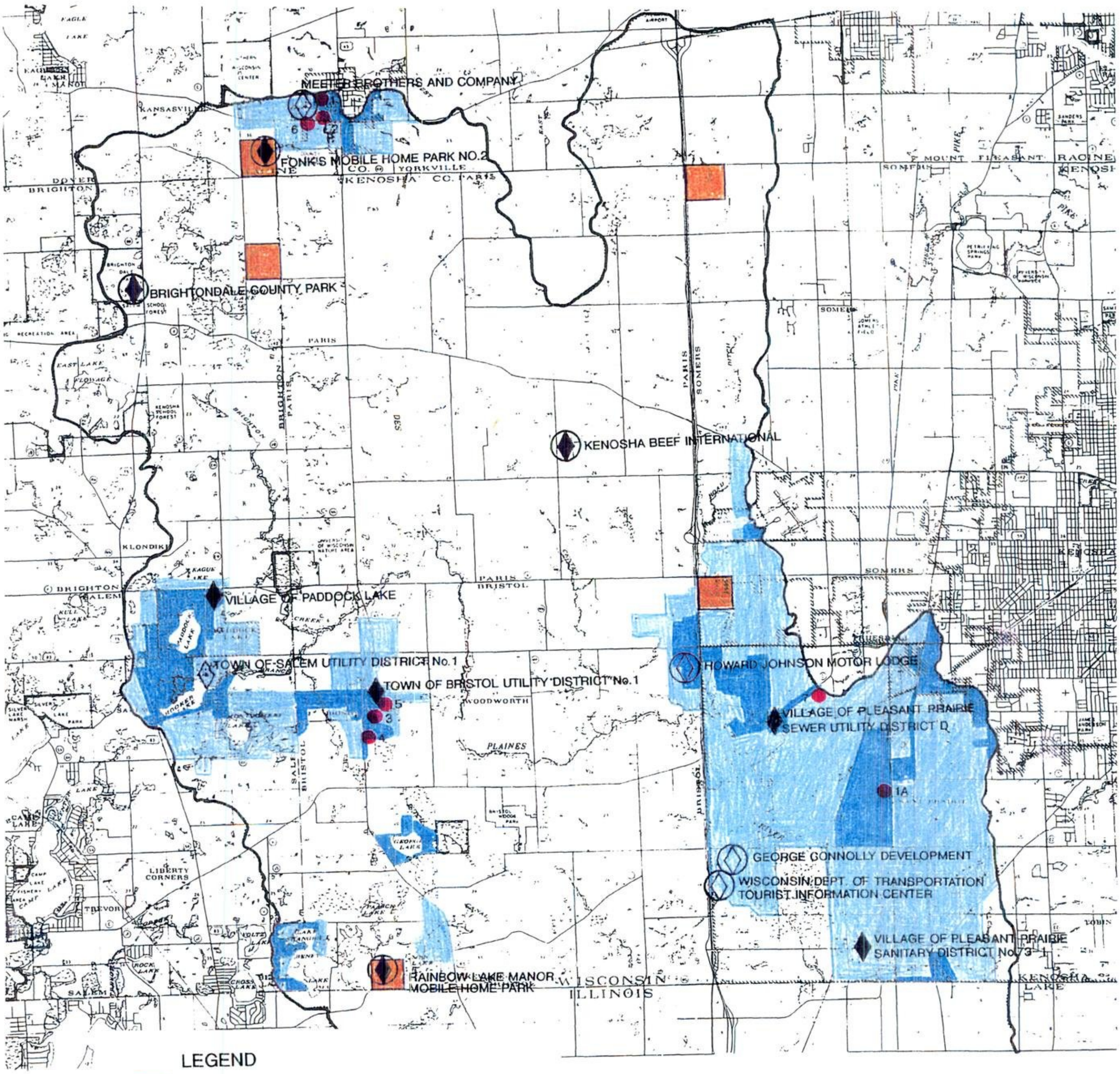
[1]In 1989, the Town of Pleasant Prairie was incorporated as a Village and the name of these special purpose units of government were changed to the Village of Pleasant Prairie Utility District "D" and the Village of Pleasant Prairie Sanitary District No. 73-1, respectively.

# Map IV-3

## SEWER SERVICE AREAS, SEWAGE TREATMENT PLANTS AND OTHER POINT SOURCES OF POLLUTION IN THE DES PLAINES RIVER WATERSHED: 1990




LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE ABANDONED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- PRIVATE SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA

Source: SEWRPC.

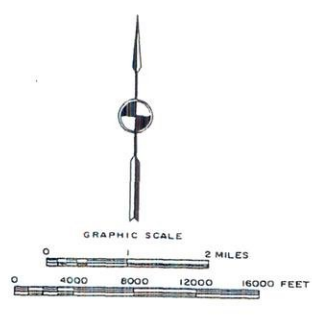


Table IV-4

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS
IN THE DES PLAINES RIVER WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| Town of Bristol Utility District No. 1 | Bristol Creek tributary of Des Plaines River | Upgrade and expand | Completed[a] (1988) |
| Village of Paddock Lake | Brighton Creek | Upgrade and expand | Completed[a] (1989) |
| Village of Pleasant Prairie Sanitary District No. 73-1 | Tributary of Des Plaines River | Upgrade[b] | No action |
| Village of Pleasant Prairie Sewer Utility District "D" | Tributary of Des Plaines River | Upgrade and expand[b] | Completed[a] (1985) |
| Town of Salem Utility District No. 1 | Salem Branch of Brighton Creek | Abandon plant[c] | No action[c] |
| **Private Sewage Treatment Plants** | **Disposal of Effluent** | **Plan Recommendation** | **Implementation Status** |
| Brightondale County Park | Soil Absorption | Maintain and Upgrade as needed | Plant maintained |
| Fonk's Mobile Home Park No. 2 | Tributary to the Des Plaines River | Maintain and Upgrade as needed | Plant maintained |
| Kenosha Beef International Company[d] | Soil Absorption | Maintain and Upgrade as needed | Plant maintained |
| Meeter Brothers Company | Tributary to the Des Plaines River | Maintain and Upgrade as needed | Plant abandoned due to industry change (1987) |
| Rainbow Lake Manor Mobile Home Park[e] | Soil Absorption | Maintain and Upgrade as needed | Plant maintained |
| George Connolly Development[g] | Tributary to the Des Plaines River | Abandon plant[f] | Plant abandoned[g] |
| Howard Johnson Motor Lodge | Des Plaines River | Abandon plant | Plant abandoned (1989) |
| Wisconsin Tourist Information Center | Tributary to the Des Plaines River | Abandon plant[f] | Plant abandoned (1991) |

[a] Plant upgrading and expansion was completed representing implementation of the plan recommendations, except for the provision of phosphorus removal facilities which have not yet been provided.

[b] A proposed revision to the initial regional water quality management plan, documented in A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, recommends the abandonment of the Village of Pleasant Prairie Sanitary District No. 73-1 and of the Village of Pleasant Prairie Sewer Utility District"D" sewage treatment plants and for sanitary sewer needs to be provided for by the Kenosha Water Utility's sewage treatment plant.

[c] The Town of Salem Utility District No. 1 sewage treatment plant was recommended to be retained in the initial regional water quality management plan. A 1991 amendment to the regional water quality management plan-2000 for the Town of Salem recommended the plant to be abandoned and for the Town of Salem Utility District No. 1 sewer service area to be served by the Town of Salem Utility District No. 2 sewage treatment plant. The plant was abandoned in 1993.

[d] Formerly Kenosha Packing Company.

[e] Formerly Paramski Mobile Home Park.

[f] The George Connolly Development and Wisconsin Tourist Information Center sewage treatment plants were recommended to be retained in the initial regional water quality management plan. A 1987 amendment to the regional water quality management plan-2000 for the City of Kenosha and environs recommended the plants be abandoned that sewer service be provided for by the Village of Pleasant Prairie Sanitary District No. 73-1.

[g] The private treatment plant serving the George Connolly Development was never placed into operation.

Source: SEWRPC.

Table IV-5

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS IN THE DES PLAINES RIVER WATERSHED: 1990

| Name of Public Sewage Treatment Plant | 1990 Estimated Total Area Served (square miles) | 1990 Estimated Total Population Served | Date of Construction and Major Modification | Sewage Treatment Unit Processes[a] | Name of Receiving Water to which Effluent is Disposed | WPDES Permit Expiration Date |
|---|---|---|---|---|---|---|
| Town of Bristol Utility District No. 1 | 0.8 | 1,200 | 1965, 1971, 1988 | Contact stabilization activated sludge, clarification, chlorination | Des Plaines River via Bristol Creek tributary | 12/31/93 |
| Village of Paddock Lake | 0.8 | 2,300 | 1958, 1967, 1988 | Oxidation ditch, clarification, microscreen, chlorination, dechlorination, ultraviolet disinfection | Brighton Creek | 12/31/99 |
| Village of Pleasant Prairie Sanitary District No. 73-1 | 0.1 | 600 | 1975 | Contact stabilization activated sludge, clarification, chemical phosphorus removal, sand filtration, chlorination | Des Plaines River via unnamed tributary | 9/30/2000 |
| Village of Pleasant Prairie Sewer Utility District D | 1.2 | 1,700 | 1966, 1985 | Oxidation ditch clarification, chlorination, post aeration | Des Plaines River via Pleasant Prairie tributary | 6/30/99 |
| Town of Salem Utility District No. 1[b] | 0.4 | 1,100 | 1970 | Activated sludge, clarification, chlorination, polishing pond, contact stabilization | Salem Branch | 9/30/89 |

Table IV-5 (continued)

| Name of Public Sewage Treatment Plant | Hydraulic Loading[c] (mgd) | | | | $BOD_5$ Loading[c] (pounds per day) | | | | Suspended Solids Loading[c] (pounds per day) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | | Design Average Annual | Number of Months in 1990 in which the Monthly Average Loading Exceeded the Design Capacity | Existing | | Design Average Annual | Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity | Existing | | Design Average Annual | Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity |
| | Average Annual | Maximum Monthly Average | | | Average Annual | Maximum Monthly Average | | | Average Annual | Maximum Monthly Average | | |
| Town of Bristol Utility District No. 1 | 0.34 | 0.49 | 0.48 | 1 | 366 | 501 | 860 | 0 | 450 | 615 | 729 | 0 |
| Village of Paddock Lake | 0.47 | 0.71 | 0.49 | 4 | 574 | 814 | 570 | 3 | 701 | 1,148 | 513 | 8 |
| Village of Pleasant Prairie Sanitary District No. 73-1 | 0.21 | 0.26 | 0.40 | 0 | 145 | 192 | 800 | 0 | 167 | 317 | -- | -- |
| Village of Pleasant Prairie Sewer Utility District D | 0.50 | 0.75 | 0.50 | 4 | 407 | 499 | 602 | 0 | 814 | 1,424 | -- | -- |
| Town of Salem Utility District No. 1 | 0.20 | 0.31 | 0.30 | 1 | 198 | 313 | 510 | 0 | 170 | 200 | -- | -- |

[a] In addition, plants typically include headworks and miscellaneous processes such as pumping, flow metering and sampling, screening and grit removal, as well as sludge handling and disposal facilities.

[b] The sewage treatment plant serving the Town of Salem Utility District No. 1 was abandoned in 1993 and its service area connected to the Town of Salem Utility District No. 2 sewerage system.

[c] Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data unless noted

Source: Wisconsin Department of Natural Resources and SEWRPC.

watershed. These plants served the following land uses: Fonk's Mobile Home Park No. 2 in Racine County; and Brightondale County Park, George Connolly Development, Howard Johnson Motor Lodge, Kenosha Packing Company (currently Kenosha Beef International Company), Meeter Brothers Company, Wisconsin Tourist Information Center, and Paramski Mobil Home Park (currently Rainbow Lake Manor Mobile Home Park) in Kenosha County. As indicated in Table IV-4, one private sewage treatment plant in the watershed as of 1975 was recommended to be abandoned in the initial plan. A subsequent amendment to the plan recommended the abandonment of two additional plants. As of 1990, each of these three plants had been abandoned. In addition, the Meeter Brothers private plant had also ceased operation because the industry the plant supported is no longer in business at this location. The remaining four private plants were recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES).

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Des Plaines River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were nine sewer service areas identified within, or partially within, the Des Plaines River watershed: Bristol-George Lake, Bristol-IH 94 and Pleasant Prairie North, Cross Lake, Hooker-Montgomery Lakes, Kenosha, Paddock Lake, Pleasant Prairie South, and Union Grove. By 1990, all of these areas had undergone refinements as recommended. The boundaries of the sewer service areas, as currently refined, are shown on Map IV-3. Table IV-6 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service area names following the refinement process. The planned sewer service areas in the Des Plaines River watershed, as refined through 1993, total about 32 square miles, or about 24 percent of the total watershed area, as shown in Table IV-6.

Table IV-6

PLANNED SANITARY SEWER SERVICE AREAS IN THE DES PLAINES RIVER WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Bristol-George Lake | 2.3 | Bristol | December 1, 1986 | SEWRPC CAPR No. 145, Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin |
| Bristol-IH 94 Pleasant Prairie North | 5.8 | Bristol/ Pleasant Prairie | December 2, 1985 | SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin |
| Camp-Center Lakes Cross Lake Rock Lake Wilmot | 0.5 | Salem South | March 3, 1986 | SEWRPC CAPR No. 143, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin |
| Hooker-Montgomery Lakes | 2.7 | Salem North | December 1, 1986 | SEWRPC CAPR No. 145 Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin |
| Kenosha Pleasant Park Somers | 13.8 | Kenosha | December 2, 1985 | SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin |
| Paddock Lake | 2.0 | Paddock Lake | December 1, 1986 | SEWRPC CAPR No. 145 Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin |
| Pleasant Prairie South | 3.4 | Pleasant Prairie South | December 2, 1985 | SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin |
| Union Grove | 1.6 | Union Grove | September 12, 1990 | SEWRPC CAPR No. 180, Sanitary Sewer Service Area for the Village of Union Grove and Environs, Racine County, Wisconsin |
| Total | 32.1 | | | |

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the Town of Bristol Utility District No. 1 and the Village of Paddock Lake sewage treatment plants, as well as the abandonment of the Town of Salem Utility District No. 1 sewage treatment plant and connection of that service area to the Town of Salem Utility District No. 2 sewerage system. The Town of Salem Utility District No. 1 sewage treatment plant in the process of being abandoned in 1993. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table IV-7. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for the public sewage treatment plants recommended to be retained.

With regard to the two treatment plants operated by the Village of Pleasant Prairie Sanitary District No. 73-1 and the Village of Pleasant Prairie Sewer Utility District "D", further consideration should be given to evaluating a potential change in the recommendations set forth in the initial plan. That potential change is based upon the findings of a 1992 sanitary sewerage and water supply system plan which was completed for the greater Kenosha area. The findings and recommendations of the planning work are contained in a report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area. That report, which was prepared for a study area including all of Kenosha County extending from Lake Michigan to a distance of one mile west of IH 94, includes portions of the Des Plaines River watershed. The report identified the sanitary sewer and water supply needs of that planning area, and evaluated alternative means of meeting those needs; recommended a coordinated set of design year 2010 sewerage and water supply system plans for the area; identified the intergovernmental, administrative, legal, and fiscal issues inherent in the implementation of the system plans; and recommended an institutional structure for implementation of those plans. The recommended sewerage system and planned service area developed in this subregional system plan are shown on Map IV-4A. As of December 1994, the intergovernmental actions and approval needed to proceed with the attendant changes to the regional water quality management plan had not been put in place. Thus, the inclusion of these plan recommendations in the updated plan is pending intergovernmental agreement on the recommendations.

On the basis of the recommendations contained in this subregional sewerage system plan, the following revisions to the initially adopted plan are proposed, pending approval of the system plan by the local units of government involved:

1. The sewer service areas as set forth in the adopted plan are to be revised to conform with those set forth under the recommended Kenosha area sewerage system plan as shown in Map IV-4a.

2. The Kenosha Water Utility sewage treatment plant is designated as the sole public sewage treatment plant to serve the area considered, as shown on Map IV-4; and the two public sewage treatment plants operated by the Village of Pleasant Prairie Sewer Utility District D and the Village of Pleasant Prairie Sanitary District No. 73-1 are recommended to be abandoned during the planning period.

3. The intercommunity trunk sewers needed to provide service, as shown on Map IV-4a, are recommended to be added to the regional plan recommendations.

Table IV-7

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE DES PLAINES RIVER WATERSHED: 1990 AND 2010

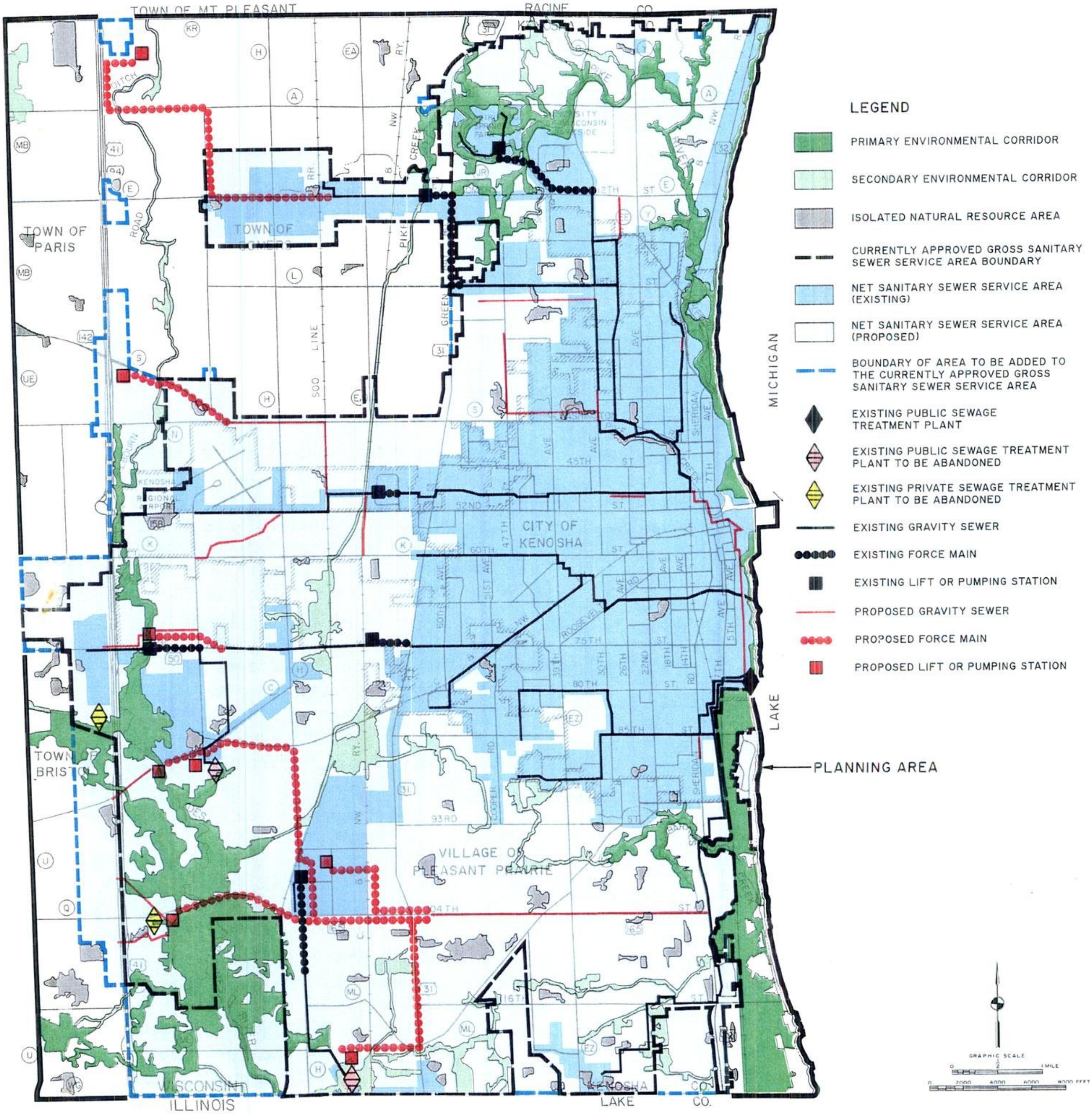
| Name of Public Sewage Treatment Plant | Sewer Service Areas | Design Capacity-Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intermediate Growth-Centralized Land Use Plan | | | High Growth-Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Total Area Served (square mile) | Resident Population Served | Planned Sewer Service Area (square mile) | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| Town of Bristol Utility District No. 1 | Bristol | 0.48 | 0.34 | 0.8 | 1,300 | 2.3 | 2,500 | 0.49 | 1998 | 2,700 | 0.52 | 1996 |
| Village of Paddock Lake | Paddock Lake | 0.49 | 0.47 | 0.8 | 2,700 | 2.1 | 4,000 | 0.63 | 1995 | 4,300 | 0.67 | 1995 |
| Village of Pleasant Prairie Sanitary District No. 73-1 | Pleasant Prairie South | 0.40 | 0.21 | 0.1 | 600 | 3.4 | 2,200 | 0.41 | 1998 | 3,100 | 0.52 | 1996 |
| Village of Pleasant Prairie Sewer Utility District "D" | Bristol/ Pleasant Prairie | 0.50 | 0.50 | 1.2 | 1,700 | 6.7 | 5,500 | 0.98 | 1995 | 6,500 | 1.1 | 1995 |

[a]Approximate year in which facility planning for a plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average design flows compared to average annual and maximum monthly flows, and age of facilities based upon date of last major construction.

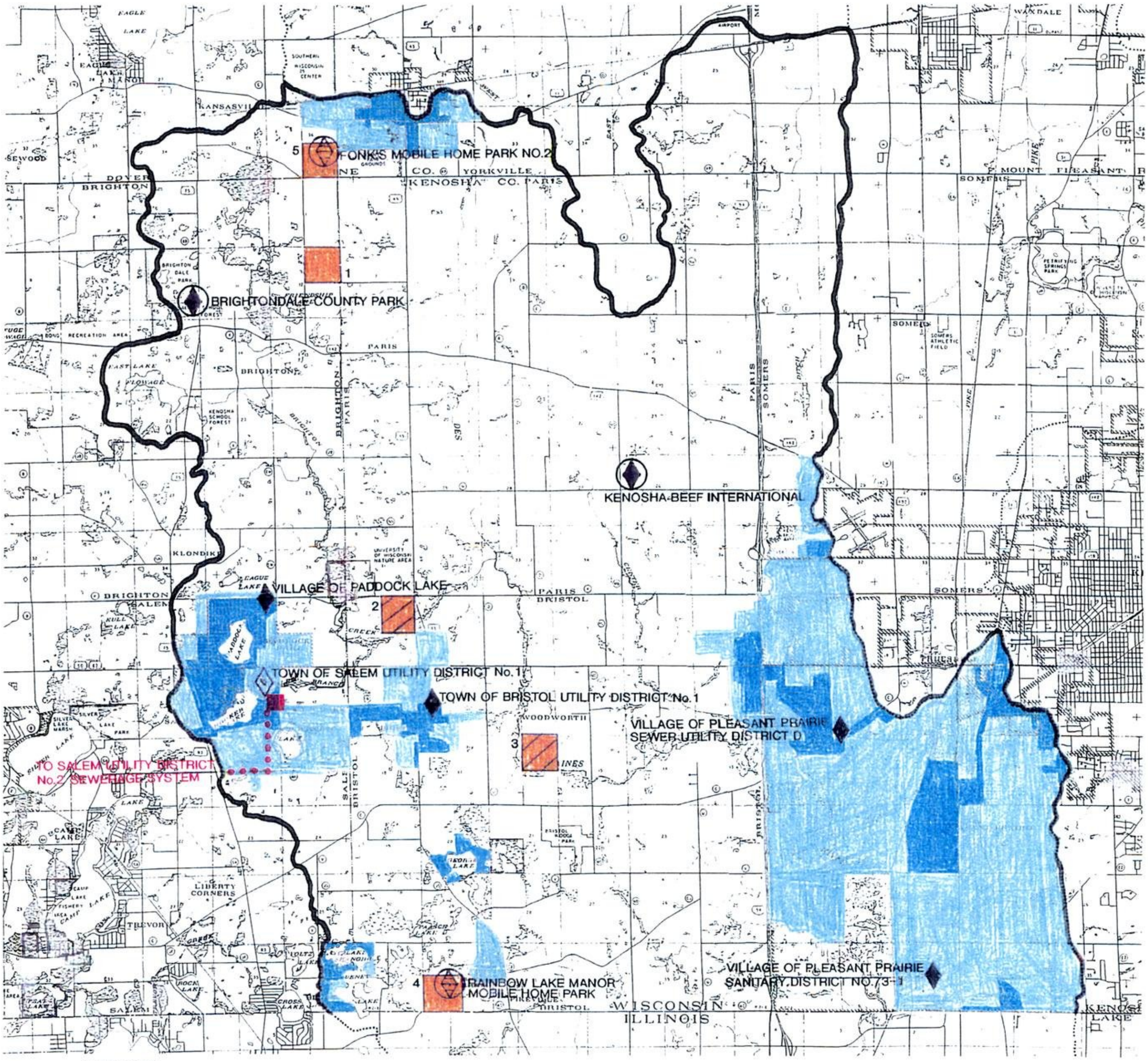
Source: SEWRPC.

Map IV-4A

RECOMMENDED SEWERAGE SYSTEM FACILITIES FOR THE GREATER KENOSHA UTILITY PLANNING AREA AS DEVELOPED IN 1992 SUBREGIONAL SYSTEM PLAN



## Map IV-4
## UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE DES PLAINES RIVER WATERSHED: 2010




LEGEND

SANITARY SEWER SERVICE AREA (EXISTING)

SANITARY SEWER SERVICE AREA (PLANNED)

EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED

EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE ABANDONED

EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED

EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED

EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO EVALUATE CONNECTION TO PUBLIC SYSTEM

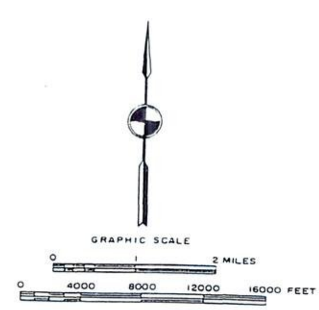
PROPOSED LIFT OR PUMPING STATION

PROPOSED FORCE MAIN

1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF PLANNED SEWER SERVICE AREA

ADDITIONAL URBAN DENSITY DEVELOPMENT SINCE 1975 OUTSIDE OF PLANNED SEWER SERVICE AREA

Source: SEWRPC.



The current point source pollution abatement plan element, including the planned sewer service areas, and including the components noted above to be held in abeyance pending approval by the City of Kenosha is summarized on Map IV-4. Table IV-7 presents selected design data for the public sewage treatment plants which are recommended to be maintained in the Des Plaines River watershed, including the two plants which are currently under consideration for abandonment. It is important to note that four of the five plants recorded monthly average hydraulic loadings during 1990 which equaled or exceeded the average design capacities of the plants, as shown in Table IV-5. Of these, two sewage treatment plants have recorded more than one month in 1990 in which the monthly average loadings exceeded the design capacity. The Town of Salem Utility District No. 1 has since been abandoned, with service currently being provided by the Town of Salem Sewer Utility District No. 2.

Table IV-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the four public sewage treatment plants in the Des Plaines River watershed. Under both the intermediate growth-centralized and high growth-decentralized land use plans, all of the public plants are anticipated to have average annual hydraulic loading rates equal to or higher than the average annual design capacity. In addition, the Village of Pleasant Prairie Sewer Utility District "D" sewage treatment plant currently has average annual hydraulic loading rates that equal the average annual design capacity of the plant. Thus, there are expected to be expansions of existing plants to provide for increased capacities, or the abandonments of selected plants and the connection of existing service areas to plants with adequate capacity.

Based upon review and analysis of the data in Tables IV-5 and IV-7, including estimates of future condition loadings on an annual average and maximum monthly basis, and based upon the age of the current facilities, estimates of the timing of needed facility planning were made. It appears that facility planning should be initiated within the next three years for all four public sewage treatment plants in the watershed, or, in the case of the two plants operated by the Village of Pleasant Prairie, plans for plant abandonment should be developed.

The current planned sanitary sewer service areas in the Des Plaines River watershed are shown on Map IV-4. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. In the Des Plaines River watershed, these sewer service areas include: Bristol, Bristol/Pleasant Prairie, Salem South, Salem North, Kenosha, Paddock Lake, Pleasant Prairie South, and Union Grove sewer service areas.

As noted above, each of the sewer service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Thus, no specific additional refinements are envisioned to be needed for the currently planned sewer service areas at this time. It is recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plants, there were four private sewage treatment plants in operation within the Des Plaines River watershed in 1990. These facilities generally serve isolated enclaves of urban land uses which are located beyond the current limits of the planned sanitary public sewer service areas. It should be noted that while the private sewage treatment plant serving the Bong Recreation Area is physically located in the Des Plaines River watershed, the plant discharges effluent to Peterson Creek in the Fox River watershed. All four plants are recommended to be retained, with two exceptions. The relatively close proximity of the Fonk's Mobile Home Park No. 2 to the Union Grove sewer service area and the Rainbow Lake Manor Mobile Home Park to the Bristol service area indicate that there is the potential for consolidation of treatment facilities in these two instances. Thus, it is recommended that at the time each of these two private plants require significant upgrading or modification that detailed facility planning be conducted to evaluate the alternative of connecting these two land uses to the adjacent public sanitary sewer systems. For the two remaining private sewage treatment plants serving the Brightondale County Park and the Kenosha Beef International Company, the need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process.

Sewer Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were three known separate sewer system flow relief devices located in the Des Plaines River watershed: one bypass to Brighton Creek from the Village of Paddock Lake; and two bypasses to the Des Plaines River, one from the Town of Bristol and one from the Village of Pleasant Prairie. These bypasses have all been eliminated as the plants were upgraded, as recommended in the adopted regional water quality management plan. As of 1990, there were no known points of sanitary sewage flow relief in the Des Plaines River watershed. However, there were reported infrequent discharges of untreated sewage from the Town of Bristol Utility District No. 1 sewerage system resulting from structural pipe failures in the system between pumping station No. 1 and the sewage treatment plant.

Current Plan Recommendations: As noted above, there are currently no known points of sewage flow relief in the sanitary sewerage systems in the Des Plaines River watershed. However, there have been structural pipe fractures in the local sewer system in the Town of Bristol Utility District No. 1 which have resulted in infrequent bypasses from the tributary sanitary sewer system by overflowing due to pipe ruptures. Sewer system improvements, including upgrading of the pumping station, force main replacement, and a new trunk sewer, have been designed and are expected to be under construction late in 1993 to correct this problem.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of three intercommunity trunk sewers in the Des Plaines River watershed, as shown in Table IV-8. One trunk sewer would connect the urban development in the Town of Bristol in the vicinity of IH 94 and STH 50 to the Pleasant Prairie Sewer Utility District "D" sewerage system. Construction of the trunk sewer was completed in 1987. An additional trunk sewer connecting the Town of Salem Utility District No. 1 to the Town of Salem Utility District No. 2 sewerage system was added to the plan in 1991 to enable abandonment of the Town of Salem Utility District No. 1 plant. This trunk sewer was completed in 1993. In addition, a portion of the trunk sewer connecting Cross and Rock Lakes in the Fox River watershed to the Town of Salem Utility District No. 2 extends into the

Table IV-8

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE DES PLAINES RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Bristol-Pleasant Prairie | Completed (1987) |
| Benet/Shangrila Lake[a] | Completed (1983) |
| Salem[b] | No action[b] |

[a] The Benet/Shangrila trunk sewer is part of the Cross-Rock Lakes trunk sewer located in the Fox River watershed.

[b] A trunk sewer providing for conveyance of sewage from the Town of Salem Utility District No. 1 sewer service area to the Town of Salem Utility District No. 2 sewerage system was added to the plan based upon a December 1991 amendment. Construction of the trunk sewer was completed in 1993.

Source: SEWRPC.

Des Plaines River watershed to connect urban development around Benet and Shangrila Lakes. This trunk sewer was completed in 1983.

Current Plan Recommendations: The current regional water quality management plan includes recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Des Plaines River watershed. As of 1990, the intercommunity trunk sewers recommended to be constructed in the watershed under the initial plan had been constructed. Upon approval of two plan amendment documents, based upon the aforementioned 1992 sanitary sewer and water supply system plan for the greater Kenosha area and a sanitary sewer and water supply system plan for the greater Racine area[2], seven new trunk sewers would be added to the plan. Four of these new trunk sewers would convey wastewater from the Pleasant Prairie-Bristol portion of the service area to the City of Kenosha sewerage system, two would connect development in the Town of Somers along IH 94 to the City of Kenosha sewerage system, and one would connect development in Racine County along IH 94 in the northern portion of the watershed to the City of Racine sewerage system, as shown on Maps IV-4A and XIII-4A.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of six known point sources of pollution identified in the Des Plaines River watershed other than public and private sewage treatment plants. These sources consisted primarily of six outfalls through which industrial cooling, process, rinse, wash waters, and filter backwash waters were discharged directly or indirectly to the surface water system. Of these, three were identified as discharging only cooling water. The remaining three were discharging other types of wastewater. The initial regional water quality management plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were eight such point sources of wastewater discharging to the Des Plaines River and its major tributaries directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table IV-9 summarizes selected characteristics of these other point sources and Map IV-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 14 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Des Plaines River watershed. These other point sources of wastewater, primarily industrial cooling process, rinse, and wash water, discharge directly or following treatment to the groundwater or the surface waters. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

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[2]A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area, Alvord, Burdick, and Howson, 1992.

Table IV-9

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
POLLUTION IN THE DES PLAINES RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID #[b] | Permit Type | Permit Number | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System [c] |
|---|---|---|---|---|---|---|---|---|---|
| American Roller Co. | Racine | 1 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Des Plaines River via storm sewer and unnamed tributary | -- |
| Bardon Rubber Products Company, Inc. | Racine | 2 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Des Plaines River via unnamed tributary | -- |
| Bristol Water Utility | Kenosha | 3 | General | 0045640-1 | 9-30-95 | 4941 | Water supply | Des Plaines River via unnamed tributary | -- |
| Contact Rubber Corp. | Kenosha | 4 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Salem Branch Creek via unnamed tributary | -- |
| I.T.O. Industries, Inc. | Kenosha | 5 | General | 0046540-2 | 9-30-95 | 3679 | Electrical components | Des Plaines River via unnamed tributary | -- |
| Plastic Parts, Inc. | Racine | 6 | General | 0044938-3 | 9-30-95 | 3089 | Plastics products | Des Plaines River via storm sewer and unnamed tributary | -- |
| Tri-Clover, Inc. | Kenosha | 7 | General | 0044938-3 | 9-30-95 | 3494 | Valves and pipe fittings | Des Plaines River via unnamed tributary | -- |
| Wisconsin Electric Power-Pleasant Prairie | Kenosha | 1A | Specific | 0043583 | 3-31-93 | 4911 | Electric services | Jerome Creek | 1,2,3,4 |

[a] Table IV-9 includes eight known, permitted point sources of wastewater discharging to the Des Plaines River and its tributaries, or to the groundwater system in the Des Plaines River watershed. As of 1993, there were 14 known, permitted point sources of water pollution.

[b] See Map IV-3: "Sewer Service Areas and Point Sources of Pollution in the Des Plaines River Watershed: 1990."

[c] The number code refers to the following treatment systems:

1. Holding pond
2. Dechlorination
3. Chlorination
4. pH Control

Source: SEWRPC

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

In 1975, there were five enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, two of these areas have been added to the planned 2010 sewer service area. Two new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map IV-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table IV-10. Two of these areas are served by a private sewage treatment plants. The remaining three areas are covered by soils, and have lot sizes, which have a high probability of not meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. Thus, for these three urban enclaves in the Des Plaines River watershed, the plan recommends that an inspection and maintenance program for the onsite sewage disposals system be instituted and that the conduct of further site-specific planning to determine the best wastewater management practice be conducted at such time as significant problems became evident. These areas should consider alternative methods of waste disposal and an intensive inspection and maintenance program for conventional systems, as well as the possibility of connection to the public sanitary sewer service areas.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Des Plaines River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can be subsequently transported to surface waters. There are currently two active landfills and 27 known abandoned landfills located in the Des Plaines River watershed. None of these landfills are known to be negatively affecting surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Des Plaines River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or groundwater. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were 11 leaking underground storage tanks in the Des Plaines River watershed identified by the Department of Natural Resources. None of these sites were permitted to discharge remediation wastewater directly to surface or ground waters. While there is little evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Table IV-10

EXISTING URBAN DEVELOPMENT OUTSIDE OF THE PLANNED PUBLIC SANITARY SEWER SERVICE AREA IN THE DES PLAINES RIVER WATERSHED: 2010

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| | Kenosha County | | |
| 1 | Town of Brighton-Section 12[c] | 240 | 2.0 |
| 2 | Town of Bristol-Section 6[c] | 101 | 2.0 |
| 3 | Town of Bristol-Section 16[c] | 109 | 0.6 |
| 4 | Mud Lake[d] | 200 | 0.5 |
| | Racine County | | |
| 5 | Town of Dover-Section 36[d] | 270 | 0.4 |
| | Total | 920 | -- |

[a]See Map IV-4.

[b]Urban development is defined in this context as concentrations of urban land uses within any given U.S. Public Land Survey quarter section that has at least 32 housing units, or an average of one housing unit per five gross acres, and is not served by public sanitary sewers.

[c] Based upon consideration of soils, lot sizes, and density, further site-specific planning should be conducted during the planning period to determine the best means of providing for wastewater management.

[d] Served by a private sewage treatment plant.

Source: SEWRPC

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters. As of 1990, there were no permitted sites discharging to surface or ground waters in the Des Plaines River watershed.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the adopted regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

### Existing Conditions and Status of Plan Implementation

For the Des Plaines River watershed, the adopted plan generally recommended nonpoint source control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent in addition to construction site erosion control, onsite sewage disposal, septic system management, and streambank erosion control. The plan also recommended that additional nonpoint source controls be provided within certain areas. Within the urban areas of the Hooker Lake and George Lake drainage areas, the plan recommends a reduction in nonpoint sources of pollution of about 50 percent. Within the rural areas of the Hooker Lake and George Lake drainage areas, the plan recommends reduction in nonpoint source pollutants of 75 and 50 percent, respectively.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, the local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin Legislature and currently provides funds for individual projects or land management practices to local governments and private landowners upon completion of the detailed plans. The funds are provided through local assistance grants administered by the Wisconsin Department of Natural Resources.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Des Plaines River watershed through local regulation and programs. The watershed has not yet been selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. However, limited implementation has been achieved through programs which include the regulation of onsite sewage disposal systems under programs currently administered by Kenosha and Racine Counties. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of new systems and for program resolution of failing systems where they are identified. In addition, since the completion of the adopted regional water quality management plan, public sewer systems have been installed for the urban development surrounding Benet-Shangri-la Lake, as recommended in the regional plan, thereby reducing onsite system pollutant discharges to the surface water and groundwater systems in the watershed. Significant progress has been made in the area of construction site erosion control. As of January 1993, the City of Kenosha and Villages of Paddock Lake and Pleasant Prairie had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities.

With regard to rural nonpoint source control, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations and sets forth criteria whereby the Department of Natural Resources may issue permits for animal feeding operations. This program is administered by the Department of Natural Resources which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program and other programs, such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and the wetland restoration programs administered by the Wisconsin Department of Natural Resources and others, are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have some positive water quality impact.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances, or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection, as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Kenosha and Racine Counties. Thus, these plans cover all of the rural lands in the Des Plaines River watershed. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

During 1994, work was initiated by the Regional Planning Commission on a comprehensive watershed plan[3] for the Des Plaines River watershed in cooperation with Kenosha and Racine Counties. This comprehensive plan will establish the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas in the watershed. Such subsequent

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[3]See SEWRPC Prospectus, Des Plaines River Watershed Planning Prospectus, September 1991.

planning would be directed toward reducing the nonpoint source pollutant loadings as well as providing for local drainage needs in the watershed.

While these local programs described above have resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

Current Plan Recommendations

It is recommended that construction erosion controls, onsite sewage disposal systems management, and streambank erosion control measures, plus land management practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings from the urban and rural lands be carried out throughout the Des Plaines River watershed. Within the urban areas in the drainage areas of George Lake and Hooker Lake, it is recommended that additional practices providing for levels of control for about a 50 percent reduction in nonpoint source loadings be provided. Also, it is recommended that additional practices providing for about a 75 percent reduction in nonpoint source loading from rural lands be provided in the Hooker Lake drainage area. The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, the watershed should be included in the Wisconsin Nonpoint Source Water Pollution Abatement Program in order to make State cost-sharing programs available for nonpoint source pollution control measures. In addition, detailed stormwater management plans in urban areas and detailed farmland management plans in rural areas should be conducted to define the practices to be installed. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[4] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Des Plaines River watershed in the medium category, indicating that inclusion in the program will likely be delayed until late in the planning period or beyond, unless the process of selection is changed and/or funding levels are increased. Because a comprehensive water resources planning program will be completed for the Des Plaines River watershed, the implementation of the nonpoint source pollution abatement component of that plan should be given a priority. Thus, it is recommended that further consideration be given to including the Des Plaines River watershed in the priority watershed program.

## WATER QUALITY MONITORING PLAN ELEMENT

Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

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[4]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southwestern Wisconsin: 1993."

As of 1993, long-term monitoring has been carried out in the Des Plaines River watershed on a sustained basis only by the U.S. Geological Survey at the station located at Russell Road on the Des Plaines River main stem about 0.5 miles downstream of the Wisconsin-Illinois State line, as shown on Map IV-5. After 1991, collection of water quality data at this station was terminated.

Currently, three of the six major lakes in the Des Plaines River watershed--Benet/Shangrila, George, and Hooker Lakes--are being monitored as part of the DNR Self-help Monitoring Program. In addition, limited additional water quality monitoring has been carried out by the U.S. Geological Survey, the Wisconsin Department of Natural Resources, and local lake management agencies.

The Wisconsin Department of Natural Resources has placed increased emphasis on monitoring and assessment of surface water quality[5] in all watersheds. The Department now envisions carrying out a one-year intensive monitoring program in the Des Plaines River watershed about once every five to seven years as part of the Fox-Illinois River Basin monitoring.

Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be re-initiated by the U.S. Geological Survey at Station Dp-4 on a continuing, long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at Dp-1, -2, and -3 and at five selected additional stations, with one station each on Brighton Creek, Dutch Gap Canal, Kilbourn Road Ditch, Center Creek, and Jerome Creek. It is recommended that this program be conducted within the next five years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated with and are consistent with the Department's current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each basin in the Region in an approximate five- to seven-year rotating cycle.

The lake monitoring program should consist, at a minimum, of one intensive monitoring effort to establish baseline conditions and of the long-term participation in the DNR Self-help Monitoring Program that can be conducted by citizen-volunteer residents on the lakes. As noted earlier, three lakes already participate in this program. For each lake, it is recommended that the monitoring program should be expanded to establish current conditions during a two-year or more period of extensive monitoring followed by a continual long-term monitoring program designed to detect changes in water quality conditions. In this regard, the monitoring program should be tailored to provide data needed for preparation or updating of comprehensive lake management plans for the major lakes in the watershed. Such programs have been undertaken on Paddock Lake. The water quality sampling program should be carried out at spring turnover (April) and during June, July, and August, during two subsequent years, with samples collected weekly.

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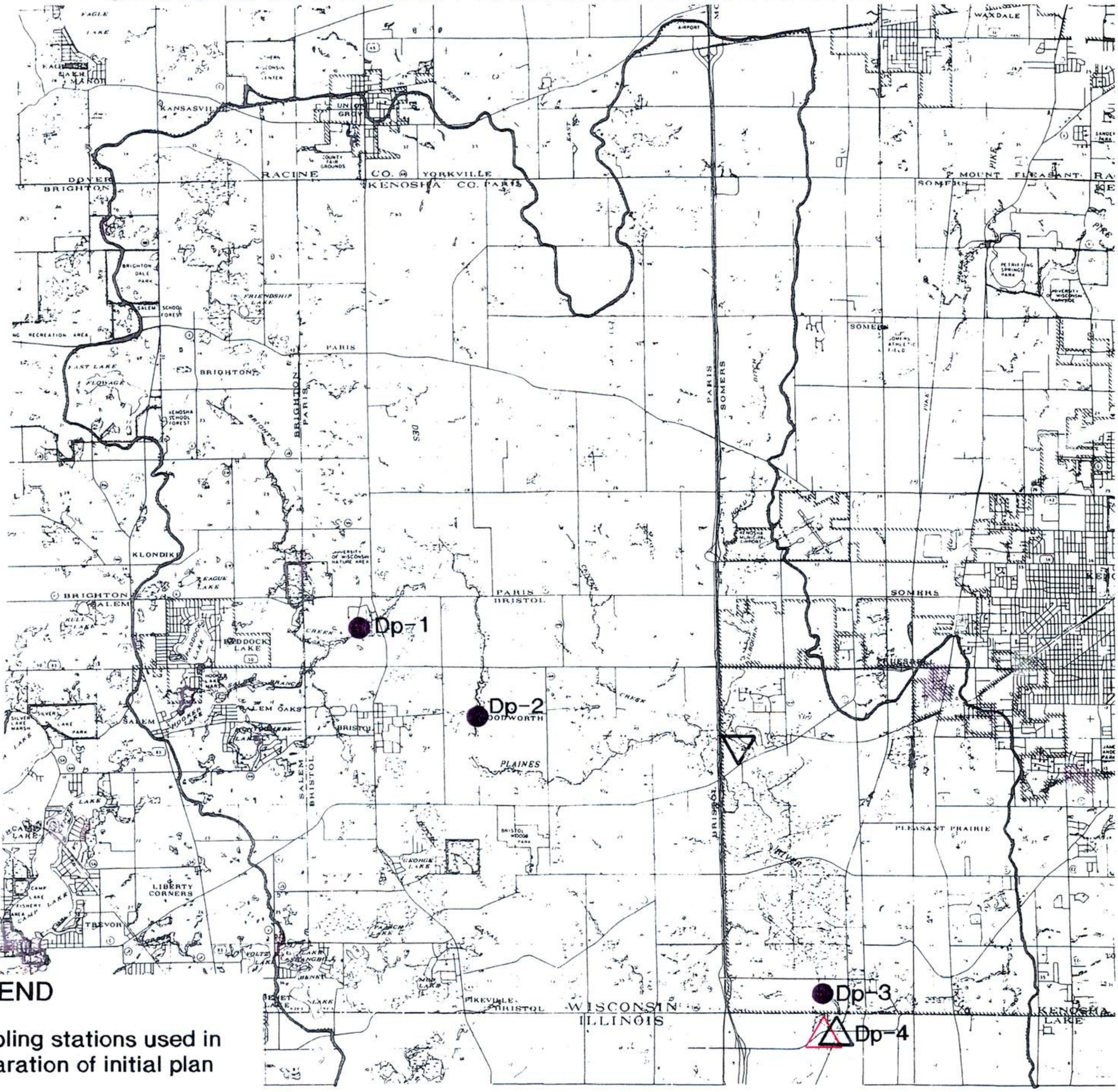
[5]Wisconsin Department of Natural Resources, Surface Water Monitoring Strategy, WR299-92, 1992.

# Map IV-5

## LOCATION OF WATER QUALITY SAMPLING STATIONS IN THE DES PLAINES RIVER WATERSHED




**LEGEND**

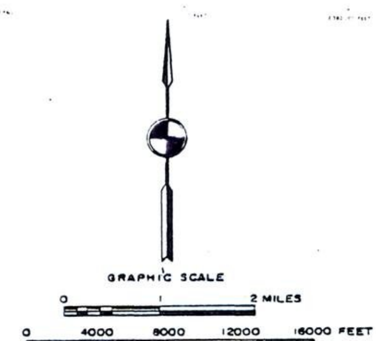
Sampling stations used in preparation of initial plan

- SEWRPC
- DNR
- USGS

Post-1976 sampling stations used in the preparation of plan update

- USGS-Long Term

Source: SEWRPC.



LAKES MANAGEMENT PLAN ELEMENT

Existing Conditions and Status of Plan Implementation

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of the major lakes in the Des Plaines River watershed and for consideration of other lake management measures. Institutional recommendations were also made for the formation of new special purpose units of government where none exist to carry out the plan implementation measures. For each major lake in the Des Plaines River watershed, the initial plan recommended that a comprehensive lake management plan be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. As noted in the previous sections, the preparation of such a comprehensive plan requires supporting water quality monitoring programs to be established.

The status of lake management, protection, and rehabilitation efforts on and around the major lakes in the Des Plaines River watershed is discussed for each major lake in the following paragraphs:

Benet/Shangrila Lake: Since preparation of the initial plan, the area has been included in the Town of Salem Utility District No. 2 and the urban development surrounding the lake has been provided with a public sanitary sewer system, as recommended in the initial plan. The lake has an approved aquatic plant management plan and has been involved in a herbicide-based aquatic plant management program. Shangrila Lake is included in the DNR Self-Help Monitoring Program and is subject to ongoing water clarity monitoring.

East Lake Flowage: The East Lake Flowage is managed by the Wisconsin Department of Natural Resources as part of the Bong Recreation Area. No specific plan implementation activities are documented as of 1993.

George Lake: An inland lake protection and rehabilitation district has been created at George Lake. The district has obtained a Chapter NR 119 Lake Management Planning Grant to assist in the preparation of components of a lake management plan.[6] An aquatic plant management plan has been prepared and approved for this lake, which has used herbicide-based aquatic plant controls; and an aquatic plant harvester has recently been purchased for use on this water body. The urban areas surrounding the lake is served by a public sanitary sewer system as recommended in the initial plan. Extensive nutrient, pest, and soils conservation management practices have been put into place in the western portions of the watershed. Both sediment and nutrient loads have been substantially reduced. The lake is included in the DNR Self-Help Monitoring Program.

Hooker Lake: An inland lake protection and rehabilitation district was recently formed around the lake. The district has received a Chapter NR 119 Lake Management Planning Grant to assist in the preparation of a lake management plan.[7] An aquatic plant management plan has been prepared and approved for this lake which has used herbicide-based aquatic plant control measures. This lake is

[6]George Lake Rehabilitation and Protection District Planning Grant #1006-1, Updated Feasibility Study--Core Sample Results Water Usage Ordinance, June 1994.

[7]Aron & Associates, Hooker Lake Community Survey, 1991.

enrolled in the DNR Self-Help Monitoring Program and is subject to ongoing water clarity monitoring. The urban development around the lake is included in the Town of Salem Utility District No. 1 and is served by a public sanitary sewer system.

Paddock Lake: The lake has an inland lake protection and rehabilitation district and a Chapter NR 119 Lake Management Planning Grant was received to assist in preparing a lake management plan.[8] The district is seeking to resolve problems associated with organic lake sediment and nuisance aquatic plant growths. Paddock Lake has an approved aquatic plant management plan.[9] While not currently enrolled in the DNR Self-Help Monitoring Program, the lake water quality is being monitored under the Planning Grant Program. Urban development around the lake is served by a public sanitary sewer system. This lake has been the subject of an Office of Inland Lake Renewal feasibility study. Recent data suggest that the lake is now eutrophic.

Unnamed Quarry Lake in the Village of Pleasant Prairie: This lake is proposed to be managed as part of a new regional park recommended to be located on the property surrounding the lake. Currently, plans are being prepared by the Village of Pleasant Prairie to develop the site.

Current Plan Recommendations

Management measures recommended and in-lake measures which are considered potentially applicable and should be considered in more detail are shown in Table IV-11 for the six major lakes in the Des Plaines River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality, biological condition, and water budget monitoring programs are reaffirmed in the updated plan recommendations for the Des Plaines River watershed. The management recommendations for the four lakes considered in detail in the initial plan--Benet/Shangrila, George, Hooker, and Paddock Lakes--are based upon review of the lake planning set forth in the initial plan and the current status of implementation of the recommendations, as well as any subsequent local planning.

It is recognized that the preparation of comprehensive lake management plans may need to be conducted in a staged manner in order to best utilize available resources. In this regard, the water quality and biological condition monitoring, aquatic plant management, and watershed protection measure planning and implementation are considered to be logical components of the comprehensive plans which can be conducted under separate planning programs, if designed to be integrated into a comprehensive lake management plan.

In addition to the recommendations noted for the major lakes in the Des Plaines River watershed, it is recommended that water quality planning and supporting monitoring be conducted for those lakes and similar water bodies in the watershed which are less than 50 acres in size, such as Montgomery Lake, where such activities are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable

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[8]Woodward-Clyde, Inc., Paddock Lake Investigations and Management Plan, February 1994.

[9]Aron & Associates, Paddock Lake Plant Management Plan, August 1993.

Table IV-11

MANAGEMENT MEASURES RECOMMENDED FOR THE MAJOR LAKES IN THE DES PLAINES RIVER WATERSHED: 1993[a]

| Lake Name | Area (acre) | Water Quality Monitoring | Prepare Comprehensive Management Plan | Watershed-Based Measures | | | | | | In-Lake Management Measures | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Public Sanitary Sewer Service | Onsite Sewage System Mgmt | Rural NPS Mgmt | Urban NPS Mgmt | Construction Site NPS Management | Live-stock Mgmt | Macro-phyte Harvest | Aeration | Nutrient Inactivation | Dredge | Sediment Cover | Water Level Mgmt | Fish Mgmt |
| Benet/ Shangrila | 186 | 0 | + | 0 | - | - | + | + | - | + | - | + | + | + | - | + |
| East Lake Flowage | 123 | + | + | - | + | + | - | - | - | - | - | - | - | - | + | 0 |
| George | 59 | 0 | 0 | 0 | - | + | + | + | 0 | 0 | - | + | + | + | + | + |
| Hooker | 87 | 0 | 0 | 0 | - | + | + | + | - | + | - | + | + | + | - | + |
| Paddock | 112 | 0 | 0 | 0 | - | - | + | + | - | + | - | + | + | - | - | + |
| Unnamed Quarry Lake | 100 | + | + | + | - | + | + | + | - | - | - | - | - | - | - | + |

0 - On-going measures.
\+ - Management measures proposed or recommended for further consideration.
\- - Management measures not specifically recommended for further consideration.

[a] Management measures recommended for further consideration in local management plans are summarized from those adopted in SEWRPC Planning Report No. 30, modified as necessary as the result of subsequent implementation actions, monitoring programs, and planning studies referenced in the previous section of the text.

Source: SEWRPC.

for consideration on the major lakes in the watershed can be considered for lake management purposes.

## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study, the 1965 through 1975 Commission stream water quality monitoring effort; the U.S. Geological Survey sampling programs from 1964 to 1977; the Wisconsin Department of Natural Resources (DNR) sampling programs in 1973 and 1976; and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Des Plaines River watershed included samplings at three Commission stations: one on Brighton Creek and two on the Des Plaines River; at one DNR station on the Des Plaines River; and at one U.S. Geological Survey station on the Des Plaines River in Lake County, Illinois, at Russell Road, about 0.5 mile downstream of the Wisconsin-Illinois State line. The sampling station locations are shown on Map IV-5.

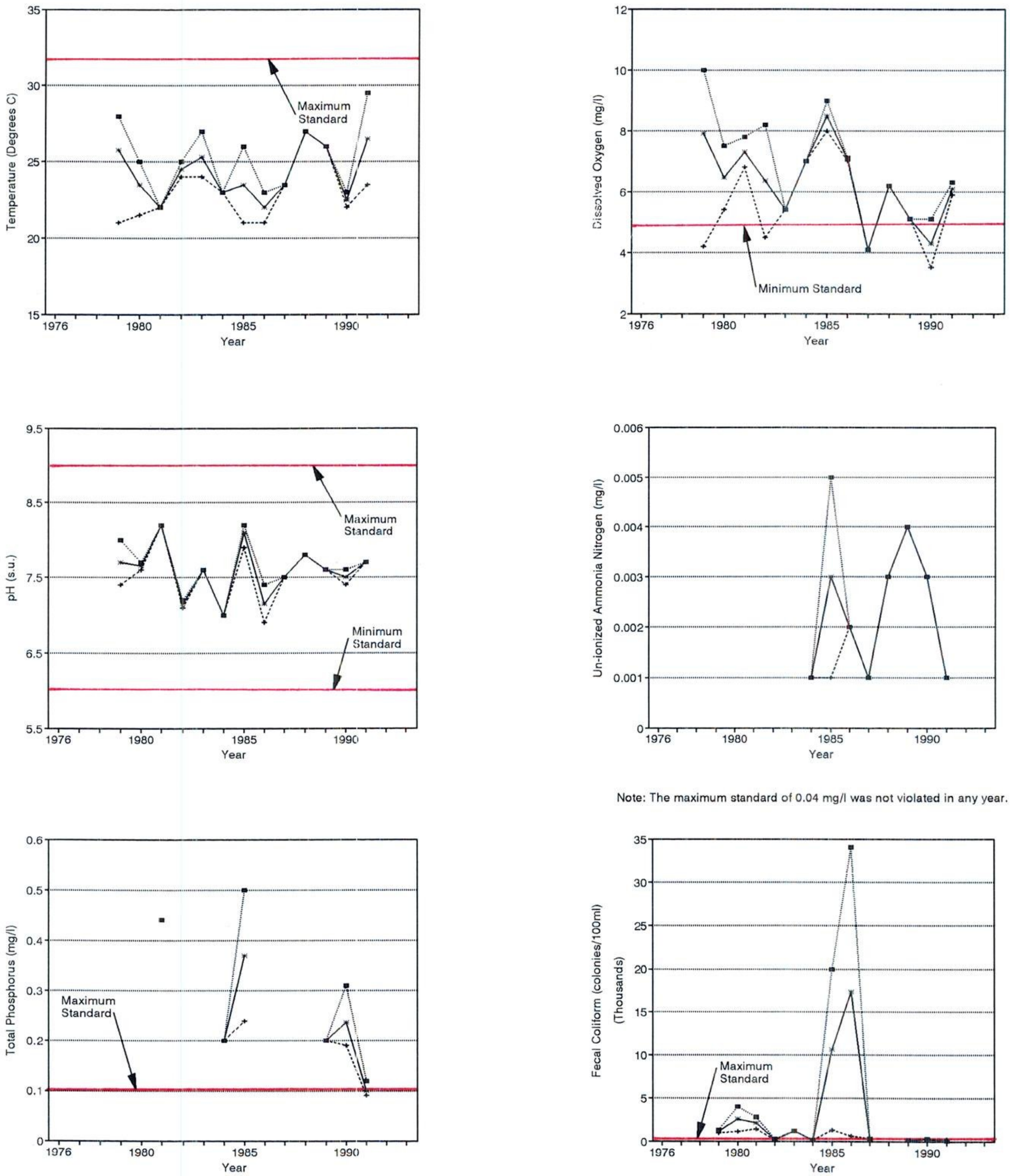
Long-term post-1976 comparable water quality data were collected at the U.S. Geological Survey sampling station Dp-4, located about 0.5 mile downstream of the Wisconsin-Illinois State line, as shown on Map IV-5. Biological condition data collected by the U.S. Environmental Protection Agency in 1979 through 1980 were also available for use in the assessment of current water quality conditions. In addition to the limited data obtained since preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Des Plaines River watershed.

The water quality data obtained at the U.S. Geological Survey sampling station Dp-4 on the main stem of the Des Plaines River at Russell Road in Illinois, for the period 1976 through 1991, are summarized in Figure IV-1. The data have been used to assess current water quality conditions to evaluate water quality trends and the occurrence of change over time, and to evaluate current conditions with respect to water quality standards. The water quality standards indicated in Figure IV-1 are those set forth for specific biological and recreational use objectives as described in Chapter II.

Review of those data for station Dp-4 indicates that there were no apparent significant changes in water quality conditions from 1979 to 1988, with a possible improvement following 1988 as evidenced by reduced volatile solids and phosphorus and less variability in dissolved oxygen levels. This improvement may be attributed, in part, to the improvements which were made between 1985 and 1989 to the Paddock Lake, Bristol, and Pleasant Prairie Sewer Utility District "D" sewage treatment plants. Although phosphorus levels have appeared to decline over the sampling period, it should be noted that these levels still exceed the standard established for streams with full recreational water use

## Figure IV-1

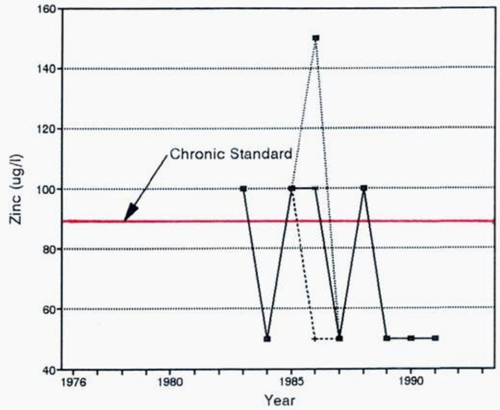
# WATER QUALITY DATA FOR THE DES PLAINES RIVER AT STATION Dp-4: 1976-1993

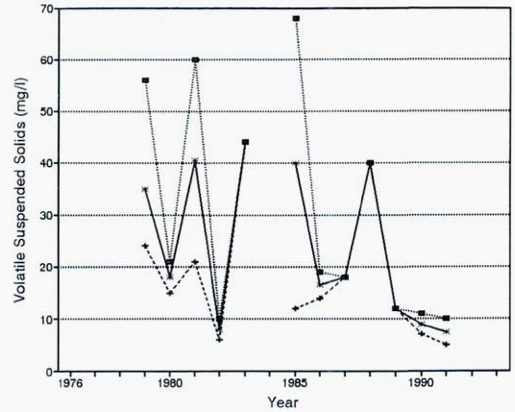



Note: The maximum standard of 0.04 mg/l was not violated in any year.

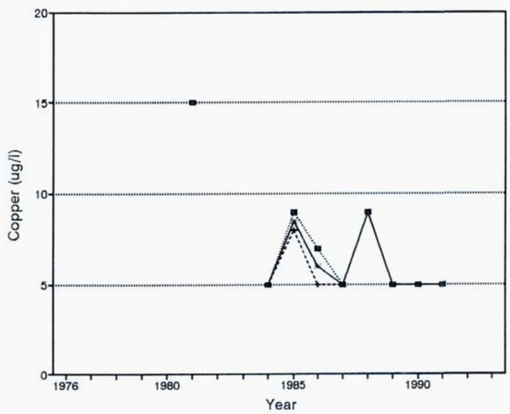
Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

## Figure IV-1 (cont'd)

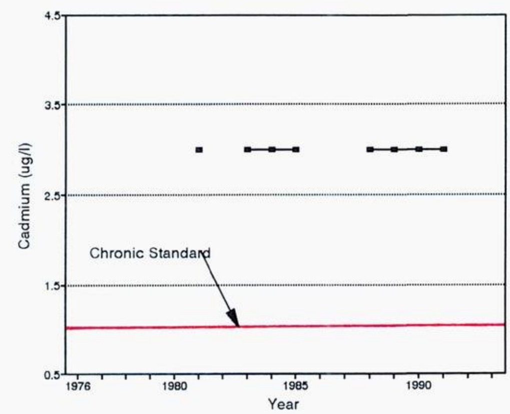


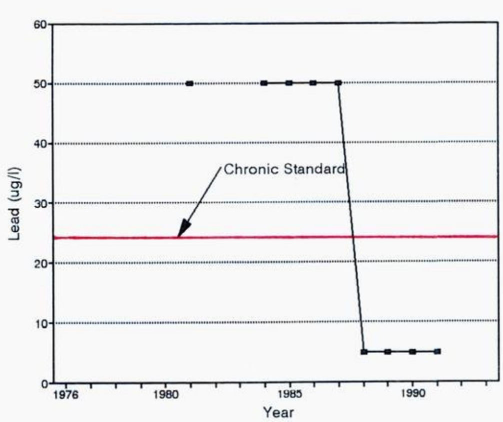

Note: The acute standard of 202.9 ug/l was not violated in any year.
Values graphed at 50 ug/l were indicated to be less than 50 ug/l.




Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.
Values graphed at 3 ug/l were indicated to be less than 3 ug/l.




Note: The acute standard of 63.3 ug/l was not violated in any year.
Values graphed at 3 ug/l were indicated to be less than 3 ug/l.



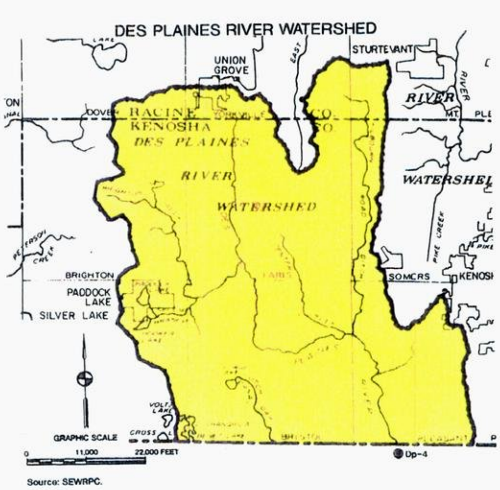

Note: The acute standard of 408.6 ug/l was not violated in any year.
Values graphed at 50 ug/l prior to 1988 were indicated to be less than 50 ug/l
and values graphed at 5 ug/l from 1988 to 1991 were indicated to be less than 5 ug/l.

**LEGEND**

**MAXIMUM VALUE**

**MINIMUM VALUE**

**AVERAGE VALUE**




Source: U.S. Geological Survey and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

objectives, as set forth in Chapter II. Temperature, pH, and un-ionized ammonia nitrogen levels remained variable with no apparent trends, but were within acceptable limits as defined by the water quality standards for the Des Plaines River main stem set forth in Chapter II. Fecal coliform levels exceed the standards. Chronic standards for some metals are also exceeded, as discussed in the next section.

Toxic and Hazardous Substances
Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Des Plaines River watershed from 1973 through 1977. In the three in-stream water quality samples for which toxic and hazardous substances were tested, levels of heptachlor epoxide, a persistent pesticide, were exceeded only once. Sample analyses for cadmium, chromium, copper, lead, mercury, nickel, zinc, PCBs, and DDT, DDE, DDD, aldrin, heptachlor, lindane, dieldrin, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency recommended levels.

Recent sampling of metals were collected by the U.S. Geological Survey from 1981 through 1991 at Station Dp-4 on the Des Plaines River, as shown in Figure IV-1. The data indicate that chronic toxicity level standards were exceeded for selected metals. However, the acute toxicity standards were not violated. It should be noted that the chronic standard for lead was not exceeded after 1988. No recent stream or lake bottom sediment analyses were conducted for toxic and hazardous substances.

Since the completion of the initial regional water quality management plan, one spill of a toxic substance into a stream within the Des Plaines River watershed has been documented by the Wisconsin Department of Natural Resources. The spill occurred in the Kilbourn Road Ditch as a result of a fuel storage accident.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Des Plaines River and its major tributaries were assessed with the results set forth in Table IV-12. Fish population and diversity was recorded as fair in the mainstem of the Des Plaines River and in Kilbourn Road Ditch, and as poor in Dutch Gap Canal, Center Creek, and the Salem Branch of Brighton Creek. An assessment of a good to fair fish population and diversity was reported for Brighton Creek. There were no recorded fish kills documented in any of the stream reaches in the Des Plaines River watershed.

Standards are not expected to be fully met for dissolved oxygen concentrations, phosphorus, and fecal coliforms in most streams of the Des Plaines River watershed. Ammonia nitrogen levels did appear to meet standards. No comprehensive data were available on water column toxic pollutants. However, limited data collected by the U.S. Geological Survey at Station Dp-4 suggest that the standards for chronic toxicity for zinc and cadmium have been occasionally exceeded, with the other metal concentrations generally within the acceptable levels, as defined in Chapter II.

No recent data were available on biotic index ratings, which are biological indicators of water quality within a stream system. High levels of streambed sedimentation were noted in the Kilbourn Road Ditch, the Des Plaines River, and Center Creek. Moderate to high levels of streambed sedimentation were noted in the remaining stream reaches of the Des Plaines River watershed.

Table IV-12

CHARACTERISTICS OF STREAMS IN THE DES PLAINES RIVER WATERSHED

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating | Streambed Sedimentation Substrate | Physical Modifications to Channel[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| Brighton Creek and Salem Branch | 17.5 | Good to fair--Brighton Creek Poor--Salem Branch | No | Yes | No | Yes | Yes | -- | -- | Moderate to High (silt) | Moderate |
| Dutch Gap Canal | 5.8 | Poor | No | Yes | No | Yes | Yes | -- | -- | Moderate to High (silt) | Major |
| Kilbourn Road Ditch | 14.8 | Poor | No | -- | No | Yes | Yes | -- | -- | High (silt) | Major |
| Des Plaines River Upstream STH 50 | 8.8 | Poor | No | Yes | No | Yes | Yes | -- | -- | High (silt) | Major |
| Des Plaines River Downstream STH 50 | 15.7 | Poor | No | Yes | No | Yes | Yes | Yes | -- | High (silt) | Major |
| Center Creek | 5.8 | Poor | No | Yes | No | Yes | Yes | -- | -- | High (silt) | Major |

[a] Based upon a 1994 SEWRPC fishery survey of the Des Plaines River watershed.

[b] The most recent water quality data available as described in Figure IV-1 were used to evaluate water quality in the Des Plaines River system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for the Des Plaines River watershed stream reaches based upon simulated year 2000 land use conditions and current level of pollutant control, if appropriate.

[c] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-13 sets forth the water quality index classifications[10] used in the initial plan for 1964, 1974-1975, and for 1990-1991 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table IV-13, recent comparative data were available only for station Dp-4, located on the Des Plaines River at Russell Road in Illinois. This station is shown on Map IV-5. The data were used for comparative purposes with earlier data from station Dp-4. The limited data available indicate that water quality conditions in 1964 and 1974-75 have improved from "fair" to "fair to good" based on 1990-91 data. This improvement can be attributed, in part, to upgrading of the Town of Bristol and Village of Pleasant Prairie Sewer Utility District "D" sewage treatment plants.

A summary of potential pollution sources in the Des Plaines River watershed by stream reach is shown in tabular summary in Table IV-14. Review of the data indicate that the only notable conversion of lands from rural to urban uses has occurred in the area tributary to the Des Plaines River in the vicinity of and downstream of STH 50 and in the area tributary to the Kilbourn Road Ditch. It should also be noted that the majority of the permitted industrial discharges in the watershed discharge to the Des Plaines River. Data on nonpoint source pollution, public and private sewage treatment plants discharging to surface waters, and additional potential impacts to surface water quality are included in Table IV-14.

Lakes

Lake water quality data available for use in preparing the initial regional water quality management plan were obtained from the Wisconsin Department of Natural Resources quarterly lake monitoring program for selected lakes, and Southeastern Wisconsin Regional Planning Commission and Wisconsin Department of Natural Resources lake use reports. Post-1975 data on phosphorus and chlorophyll-a concentrations and Secchi disc measurements for major lakes in the Des Plaines River watershed, where available, are presented in Table IV-15.

Toxic and Hazardous Substances: There have been no reported substance spills in lakes in this watershed as reported up to 1993.

Water Quality Assessments: Data from Table IV-15 were used in the calculation of trophic state indices for each of the major lakes where data were available. Trophic states, indicating degrees of nutrient enrichment in the lakes, were assigned using the Wisconsin Trophic State Index[11] for each major lake in the Des Plaines River watershed where data were available, as indicated in Table IV-16. The available trophic state index values using the Carlson Trophic State Index[12] are also provided for current and historic conditions, as shown in Table IV-17.

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[10]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

[11]R.A. Lillie et al, "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," Research Management Findings, No. 35, May 1993.

[12]Robert E. Carlson, "A Trophic State Index for Lakes," Limnology and Oceanography, Vol. 22(2), March 1977.

Table IV-13

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE DES PLAINES RIVER WATERSHED 1964, 1974-75, AND 1990-91

| Main Stem Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July and August 1990-1991 |
|---|---|---|---|
| Dp-2 | Fair | Fair | -- |
| Dp-3 | Fair | Fair | -- |
| Dp-4 | Fair | Fair | Fair to Good |
| Tributary Station[a] | | | |
| Dp-1 | Excellent | Fair | -- |
| Watershed Average | Fair | Fair | -- |

[a] See Map IX-5 for sampling station locations.

Source: U.S. Geological Survey and SEWRPC.

Table IV-14

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE DES PLAINES RIVER WATERSHED: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Brighton Creek and Salem Branch | insignificant | insignificant | -- | x | x | 2 | -- | 1 | -- | Town of Salem Utility District No. 1 public sewage treatment plant recommended for abandonment | 1,2 |
| Dutch Gap Canal | insignificant | insignificant | -- | -- | x | -- | -- | -- | -- | -- | -- |
| Kilbourn Road Ditch | insignificant | moderate | 1990-fuel spill | x | x | -- | -- | -- | -- | -- | -- |
| Des Plaines River Upstream of STH 50 | insignificant | insignificant | -- | -- | x | 1 | 1 | 5 | -- | Meeter Brothers and Company private sewage treatment plant abandoned in 1981.<br>Fonk's Mobile Home Park No. 2 private sewage treatment plant to evaluate connection to public system | 1<br>-- |
| Des Plaines River downstream of STH 50 | insignificant | major | -- | x | x | 2 | -- | 2 | -- | Wisconsin Tourist Information Center private sewage treatment plant abandoned in 1991<br>Village of Pleasant Prairie Sewer Utility District "D" and Village of Pleasant Prairie Sanitary District No. 73-1 public sewage treatment plants are recommended for abandonment pending approval of plan amendment by the City of Kenosha | 1<br>-- |
| Center Creek | insignificant | insignificant | -- | -- | x | -- | -- | -- | -- | Howard Johnson Motor Lodge private sewage treatment plant abandoned in 1989 | -- |

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] Number codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place
2. Abandonment of Sewage Treatment Plant Underway

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-15

WATER QUALITY OF THE MAJOR LAKES IN THE DES PLAINES RIVER WATERSHED

| Lake Name | Area (acre) | Total Phosphorus (mg/l) | | | | | Chlorophyll-a (μg/l) | | | | | Secchi Disk (feet) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] |
| Benet/ Shangrila Lake | 188 | 0.54 | 0.01 | 0.17(16) | 1977-78 | LSF | -- | -- | -- | -- | -- | 3.0 | 1.5 | 2.25(2) | 1991 | Self-Help |
| East Lake Flowage | 123 | 0.24 | 0.10 | 0.15(3) | 1977 | LSF | -- | -- | -- | -- | -- | 1.0 | 1.0 | 1.0(1) | 1977 | LSF |
| George Lake | 59 | 0.22 | 0.03 | 0.08(38) | 1976-80 | LSF | -- | -- | -- | -- | -- | 7.0 | 1.25 | 2.7(35) | 1988-92 | Self-Help |
| Hooker Lake | 87 | 0.18 | 0.02 | 0.05(17) | 1977-92 | LSF/USGS | 19.00 | 9.00 | 13.00(4) | 1992 | USGS | 7.2 | 2.6 | 5.4(10) | 1991-92 | Self-Help |
| Paddock Lake | 112 | -- | -- | -- | -- | -- | 8.37 | 0.54 | 2.2(15) | 1977 | ERA | 6.25 | -- | -- | -- | -- |
| Unnamed Lake/ Pleasant Prairie | 100 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

[a]Number in parentheses refers to number of samples taken.

[b] The following sources were cited:
LSF.........Wisconsin Department of Natural Resources, Lake Survey Forms
SELF-HELP...Wisconsin Self-Help Lake Monitoring Program Data, 1986-1988
ERA ........Environmental Resource Assessment Report
USGS .......U.S. Geological Survey, Water Resources Data-Wisconsin (annual)

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-16

TROPHIC STATE INDEX VALUES FOR MAJOR LAKES WITHIN THE DES PLAINES RIVER WATERSHED[a]

| Lake Name | Wisconsin Trophic State Index Values[b] | | | |
|---|---|---|---|---|
| | Total-P | Chlorophyll-a | Secchi | Mean |
| Benet/Shangrila | 68.0 | -- | 65.6 | 66.8 |
| East Lake Flowage | 67.0 | -- | 67.0 | 67.0 |
| George Lake | 62.1 | -- | 57.1 | 59.6 |
| Hooker Lake | 58.9 | 54.1 | 51.7 | 54.9 |
| Paddock Lake | 72.8 | 40.7 | 56.2 | 56.6 |
| Unnamed Lake/ Pleasant Prairie | -- | -- | -- | -- |

[a] Wisconsin Trophic State Index values were calculated using water chemistry data shown in Table IV-15.

[b] Wisconsin Trophic State Index ranges:
- Below 44 = oligotrophic
- 45 - 53 = mesotrophic
- 54 - 75 = eutrophic
- Above 75 = hypertrophic

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-17

COMPARISON OF TROPHIC STATE INDEX VALUES FOR MAJOR LAKES IN THE DES PLAINES RIVER WATERSHED[a]

| Lake Name | Carlson Trophic State Index Values[b] | | |
|---|---|---|---|
| | Satellite Information 1979-1981 | Water Chemistry pre-1981 | Water Chemistry 1981-1991 |
| Benet/Shangrila | 51 | 70 | 67 |
| East Lake Flowage | -- | 77 | -- |
| George Lake | 57 | 62 | 64 |
| Hooker Lake | 51 | 58 | 54 |
| Paddock Lake | 49 | 57 | -- |
| Unnamed Lake/ Pleasant Prairie | -- | -- | -- |

[a]Carlson TSI values were calculated from available data from spring measurements for phosphorus and from summer measurements for chlorophyll-a and water clarity. Water Chemistry Values were calculated from data shown in Table IV-15. Satellite information values were determined from Wisconsin's Lakes-A Trophic Assessment Using Landsat Digital Data, 1983.

[b]Carlson Trophic State Index ranges:

Below 40 = oligotrophic
40 - 50 = mesotrophic
50 - 60 = eutrophic
Above 60 = hypertrophic

Source: Wisconsin Department of Natural Resources, U.S. Environmental Protection Agency, and SEWRPC

The data available indicate all of the lakes may be classified as in the eutrophic, or nutrient-enriched, range. Two of these lakes--Benet/Shangrila and Paddock--are classified as drained lakes. George, Hooker, and East Lake Flowage are drainage lakes. East Lake Flowage is part of the Wisconsin Department of Natural Resources Bong Recreation Area and is managed by the Department for a variety of wildlife and recreational uses. There are no water quality data available for the unnamed lake in U.S. Public Survey Section 20, Township 1 North, Range 23 East, in the Village of Pleasant Prairie which was created in the late 1980s at a now abandoned quarry site. No conclusions regarding changes in water quality conditions between 1976 and 1991 can be drawn based upon the limited data available.

Fish kills, primarily related to seasonal fluctuations in water temperature and dissolved oxygen levels, as well as spawning activities, do not normally occur in the lakes in the Des Plaines River watershed. Since the initial plan, one recorded fish kill occurred in Hooker Lake in June 1984. However, this occurrence does not appear to be chronic. Thus, despite the obvious concerns that this episode creates among lake users, it does not appear to warrant special consideration at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, all of the stream reaches studied in the Des Plaines River watershed, as of 1993, are recommended for warmwater sportfish and full recreational uses, except for the tributary extending from the main stem to the Village of Pleasant Prairie sewage treatment plant, which is recommended for a warmwater forage fish and limited recreational use. These water use objectives and associated water quality standards are discussed in Chapter II.

Based upon the available data for sampling stations in the watershed, the main stem of the Des Plaines River downstream of STH 50 did not fully meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. More recent data available for the period of 1979 through 1991 and analyses indicate that there has been some modest improvement in water quality conditions. However, some of the standards associated with the recommended water use objectives continue to not be fully achieved. As shown in Figure IV-1, violations of the dissolved oxygen, total phosphorus, and fecal coliform levels occurred at station Dp-4 on the main stem of the Des Plaines River just south of the Wisconsin-Illinois border. Based upon a review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the dissolved oxygen, fecal coliform, and phosphorus standards also occur at upstream stations.

There are currently two stream reaches for which the water use objectives set forth herein are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. Chapter NR 104 classifies a portion of Salem Branch downstream of the now abandoned Town of Salem Utility District No. 1 sewage treatment plant as capable of supporting a limited forage fish community, while the objectives set forth herein recommend a warmwater sport fish objective. Chapter NR 104 classifies the tributary of the Des Plaines River to the Village of Pleasant Prairie sewage treatment plant as a limited forage fishery, while the recommended objectives set forth herein provide for a warmwater forage fishery and limited recreational use. It is recommended that stream appraisals to further assess the potential for a higher use objective be conducted for Salem Branch and the Pleasant Prairie tributary. These appraisals are recommended to be carried out as part of the next one-year monitoring period envisioned to be carried out in the Des Plaines River watershed.

The waters of Benet/Shangrila Lakes, East Lake Flowage, George Lake, Hooker Lake, Paddock Lake, and the unnamed quarry lake in Pleasant Prairie are recommended for the maintenance of a warmwater sport fishery and full recreational use. George and Paddock Lakes, for which complete water quality data were available between 1965 and 1975, violated the standards for total phosphorus of 0.02 mg/l recommended by the Commission. In addition, George Lake and Benet/-Shangrila Lake violated the dissolved oxygen standard on at least one occasion between 1965 and 1975. Modeling data developed in the initial plan indicates that Lakes George, Paddock, Benet/Shangrila, and Hooker did not meet the phosphorus standard.

As shown in Table IV-15, recent monitoring data are available for Benet/Shangrila, George, and Hooker Lakes to assess the current compliance with water quality standards for the major lakes in the Des Plaines River watershed. Based upon that data as summarized in the Carlson Trophic State Index values set forth in Table IV-17, most lakes in the watershed could be expected to have an annual average total phosphorus concentration in excess of the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47. All of the lakes in the watershed for which data were available had TSI values in excess of this value and hence would not be expected to meet the standard. No data were available for the unnamed quarry lake in the Village of Pleasant Prairie.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

There are three water quality-related issues remaining to be resolved in the Des Plaines River watershed. The only major issue remaining to be resolved with regard to point sources of pollution deals with the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991. The recommendations of that plan include revisions to the planned sewer service areas in the greater Kenosha area and provisions to abandon the two existing sewage treatment plants operated by the Village of Pleasant Prairie, with the areas served by these plants being connected to the City of Kenosha sewage system for treatment plant purposes. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1991 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

The second issue relates to the need for a second level nonpoint source pollution abatement program to be carried out in the watershed. It is recommended that the Wisconsin Department of Natural Resources and Racine and Kenosha Counties undertake the preparation of a detailed planning program as part of, or as a follow-up to the ongoing Des Plaines River comprehensive planning program being carried out by the Southeastern Wisconsin Regional Planning Commission for Kenosha and Racine Counties.

In addition to these two major issues, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological condition survey of Salem Branch and the Pleasant Prairie tributary, in order to reevaluate the current water use objectives during the next monitoring period when the

Department will be devoting its efforts in the Des Plaines River watershed as is envisioned within the next five to seven years.

## Chapter V

## FOX RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

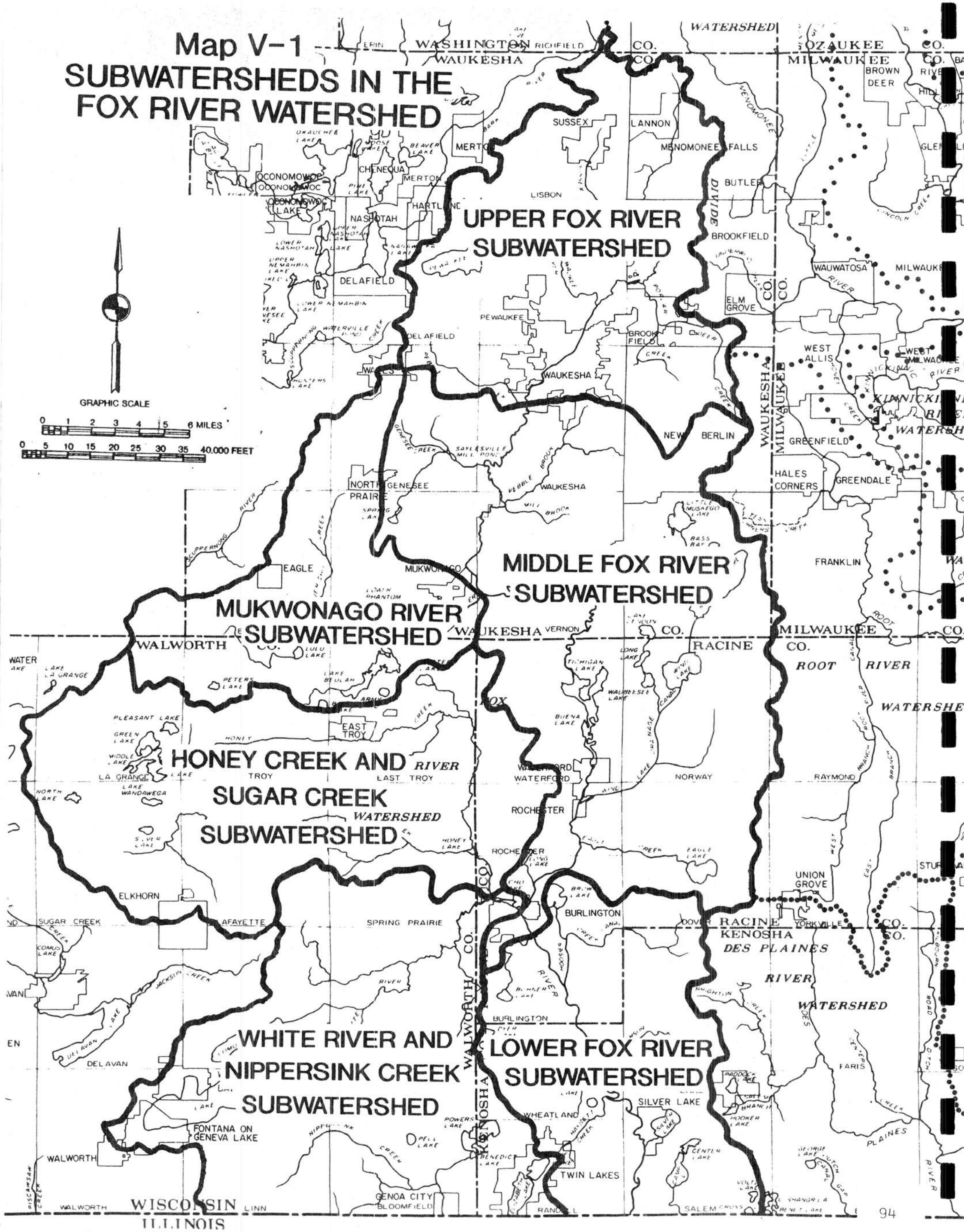
### INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Fox River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Fox River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included. Plan implementation setting forth designated management agency responsibilities is presented in Chapter XVII on a regional basis.

The Fox River watershed is located in the south central portion of the Region. That part of the watershed contained within the Region--about 934 square miles--is only a small part of a much larger watershed. The main stem of the Fox River rises in Waukesha County near the Village of Lannon and flows approximately 81 miles south through Racine and Kenosha Counties before crossing the State line just east of the Salem-Randall Town line. The river continues to flow in a southerly direction to its confluence with the Illinois River. Rivers and streams in the watershed are part of the Mississippi River drainage system as the watershed lies west of the subcontinental divide. The boundaries of the basin and its principal subwatersheds, together with the locations of the main channels of the Fox River and its principal tributaries, are shown on Map V-1.

Within the Southeastern Wisconsin Region, the Fox River watershed contains 45 major lakes having a surface area of 50 acres or more. These lakes are distributed within six subwatersheds: the Lower Fox River, Middle Fox River, Upper Fox River, Honey/Sugar Creeks, Mukwonago River, and White River/Nippersink Creek subwatersheds. The major lakes in the Lower Fox River subwatershed are Bohner Lake, Browns Lake, Camp Lake, Center Lake, Cross Lake, Dyer Lake, Lilly Lake, Silver Lake-Kenosha, and Voltz Lake. The major lakes in the Middle Fox River watershed are Big Muskego Lake, Lake Denoon, Eagle Lake, Kee Nong Go Mong Lake, Little Muskego Lake, Long Lake, Spring Lake-Waukesha, the Waterford Impoundment comprised of Buena and Tichigan Lakes, Waubeesee Lake, and Wind Lake. The major lake in the Upper Fox River subwatershed is Pewaukee Lake. The major lakes in the Honey/Sugar Creeks subwatershed are the three Lauderdale Lakes-Green, Middle, and Mill Lakes, North Lake-Walworth, Pleasant Lake, Potter Lake, Silver

# Map V-1
# SUBWATERSHEDS IN THE FOX RIVER WATERSHED



Lake-Walworth, and Wandawega Lake. The major lakes in the Mukwonago River subwatershed are Army Lake, Lake Beulah, Booth Lake, Eagle Spring Lake, Lower Phantom Lake, Lulu Lake, Peters Lake, and Upper Phantom Lake. The major lakes in the White River/Nippersink Creek subwatershed are Benedict/Tombeau Lake, Lake Como, Echo Lake, Elizabeth Lake, Geneva Lake, Lake Mary, Pell Lake, and Powers Lake. Physical characteristics of the major lakes in the Fox River watershed are set forth in Table V-1. The data indicate that major lakes in the watershed have a combined surface water area of about 21,872 acres, or about 4 percent of the total area of the watershed.

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendation, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Fox River watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table V-2 summarizes the existing land uses in the Fox River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains numerous urbanized areas, 83 percent of the watershed was still in rural and other open land uses in 1990. These rural uses included about 52 percent of the total watershed in agricultural and related rural uses, about 9 percent in woodlands, about 16 percent in surface water and wetlands, and about 6 percent in other open lands. The remaining 17 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map V-2.

Within the Fox River watershed, major concentrations of urban development exist in all four counties, with the majority of urban development increases since 1975 occurring in Waukesha County. Urban development has been taking place rapidly in and around the Cities of Muskego, New Berlin, and Waukesha, and the Town of Pewaukee, and along the Blue Mound Road corridor in the City and Town of Brookfield. Other concentrations of urban-related land uses within Waukesha County are located in the Village of Pewaukee and around Pewaukee Lake; in the Village and the Town of Mukwonago; and within the Towns of Vernon and Genesee. In addition, scattered urban development has occurred throughout the watershed in Waukesha County. The Fox River watershed contains two major commercial centers, the Waukesha Central Business District in downtown Waukesha and the Blue Mound Road corridor in Brookfield; and four major industrial centers, Pewaukee, Waukesha North and South, and New Berlin, all in Waukesha County.

Table V-1

PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE FOX RIVER WATERSHED

| SUBWATERSHED Lake Name | Surface Area (acres) | Direct Tributary Drainage Area (acres) | Shoreline (miles) | Maximum Depth (feet) | Mean Depth (feet) | Volume (acre-feet) |
|---|---|---|---|---|---|---|
| **FOX RIVER UPPER** | | | | | | |
| Pewaukee Lake | 2,493 | 14,819 | 13.7 | 45.0 | 10.0 | 24,930 |
| **FOX RIVER MIDDLE** | | | | | | |
| Big Muskego Lake | 2,177 | 12,150 | 26.13 | 4.0 | 2.5 | 5,469 |
| Denoon Lake | 162 | 1,013 | 2.4 | 55 | 18 | 2,940 |
| Eagle Lake | 520 | 2,910 | 4.37 | 15 | 7.0 | 3,640 |
| Kee Nong Go Mong Lake | 88 | 1,337 | 2.5 | 25 | 8.7 | 770 |
| Little Muskego Lake | 506 | 7,067 | 5.7 | 65 | 15 | 7,170 |
| Long Lake | 102 | 1,858 | 3.4 | 5 | 2.5 | 259 |
| Spring Lake (Waukesha County) | 105 | 3,096 | 2.2 | 22 | 5 | 553 |
| Waterford Impoundment (Buena & Tichigan Lakes) | 1,133 | 14,375 | 28 | 63 | 6 | 8,244 |
| Waubeesee Lake | 129 | 553 | 3.1 | 73 | 19 | 2,450 |
| Wind Lake | 936 | 8,381 | 9.3 | 47 | 9.6 | 8,995 |
| **FOX RIVER LOWER** | | | | | | |
| Bohner Lake | 135 | 1,098 | 1.9 | 30 | 9.2 | 1,243 |
| Browns Lake | 396 | 526 | 5.7 | 44 | 8 | 3,135 |
| Camp Lake | 461 | 2,566 | 4.8 | 19 | 5 | 2,328 |
| Center Lake | 129 | 2,243 | 6.5 | 28 | 8 | 1,136 |
| Cross Lake | 87 | 436 | 2.2 | 35 | 11.8 | 1,027 |
| Dyer Lake | 56 | 1,353 | 1.16 | 13 | 5 | 275 |
| Lilly Lake | 88 | 307 | 1.3 | 6 | 4.7 | 415 |
| Silver Lake (Kenosha Co) | 464 | 3,191 | 4.1 | 44 | 10 | 4,819 |
| Voltz Lake | 52 | 257 | 2.3 | 24 | 7 | 362 |

Table V-1 (cont'd)

| SUBWATERSHED Lake Name | Surface Area (acres) | Direct Tributary Drainage Area (acres) | Shoreline (miles) | Maximum Depth (feet) | Mean Depth (feet) | Volume (acre-feet) |
|---|---|---|---|---|---|---|
| **HONEY/SUGAR CREEKS** | | | | | | |
| Lauderdale Lakes (Green, Middle, Mill) | 841 | 5,429 | 16 | 57 | 15 | 12,591 |
| North Lake (Walworth County) | 191 | 9,131 | 4.8 | 2.8 | 2.0 | 382 |
| Pleasant Lake | 155 | 1,216 | 2.7 | 29 | 12.5 | 1,910 |
| Potter Lake | 162 | 380 | 2.2 | 26 | 8 | 1,296 |
| Silver Lake (Walworth County) | 85 | 270 | 1.5 | 3.0 | 2.8 | 211 |
| Wandawega Lake | 119 | 910 | 2.25 | 8 | 4 | 476 |
| **MUKWONAGO RIVER** | | | | | | |
| Army Lake | 78 | 356 | 1.5 | 17 | 8 | 625 |
| Beulah Lake | 834 | 5,283 | 15.3 | 58 | 17 | 14,279 |
| Booth Lake | 113 | 146 | 1.79 | 24 | 12.2 | 1,396 |
| Eagle Spring Lake | 311 | 5,859 | 4.0 | 8 | 3.6 | 1,127 |
| Lulu Lake | 84 | 10,317 | 2.4 | 40 | 24 | 2,009 |
| Peters Lake | 64 | 1,295 | 1.51 | 8 | 3 | 215 |
| Upper/Lower Phantom Lake | 540 | 20,178 | 3.91 | 29 | 5.1 | 2,750 |
| **WHITE RIVER/ NIPPERSINK CREEK** | | | | | | |
| Benedict Lake | 78 | 2,589 | 3.7 | 37 | 15.4 | 1,888 |
| Lake Como | 946 | 4,058 | 8.0 | 9 | 4.3 | 4,033 |
| Echo Lake | 71 | 3,476 | 2.46 | 11 | 1.8 | 129 |
| Elizabeth Lake | 865 | 5,029 | 5.4 | 32 | 11 | 6,900 |
| Geneva Lake | 5,262 | 12,750 | 20.2 | 135 | 61 | 320,982 |
| Lake Mary | 315 | 1,143 | 3.5 | 33 | 9 | 1,957 |
| Pell Lake | 86 | 1,011 | 1.8 | 13 | 3.6 | 314 |
| Powers Lake | 459 | 2,426 | 5.3 | 33 | 16.2 | 7,453 |
| **TOTAL** | 21,872 | 172,788 | 240.98 | -- | -- | 463,067 |

Source: SEWRPC

Table V-2

**LAND USE IN THE FOX RIVER WATERSHED: 1975 and 1990[a]**

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 43,658 | 7.3 | 56,783 | 9.5 | 13,125 | 30.1 |
| Commercial | 1,558 | 0.3 | 2,147 | 0.4 | 589 | 37.8 |
| Industrial | 1,674 | 0.3 | 2,580 | 0.4 | 906 | 54.1 |
| Transportation, Communication, and Utilities[b] | 27,958 | 4.7 | 31,469 | 5.2 | 3,511 | 12.6 |
| Governmental and Institutional | 3,015 | 0.5 | 3,185 | 5.3 | 170 | 5.6 |
| Recreational | 7,336 | 1.2 | 8,068 | 1.4 | 732 | 10.0 |
| Subtotal | 85,199 | 14.3 | 104,232 | 17.4 | 19,033 | 22.3 |
| Rural | | | | | | |
| Agricultural and Related | 341,385 | 57.0 | 313,435 | 52.3 | -27,950 | - 8.2 |
| Lakes, Rivers, Streams and Wetlands | 94,570 | 15.8 | 94,342 | 15.8 | - 228 | - 0.4 |
| Woodlands | 51,542 | 8.6 | 51,183 | 8.6 | - 359 | - 0.7 |
| Open Lands[c], Landfills, Dumps, and Extractive | 26,004 | 4.3 | 35,508 | 5.9 | 9,504 | 99.4 |
| Subtotal | 513,501 | 85.7 | 494,468 | 82.6 | -19,033 | - 3.7 |
| Total | 598,700 | 100.0 | 598,700 | 100.0 | 0 | -- |

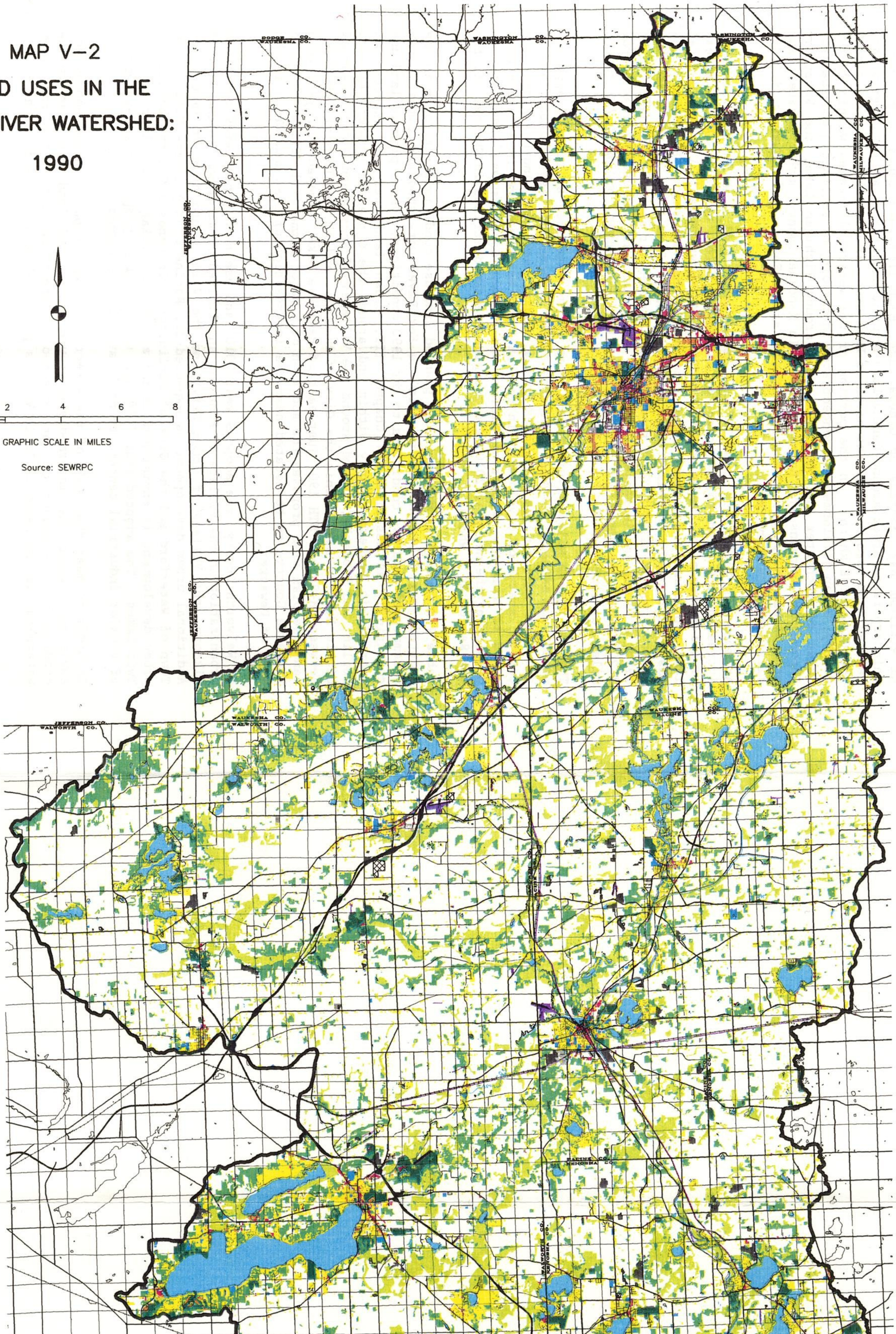
[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

# MAP V-2
# LAND USES IN THE FOX RIVER WATERSHED: 1990




-LEGEND-

- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREETS AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION, COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

Source: SEWRPC.

The Fox River watershed is about 935 square miles in areal extent, or about 35 percent of the total Region. In 1990 about 163 square miles, or about 17 percent of the watershed, was in urban land uses.

In the portion of the watershed contained in Walworth County, urban-related land uses are located primarily in and around the City of Lake Geneva, the Villages of Williams Bay, Fontana on Geneva Lake, East Troy, and Genoa City, and in unincorporated areas around Geneva Lake and the Lauderdale Lakes. Other urban-related land uses occur to the north of Lake Como, around Pell Lake, and within the City of Elkhorn. In the portion of the watershed located within Racine County, urban development is concentrated in the City of Burlington and the Villages of Rochester and Waterford, and around Tichigan Lake, the Waterford Impoundment, Browns and Bohner Lakes. In Kenosha County, urban-related land uses within the watershed are concentrated around Powers, Camp, Center, Silver, Elizabeth, and Mary Lakes.

As shown in Table V-2, from 1975 to 1990, urban land uses in the watershed increased from about 85,200 acres, or 133 square miles, to about 104,200 acres, or 163 square miles, or by about 22 percent. As shown in Table V-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 43,600 acres, or about 68 square miles in 1975 to about 56,800 acres, or about 89 square miles in 1990, a 30 percent increase. Commercial and industrial land uses increased from 3,200 acres, or about 5.0 square miles, to 4,700 acres, or about 7.3 square miles, an increase of 47 percent.

The 163 square miles of urban land uses in the watershed as of 1990 approximated, but exceeded somewhat, the staged 1990 planned increase in urban land of about 153 square miles envisioned in the adopted year 2000 land use plan. The current status of development in the Fox River watershed and in adjacent portions of Waukesha, Walworth, Racine, and Kenosha Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table V-3 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Fox River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban land uses are expected to increase in Waukesha County within and around the Cities of Brookfield, New Berlin, and Waukesha; in and around the Villages of Sussex and Lannon; east of Little Muskego Lake within the City of Muskego; and in the Town of Pewaukee, between IH-94 and STH 190, just east of Pewaukee Lake. The adopted year 2010 land use plan also proposes the addition of a major commercial office center in Waukesha County, to be located near the intersection of I-94 and CTH J in the Town of Pewaukee.

In Walworth County, the adopted year 2010 land use plan anticipates increased urbanization in the Village of Fontana, and limited urban growth in the City of Elkhorn, the Village of Genoa City, and the Village and Town of East Troy. Additional urban development is expected for Racine County in the Village and Town of Waterford and the City of Burlington. In Kenosha County, additional urban development is envisioned in and around the Villages of Silver Lake and Twin Lakes. The adopted year 2010 land use plan also proposes the development of a major industrial center, to be located in Burlington.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Fox River watershed, as indicated in Table V-3, is projected to increase from the 1990

Table V-3

EXISTING AND PLANNED LAND USE IN THE FOX RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 56,783 | 9.5 | 65,226 | 10.9 | 8,443 | 14.8 | 78,497 | 13.1 | 21,714 | 38.2 |
| Commercial | 2,147 | 0.4 | 2,267 | 0.4 | 120 | 5.6 | 2,516 | 0.4 | 360 | 17.2 |
| Industrial | 2,580 | 0.4 | 3,350 | 0.6 | 770 | 29.8 | 4,316 | 0.7 | 1,736 | 67.3 |
| Transportation, Communication, and Utilities[b] | 31,469 | 5.2 | 34,705 | 5.8 | 3,236 | 10.3 | 38,939 | 6.5 | 7,470 | 23.7 |
| Governmental and Institutional | 3,185 | 0.5 | 3,489 | 0.6 | 304 | 9.5 | 3,813 | 0.7 | 628 | 19.7 |
| Recreational | 8,068 | 1.4 | 9,227 | 1.5 | 1,159 | 14.4 | 9,730 | 1.6 | 1,662 | 20.6 |
| Subtotal | 104,232 | 17.4 | 118,264 | 19.8 | 14,032 | 13.5 | 137,811 | 23.0 | 33,579 | 32.2 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 313,435[d] | 52.3 | 314,135 | 52.5 | 700[d] | 0.2[d] | 297,445 | 49.7 | - 15,990 | - 5.1 |
| Lakes, Rivers, Streams, and Wetlands | 94,342 | 15.8 | 93,116 | 15.5 | - 1,226 | - 1.3 | 93,116 | 15.6 | - 1,226 | - 1.3 |
| Woodlands | 51,183 | 8.6 | 50,202 | 8.4 | - 981 | - 1.9 | 49,783 | 8.3 | - 1,400 | - 2.7 |
| Open Lands,[c] Landfills, Dumps, and Extractive | 35,508 | 5.9 | 22,983 | 3.8 | - 12,525 | - 34.3 | 20,545 | 3.4 | - 14,963 | - 42.1 |
| Subtotal | 494,468 | 82.6 | 480,436 | 80.2 | - 5,351 | - 4.15 | 460,889 | 77.0 | - 33,579 | - 6.8 |
| Total | 598,700 | 100.0 | 598,700 | 100.0 | 0 | -- | 598,700 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

[d] Existing 1990 agricultural and related land uses are at about the same level as projected 2010 levels under the intermediate growth-centralized land use plan.

Source: SEWRPC.

total of about 163 square miles, or about 17 percent of the total area of the watershed, to about 185 square miles, or about 20 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 215 square miles, or about 23 percent of the total watershed by year 2010. It is important to note that the 83 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space use through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 773 square miles in 1990 to about 751 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 721 square miles under the high growth-decentralized land use plan, decreases of about 3 and 7 percent between 1990 and 2010 for the two year 2010 plans considered.

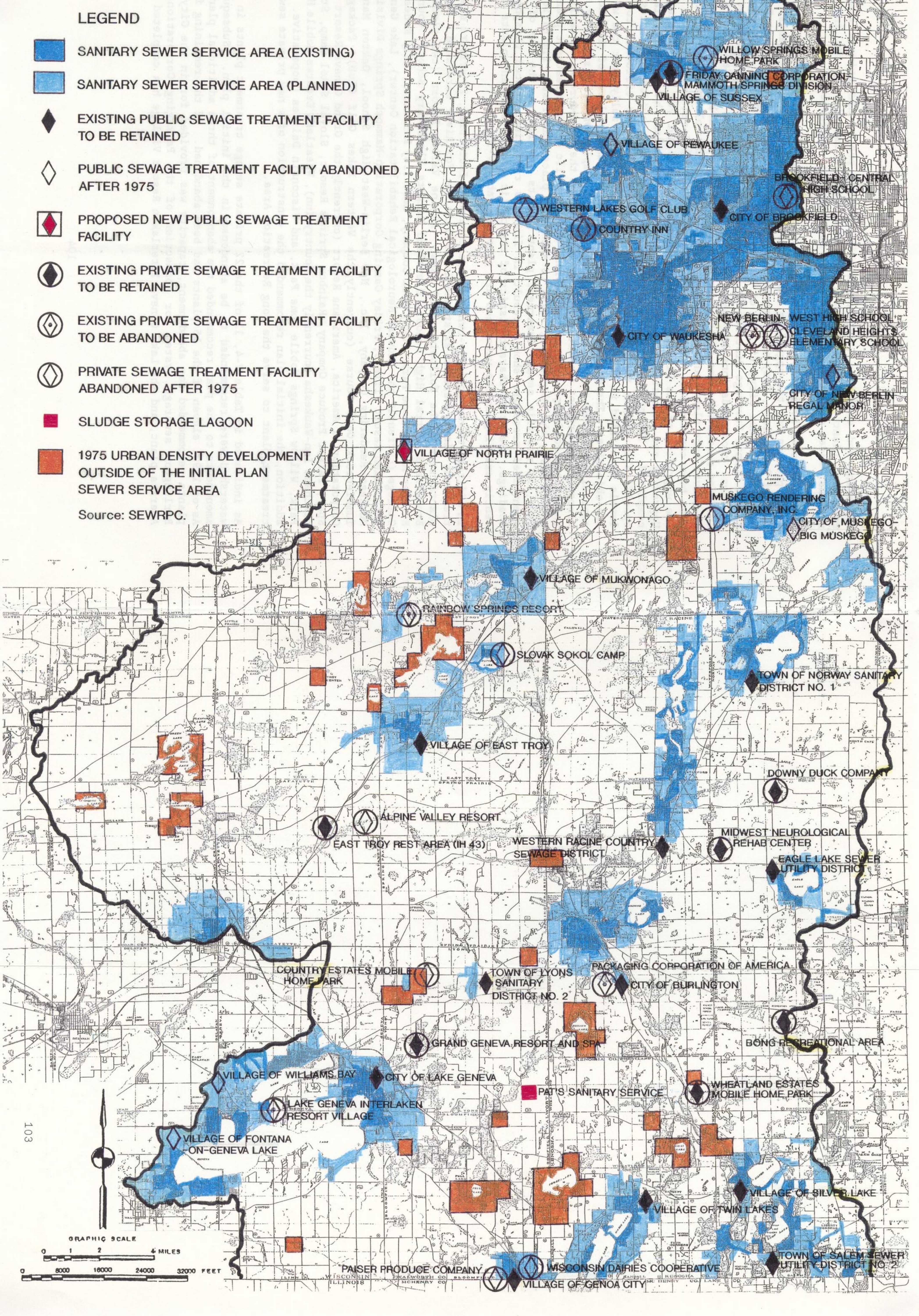
## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Fox River watershed--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary sewer service areas located in the watershed.

### Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were sixteen public sewage treatment facilities located in the Fox River watershed, as shown on Map V-3. The City of Waukesha, City of Burlington, City of Brookfield, Village of Silver Lake, and the Western Racine County Sewerage District sewage treatment plants discharged directly to the main stem of the Fox River. The Village of Fontana on Geneva Lake and the Village of Williams Bay treatment plants utilized soil absorption for the discharge of treated effluent; the Village of Twin Lakes treatment plant discharged to Bassett Creek; the City of Lake Geneva treatment plant discharged to the White River; the City of Muskego treatment plant discharged to Big Muskego Lake; the City of New Berlin Regal Manor plant discharged to Deer Creek; the Village of East Troy plant discharged to Honey Creek; the Village of Genoa City plant discharged to Nippersink Creek; the Village of Mukwonago plant discharged to the Mukwonago River; the Village of Pewaukee plant discharged to the Pewaukee River; and the Village of Sussex plant discharged to Sussex Creek. Of these sixteen plants, the plants operated by the Cities of Muskego and New Berlin, and the Villages of Pewaukee, Williams Bay, and Fontana on Geneva Lake were abandoned after 1975, as recommended in the initial plan. The status of implementation in regard to the abandonment, Map V-8

# SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE FOX RIVER WATERSHED: 1990



upgrading and expansion, and construction of the public and private sewage treatment plants in the Fox River watershed, as recommended in the initial regional water quality management plan, is summarized in Table V-4.

As can be seen by review of Table V-4, full implementation of the initial plan would provide for the upgrading and expansion, as needed, of eight plants: the City of Brookfield, City of Waukesha, City of Lake Geneva, Village of East Troy, Village of Genoa City, Village of Sussex, Village of Twin Lakes, and Western Racine County Sewerage District No. 2 sewage treatment plants. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the upgrading of the City of Burlington and Village of Silver Lake plants and for the construction of six new plants, five of which have been constructed. Construction of the Village of North Prairie plant and the upgrading of the Village of Silver Lake plant has not yet been completed. Upgrading and expansion of the Village of Twin Lakes plant has been partially completed. The plants in the watershed have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluents to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site specific phosphorus limitations on all public sewage treatment plants, and in 1993, the adoption of rules to allow for placement of such limitations. Thus, as specific sewage treatment plant permits are issued, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. Selected characteristics of the public sewage treatment plants currently existing in the watershed are given in Table V-5.

In addition to the publicly-owned sewage treatment facilities, 22 private sewage treatment plants were in existence in 1975 in the Fox River watershed. These plants served the following land uses: Alpine Valley Resort (two plants), Brookfield Central High School, Cleveland Heights Elementary School, Country Estates Mobile Home Park, Downy Duck Company, East Troy Rest Area, Holy Redeemer College (currently the Midwest Neurological Rehabilitation Center), Lake Geneva Interlaken Resort Village, Friday Canning Corporation-Mammoth Springs Division, Muskego Rendering Company, Inc., New Berlin-West High School, Oakton Manor-Tumblebrook Golf Course (currently the Western Lakes Golf Club), Packaging Corporation of America, Americana Resort (currently the Grand Geneva Resort and Spa), Paiser Produce Company, Rainbow Springs Resort, Sloval Sokol Camp, Steeplechase Inn-Waukesha (currently the Country Inn), Wheatland Estates Mobile Home Park, Willow Springs Mobile Home Park, and Wisconsin Dairies Cooperative. In addition, the initial plan recommended the construction of a new private sewage treatment plant to serve the Bong Recreation Area.

As indicated in Table V-4, 12 of the 22 private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. Subsequent amendments to the plan recommended the abandonment of three additional plants. As of 1990, eleven of the 15 plants had been abandoned. Of the remaining four plants recommended for abandonment, capacity was provided for in the City of Burlington sewerage system for connection of the Packaging Corporation of America plant, and the Lake Geneva Interlaken Resort Village has completed

Table V-4

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS
IN THE FOX RIVER WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| City of Brookfield | Fox River | Upgrade and expand | Completed first of two phases (1985)[a] |
| City of Burlington | Fox River | Upgrade | Local facility plan completed (1990)[b] |
| Eagle Lake Sewer Utility District | Eagle Creek | Construct new plant | Completed[c] (1978) |
| Village of East Troy | Honey Creek | Upgrade and expand | Completed (1982) |
| City of Lake Geneva | White River | Upgrade and expand | Completed (1986) |
| Village of Genoa City | Nippersink Creek | Upgrade and expand | Completed[c] (1985) |
| Town of Lyons Sanitary District No. 2 | White River | Construct new plant | Completed[c] (1981) |
| Village of Mukwonago | Mukwonago River[d] | Construct new plant | Completed (1980) |
| Village of North Prairie | Soil Absorption | Construct new plant | Facility plan completed (1989) |
| Town of Norway Sanitary District No. 1 | Wind Lake Drainage Canal | Construct new plant | Completed[c] (1978) |
| Town of Salem Sewer Utility District No. 2 | Fox River | Construct new plant | Completed (1981) |
| Village of Silver Lake | Fox River | Upgrade | No action |
| Village of Sussex | Sussex Creek | Upgrade and expand[e] | Facility plan underway[e] |
| Village of Twin Lakes | Bassett Creek | Upgrade and expand | Partially completed (1988) |
| City of Waukesha | Fox River | Upgrade and expand | Construction completed (1979)[f] |
| Western Racine County Sewerage District | Fox River | Upgrade and expand | Completed (1987) |
| Village of Fontana-on-Geneva Lake | Soil Absorption | Abandon plant-connection to new Fontana-Walworth plant | Plant abandoned (1986) |
| City of Muskego-Big Muskego | Big Muskego Lake | Abandon plant | Plant abandoned (1984) |
| City of New Berlin-Regal Manor | Deer Creek | Abandon plant | Plant abandoned (1984) |
| Village of Pewaukee | Pewaukee River | Abandon plant | Plant abandoned (1981) |
| Village of Williams Bay | Soil Absorption | Abandon plant | Plant abandoned (1986) |
| **Private Sewage Treatment Plants** | **Disposal of Effluent** | **Plan Recommendation** | **Implementation Status** |
| Bong Recreational Area | Peterson Creek | Construct new plant | Plant constructed (1980) |
| Grand Geneva Resort and Spa[g] | White River | Maintain and upgrade as needed | Plant maintained |
| Downy Duck Company | Soil Absorption | Maintain and upgrade as needed | Plant maintained |
| East Troy Rest Area (IH 43) | Tributary to Sugar Creek | Maintain and upgrade as needed | Plant maintained and upgraded |
| Midwest Neurological Rehabilitation Center[h] | Tributary to Wind Lake Canal | Maintain and upgrade as needed | Plant maintained |
| Friday Canning Corporation-Mammoth Springs Division | Soil Absorption | Maintain and upgrade as needed | Plant maintained |
| Wheatland Estates Mobile Home Park | Minor Tributary to the Fox River | Maintain and upgrade as needed | No action |
| Lake Geneva Interlaken Resort Village | Soil Absorption | Abandon plant | Facility planning underway to enable abandonment[i] |
| Willow Springs Mobile Home Park | Soil Absorption | Abandon plant | No action |
| Rainbow Springs Resort | Tributary to Mukwonago River | Abandon plant[j] | Not in operation |
| New Berlin-West High School | Tributary to Poplar Creek | Abandon plant | No action |
| Packaging Corporation of America | Tributary to Fox River | Abandon plant | No action; Capacity provided in Burlington sewerage system for connection |

Table V-4 (cont'd)

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| Alpine Valley Resort (two plants) | Soil Absorption | Abandon plants[k] | Plants abandoned (1990) |
| Brookfield Central High School | Soil Absorption | Abandon plant | Plant abandoned (1980) |
| Cleveland Heights Elementary School | Tributary to Poplar Creek | Abandon plant | Plant abandoned (1986) |
| Country Estates Mobile Home Park | Tributary to Ore Creek | Abandon plant[l] | Plant abandoned with connection to Town of Lyons Sanitary District No. 2 (1988) |
| Muskego Rendering Company, Inc. | Soil absorption | Abandon plant | Plant abandoned (1981) |
| Western Lakes Golf Club[m] | Pewaukee Lake | Abandon plant | Plant abandoned (1980) |
| Paiser Produce Company | Soil Absorption | Abandon plant | Plant abandoned (1978) |
| Slovak Sokol Camp | Soil Absorption | Abandon plant | Plant abandoned (1982) |
| Country Inn-Waukesha[n] | Soil Absorption | Abandon plant | Plant abandoned (1984) |
| Wisconsin Dairies Cooperative | Nippersink Creek | Abandon plant | Plant abandoned (1979) |

[a] Facility planning for a second phase expansion and upgrading was under preparation as of 1993.

[b] New plant was placed into service May 1992.

[c] Plant upgrading and expansion was completed representing implementation of the plan recommendations, excepting for the provision of phosphorus removal facilities which have not yet been provided.

[d] New plant discharge recommended to be conveyed to the Fox River mainstem in an outfall sewer.

[e] The Sussex plant was recommended for abandonment in the initial regional water quality management plan. A 1989 amendment to the Regional Water Quality Management Plan-2000 for the Upper Fox River Watershed Brookfield and Sussex Sewage Treatment Plants provided for the plant to be a permanent facility after upgrading and expansion. The permanent facility was under construction during 1994.

[f] A major expansion and upgrading of the Waukesha sewage treatment plant was under construction during 1993.

[g] Formerly the Americana Resort.

[h] Formerly Holy Redeemer College.

[i] The Lake Geneva Interlaken Resort village sewage treatment plant was abandoned in 1993 with the resort connected to the Walworth County Metropolitan Sewerage District.

[j] The Rainbow Springs Resort sewage treatment plant was recommended to be retained in the initial regional water quality management plan. A 1987 amendment to the regional water quality management plan for the Village of Mukwonago, Towns of East Troy and Mukwonago recommended the plant to be abandoned and for the Rainbow Springs Resort sewer service area to be served by the Village of Mukwonago sewage treatment plant.

[k] The Alpine Valley Resort sewage treatment plants were recommended to be retained in the initial regional water quality management plan. A 1989 amendment to the Regional Water Quality Management Plan-2000 for the Towns of East Troy, LaFayette, and Spring Prairie, and Village of East Troy recommended the plants to be abandoned and for the Alpine Valley Resort sewer service area to be served by the Village of East Troy sewage treatment plant.

[l] The Country Estates Mobile Home Park sewage treatment plant was recommended to be retained in the initial regional water quality management plan. A 1987 amendment to the Regional Water Quality Management Plan-2000 for the Country Estates Sanitary District, Town of Lyons recommended the plant to be abandoned and for the Country Estates sewer service area to be served by the Town of Lyons Sanitary District No. 2 sewage treatment plant.

[m] Formerly Oakton Manor - Tumblebrook Golf Course.

[n] Formerly Steeplechase Inn.

Source: SEWRPC.

Table V-5

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS IN THE FOX RIVER WATERSHED: 1990

| Name of Public Sewage Treatment Plant | 1990 Estimated Total Area Served (square miles) | 1990 Estimated Total Population Served | Date of Construction and Major Modification | Major Sewage Treatment Unit Processes[a] | Name of Receiving Water to which Effluent is Disposed | WPDES Permit Expiration Date |
|---|---|---|---|---|---|---|
| City of Brookfield | 14.8 | 33,800 | 1973, 1982, 1988[c] | Phosphorus removal, activated sludge, clarification sand filtration, chlorination, dechlorination, post aeration | Fox River | 6/30/98 |
| City of Burlington | 3.3 | 10,400 | 1934, 1938, 1962, 1972, 1975[d] | Activated sludge (contact stabilization), clarification, phosphorus removal, chlorination, post aeration | Fox River | 3/31/99 |
| Eagle Lake Sewer Utility District | 0.6 | 1,200 | 1978 | Activated sludge, rotating biological contactor, clarification, chlorination, sand filters | Eagle Creek | 9/30/98 |
| Village of East Troy | 1.1 | 3,600 | 1960, 1982 | Activated sludge, clarification, phosphorus removal, sand filtration, chlorination | Honey Creek | 6/30/98 |
| City of Lake Geneva | 2.6 | 6,400 | 1930, 1966, 1986 | Oxidation ditch, clarification, seepage cell system | Groundwater system and the White River | 6/30/99 |
| Village of Genoa City | 0.6 | 1,200 | 1923, 1959, 1985 | Oxidation ditch, clarification, chlorination | Nippersink Creek | 6/30/98 |
| Town of Lyons Sanitary District No. 2 | 0.3 | 1,000 | 1981 | Oxidation ditch, clarification, ultraviolet disinfection | White River | 6/30/98 |
| Village of Mukwonago | 1.0 | 4,400 | 1950, 1971, 1980 | Activated sludge, clarification, phosphorus removal, chlorination basin | Fox River | 6/30/98 |
| Town of Norway Sanitary District No. 1 | 3.5 | 4,900 | 1978 | Activated sludge, clarification, phosphorus removal, sand filtration, chlorination | Wind Lake Drainage Canal | 3/31/92 |
| Town of Salem Sewer Utility District No. 2 | 2.6 | 4,900 | 1981 | Activated sludge, clarification, phosphorus removal, chlorination, dechlorination | Fox River | 3/31/97 |
| Village of Silver Lake | 0.6 | 1,800 | 1967, 1987, 1988 | Activated sludge, clarification, chlorination, dechlorination | Fox River | 12/31/98 |
| Village of Sussex | 1.7 | 4,400 | 1960, 1975, 1978[e] | Activated sludge (contact stabilization), clarification, filtration, phosphorus removal, chlorination | Sussex Creek | 6/30/96 |
| Village of Twin Lakes | 2.3 | 4,000 | 1958, 1972, 1975, 1988 | Activated sludge (contact stabilization), trickling filter, clarification, phosphorus removal, chlorination, polishing pond | Bassett Creek via unnamed tributary | 12/31/93 |
| City of Waukesha | 14.6 | 57,000 | 1949, 1967, 1979[f] | Primary trickling filter, clarification, secondary trickling filters, clarification, sand filters, phosphorus removal, chlorination | Fox River | 12/31/93 |
| Western Racine County Sewerage District | 3.7 | 6,400 | 1968, 1987 | Activated sludge (contact stabilization), clarification, phosphorus removal, chlorination | Fox River | 12/31/99 |

Table V-5 (cont'd)

| Name of Public Sewage Treatment Plant | Hydraulic Loading[b] (mgd) | | | | $BOD_5$ Loading[b] (pounds/day) | | | | Suspended Solids Loading[b] (pounds/day) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | | | | Existing | | | | Existing | | | |
| | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Flow Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity |
| City of Brookfield | 6.74 | 10.36 | 10.0[c] | 1 | 8,332 | 9,422 | 15,200 | 0 | 7,885 | 9,163 | 22,500 | 0 |
| City of Burlington | 2.15 | 2.57 | 2.5[d] | 1 | 5,754 | 6,792 | 5,000 | 12 | 4,091 | 5,260 | -- | 0 |
| Eagle Lake Sewer Utility District | 0.19 | 0.34 | 0.4 | 0 | 160 | 220 | 680 | 0 | 153 | 243 | -- | 0 |
| Village of East Troy | 0.27 | 0.30 | 0.70 | 0 | 562 | 642 | 1,197 | 0 | 625 | 705 | 1,408 | 0 |
| City of Lake Geneva | 1.24 | 1.56 | 1.74 | 0 | 2,154 | 2,597 | 2,221 | 4 | 1,818 | 2,189 | 2,605 | 0 |
| Village of Genoa City | 0.07 | 0.09 | 0.22 | 0 | 85 | 140 | 494 | 0 | 67 | 100 | -- | 0 |
| Town of Lyons Sanitary District No. 2 | 0.08 | 0.12 | 0.10 | 2 | 142 | 161 | 282 | 0 | 81 | 93 | -- | 0 |
| Village of Mukwonago | 0.51 | 0.68 | 1.5 | 0 | 606 | 698 | 2,502 | 0 | 605 | 796 | 3,129 | 0 |
| Town of Norway Sanitary District No. 1 | 0.67 | 1.03 | 0.75 | 5 | 798 | 1,109 | 1,275 | 0 | 1,076 | 2,463 | 1,500 | 1 |
| Town of Salem Sewer Utility District No. 2 | 0.78 | 1.09 | 1.57 | 0 | 698 | 1,021 | 2,550 | 0 | 3,000 | 1,563 | 3,000 | 0 |
| Village of Silver Lake | 0.22 | 0.29 | 0.36 | 0 | 197 | 247 | 510 | 0 | 275 | 356 | -- | 0 |
| Village of Sussex | 0.98 | 1.46 | 1.00[e] | 3 | 1,092 | 1,168 | 1,580 | 0 | 1,025 | 1,195 | 2,000 | 0 |
| Village of Twin Lakes | 0.37 | 0.43 | 0.71 | 0 | 474 | 600 | 1,390 | 0 | 533 | 673 | -- | 0 |
| City of Waukesha | 8.74 | 11.74 | 16.0[f] | 0 | 14,956 | 31,168 | 20,000 | 2 | 27,727 | 79,042 | -- | 0 |
| Western Racine County Sewerage District | 0.71 | 0.99 | 1.00 | 0 | 1,212 | 1,858 | 1,700 | 1 | 1,319 | 1,843 | 2,080 | 0 |

[a]In addition, plants typical include headworks and miscellaneous processes such as pumping, flow metering and sampling, screening and grit removal, as well as sludge handling and disposal facilities.
[b]Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data unless noted.
[c]As of 1994, the City of Brookfield had completed facility planning for a sewage treatment plant expansion to provide for a capacity of 12.5 mgd on an average annual basis.
[d]In May of 1992, the City of Burlington completed construction of a new sewage treatment plant with a design capacity of 3.5 mgd on an average annual basis.
[e]As of 1994, the Village of Sussex plant was under construction providing for a design capacity of 3.2 mgd on an average annual basis and 4.0 on a maximum monthly basis.
[f]As of 1994, the City of Waukesha plant was under construction providing for an upgrading and expansion project with a design capacity of 14.0 mgd on an average dry weather basis and 18.5 mgd on an average wet weather basis.

Source: Wisconsin Department of Natural Resources and SEWRPC.

facility planning to enable its abandonment.[1] In addition, capacity is being provided in the Village of Sussex sewage treatment plant, presently under construction, for the Willow Springs Mobile Home Park. No action has been taken with regard to the abandonment of New Berlin-West High School sewage treatment plant. The remaining private plants were recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES) permit.

In addition to these private sewage treatment plants, there is also a sludge storage lagoon operated by Pat's Sanitary Service in the northwest one-quarter of U.S. Public Land Survey Section 36, Township 21 North, Range 18 East, Town of Lyons, as shown on Map V-3. This lagoon is permitted under the WPDES.

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Fox River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Wisconsin Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social affects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were 35 sewer service areas identified within, or partially within, the Fox River watershed: Brookfield West, Burlington, Camp-Center Lakes, Cross Lake, Rock Lake, Wilmot, Elkhorn, Walworth County Institutions, Lake Como, Williams Bay, Fontana, Walworth, Eagle Lake, East Troy, Potter Lake, Genoa City, Hartland, Lake Geneva, Lyons, Menomonee Falls, Mukwonago, Muskego, New Berlin, Paddock Lake, North Prairie, Pewaukee, Silver Lake, Sussex-Lannon, Tichigan Lake, Twin Lakes, Waterford/Rochester, Wales, Waukesha, and Wind Lake. Currently, all of these areas, with the exception of North Prairie, Wales, Fontana, Walworth, and Wind

[1]The Lake Geneva Interlaken Resort Village plant was abandoned in 1993 and the resort was connected to the Walworth County Metropolitan Sewerage District sewerage system.

Lake, have undergone refinements as recommended[2]. The boundaries of the sewer service areas through 1993 are shown on Map V-3. Table V-6 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer service area in the Fox River watershed, as refined through 1993, totals about 188 square miles, or about 20 percent of the total watershed area, as shown in Table V-6.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the City of Brookfield, City of Burlington, City of Waukesha, City of Lake Geneva, Village of East Troy, Village of Genoa City, Village of Silver Lake, Village of Twin Lakes and Western Racine County Sewerage District sewage treatment plants. This same recommendation applies to the plants constructed or reconstructed since the initial plan in accordance with the plan recommendations, including the Village of Mukwonago, the Eagle Lake Sewer Utility, Town of Lyons Sanitary District No. 2, Town of Norway Sanitary District No. 1, and the Town of Salem Sewer Utility District No. 2 sewage treatment plants. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table V-7. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for the 15 public sewage treatment plants recommended to be retained.

With regard to the Village of Sussex plant, an amendment to the regional water quality management plan[3] served to change the initial recommendation which recommended the abandonment of the Sussex sewage treatment plant and the subsequent connection of its tributary service area to the City of Brookfield sewage treatment plant. This amendment was based upon an evaluation of a formal request for a plan amendment by a joint sewer study committee comprised of the following four communities, Sussex, Lisbon, Menomonee Falls, and Lannon, and of a facility plan prepared by Strand Associates, Inc. for the committee.[4] The amendment identified the sanitary sewer needs of the area, and evaluated alternative means of meeting those needs; evaluated the alternatives set forth in the facility plan; and set forth a recommendation as an amendment to the initial water quality plan. The amendment recommended expansion and reconstruction of the Sussex sewage treatment plant and recommended designation of the plant as a permanent facility to serve the Villages of Lannon and Sussex, and portions of the Village of Menomonee Falls and Town of Lisbon.

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[2]In addition, as of June 1994, the sewer service area for Bohner Lake was identified and refined as set forth in the Amendment to the Regional Water Quality Management Plan-2000, City of Burlington/Bohner Lake Sanitary Sewer Service Areas.

[3]Amendment to the Regional Water Quality Management Plan - 2000 for the Upper Fox River Watershed Brookfield and Sussex Sewage Treatment Plants, May 1989.

[4]Reevaluation of Regional Wastewater Treatment for Upper Fox River Watershed, Strand Associates, Inc., August 1988.

Table V-6

PLANNED SANITARY SEWER SERVICE AREAS IN
THE FOX RIVER WATERSHED: 1993[a,b]

| Name of Initially Refined Sanitary Sewer Service Area(s) | Planned Sewer Service Area in Fox River Watershed (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| | | Refined Sanitary Sewer Service Areas | | |
| -- | 0.1 | Alpine Valley | December 4, 1989 | Amendment to the Regional Water Quality Management Plan-2000, Towns of East Troy, LaFayette, and Spring Prairie, and Village of East Troy |
| Brookfield East<br>Elm Grove<br>Brookfield West | 13.4 | Brookfield East<br><br>Brookfield West | December 4, 1991 | SEWRPC CAPR No. 109, Sanitary Sewer Service Area for the City and Town of Brookfield and the Village of Elm Grove, Waukesha County, Wisconsin |
| Burlington | 10.3 | Burlington | June 16, 1986 | SEWRPC CAPR No. 78, Sanitary Sewer Service Area for the City of Burlington, Racine County, Wisconsin |
| Camp-Center Lakes<br>Cross Lake<br>Rock Lake<br>Wilmot | 6.7 | Salem South | March 3, 1986 | SEWRPC CAPR No. 143, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin |
| Delavan<br>Delavan Lake<br>Elkhorn<br>Walworth County Institutions<br>Lake Como<br>Williams Bay<br>-- | 14.8 | Delavan-Delavan Lake<br>Elkhorn<br><br><br>Lake Como<br>Williams Bay<br>Geneva National-Interlaken | December 4, 1991 | SEWRPC CAPR No. 56, 2nd Edition, Sanitary Sewer Service Areas for the Walworth County Metropolitan Sewerage District |
| Eagle Lake | 2.2 | Eagle Lake | January 18, 1993 | SEWRPC CAPR No. 206, Sanitary Sewer Service Area for the Eagle Lake Sewer Utility District, Racine County, Wisconsin |
| -- | 0.9 | Eagle Spring Lake | December 2, 1985 | Amendment to the Regional Water Quality Management Plan-2000, Eagle Spring Lake Sanitary District |
| East Troy<br>Potter Lake | 8.1 | East Troy<br>Potter Lake<br>Army Lake | June 16, 1993 | SEWRPC CAPR No. 112, 2nd Edition, Sanitary Sewer Service Area for the Village of East Troy and Environs, Walworth County, Wisconsin |
| Genoa City | 1.6 | Genoa City | March 6, 1989 | SEWRPC CAPR No. 175, Sanitary Sewer Service Area for the Village of Genoa City, Kenosha and Walworth Counties, Wisconsin |
| Hartland | 0.8 | Hartland | June 17, 1985 | SEWRPC CAPR No. 93, Sanitary Sewer Service Area for the Village of Hartland, Waukesha County, Wisconsin |

Table V-6 (cont'd)

| Name of Initially Refined Sanitary Sewer Service Area(s) | Planned Sewer Service Area in Fox River Watershed (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Hooker-Montgomery Lakes | 0.8 | Salem North | December 1, 1986 | SEWRPC CAPR No. 145, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin |
| Lake Geneva | 8.3 | Lake Geneva | January 18, 1993 | SEWRPC CAPR No. 203, Sanitary Sewer Service Area for the City of Lake Geneva and Environs, Walworth County, Wisconsin |
| Lyons | 1.5 | Lyons<br>Country Estates Sanitary District | September 15, 1993 | SEWRPC CAPR No. 158, 2nd Edition, Sanitary Sewer Service Area for the Town of Lyons Sanitary District No. 2, Walworth County, Wisconsin |
| Menomonee Falls | 7.4 | Lannon<br>Menomonee Falls | June 16, 1993 | SEWRPC CAPR No. 208, Sanitary Sewer Service Area for the Villages of Lannon and Menomonee Falls, Waukesha County, Wisconsin |
| Mukwonago | 7.8 | Mukwonago | December 5, 1990 | SEWRPC CAPR No. 191, Sanitary Sewer Service Area for the Village of Mukwonago, Waukesha County, Wisconsin |
| -- | 0.3 | Mukwonago County Park | June 21, 1984 | Amendment to the Regional Water Quality Management Plan-2000, Village of Mukwonago, Towns of East Troy and Mukwonago |
| Muskego | 12.0 | Muskego | March 3, 1986 | SEWRPC CAPR No. 64, Sanitary Sewer Service Area for the City of Muskego, Waukesha County, Wisconsin |
| New Berlin | 8.5 | New Berlin | December 7, 1987 | SEWRPC CAPR No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin |
| Paddock Lake | 0.1 | Paddock Lake | December 1, 1986 | SEWRPC CAPR No. 145, Sanitary Sewer Service Area of the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin |
| Pewaukee | 26.1 | Pewaukee | June 17, 1985 | SEWRPC CAPR No. 113, Sanitary Sewer Service Area for the Town of Pewaukee Sanitary District No. 3, Lake Pewaukee Sanitary District, and Village of Pewaukee, Waukesha County, Wisconsin |
| -- | 1.4 | Rainbow Springs | June 21, 1984 | Amendment to the Regional Water Quality Management Plan-2000, Village of Mukwonago, Towns of East Troy and Mukwonago |

Table V-6 (cont'd)

| Name of Initially Refined Sanitary Sewer Service Area(s) | Planned Sewer Service Area in Fox River Watershed (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Silver Lake | 1.9 | Silver Lake | June 15, 1987 | SEWRPC CAPR No. 119, Sanitary Sewer Service Area for the Village of Silver Lake, Kenosha County, Wisconsin |
| Sussex-Lannon[b] | 4.8 | Sussex | June 16, 1983 | SEWRPC CAPR No. 84, Sanitary Sewer Service Area for the Village of Sussex, Waukesha County, Wisconsin |
| Twin Lakes | 7.8 | Twin Lakes | June 15, 1987 | SEWRPC CAPR No. 149, Sanitary Sewer Service Area for the Village of Twin Lakes, Kenosha County, Wisconsin |
| Waterford/Rochester Tichigan Lake | 9.3 | Waterford/ Rochester | June 16, 1986 | SEWRPC CAPR No. 141, Sanitary Sewer Service Area for the Waterford/Rochester Area, Racine County, Wisconsin |
| Waukesha | 30.6 | Waukesha | December 2, 1985 | SEWRPC CAPR No. 100, Sanitary Sewer Service Area for the City of Waukesha and Environs, Waukesha County, Wisconsin |
| Subtotal | 187.5 | | | |
| Unrefined Sanitary Sewer Service Areas | | | | |
| Denoon Lake<br>Fontana<br>North Prairie<br>Sussex (part)[b]<br>Wales<br>Walworth<br>Wind Lake | 1.4<br>4.3<br>1.9<br>2.6<br>1.3<br>0.3<br>5.3 | | | |
| Subtotal | 17.1 | | | |
| Total | 204.6 | | | |

[a]As of June 1994, the sewer service area for Bohner Lake was identified and refined as set forth in the Amendment to the Regional Water Quality Management Plan--2000, City of Burlington/Bohner Lake Sanitary Sewer Service Areas. The refined sanitary sewer service area encompasses 1.5 square miles.

[b]As of September 1994, the Sussex sewer service area was amended as set forth in SEWRPC Community Assistance Planning Report No. 84, 2nd Edition, Sanitary Sewer Service Area for the Village of Sussex, Waukesha County, Wisconsin. The refined sanitary sewer service area encompasses 7.4 square miles.

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

Table V-7

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE FOX RIVER WATERSHED: 1990 AND 2010

| Name of Public Sewage Treatment Plant | Sewer Service Area | Design Capacity-Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Planned Sewer Service Area (square mile) | Intermediate Growth Centralized Land Use Plan | | | High Growth Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Total Area Served (square mile) | Resident population Served | | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| City of Brookfield | Brookfield West, Pewaukee | 10.00[b] | 6.74 | 14.8 | 33,800 | 47.7 | 52,100 | 12.50[b] | >2010[b] | 78,800 | 15.5 | 2010[b] |
| City of Burlington | Burlington, Bohner Lake | 3.50[c] | 2.15 | 3.3 | 10,400 | 11.8 | 13,500 | 2.54 | >2010[c] | 18,800 | 3.20 | 2000[c] |
| Eagle Lake Sewer Utility District | Eagle Lake | 0.40 | 0.19 | 0.6 | 1,200 | 2.2 | 1,200 | 0.19 | 1998 | 1,800 | 0.27 | 1996 |
| Village of East Troy | East Troy, Potter Lake, Army Lake, Alpine Valley | 0.70 | 0.27 | 1.1 | 3,600 | 8.2 | 5,500 | 0.51 | 2002 | 9,200 | 0.97 | 1996 |
| City of Lake Geneva | Lake Geneva | 1.74 | 1.24 | 2.6 | 6,400 | 8.3 | 9,200 | 1.59 | 2000 | 16,800 | 2.54 | 1996 |
| Village of Genoa City | Genoa City | 0.22 | 0.10 | 0.6 | 1,200 | 1.6 | 1,800 | 0.18 | 2005 | 3,000 | 0.32 | 2000 |
| Town of Lyons Sanitary District No.2 | Lyons | 0.10 | 0.08 | 0.3 | 1,000 | 1.5 | 1,500 | 0.14 | 1997 | 2,400 | 0.26 | 1995 |
| Village of Mukwonago | Mukwonago, Eagle Spring Lake, Mukwonago County Park, Rainbow Springs | 1.50 | 0.51 | 1.0 | 4,400 | 10.4 | 7,500 | 1.0 | 2000 | 19,200 | 2.46 | 1998 |
| Village of North Prairie (proposed plant)[d] | North Prairie | -- | -- | -- | -- | 1.9 | -- | -- | -- | 3,600 | 0.45 | -- |
| Town of Norway Sanitary District No. 1 | Wind Lake Lake Denoon | 0.75 | 0.67 | 3.5 | 4,900 | 6.7 | 5,900 | 0.80 | 1995 | 6,800 | 0.91 | 1995 |
| Town of Salem Sewer Utility District No. 2 | Salem South Salem North | 1.57 | 0.78 | 2.6 | 4,900 | 10.7[e] | 9,300[e] | 1.33[e] | 2000 | 10,200[e] | 1.44[e] | 1998 |
| Village of Silver Lake | Silver Lake | 0.36 | 0.22 | 0.6 | 1,800 | 1.9 | 2,900 | 0.36 | 1995 | 3,200 | 0.40 | 1995 |
| Village of Sussex | Sussex, Lannon, Menomonee Falls | 3.2[f] | 0.98 | 1.7 | 4,400 | 13.7 | 19,800 | 2.91 | >2010 | 33,100 | 4.57 | 2000 |
| Village of Twin Lakes | Twin Lakes | 0.50 | 0.37 | 2.3 | 4,000 | 7.8 | 7,000 | 0.70 | 1995 | 7,400 | 0.80 | 1995 |

Table V-7 (continued)

| Name of Public Sewage Treatment Plant | Sewer Service Area | Design Capacity-Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intermediate Growth Centralized Land Use Plan | | | High Growth Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Total Area Served (square mile) | Resident population Served | Planned Sewer Service Area (square mile) | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| City of Waukesha | Waukesha | 14.0[g] | 8.74 | 13.4 | 57,000 | 30.6 | 74,300 | 14.00[g] | 2003 | 105,900 | 15.0 | 2000 |
| Western Racine County Sewerage District | Waterford, Rochester | 1.00 | 0.71 | 3.7 | 6,400 | 9.3 | 8,700 | 1.00 | 2007 | 10,600 | 1.24 | 1998 |

[a] Approximate year in which facility planning for a plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average design flows compared to average annual and maximum monthly flows and age of facilities based upon date of last major construction.

[b] Facility planning for plant expansion and upgrading completed. Design flows based upon design year 2014 as documented in a May 1993 facility plan.

[c] Based upon new plant which was placed into service in 1992.

[d] Alternative of constructing a new plant and the alternatives of connection to an existing sewerage system and continued use of onsite sewage disposal systems are recommended to be evaluated in further subregional system planning.

[e] Includes Salem North sewer service area. As of 1993, Town of Salem Utility District No. 1 sewage treatment plan was abandoned and service area was served by Town of Salem Utility District No. 2.

[f] During 1993, the Village of Sussex sewage treatment plant was under construction providing for an upgraded and expanded plant with a hydraulic design capacity of 3.2 mgd on an average annual basis and 4.0 mgd on a maximum monthly basis.

[g] Based upon March 1990 facility plan. During 1993, an addition and expansion of the City of Waukesha sewage treatment plant was under construction providing for a hydraulic capacity of 14.0 mgd on an average annual basis and 18.5 mgd on a wet weather average basis.

Source: SEWRPC.

With regard to the proposed Village of North Prairie sewage treatment plant, a facility plan[5] was prepared in two phases during 1986 through 1989 which concluded that the lowest cost alternative means of providing for sanitary sewage disposal was the continued reliance of onsite systems, including replacement as needed using conventional, mound type, or other special soil absorption systems or holding tanks. It was also recommended in the facility plan that the Village continue to periodically monitor the groundwater system in the Village for potential degradation from onsite sewage disposal systems. This facility planning effort was the subject of public informational meetings held during 1988 and 1989. Based upon the findings of the facility plan, the plan includes a recommendation for future periodic groundwater monitoring and onsite sewage disposal system surveillance to be conducted to assess the viability of onsite systems. It is further recommended that at such time as there is evidence that onsite sewage systems are not a viable long-term solution for all or portions of the Village, then additional subregional planning should be conducted to determine the most cost-effective means of providing sanitary sewer service. Such evaluations should include alternatives providing for the connection of the Village to the Village of Mukwonago, or alternatively, the City of Waukesha sewerage system, as well as the potential construction of a new plant.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map V-4. Table V-7 presents selected design data for the 15 public sewage treatment plants which are recommended to be maintained in the Fox River watershed. It is important to note that five plants recorded monthly average hydraulic loadings during 1990 which equaled or exceeded the average design capacities of the plants, as shown in Table V-5. Of these, three sewage treatment plants have recorded more than one month in 1990 in which the monthly average loadings exceeded the design capacity. One of these plants--the City of Burlington--has since been reconstructed at a new site with an increased capacity. Thus, no further capacity problems exist at that plant. The Village of Sussex sewage treatment plant is currently under construction to provide for increased capacity, and the City of Brookfield has completed facility planning for a plant expansion. Other plants which are currently approaching their design capacities are the Town of Norway Sanitary District No. 1 and the Town of Lyons Sanitary District No. 2 sewage treatment plants. In addition, facility planning should be initiated in the near future for the Village of Silver Lake and the Village of Twin Lakes sewage treatment plants due to the age of major portions of the plant facilities.

Table V-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the 15 public sewage treatment plants in the Fox River watershed. Under the intermediate growth-centralized land use plan, seven of the 16 public plants are anticipated to have average annual hydraulic loading rates equal to or higher than the average annual design capacity. Under the high growth-decentralized land use plan, 12 of the existing plants are anticipated to have loading rates equal to or higher than the average annual design capacity. Thus, there is expected to be significant additional treatment plant expansion and associated costs under the higher growth decentralized future scenario than would be expected under the intermediate growth-centralized land use plan.

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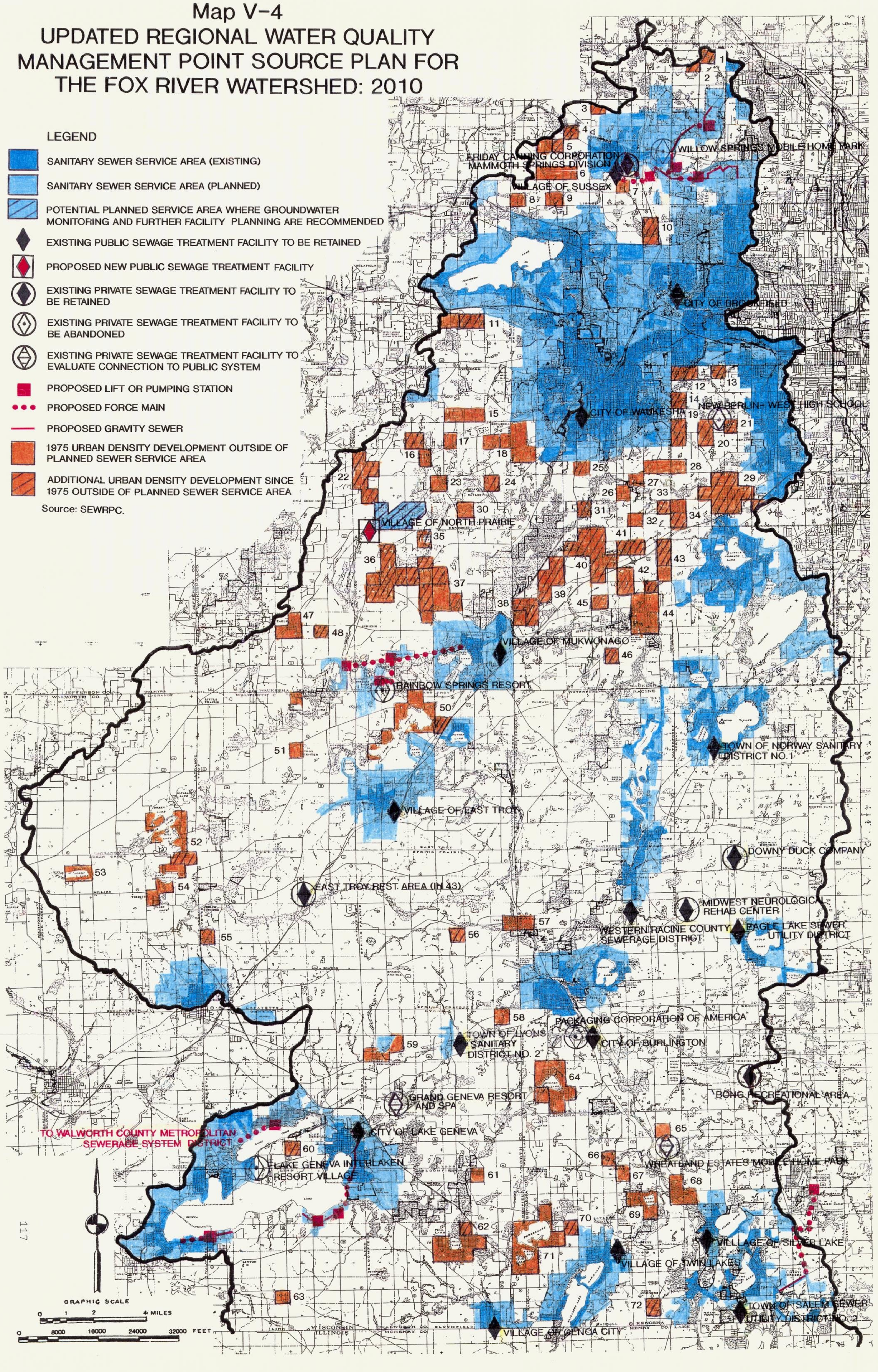
[5]Ruekert & Mielke, Inc., Village of North Prairie Wastewater Facility Plan, Phase One, July 1986; Phase Two, December 1989.

# Map V-4
# UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE FOX RIVER WATERSHED: 2010



Based upon review and analysis of the data in Tables V-5 and V-7, including estimates of future condition loadings on an annual average and maximum monthly basis, and based upon the age of the current facilities, estimates of the timing of needed facility planning were made. It appears that facility planning should be initiated during the next three years by the Village of Silver Lake, the Village of Twin Lakes, the Town of Norway Sanitary District No. 1, the Town of Lyons Sanitary District No. 2, and the Western Racine County Sewerage District to consider the need for expansion and upgrading of their sewage treatment plants. As noted earlier, four plants have recently undergone facility planning and/or construction, and no additional facility planning is expected to be needed for the plants operated by the Cities of Brookfield, Burlington, and Waukesha, and the Village of Sussex. The remaining five sewage treatment plants are expected to begin facility planning to consider the need for plant expansions later in the planning period, assuming that development occurs in accordance with the recommended year 2010 land use plan as described for the intermediate growth-centralized land use future condition. Should development occur as envisioned under the high growth-decentralized land use future scenario, facility planning for nearly all of the public sewage treatment plants in the Fox River watershed should be initiated within the next three years, except for the Brookfield, Burlington, Genoa City, Sussex, and Waukesha plants which recently completed facility planning or construction programs. Continued review of plant operations and State required compliance maintenance reports for all plants will provide the basis for determining the timing for initiating facility planning programs to explore plant expansion alternatives.

The current planned sanitary sewer service areas in the Fox River watershed are shown on Map V-4. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. All or portions of the following sewer service areas are located in the Fox River watershed: Alpine Valley, Brookfield West, Burlington, Salem South, Country Estates Sanitary District, Denoon Lake, Elkhorn, Fontana, Lake Como, Williams Bay, Eagle Lake, Eagle Spring Lake, East Troy, Potter Lake, Army Lake, Walworth, Geneva National-Interlaken, Genoa City, Hartland, Salem North, Lake Geneva, Lyons, Lannon, Menomonee Falls, Mukwonago, Mukwonago County Park, Muskego, New Berlin, North Prairie, Paddock Lake, Pewaukee, Rainbow Springs, Silver Lake, Sussex, Twin Lakes, Waterford/Rochester, Wales, Waukesha, and Wind Lake. Together, the planned service areas within the watershed total about 205 square miles, or about 22 percent of the Fox River watershed.

As noted above, most of the sewer service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Additional refinements are envisioned to be needed for the Denoon Lake, Fontana, Walworth, and Wind Lake sewer service areas. It is recommended that these refinements be conducted in 1995 and 1996. In addition, the North Prairie and Wales sewer service areas will have to be refined at such time as public sanitary sewer services are implemented in those areas. It is recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plants, there were ten private sewage treatment plants in operation within the Fox River watershed in 1990, plus the plant serving the

Bong Recreation Area which is located in the Des Plaines River watershed but discharges effluent through a drainage system to Peterson Creek, a tributary of the Fox River. These facilities generally serve isolated enclaves of urban land uses which are located beyond the current limits of the planned sanitary public sewer service areas. The updated plan recommends that four of the 11 plants in operation, be abandoned: the Lake Geneva Interlaken Resort,[6] the Packaging Corporation of America, the New Berlin West High School, and the Willow Springs Mobile Home Park. A 1987 amendment to the initial water quality plan recommended that the Rainbow Springs Resort also be abandoned, with service provided for by the Village of Mukwonago sewage treatment plant. In addition, the relatively close proximity of the Grand Geneva Resort and Spa to the Lake Geneva sewer service area indicates that there is potential for the consolidation of treatment facilities in this instance. Thus, it is recommended that at the time this private plants require significant upgrading or modification, that detailed facility planning be conducted to evaluate the alternative of connecting the land uses to the City of Lake Geneva public sanitary sewer systems. For the remaining five private sewage treatment plants serving the Bong Recreation Area, the Downy Duck Farm, the Friday Canning Company, the Midwest Neurological Rehabilitation Center, the East Troy Rest Area IH 43, and the Wheatland Mobile Home Park, the need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process. The Wheatland Mobile Home Park plant recommendations would be reevaluated as part of the subregional evaluation for the Town of Wheatland area as recommended in the last section of this chapter.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 20 known separate sewer system flow relief devices located in the Fox River watershed: one bypass discharging to the White River from the City of Lake Geneva; one bypass discharging to Honey Creek from the Village of East Troy; one bypass to Nippersink Creek from the Village of Genoa City; one bypass to the Silver Lake Outlet Canal from the Village of Silver Lake; one bypass into Big Muskego Lake from the City of Muskego; and eight bypasses discharging into the Fox River from the City of Waukesha. In addition, as of 1975, the City of Waukesha also maintained two portable pumping locations which discharged to the Fox River, while the City of Brookfield maintained two portable pumping locations discharging to Deer Creek and Fox Creek. The Village of Sussex maintained one portable pumping station that discharged to Sussex Creek, while the Village of Menomonee Falls had two portable pumping stations discharging to the Fox River. During the period of 1988 through 1993, the only flow relief devices which existed in the sanitary sewer systems were selected bypasses and portable pumping station sites which physically remained in the sewerage system but which function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table V-8, 41 reported points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Fox River watershed. These flow relief points are located in ten sewerage systems. However, these flow relief points have only been in operation infrequently, with the average discharge occurrence frequency over this five-year period being about once per five years per flow relief location. This equates to an average of about eight isolated overflow occurrences per year considering all the reported bypassing.

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[6]The Lake Geneva Interlaken Resort Village plant was abandoned in 1993.

Table V-8

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE FOX RIVER WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | Comments |
|---|---|---|---|---|---|---|---|
| | | Cross-overs | Pumping Station Bypasses | Other Bypasses | Portable Pumping System Locations | Total | |
| City of Brookfield | -- | -- | 2 | -- | 14 | 16 | Used only in case of equipment failure or extreme wet weather conditions |
| Village of Twin Lakes | -- | -- | 1 | -- | -- | 1 | Used only in case of severe wet weather conditions |
| Town of Linn Sanitary District | 1 | -- | -- | -- | -- | 1 | Used only in case of equipment failure |
| Village of Pewaukee | -- | -- | 2 | -- | -- | 2 | Used only in case of extreme wet weather |
| City of Waukesha | 1 | -- | 5 | -- | -- | 6 | Bypasses are used infrequently, only when unanticipated equipment failure occurs |
| Town of Norway Sanitary District No. 1 | 1 | -- | 2 | -- | -- | 3 | Used only in the case of equipment failure or extreme wet weather conditions |
| Village of Waterford | -- | -- | 1 | -- | -- | 1 | Used only in case of equipment failure |
| Village of Sussex | 1 | -- | -- | -- | 4 | 5 | Portable pumps used at pumping stations and used only in cases of extreme wet weather or equipment failure conditions |
| Fontana-Walworth Water Pollution Control Commission | -- | -- | 3 | -- | -- | 3 | Used only in case of equipment failure or extreme wet weather conditions |
| Walworth County Metropolitan Sewerage District | -- | -- | 3 | -- | -- | 3 | Used only in case of equipment failure or extreme wet weather conditions |
| TOTAL | 4 | -- | 19 | -- | 18 | 41 | |

Source: SEWRPC.

Current Plan Recommendations: It is recommended that the Cities of Brookfield and Waukesha; the Villages of Pewaukee, Sussex, Twin Lakes, and Waterford; the Town of Norway Sanitary District No. 1 and the Town of Lyons Sanitary District No. 2 continue to monitor the sewerage system operations to ensure that the use of the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading be conducted with the assumption that there will be no planned bypasses of untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of 25 intercommunity trunk sewers in the Fox River watershed, as shown in Table V-9. Five of these trunk sewers would connect outlying communities to the City of Brookfield sewage treatment plant. These trunk sewers have been fully constructed except for the Poplar Creek and River Road trunk sewers. The Poplar Creek trunk sewer is only partially completed to near the southern limits of the City of Brookfield and has not been extended into the City of New Berlin due to a change in the New Berlin sewer service area, which would defer the remaining portion of this sewer until after the year 2000. In addition, the westerly portion of the River Road trunk sewer in the City of Brookfield has not yet been constructed. Construction of the New Berlin-Hales Corners and Franklin-Muskego trunk sewers to enable the abandonment of the City of New Berlin Regal Manor and the City of Muskego-Northeast and Big Muskego sewage treatment plants have been completed. The trunk sewer connecting the Village of Lannon and portions of the Village of Menomonee Falls to the Village of Sussex sewerage system has not yet been completed. The two trunk sewers providing for the relocation of the Mukwonago sewage treatment plant and the connection of the Potter Lake community to the East Troy sewerage system have been completed. The trunk sewers to connect the Lake Denoon area to the Town of Norway Sanitary District No. 1 sewerage system and the Tichigan Lake area to the Western Racine County Sewerage District sewerage system have been constructed. Three trunk sewers connecting the Town of Salem Sewer Utility District No 2 service area have also been completed. The trunk sewer to connect the urban development south of Geneva Lake in the Town of Linn to the City of Lake Geneva sewerage system has not yet been constructed. Connections of the Geneva National Sanitary District and the Village of Williams Bay to the Walworth County Metropolitan sewerage system have been completed. However, the connection of the Como Lake North area has not yet been constructed. The trunk sewer connecting urban development along the southwest shore of Geneva Lake to the Village of Fontana on Geneva Lake sewerage system has not been implemented, while the trunk sewer needed to connect Fontana on Geneva Lake to the Fontana-Walworth Water Pollution Control Commission has been completed. It should also be noted that a portion of the trunk sewer connecting the Town of Salem Utility District No. 1 in the Des Plaines River watershed to the Town of Salem Utility District No. 2 sewerage system is located in the Fox River watershed and that trunk sewer has been completed.

Current Plan Recommendations: The current regional water quality management plan includes recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Fox River watershed, as shown on Map V-4.

Table V-9

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE FOX RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Northwest-River Road | Partially completed (1987) |
| Springdale | Completed (1979 and 1990) |
| Pewaukee Lake-Pewaukee | Completed (1979) |
| Pewaukee-Brookfield | Completed (1980) |
| Poplar Creek | Partially completed |
| Lannon-Sussex[a] | No action[a] |
| New Berlin-Hales Corners | Completed (1984) |
| Franklin-Muskego | Completed (1984) |
| Mukwonago | Completed (1980) |
| Potter Lake-East Troy | Completed (1982) |
| Eagle Spring-Mukwonago | No Action |
| Muskego-Norway | Completed (1978) |
| Tichigan Lake-Rochester | Completed (1988) |
| Silver Lake-Camp Lake | Completed (1981) |
| Wilmot | Completed (1983) |
| Cross-Rock Lakes | Completed (1983) |
| Lake Geneva South | No action |
| Como Lake North[b] | No action |
| Geneva Lake National to WalcoMet[c] | Completed (1990) |
| Williams Bay-Delavan Lake[d] | Completed (1986) |
| Fontana-Linn | No action |
| Fontana-Walworth | Completed (1986) |

[a]Lannon-Sussex trunk sewer added to the plan based upon a May 1989 plan amendment. Facility planning was completed in 1994.

[b]Como Lake North trunk sewer connecting the north shore of Como Lake to the City of Lake Geneva sewage treatment plant was deleted from the plan and a new trunk sewer connecting the north shore of Como Lake to the Walworth County Metropolitan sewerage system was added to the plan based upon a December 1991 plan amendment.

[c]Geneva National-WalCoMet trunk sewer added to plan based upon a November 1989 plan amendment.

[d]Williams Bay-Delavan Lake trunk sewer added to plan based upon a March 1985 plan amendment.

Source: SEWRPC.

Four intercommunity trunk sewers in the Fox River watershed are currently recommended to be constructed. These trunk sewers include connections from Menomonee Falls and Lannon to the Sussex sewerage system; from the south shore of Geneva Lake to the City of Lake Geneva sewerage system; from the north shore of Lake Como to the Walworth County Metropolitan Sewerage District sewerage system via the Geneva National Sanitary District sewerage system; and a trunk sewer connecting Eagle Spring Lake, Mukwonago County Park, and Rainbow Springs Resort to the Village of Mukwonago sewerage system. In addition, the remaining portion of the River Road trunk sewer connecting portions of the Town of Pewaukee and the Town and City of Brookfield to the City of Brookfield sewerage system is recommended to be completed.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of 37 known point sources of pollution identified in the Fox River watershed other than public and private sewage treatment plants. These sources discharge industrial cooling, process, rinse, wash, and filter backwash waters through 54 outfalls directly or indirectly to the surface water or groundwater system. Of these point source outfalls, three were identified as minor or intermittent discharges. The remaining 34 were other types of wastewater discharges, predominantly--24, or about 71 percent of those remaining--cooling water. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 84 such known point sources of wastewater discharging to the Fox River and its major tributaries or to the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table V-10 summarizes selected characteristics of these other point sources and Map V-5 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 116 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters or groundwater in the Fox River watershed. These point sources of wastewater discharge primarily industrial cooling, process, rinse, and wash water directly, or following treatment, to the groundwater or the surface waters. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were 42 enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, four of these areas had been added to the planned 2010 sewer service area as part of the plan amendment process. Due to increased urban growth within the watershed since 1975, 34 new enclaves of urban development have been created beyond the planned sewer service areas, and 16 of the urban development enclaves identified in the initial plan have been expanded, as shown on Map V-4. The corresponding

Table V-10

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
WATER POLLUTION IN THE FOX RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID#[b] | Permit Type | Permit Number | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| APS Industries | Waukesha | 1 | General | 0046507-2 | 9-30-95 | -- | -- | Groundwater discharge | -- |
| Ace Redi-Mix, Inc. | Waukesha | 2 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Alby Block Co. | Racine | 3 | General | 0046507-2 | 9-30-95 | 3271 | Concrete block and brick | Groundwater discharge | -- |
| Basset Ready Mix | Kenosha | 4 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Absorption pit | -- |
| Burlington Swimming Pool | Racine | 5 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Echo Lake via storm sewer | -- |
| Carroll College Van Male Pool | Waukesha | 6 | General | 0046523-2 | 9-30-95 | 8221 | College/University | Fox River via storm sewer | -- |
| East Troy Ready Mix | Walworth | 7 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Echo Lake Farm Produce Co., Inc. | Racine | 8 | General | 0044938-3 | 9-30-95 | 2015 | Poultry slaughtering & processing | Echo Lake | -- |
| Elmbrook Memorial Hospital | Waukesha | 9 | General | 0044938-3 | 9-30-95 | 8062 | General med. & surgical hospital | Fox River via storm sewer | -- |
| GE Medical Systems - C.T. | Waukesha | 10 | General | 0044938-3 | 9-30-95 | 3844/3845 | Electro. med. equip, etc. | Poplar Creek via unnamed trib. | -- |
| Hales Corners Block Co. | Racine | 11 | General | 0046507-2 | 9-30-95 | 3271 | Concrete block and brick | Groundwater discharge | -- |
| Halquist Stone Co., Inc. | Waukesha | 12 | General | 0046515-2 | 9-30-95 | 3281 | Cut stone & stone products | Sussex Creek | -- |
| Herb's Service | Walworth | --[d] | General | 0046566-1 | 9-30-95 | 5541 | Gasoline service station | Lake Geneva | -- |
| J.W. Peter & Sons | Racine | 14 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| Jacob's Ready-Mix | Walworth | 15 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Lake Geneva Culligan Water Cond. | Racine | 16 | General | 0046540-1 | 9-30-95 | 1711 | Plumbing: water conditioning | Fox River via storm sewer | -- |
| Lake Geneva Water Treatment Plant | Walworth | 17 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | White River | -- |
| Lanson Industries, Inc. | Waukesha | 18 | General | 0044938-3 | 9-30-95 | 3699 | Electric equipment & supplies | Muskego Canal via unnamed trib. | -- |
| Lavelle Industries, Inc. | Racine | 19 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Fox River via storm sewer | -- |
| Maple Leaf Farms-Burlington Feed Mill | Racine | 20 | General | 0044938-3 | 9-30-95 | 2048 | Prepared animal feeds | Fox River via storm sewer | -- |
| Meyer Material Co. KD Pit | Kenosha | 21 | General | 0046515-2 | 9-30-95 | 1442 | Construction sand & gravel | Groundwater discharge | -- |
| Milupa Company | Walworth | 22 | General | 0044938-3 | 9-30-95 | 2023 | Dry/condensed/evap. products | Honey Creek via storm sewer | -- |
| Milwaukee Chaplet & Mfg. Co. Inc. | Waukesha | 23 | General | 0044938-3 | 9-30-95 | 3559 | Special industry machinery | Deer Creek | -- |
| Muskego H.S. (Pool) | Waukesha | 24 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Muskego Canal via unnamed trib. | -- |
| New Berlin Public Schools | Waukesha | 25 | General | 0046523-2 | 9-30-95 | 8299 | Schools/educational serv. | Deer Creek via drainage ditch | -- |
| N. B. Public Schools: Eisenhower H.S. | Waukesha | 26 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Deer Creek via drainage ditch | -- |
| N. B. Public Schools: N.B. West H.S. | Waukesha | 27 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Poplar Creek via unnamed trib. | -- |
| New Berlin Redi-Mix Inc. | Waukesha | 28 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Mill Creek via unnamed trib. | -- |
| Outboard Marine Corp. Research Ctr. | Waukesha | 29 | General | 0044938-3 | 9-30-95 | 3733 | Commercial nonphysical research | Pewaukee River via storm sewer | -- |
| Park & Rec.: Eisenhower Pool | Waukesha | 30 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Deer Creek via drainage ditch | -- |
| Quality Aluminum Casting Co. | Waukesha | 31 | General | SPEC PERM | 9-30-95 | 3363 | Copper foundry | Fox River via storm sewer | -- |
| Quality Concrete Products Co., Inc. | Waukesha | 32 | General | 0046507-2 | 9-30-95 | 3271 | Concrete block & brick | Groundwater discharge | -- |
| R. Frederick Redi-Mix | Waukesha | 33 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Recreation Ctr. Pool - Genoa City | Walworth | 34 | General | 0046523-2 | 9-30-95 | 7999 | Amusement & recreation | Nippersink Creek via storm sewer | -- |
| Rubber Products Inc. | Waukesha | 35 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Pewaukee River | -- |
| S & M Rotogravure Service Inc. | Waukesha | 36 | General | 0044938-3 | 9-30-95 | 2754 | Commercial printing-gravure | Deer Creek via drainage ditch | -- |
| Sanofi Bio Ingredients Inc. | Waukesha | 37 | General | 0044938-3 | 9-30-95 | 2022 | Cheese-natural & processed | Fox River via storm sewer | -- |
| Spancrete Industries, Inc. | Waukesha | 38 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| Stanek Tool Corp. | Waukesha | 39 | General | 0044938-3 | 9-30-95 | 3544 | Special dies, tools, jigs, etc. | Deer Creek via drainage ditch | -- |
| Taylor Dynamometer & Mach. Co. Inc. | Waukesha | 40 | General | 0044938-3 | 9-30-95 | 3829 | Measuring & control devices | Deer Creek | -- |

Table V-10 (cont'd)

| Facility Name | County | Map ID#[b] | Permit Type | Permit Number | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Trent Tube Div.-Crucible Materials | Walworth | --[d] | General | 0046566-2 | 9-30-95 | 3317 | Steel pipe and tubes | Honey Creek via storm sewer | -- |
| Trent Tube Inc.-Plant #1 | Walworth | 42 | General | 0044938-3 | 9-30-95 | 3317 | Steel pipe and tubes | Honey Creek via storm sewer | -- |
| Uhen's Garage | Kenosha | --[d] | General | 0046566-2 | 9-30-95 | 5541 | Gasoline service station | Groundwater discharge | -- |
| Waukesha Block Co., Inc. | Waukesha | 44 | General | 0046507-2 | 9-30-95 | 3271 | Concrete block & brick | Groundwater discharge | -- |
| Waukesha Board of Education | Waukesha | 45 | General | 0046523-2 | 9-30-95 | 8299 | School/educational serv. | Fox River via storm sewer | -- |
| Wauk. Bd. of Ed.: Central Middle Sch. | Waukesha | 46 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Fox River via storm sewer | -- |
| Wauk. Bd. of Ed.: North H.S. Pool | Waukesha | 47 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Brandy Brook via unnamed trib. | -- |
| Waukesha Bd. of Ed: South H.S. Pool | Waukesha | 48 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Fox River via storm sewer | -- |
| Waukesha Concrete Products Co., Inc. | Waukesha | 49 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| Wauk. Cty. Trans. Dept.: Crites Field | Waukesha | 50 | General | 0046531-1 | 9-30-90 | 4581 | Airports/field services | Fox River via storm sewer | -- |
| Waukesha Foundry, Inc. | Waukesha | 51 | General | SPEC PERM | 9-30-95 | 3325 | Steel foundry | Fox River via storm sewer | -- |
| Waukesha Lime & Stone Co., Inc. | Waukesha | 52 | General | 0046515-2 | 9-30-95 | 3295/3274 | Lime/ground/treat. minerals | Fox River | -- |
| Waukesha Park & Rec. Dept (WPR) | Waukesha | 53 | General | 0046523-2 | 9-30-95 | 9199 | General government | Fox River via storm sewer | -- |
| Waukesha P&R Dept.: Buchner Pool | Waukesha | 54 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Fox River via storm sewer | -- |
| Waukesha P&R Dept.: Horeb Pool | Waukesha | 55 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Fox River via storm sewer | -- |
| Waukesha YMCA | Waukesha | 56 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Fox River via storm sewer | -- |
| West Shore Pipeline Co. | Racine | --[e] | General | 0046566-1 | 9-30-95 | 5171 | Petroleum bulk stations, term. | Goose Lk Branch Canal via ditch | -- |
| Western Bituminous Co. | Waukesha | 58 | General | 0046515-2 | 9-30-95 | 2951 | Asphalt paving, mixtures, blocks | Groundwater discharge | -- |
| Williams Bay Water Utility | Walworth | 59 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Lake Geneva | -- |
| Wilmot Ready Mix Inc. | Kenosha | 60 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| Wislanco Stone Co. | Waukesha | 61 | General | 0046501-1 | 9-30-95 | 3281 | Cut stone & stone products | Groundwater discharge | -- |
| YWCA of Waukesha | Waukesha | 62 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Fox River via storm sewer | -- |
| AT&T (Switching Center-Waukesha) | Waukesha | 1A | Specific | 0023132 | 06-30-92 | 4812 | Radio/phone communications | Fox River via unnamed trib. | None |
| Akerman, Inc. | Waukesha | 2A | Specific | 0043206 | 06-30-91 | 3499 | Fabricated metals products | Fox River via unnamed trib. | None |
| American National Can Co. | Racine | 3A | Specific | 0027251 | 03-31-91 | 3221 | Glass containers | Fox River via storm sewer | 1, 2 |
| Amron Corp. | Waukesha | 4A | Specific | 0026417 | 12-31-91 | 3479 | Metal coating & allied services | Fox River via storm sewer | 2, 3, 4, 5 |
| Beatrice Cheese, Inc. | Waukesha | 5A | Specific | 0070891 | 06-30-92 | 5143 | Dairy prod. exc. dried or canned | Groundwater discharge | None |
| Continental Plastic Containers | Racine | 6A | Specific | 0052710 | 12-31-88 | 3081 | Unsupported plastics film & sheet | Groundwater discharge | 6 |
| Cooper Power Systems, RTE Division | Waukesha | 7A | Specific | 0001350 | 03-31-93 | 3612 | Transformers - exc. electric | Fox River | 2 |
| Melson Meat Co, Inc. | Waukesha | 10A | Specific | 0048097 | -- | 2011 | Meat packing plant | Groundwater discharge | None |
| Navistar International Trans. Corp. | Waukesha | 11A | Specific | 0000566 | 06-30-91 | 3321 | Gray & ductile iron foundry | Fox River via storm sewer | None |
| Packaging Corp. of America | Racine | 12A | Specific | 0027073 | 12-31-92 | 2653 | Corrugated & solid fiber boxes | Fox River via unnamed tributary | 11, 12, 13 |
| Plastic Molded Concepts, Inc.-Eagle | Waukesha | 13A | Specific | 0047015 | 03-31-95 | 3444 | Special dies, tools, jigs, fixt. | Eagle Spring Lk. via unnamed trib. | None |
| QuadGraphics - Pewaukee | Waukesha | 14A | Specific | 0043800 | 09-30-91 | 2752 | Commerical printing - lithographic | Fox River via drainage ditch | None |
| S & M Rotogravure Service, Inc. | Waukesha | 15A | Specific | 0042188 | 06-30-89 | 2754 | Commercial printing - gravure | Deer Creek via drainage ditch | None |
| S & R Egg Farms, Inc. - Genesee | Waukesha | 16A | Specific | 0056600 | 06-30-91 | 6252 | Chicken eggs | Groundwater discharge | None |
| S & R Egg Farms, Inc. - LaGrange | Walworth | 17A | Specific | 0056537 | 06-30-91 | 0252 | Chicken eggs | Groundwater discharge | None |
| Trent Tube Div.-Crucible Materials | Walworth | 18A | Specific | 0038938 | 03-31-92 | 3317 | Steel pipe and tubes | Honey Creek via storm sewer | 2, 4, 5, 14 |
| Vulcan Materials Co. - Sussex | Waukesha | 19A | Specific | 0001198 | 12-31-91 | 1442 | Construction sand and gravel | Sussex Creek | 8 |
| Waste Mgmt. of WI: Metro Landfill | Milwaukee | 20A | Specific | 0045250 | 12-31-90 | 4953 | Refuse systems | Muskego Lake via unnamed trib. | 1, 8 |
| Wauk. County Trans. Dept.-Emissions | Waukesha | 21A | Specific | 0047953 | -- | 9512 | Air, water, solid waste management | Pewaukee River | None |
| Waukesha Engine Div. - Dresser Ind. | Waukesha | 22A | Specific | 0027227 | 06-30-92 | 3519 | Internal combustion engines | Fox River | None |
| WI Electric, Hwy. 59 Landfill 918 | Waukesha | 23A | Specific | 0047686 | -- | -- | -- | Groundwater discharge | None |
| Wisconsin Precision Casting Corp. | Walworth | 24A | Specific | 0048038 | -- | 3324 | Steel investment foundries | Honey Creek via drainage ditch | None |

Footnotes follow.

Table V-10 (cont'd)

[a] Table V-10 includes 84 known, permitted sources of wastewater discharging to the Fox River and its tributaries, or to the groundwater system in the Fox River watershed. As of 1993, there were 116 known, permitted point sources of water pollution.

[b] See Map V-5, Point Sources of Pollution Other Than Sewage Treatment Facilities in the Fox River Watershed: 1990.

[c] The number code refers to the following treatment systems:

1. Gravity sedimentation
2. Oil and grease removal
3. Multimedia filters
4. Pressure filters
5. Tube/Plate settlers
6. Land disposal - general
7. Stabilization lagoon
8. Holding pond
9. Spray Irrigation
10. Absorption pond
11. ACT sludge extended air
12. Sand filters
13. Chlorination
14. Chemical conversion/addition

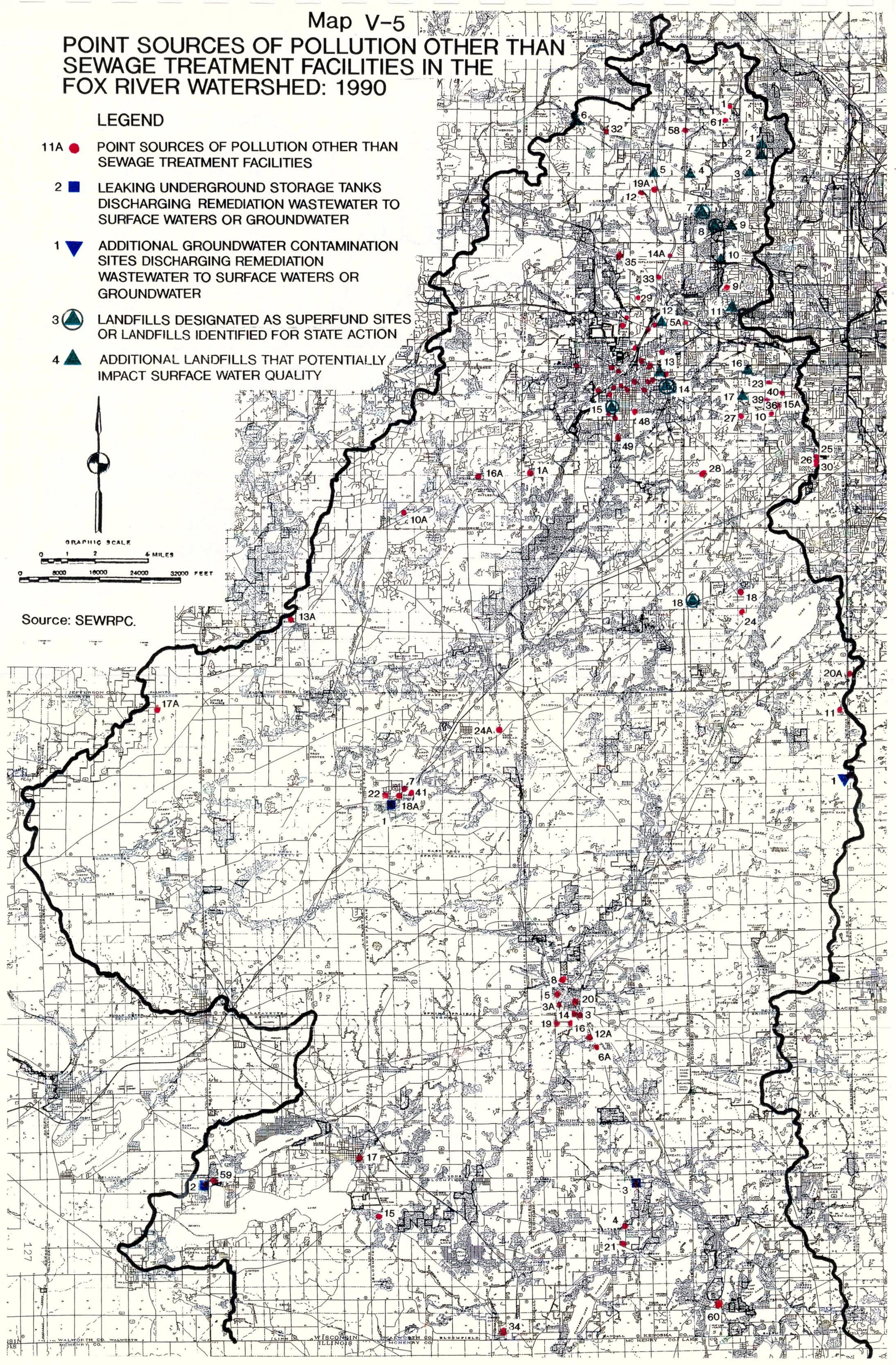
[d] Permitted as Leaking Underground Storage Tank (LUST) remediation sites discharging to surface cr ground waters as of 1990. As of 1993, there were four additional Leaking Underground Storge Tank remediation sites discharging to surface or ground waters in the Fox River Watershed. See Table V-12, "Miscellanecus Potential Pollution Sources in the Fox River Watershed: 1990", for map identification number.

[e] Reported as a ground water contamination site as of 1990. Remediation waste water from site is permitted to discharge to surface water. See Table V-12, "Miscellaneous Potential Pollution Sources in the Fox River Watershed: 1990", for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

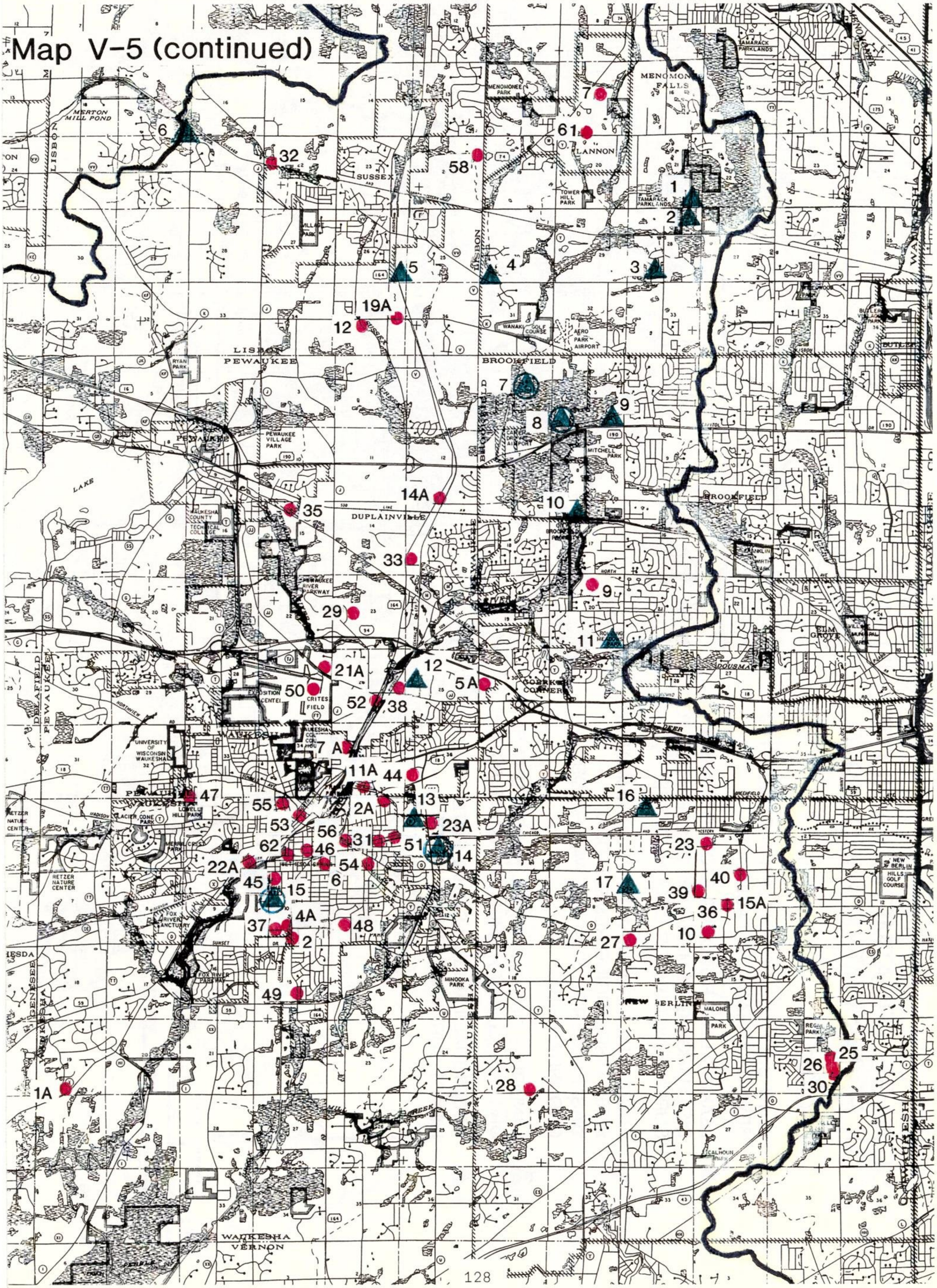
Map V-5

# POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE FOX RIVER WATERSHED: 1990




Source: SEWRPC.

Map V-5 (continued)



urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table V-11. One of these areas is served by a private sewage treatment plant. As shown in Table V-11, approximately one-half of these areas--37 of the 72 areas--are covered by soils and have lot sizes which indicate a high probability of meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. The remaining areas have soils and lot sizes having a high probability of not meeting these criteria and alternative wastewater disposal methods should be considered for incorporation into public sanitary sewer service areas. Many of these latter areas are located adjacent to lakes where alternative forms of wastewater management should be investigated during the planning period including the urban enclaves around Genesee Lakes, Lilly Lake, Powers Lake, Benedict-Tombeau Lake, Pell Lake, Booth Lake, Beulah Lake, North Lake, and Honey Lake. Generally, for all of the remaining enclaves located in areas where soils are not considered to meet current criteria, it is recommended that an inspection and maintenance program for the onsite sewage disposal system be instituted and that further site-specific planning to determine the best wastewater management practices be conducted at such time as significant problems become evident.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Fox River watershed, including those currently abandoned, have the potential to affect water quality through release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can be subsequently transported to surface waters.

There are currently seven active landfills and 170 known abandoned landfills located in the Fox River watershed. Two of the abandoned landfills, the Master Disposal Service Landfill in the Town of Brookfield and the Muskego Sanitary Landfill located in the City of Muskego, were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean up of hazardous waste sites. Three of the abandoned landfills, the City of Waukesha Sanitary Landfill located in the City of Waukesha, the Anchor Coatings, Inc. Landfill and the Martha Zaretzke Landfill, both located in the Town of Brookfield, have been identified for consideration under State programs for possible clean-up action due to the potential for groundwater and/or surface water contamination. The location of these and other landfills which are potentially impacting surface or groundwater in the Fox River watershed are shown on Map V-5 and listed in Table V-12.

In August 1984, the Master Disposal Service Landfill was designated as a high priority site for the Superfund program. The landfill, operational from 1962 until 1983, received various municipal and industrial wastes, including hazardous waste. Oil and other debris were reportedly released into channels at the site which drain into the Fox River. Analyses conducted in 1990 and 1991 to determine impacts of the landfill on surface water found significantly elevated levels of iron downstream of the site in the main drainage channel and in the Fox River. Levels of cadmium exceeding Federal and State ambient water quality criteria were also detected downstream of the site, while no cadmium was detected upstream of the site. Elevated levels of some volatile organic compounds and

Table V-11

EXISTING URBAN DEVELOPMENT OUTSIDE OF THE PLANNED PUBLIC SANITARY SEWER SERVICE AREA IN THE FOX RIVER WATERSHED: 2010

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| Waukesha County | | | |
| 1 | Village of Menomonee Falls-Section 5[c] | 310 | 0.5 |
| 2 | Village of Menomonee Falls-Section 6[c] | 115 | 0.5 |
| 3 | Town of Lisbon-Section 15 | 134 | -- |
| 4 | Town of Lisbon-Section 21 | 169 | 0.5 |
| 5 | Town of Lisbon-Section 20 | 347 | 1.0 |
| 6 | Town of Lisbon-Sections 28 and 29 | 717 | 0.5 |
| 7 | Town of Lisbon-Section 35[c] | 138 | 0.3 |
| 8 | Town of Lisbon-Section 31[c] | 309 | 0.3 |
| 9 | Town of Lisbon-Section 32[c] | 238 | 0.5 |
| 10 | Town of Pewaukee-Sections 1 and 12[c] | 258 | -- |
| 11 | Town of Delafield-Sections 26 and 27[c] | 423 | -- |
| 12 | City of New Berlin-Section 6[c] | 486 | -- |
| 13 | City of New Berlin-Section 5[c] | 225 | -- |
| 14 | City of New Berlin-Section 7[c] | 113 | -- |
| 15 | Town of Genesee-Sections 10 and 11[c] | 917 | 0.5 |
| 16 | Town of Genesee-Sections 16 and 21 | 298 | 1.1 |
| 17 | Town of Genesee-Section 15 | 130 | 1.2 |
| 18 | Town of Genesee and Town of Waukesha Sections 13, 18, and 19 | 1398 | -- |
| 19 | City of New Berlin-Section 18 | 312 | -- |
| 20 | City of New Berlin-Section 17[c] | 389 | 1.0 |
| 21 | City of New Berlin-Section 16[c] | 323 | 0.5 |

Table V-11 (cont'd)

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| 22 | Town of Genesee-Sections 19 and 30[c] | 566 | 2.7 |
| 23 | Town of Genesee-Section 27 | 177 | 2.8 |
| 24 | Town of Genesee-Section 25[c] | 102 | 1.7 |
| 25 | Town of Waukesha-Section 21 | 447 | -- |
| 26 | Town of Waukesha-Section 26 | 378 | 1.0 |
| 27 | Town of Waukesha-Section 26 | 150 | 1.0 |
| 28 | City of New Berlin and Town of Waukesha-Sections 19 and 24[c] | 698 | 0.5 |
| 29 | City of New Berlin-Sections 28, 29, 32, 33, and 34 | 1973 | -- |
| 30 | Town of Genesee-Section 35 | 330 | 3.0 |
| 31 | Town of Waukesha-Section 33 | 100 | 1.6 |
| 32 | Town of Waukesha-Section 35[c] | 121 | 2.5 |
| 33 | Town of Waukesha-Section 36 | 138 | 1.6 |
| 34 | City of New Berlin-Section 31 | 774 | 1.0 |
| 35 | Town of Mukwonago-Section 4[c] | 113 | 3.0 |
| 36 | Town of Mukwonago-Sections 5, 7, 8, 17, and 18 | 1545 | 1.7 |
| 37 | Town of Mukwonago-Sections 9, 10, 15, 16, and 21 | 1791 | 0.5 |
| 38 | Town of Vernon-Sections 18 and 19[c] | 732 | -- |
| 39 | Town of Vernon-Sections 8 and 17 | 719 | 1.3 |
| 40 | Town of Vernon-Sections 3, 4, and 10[c] | 1725 | 2.6 |
| 41 | Town of Vernon-Section 2[c] | 302 | 2.2 |
| 42 | Town of Vernon-Sections 11 and 14 | 331 | 1.6 |
| 43 | Town of Vernon-Sections 1 and 12 | 667 | -- |
| 44 | Town of Vernon-Sections 13, 14, 23, and 24 | 1852 | 0.7 |
| 45 | Town of Vernon-Section 15[c] | 124 | 2.6 |

Table V-11 (cont'd)

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| 46 | Town of Vernon-Section 27 | 176 | 2.0 |
| 47 | Village of Eagle-Section 22 | 1130 | 1.3 |
| 48 | Town of Eagle-Section 23 | 153 | 0.8 |
| | Walworth County | | |
| 49 | Town of Troy-Section 3[c] | 133 | 1.0 |
| 50 | Town of East Troy-Sections 4, 5, 8, 9, 10, and 18[c] | 817 | -- |
| 51 | Town of Troy-Section 15 | 122 | 1.5 |
| 52 | Town of Sugar Creek and Town of LaGrange-Sections 1, 25, 26, 35, 36[c] | 595 | 3.5 |
| 53 | Town of Sugar Creek-Section 5[c] | 118 | 4.2 |
| 54 | Town of Sugar Creek-Sections 1, 2, and 11 | 736 | 2.1 |
| 55 | Town of Lafayette-Section 19 | 190 | 0.5 |
| 56 | Town of Spring Prairie-Section 22 | 114 | 2.3 |
| 57 | Town of Spring Prairie and Town of Rochester-Sections 13 and 18[c] | 499 | 1.0 |
| 58 | Town of Lyons-Section 1[c] | 62 | 0.5 |
| 59 | Town of Lyons-Sections 7 and 8[c] | 534 | -- |
| 60 | Town of Geneva-Section 34 | 180 | 1.0 |
| 61 | Town of Bloomfield-Section 2[c] | 118 | 2.6 |
| 62 | Town of Bloomfield-Sections 14, 15, 16, 21, and 22 | 1894 | 1.5 |
| 63 | Town of Linn-Section 28 | 115 | 2.3 |
| | Racine County | | |
| 64 | Town of Burlington-Sections 17, 18, 19, and 20[c] | 1651 | 1.7 |
| | Kenosha County | | |
| 65 | Town of Wheatland-Section 25[d] | 516 | 2.5 |

Table V-11 (cont'd)

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| 66 | Town of Wheatland-Section 34[c] | 131 | 2.3 |
| 67 | Town of Wheatland-Section 3[c] | 132 | 2.0 |
| 68 | Town of Wheatland and Town of Salem-Sections 1, 7, and 12[c] | 579 | -- |
| 69 | Town of Wheatland-Section 11[c] | 561 | 1.3 |
| 70 | Town of Randall-Section 17 | 158 | -- |
| 71 | Town of Randall and Town of Wheatland and Town of Bloomfield-Sections 7, 13, 17, 18, 19, and 24 | 1068 | 0.5 |
| 72 | Town of Randall-Section 35 | 256 | 0.2 |
| | Total | 36,689 | -- |

[a] See Map V-4

[b] Urban development is defined in this context as concentrations of urban land uses within any given U.S. Public Land Survey quarter section that has at least 32 housing units, or an average of one housing unit per five gross acres, and is not served by public sanitary sewers.

[c] Based upon consideration of soils, lot sizes, and density, further site-specific planning should be conducted during the planning period to determine the best means of providing for wastewater management.

[d] Served by a private sewage treatment plant.

Source: SEWRPC.

Table V-12

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE FOX RIVER WATERSHED: 1990

| Map ID Number[a] | Landfills Indicated to Be Potential Pollution Sources | Civil Division Location | Surface Water Potentially Impacted |
|---|---|---|---|
| | | Waukesha County: | |
| 1 | Industrial Waste Corp. Landfill[b] | Village of Menomonee Falls | Fox River |
| 2 | Mill Lands, Inc. Landfill[b] | Village of Menomonee Falls | Fox River |
| 3 | Unnamed landfill - Village of Menomonee Falls Section 28[b] | Village of Menomonee Falls | Fox River |
| 4 | Unnamed landfill - Village of Menomonee Falls Section 30[b] | Village of Menomonee Falls | Fox River |
| 5 | Vulcan Materials Landfill[b] | Town of Lisbon | Sussex Creek |
| 6 | Milwaukee Road Landfill[b] | Town of Lisbon | Sussex Creek |
| 7[c] | Martha Zaretzke Landfill | Town of Brookfield | Fox River |
| 8[d] | Master Disposal Sanitary Landfill | Town of Brookfield | Fox River |
| 9 | Fly ash disposal site[b] | City of Brookfield | Fox River |
| 10 | Unnamed landfill-City of Brookfield Section 17[b] | City of Brookfield | Fox River |
| 11 | United Waste Systems Landfill[b] | City of Brookfield | Poplar Creek |
| 12 | Johnson Sand and Gravel Landfill[b] | Town of Pewaukee | Fox River |
| 13 | Unnamed landfill-Town of Waukesha Sec. 1[b] | Town of Waukesha | Fox River |
| 14[c] | Anchor Coatings, Inc. Landfill | City of Waukesha | -- |
| 15[c] | City of Waukesha Sanitary Landfill | City of Waukesha | Fox River |
| 16 | Industrial Waste Corp. Landfill[b] | City of New Berlin | Poplar Creek |
| 17 | Bodus Landfill[b,e] | City of New Berlin | Poplar Creek |
| 18[d] | Muskego Sanitary Landfill | City of Muskego | -- |
| | Leaking Underground Storage Tank Sites[f,g] | | Receiving Water |
| 1 | Trent Tube-Division of Crucible Materials | Village of East Troy, Walworth County | Honey Creek |
| 2 | Herb's Service | Village of Williams Bay, Walworth County | Lake Geneva |
| 3 | Uhen's Garage | Town of Wheatland, Kenosha County | groundwater |
| | Additional Groundwater Contamination Sites[f,h] | | Receiving Water |
| 1 | West Shore Pipeline Company | Town of Norway, Racine County | Wind Lake Drainage Canal tributary |

[a] Refers to Map V-5, Point Sources of Pollution other than Sewage Treatment facilities in the Fox River Watershed: 1990.

[b] As indicated in Wisconsin Department of Natural Resources, Upper Fox River Priority Watershed Stream Appraisals, February 1993.

[c] Identified for State action.

[d] Superfund site.

[e] Bodus Landfill was determined to have collected mixed industrial wastes during its operation and is considered by the U.S. Environmental Protection Agency to have potentially accepted hazardous wastes. A comprehensive site assessment has not yet been completed.

[f] Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters.

[g] As of 1993, there were three additional leaking underground storage tank sites in the Fox River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Horn Oil Company in the Village of Mukwonago, Waukesha County which is permitted to discharge to Vernon Marsh via a drainage ditch; Burlington Consumer Cooperative in the City of Burlington, Racine County which is permitted to discharge to the Fox River; and Genesee Aggregate Corporation in the Village of Sussex, Waukesha County which is permitted to discharge to groundwater.

[h] As of 1993, there was one additional groundwater contamination site whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: STS Consultants LTD-Waukesha Foods Warehouse in the City of Waukesha, Waukesha County which is permitted to discharge to the Fox River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

inorganic compounds were also found in groundwater downgradient of the site. Remedial actions are currently underway at this landfill site.

The Muskego Sanitary Landfill was designated as a Superfund site in September 1985. During its operation from 1954 to 1981, household, municipal, industrial, and commercial wastes were accepted at the site, including waste oils and paint products. Samples taken from on-site monitoring wells and residential wells near the site indicated contamination of groundwater from volatile organic compounds and other chemical contaminants. As permanent surface water features are not present on or near the site, impacts to surface water are considered minimal. Remediation efforts for the Muskego Sanitary Landfill are currently underway.

Leaking Underground Storage Tanks: Leaking Underground Storage Tanks in the Fox River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were three known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters and one known, permitted leaking underground storage tank discharging remediation waters to groundwater in the Fox River watershed, as indicated in Table V-12 and shown on Map V-5. As of 1993, there were three additional leaking underground storage tanks in the Fox River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table V-12.

As of 1993, there were 365 additional leaking underground storage tanks in the Fox River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is little evidence to document the impact of these individual point sources on water quality within the watershed, it can reasonably be assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters. As of 1990, there was one permitted site discharging to surface water, as indicated in Table V-12. As of 1993, there was one additional such site known to be discharging to surface water, as indicated in Table V-12.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Fox River watershed, the initial plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, onsite sewage disposal system management, and streambank erosion control. The plan recommended that additional nonpoint source controls be provided in certain areas. Within the urban areas of the Big Muskego, Denoon, Little Muskego, Pewaukee, Waubeesee, and Wind Lake drainage areas, the plan recommends a reduction of nonpoint source pollution by about 50 percent. Within the rural areas of the Big Muskego, Center, Denoon, Eagle Spring, Little Muskego, Pewaukee, and Wind Lake drainage areas, the plan recommends a reduction of about 75 percent. Finally, in the rural areas of the Benedict/Tombeau, Dyer, Kee Nong Go Mong, Lulu, North-Walworth, Pell, Powers, and Waubeesee Lake drainage areas, the plan recommends a reduction in nonpoint source pollution of about 50 percent.

In 1970, the Commission prepared a comprehensive plan[7] for the Fox River watershed. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas and for rural nonpoint source management planning in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Fox River watershed through a variety of local and State regulations and programs. These programs include the regulation of onsite sewage disposal systems under programs currently administered by Kenosha, Racine, Walworth, and Waukesha Counties in the unincorporated areas and by the local units of government in incorporated areas served by onsite systems. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified. Significant progress has also been made in the area of construction site erosion control. As of January 1993, Waukesha and Walworth Counties; the Cities of Brookfield, Muskego, New Berlin, and Waukesha; the Villages of Fontana on Geneva Lake and Williams Bay; and the Town of Delafield had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. The Villages of Big Bend, North Prairie, Silver Lake, and Sussex, and the Towns of Lisbon, Norway, Mukwonago, and Salem also had ordinances providing for construction site erosion control requirements which were developed independently from the model.

With regard to rural nonpoint source pollution controls, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program has been used in a few selected cases in

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[7]SEWRPC Planning Report No. 12, A Comprehensive Plan for the Fox River Watershed, February 1970.

the Fox River watershed. Other programs, such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Kenosha, Racine and Waukesha Counties. In addition, an agricultural soil erosion control plan for Walworth County was prepared by a consultant. Thus, these plans have been prepared for all rural areas of the Fox River watershed in Southeastern Wisconsin. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While the local programs described above have probably resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin State Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources.

As of 1993, there were two priority watershed projects[8] underway in the Fox River watershed. These projects are the Upper Fox River priority watershed project[9] and the Little Muskego, Big Muskego, and Wind Lakes priority watershed project.[10]

Little Muskego, Big Muskego, and Wind Lake Priority Watershed Project: The Little Muskego, Big Muskego, and Wind Lakes Priority Watershed Project was designated a "priority watershed" in 1991. Planning for the Little Muskego, Big Muskego, and Wind Lakes priority watershed project was completed in 1993, and implementation of practices began in January 1994 and will continue for eight years. Rural elements of the Little Muskego, Big Muskego, Wind Lake priority watershed project are administered by both the Waukesha and Racine County Land Conservation Committees. Urban elements of the project are being implemented by other local units of government including the Cities of Muskego and New Berlin, the Town of Norway, the Big Muskego/Bass Bay Lake District, the Little Muskego Lake District, and the Wind Lake Management District.

The Little Muskego, Big Muskego, and Wind Lake priority watershed project established pollutant reduction goals of 55 percent for sediment and 60 percent for phosphorus. The program had no specific reduction goal for metals and other toxic materials from urban runoff. However, the plan indicated that controls of these materials would be achieved by the practices needed to meet reductions for sediment and phosphorus. The loading reductions noted above were based upon further lake modeling analyses work conducted by the Wisconsin Department of Natural Resources staff for Big Muskego and Little Muskego Lakes and upon the completed modeling work conducted by the Regional Planning Commission for Wind Lake. The nonpoint source pollutant reduction goals set forth in the Little Muskego, Big Muskego, and Wind lakes priority watershed project are similar to those established in the initial regional water quality management plan.

To achieve the recommended pollutant reduction goals, the Little Muskego, Big Muskego, and Wind Lakes priority watershed plan included recommendations and funding eligibility for the following projects:

Rural Land Management--

- Provision of streambank erosion control practices for fourteen specific sites with a total of about 6,900 feet of eroding streambank. Upon full implementation, the installation of erosion control measures would reduce the sediment loading from streambanks in the study subwatershed by about 60 percent.

- Preparation of detailed conservation plans to develop the best management practices for about 2,000 acres of cropland. Upon full implementation, these practices would reduce the sediment loading from croplands in the study subwatershed by about 60 percent.

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[8]During 1994, a third priority watershed project was initiated for the Camp-Center Lakes subwatershed.

[9]Wisconsin Department of Natural Resources, A Nonpoint Source Pollution Control Plan for the Upper Fox River Priority Watershed Project, November 1993.

[10]Wisconsin Department of Natural Resources, A Nonpoint source Pollution Control Plan for the Muskego/Wind Lakes Priority Watershed Project, October 1993.

- Installation of facilities and management practices for two barnyards representing a reduction of about 87 percent of the phosphorus loading from barnyards in the study subwatershed.

Urban Land Management--The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for: implementation of construction erosion controls; the institution of public information and education programs on nonpoint source pollution abatement; and the institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers. The plan further recommends the development of a "segmented program" providing for stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices. Specific core and segmented program elements include:

- Provision of construction site erosion control for about 900 acres of new urban development which is expected in the watershed during the planning period. Implementation of such controls should reduce the sediment and phosphorus loading from construction sites up to 75 percent.

- Conduct information and education programs to educate policy makers, elected officials, and citizens about urban and rural nonpoint pollution.

- The preparation of detailed stormwater management plans to determine the best practices to be installed in the urban areas. These plans address water quantity and quality problems in developed and developing urban areas.

Upper Fox River Priority Watershed Project: The Upper Fox River priority watershed project was designated a "priority watershed" in 1990. Planning for the Upper Fox River priority watershed project was completed in 1993, and implementation of practices began in January 1994 and will continue for eight years.

Rural elements of the Upper Fox River priority watershed project are administered by the Waukesha County Land Conservation Committee. Urban elements of the project are being administered by the Cities of Brookfield, New Berlin, and Waukesha; the Villages of Hartland, Lannon, Menomonee Falls, Pewaukee, Sussex, and Wales; the Towns of Brookfield and Pewaukee; and the Pewaukee Lake Sanitary District.

The Upper Fox River priority watershed project established nonpoint source pollutant reduction goals to obtain sediment loading reductions and phosphorus reductions ranging from 49 to 75 percent for the subareas considered. These loading reductions were based primarily upon field inventories of the streams in the Upper Fox River watershed. Observations were made of the sediment imbeddedness and biological conditions of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. In addition, the pollutant reduction goals were based upon a qualitative consideration of the toxicity of metals in urban runoff.

The nonpoint source pollutant reductions set forth in the Upper Fox River priority watershed plan are consistent with the recommendations of the initial plan for the area tributary to Pewaukee Lake. For the remaining areas of the Upper Fox River watershed, the priority watershed project reduction goals exceed those of the initial areawide water quality management plan.

The recommendations of the priority watershed plan for the rural areas are plans generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. Certain components of the plan recommendations for the urban and urbanizing areas such as construction erosion control, are expected to be readily implemented. However, other components of the recommended plan such as retrofitting urban land management practices in developed areas are costly and full implementation will be difficult.

To achieve these pollutant reduction goals, the Upper Fox River priority watershed project includes recommendations and funding eligibility for the following rural and urban nonpoint source control measures. The levels of nonpoint source reduction used to develop the cost-eligible practices are generally similar to those recommended in the initial plan for the area tributary to Pewaukee Lake. However, higher levels of reduction are used in the priority watershed plan than were recommended in the initial plan for the remainder of the Upper Fox River subwatershed. The plan also recommended that further detailed stormwater management planning and assessments be carried out as part of the subsequent plan implementation actions.

Rural Land Management--

- Provision of fencing and other streambank erosion control practices for about 36,000 feet of eroding streambank. Upon full implementation, the installation of erosion control measures would reduce the sediment loading from streambanks in the study subwatershed by about 75 percent.

- Formation of detailed conservation plans to develop the best management practices for about 1,300 acres of cropland. Upon full implementation, these practices would reduce the sediment loading from croplands in the study subwatershed by about 50 to 70 percent.

- Installation of management practices for 17 barnyards representing a reduction of about 69 percent of the phosphorus loading from barnyards in the study subwatershed.

- Installation of facilities and management practices for 16 livestock operations to change manure spreading practices. This will reduce the phosphorus loading from such operations by about 70 percent.

- Improved nutrient and pesticide management for eligible cropland.

Urban Land Management--The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for implementation of construction erosion controls; the institution of a public information and education program on nonpoint source pollution abatement; and institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers. The plan further recommends the development of a "segmented program" providing for the stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices is also recommended. Specific core and segmented programs include:

- Provision of construction site erosion control for about 6,000 acres of new urban development which is expected in the watershed during the planning period. Implementation of such controls should reduce the sediment and phosphorus loading from construction sites by about 70 percent.

- Provision of nonpoint source control practices on about 5,400 acres of existing urban land and about 6,000 acres of new urban land are targeted for nonpoint source control. Possible urban nonpoint source pollution control practices include wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban areas. These plans address water quantity and water quality problems in developed and developing urban areas.

<u>Current Plan Recommendations</u>: It is recommended that construction site erosion control, onsite sewage system management, and streambank erosion controls, plus land management practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings be carried out throughout the Fox River watershed. Additional nonpoint source controls are recommended to be provided in certain areas to provide from about 50 to 75 percent reduction in nonpoint source pollution. Within the urban areas in the drainage areas of Denoon, Little Muskego, Pewaukee, Waubeesee, and Wind Lakes, it is recommended that additional practices providing for levels of control for about a 50 percent reduction in nonpoint source loadings be provided. Also, it is recommended that additional practices providing for about a 50 percent reduction in nonpoint source pollutant loadings be provided in the Benedict/Tombeau, Dyer, Kee Nong Go Mong, Lulu, North-Walworth, Pell, Powers, and Waubeesee Lake drainage areas and about a 75 percent reduction in nonpoint source loading from rural lands be provided in the Center, Denoon, Eagle Spring, and Pewaukee drainage areas. In addition, it is recommended that nonpoint source control measures to achieve a 55 percent reduction in sediment and a 60 percent reduction in phosphorus be carried out in the Big Muskego, Little Muskego, and Wind Lakes drainage area. It is further recommended that the levels of control set forth above as developed for the urban and urbanizing areas under the Upper Fox River priority watershed project, be utilized as the initial basis for stormwater management planning and project eligibility under the State priority watershed program. These levels of reduction are recommended to be refined based upon subsequent detailed stormwater management planning and based upon additional monitoring and quantitative analyses which are recommended to be conducted during the plan implementation period. These data and consideration of estimated costs and available funds for the urban practices are recommended to be evaluated to define the recommended final level of control. Such refinement would include further consideration of toxics reduction requirements.

The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, additional portions of the Fox River watershed should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make state cost-sharing funds and related programs available for nonpoint source pollution control measures. In addition, detailed stormwater management plans in urban areas and farmland management plans in rural areas should be conducted to determine the practices to be installed. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[11] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Fox River watersheds in the high category, indicating that inclusion in the program will be possible in the future, when the existing planning projects are completed, or additional funds and staff become available within the Department of Natural Resources.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

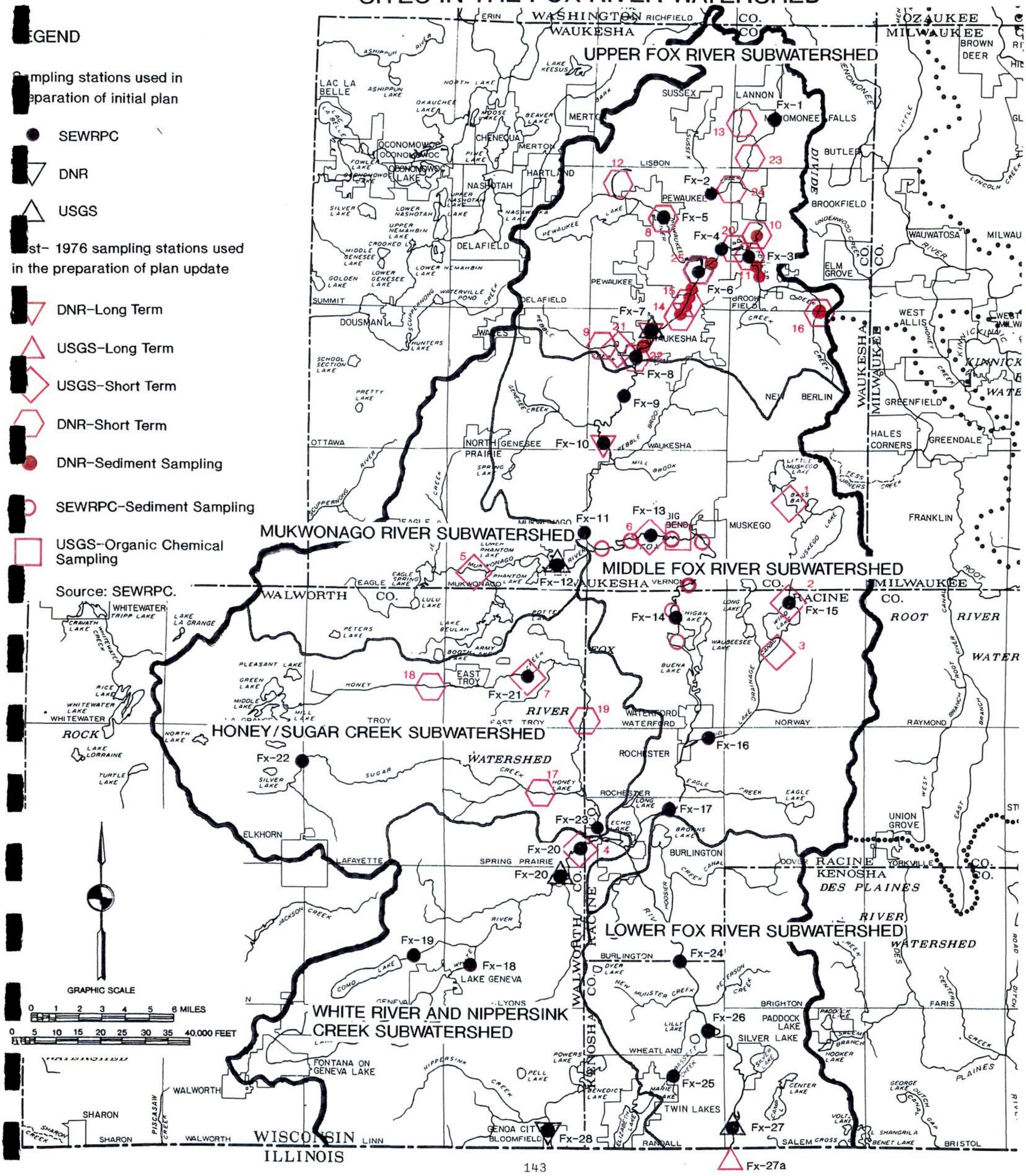
As of 1993, long-term monitoring has been carried out in the Fox River watershed on a sustained basis by the Wisconsin Department of Natural Resources (DNR) at two stations located on the Fox River main stem, one at CTH I just south of the City of Waukesha and one at Prairie Avenue in the City of Waukesha; and by the U.S. Geological Survey at one station located on the Fox River main stem at Russell Road about 1.5 miles south of the Wisconsin-Illinois State line, as shown on Map V-6. In addition, during 1991 and 1992, water quality and biological assessment monitoring has been carried out in the Upper Fox River subwatershed by the Wisconsin Department of Natural Resources. Short-term monitoring has also been conducted at 27 sites by the DNR during the period 1988 through 1993, as described later in this chapter. Some of these water quality sampling surveys were limited to one sample and only a few basic parameters were analyzed as dictated by the specific intended use of the surveys. However, data collected at about 25 sites, as shown on Map V-6, was considered to be potentially useful for review along with the long-term monitoring data to characterize the water quality.

Currently, water quality monitoring is being carried out on several lakes as part of the DNR Self-help Program, including Benedict/Tombeau, Beulah, Big Muskego, Bohner, Booth, Camp, Center, Cross, Eagle, Eagle Spring, Elizabeth, Geneva, Lilly, Little Muskego, Mary, Pell, Pleasant, Powers, Silver Lakes (Kenosha County), Spring Lake (Waukesha County), Upper Phantom and Waubeesee Lakes and the Waterford Impoundment (Racine County). In addition, limited additional water quality monitoring has been carried out on some of the major

[11]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

## Map V-6

# LOCATIONS OF WATER QUALITY AND SEDIMENT SAMPLING SITES IN THE FOX RIVER WATERSHED



lakes in the watershed by the U.S. Geological Survey, the Wisconsin Department of Natural Resources, local lake management agencies, and the Southeastern Wisconsin Regional Planning Commission.

Water resource appraisal monitoring was conducted in 1990 for the Upper Fox River watershed as part of the Upper Fox River Priority Watershed Project. Future evaluation monitoring is anticipated to be conducted for the Upper Fox River watershed as part of the evaluation phase of the priority watershed project. The Department has placed increased emphasis on monitoring and assessment of surface water quality[12] in all watersheds and now envisions carrying out a one-year intensive monitoring program in the Fox River watershed about once every five to seven years.

As part of the process of reviewing and evaluating public sewage treatment plant effluent requirements for meeting water quality standards, the DNR is currently conducting a study to assess the total maximum daily pollutant loadings from both point source and nonpoint sources which would desirably be discharged to the Upper Fox River in the reaches of the River most directly affected by the Sussex, Brookfield, and Waukesha sewage treatment plants. The analysis is being conducted to estimate the total allowable loadings to the Upper Fox River system based upon established dissolved oxygen and phosphorus standards. The total maximum daily loads calculated are anticipated to potentially affect the permitting of point sources of pollution and the level of control recommended to be achieved through nonpoint source pollution abatement programs in the watershed.

Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the Wisconsin Department of Natural Resources and U.S. Geological Survey at stations Fx-7, Fx-10, and Fx-27a on a continuing long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at these three stations and at 14 selected additional stations, with three stations located on the main stem of the Fox River and one station each located on Sussex Creek, Genesee Creek, Poplar Creek, Honey Creek, Sugar Creek, the Pewaukee River, the Mukwonago River, the White River, the Wind Lake Drainage Canal, Nippersink Creek, and Bassett Creek. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated with and are consistent with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five- to seven-year rotating cycle.

The lake monitoring program for each lake should consist, at a minimum, of one intensive monitoring effort to establish baseline conditions and of the long-term participation in the DNR Self-help Monitoring Program that can be conducted by citizen-volunteer residents on the lakes. As noted earlier, several lakes already participate in this program. For each lake, it is recommended that the monitoring program should be expanded to establish current conditions during a

[12]Wisconsin Department of Natural Resources, Surface Water Monitoring Strategy, WR299-92, 1992.

two-year or more period of intensive monitoring followed by a continual long-term monitoring program designed to detect changes in water quality conditions. In this regard, the monitoring program should be tailored to provide data needed for preparation or updating of comprehensive lake management plans for the major lakes in the watershed. Such programs are being undertaken by the U.S. Geological Survey on Lakes Denoon, Waubeesee, Powers, Big Muskego, Kee Nong Go Mong, Eagle Spring, Little Muskego, Eagle and Potter, and the DNR under the Long-Term Trends Program on Browns and Pewaukee Lakes. The water quality sampling program should be carried out at spring turnover (April) and during June, July, and August, during two subsequent years, with samples collected weekly.

LAKES MANAGEMENT PLAN ELEMENT

Existing Condition and Status of Plan Implementation

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of the major lakes in the Fox River watershed and for consideration of other lake management measures. Institutional recommendations were also made for the formation of new special purpose units of government where none exist to carry out the plan implementation measures. For each major lake in the Fox River watershed, the initial plan recommended that a comprehensive lake management plan be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. As noted in the previous section, the preparation of such a comprehensive plan requires that supporting water quality monitoring programs be established.

The status of lake management, protection, and rehabilitation efforts on and around the major lakes in the Fox River watershed is discussed for each major lake in the following paragraphs:

Army Lake: No specific plan implementation activities are documented for this lake as of 1993. The urban development surrounding the lake is recommended to be provided with a public sanitary sewer system.

Benedict/Tombeau Lakes: Both lakes are enrolled in the DNR Self-help Monitoring Program and are subject to on-going water clarity monitoring by citizen volunteers.

Beulah Lake: The Town of East Troy Sanitary District No. 1 is actively involved in operating an aquatic plant harvesting program on the lake. Incipient growths of *Myriophyllum spicatum*, Eurasian water milfoil, have been observed and were targeted for specific control measures including manual controls, sediment covering, and site specific chemical treatments beginning in 1993 when a Eurasian Water Milfoil Plan was completed for the Lake. The Sanitary District also participates in the DNR Self-help Monitoring Program and maintains dissolved oxygen and temperature profiles for five sample sites on the Lake.

Big Muskego Lake: The Big Muskego/Bass Bay Protection and Rehabilitation District was formed of properties around the Lake and has conducted lake water quality studies with the assistance of a Chapter NR 119 Lake Management Planning Grant. Water level manipulations have been recommended in the Wind Lake Management Plan which is currently being implemented.[13] The District is participating in the DNR Self-help Monitoring Program and has an active public information role. The lake is included in the Muskego-Wind Lakes Priority Watershed Project planning area[14] and, together with Wind Lake, is the subject of a U.S. Environmental Protection Agency Clean Lakes grant to partially fund the costs of an anticipated drawdown pursuant to the Big Muskego Lake management elements of the Wind Lake Management Plan.[15] The area adjacent to Bass Bay on the northern shore of the Lake is currently provided with a public sanitary sewer system with that system being connected to the Milwaukee Metropolitan sewerage system; the local sewage treatment plant which historically discharged to the lake was abandoned in 1984, as was recommended in the initial plan.

<u>Bohner Lake:</u> The Bohners Lake Improvement Association obtained an NR 119 Lake Management Planning Grant and has completed a plan addressing nonpoint source pollution-related problems at its inlet.[16] This study recommended application of watershed-based soil loss control measures or use of a sediment control structure at the lake inlet. The Association is a participant in the DNR Self-help Monitoring Program. An approved aquatic plant management plan has been prepared for the Lake and serves as the basis for aquatic plant management activities on the Lake. A sanitary district was formed of properties around the lake and facility planning recommending a public sanitary sewer system for the urban development around the lake was completed.[17]

<u>Booth Lake:</u> A portion of the urban development surrounding the lake is recommended to be provided with a public sanitary sewer system. The Booth Lake Property Owners Association participates in the DNR Self-help Monitoring Program. Booth Lake has recently been included in a DNR sensitive areas survey which determined that the entire waterbody was potentially sensitive to habitat disturbances.

<u>Browns Lake:</u> This is a DNR Long-term Trend Monitoring lake, the lakeshore of which has been provided with a public sanitary sewer system by the Browns Lake Sanitary District. The District also conducts aquatic plant management activities on the Lake in accordance with an approved aquatic plant management plan.[18]

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[13] SEWRPC Community Assistance Plan No. 198, <u>A Management Plan for Wind Lake, Racine County, Wisconsin</u>, December 1991.

[14] Wisconsin Department of Natural Resources, Publication No. WR-340-93, <u>A Nonpoint Source Control Plan for the Muskego-Wind Lakes Priority Watershed Project</u>, October 1993.

[15] Muskego-Wind Lakes Priority Watershed Newsletter, <u>Big Muskego Lake-Bass Bay Management Alternatives</u>, March 1994.

[16] R.A. Smith & Associates, Inc., <u>Bohners Lake Inlet Watershed Study</u>, March 1993.

[17] Crispell-Snyder, Inc., <u>Bohners Lake Facilities Plan</u>, May 1992.

[18] Aron & Associates, <u>Browns Lake Plant Management Plan</u>, 1992.

Camp Lake: Lake management actions on Camp Lake are conducted under the auspices of the Camp and Center Lake Rehabilitation District, which is preparing a lake management plan with the assistance of funding provided under the Chapter NR 119 Lake Management Planning Grant Program. The present studies are being conducted to develop a proposed dam improvement project. Camp Lake has an approved aquatic plant management plan. Camp and Center Lakes are also included in the nonpoint source pollution abatement priority lakes watershed planning program initiated during 1993. On-going water clarity monitoring is conducted through the DNR Self-help Monitoring Program. All of the urban development around the lake is provided with a public sanitary sewer system, as was recommended in the initial plan.

Center Lake: Adjoining Camp Lake, the Camp and Center Lake Rehabilitation District conducts regular monitoring of this Lake under the DNR Self-help Monitoring Program. The District is also undertaking preparation of a lake management plan with assistance of funding provided by the Chapter NR 119 Lake Management Planning Grant Program and is participating with other governmental units in the nonpoint source pollution abatement priority watershed planning program initiated on Camp and Center Lakes during 1993. This lake also has an approved aquatic plant management plan. All of the urban development of the lakeshore is provided with a public sanitary sewer system, as was recommended in the initial plan.

Lake Como: The Town of Geneva conducts an aquatic plant management program on the lake and has an approved aquatic plant management plan. Small portions of the developed areas on the southwestern shore of the Lake, including the Interlaken Resort, are connected to a public sanitary sewer system operated by the Geneva National Sanitary District. The Town of Geneva has received a Chapter NR 119 Lake Management Planning Grant to assist in completing a sewerage system facilities study to evaluate the best means to extend sewer services to the urban development around this lake. The urban development around this lake is recommended to be provided with a public sanitary sewer system.

Cross Lake: This lake has a property owners association which participates in the DNR Self-help Monitoring Program. The urban development of the lakeshore is provided with a public sanitary sewer system, as was recommended in the initial plan.

Lake Denoon: The Lake Denoon Advancement Association has received a Chapter NR 119 Lake Management Planning Grant to assist in preparing water quality elements of a lake management plan for the lake. Water quality studies are being carried out by Tri-Lakes Conservation Inc., which serves Lake Denoon and its neighbors Waubeesee and Kee Nong Go Mong Lakes. A stormwater detention pond system has been proposed, and partially implemented by the Association, to reduce nonpoint source loads on the Lake. The urban development of the lakeshore and areas north of the lake are provided with a public sanitary sewer system, as was recommended in the initial plan.

Dyer Lake: No recent data are available and no specific plan implementation activities have been documented for this lake as of 1993.

Eagle Lake: A watershed-wide lake user survey was completed in 1991.[19] This survey documented the continued decline of the lake's water quality as perceived by the surrounding community, a decline supported by the monitoring data. In conjunction with this perceived decline in water quality, a fish eradication project was conducted on the Lake during 1992. The Eagle Lake Property Owners Improvement Association have received a Chapter NR 119 Lake Management Planning Grant to assist in the preparation of a lake management plan, the aquatic plant management portion of which has been completed.[20] The Association participates in the DNR Self-help Monitoring Program. The urban areas of the lake have been provided with a public sanitary sewer system as recommended in the initial plan. Dam and dike modifications were undertaken during 1992.

Eagle Spring Lake: A management plan for the lake is being prepared with financial assistance being awarded to the Eagle Spring Lake District under the Chapter NR 119 Lake Management Planning Grant Program. This program is also financing in part water quality studies being carried out by the USGS. The District also participates in on-going monitoring under the DNR Self-help Monitoring Program. The urban development around the lake is recommended to be provided with a public sanitary sewer system.

Echo Lake: The southern and eastern shores of the Echo Lake have been provided with a public sanitary sewer system.

Elizabeth Lake: Refinement of the lake management proposals developed for this lake under the earlier lake management plan has been undertaken with the financial assistance of a Chapter NR 119 Lake Management Planning Grant awarded to the Twin Lakes Protection and Rehabilitation District. Both watershed and in-lake management measures were recommended in this plan refinement.[21] Specifically, adoption of construction site erosion ordinances, preparation of a storm-water plan, and close liaison with government units in the watershed was recommended. In the lake, limited dredging was suggested. The District undertakes regular water clarity monitoring of the lake under the DNR Self-help Monitoring Program. The urban development of the lakeshore is provided with a public sanitary sewer system.

Geneva Lake: Geneva Lake was the first of Wisconsin's lakes to have a lake association, and several local associations continue to be active around the lake. The Geneva Lake Environmental Agency, created by intergovernmental agreement between the lakeshore municipalities, is actively involved in lake management activities both on the lake and in the immediate watershed. One of the lake associations, The Geneva Lake Conservancy, Inc., has received funding to permit the Geneva Lake Environmental Agency to undertake watershed nonpoint source contaminant modelling with assistance from the Chapter NR 119 Lake Management Planning Grant Program. In addition, the DNR conducts an ongoing monitoring program of the wetlands located in Big Foot Beach State Park. An

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[19]Michael J. Losik & Associates, Inc., Eagle Lake Lake Management Planning Grant, October 1992.

[20]Aron & Associates, Eagle Lake Plant Management Plan, May 1995.

[21]Discovery Group Ltd and Blue Water Science, Lake Management Plan: Twin Lakes Protective and Rehabilitation District, Twin Lakes, Wisconsin, February 1993; Aron & Associates, Twin Lakes Plant Management Plan, May 1995.

approved aquatic plant management plan has been prepared for Geneva Lake, and the lake is monitored regularly under the DNR Self-help Monitoring Program. A lake management plan for the Lake was prepared and approved in 1985.[22] The incorporated communities, including the City of Lake Geneva and the Villages of Williams Bay and Fontana on Geneva Lake, are provided with public sanitary sewer systems.

Kee Nong Go Mong Lake (Long Lake): Water quality studies are currently being carried out by Tri-Lakes Conservation, Inc. with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Tri-Lakes Conservation Inc. serves Kee Nong Go Mong Lake, Lake Denoon and Waubeesee Lake. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended. A water use management plan for the lake's outlet channel, the Anderson Canal, is being implemented.[23]

Lauderdale Lakes: Lauderdale Lakes comprise the three interconnected lake basins of Green, Middle and Mill Lakes. The lakes are currently being monitored as part of the planning program being undertaken by the Lauderdale Lakes Improvement Association, Lauderdale Lakes Protection and Rehabilitation District, and Town of LaGrange, with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. The District is evaluating several options for the treatment of sanitary sewerage/septage generated by surrounding households. Continued reliance on onsite and clustered sewage disposal systems is currently the District's preferred alternative.[24] Lauderdale Lakes have an approved aquatic plant management plan.

Lilly Lake: The Lilly Lake Rehabilitation District participates in the DNR Self-help Monitoring Program.

Little Muskego Lake: Both the Little Muskego Lake Association and Little Muskego Lake Protection and Rehabilitation District are actively involved with lake management issues, including the installation and maintenance of a controversial aeration system. As a result of investigations conducted with the financial assistance of Phase I and Phase II Chapter NR 119 Lake Management Planning Grants, the effectiveness of the aeration system in the lake was assessed and the system was shut down in 1991. Under a Phase III Lake Management Planning Grant, a lake management plan is being prepared in which aeration will again be evaluated as a management option for the Lake. The lake organizations also have an approved aquatic plant management plan. The DNR also recently completed a sensitive area survey of the Lake. The Lake is included in the

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[22] SEWRPC Community Assistance Planning Report No. 60, A Water Quality Management Plan for Geneva Lake, Walworth County, Wisconsin, October 1985.

[23] SEWRPC Community Assistance Planning Report No. 182, A Water Use Management Plan for Waubeesee Lake and the Anderson Canal, Racine County, Wisconsin, December 1990.

[24] R.A. Smith & Associates, Inc. Final Report for the Lauderdale Lakes Area and Wastewater Feasibility Study for the Lauderdale Lakes Management District, March 1992; and RUST Environment and Infrastructure, Inc., Facilities Plan for Wastewater Collection and Treatment Facilities, Lauderdale Lakes, Wisconsin, 1994.

Muskego-Wind Lakes Priority Watershed planning area[25] under whose auspices an appraisal of lake water quality was recently completed. Monitoring of the lake is undertaken as part of the DNR Self-help Monitoring Program. The lakeshore is provided with a public sanitary sewer system.

Long Lake (Burlington/Rochester, Racine County): No recent data are available on this lake, and no specific plan implementation activities have been documented as of 1993.

Lulu Lake: No specific plan implementation activities have been documented for this lake as of 1993 but it is currently classified by the DNR as an "Outstanding Resource Water." Some aspects of the management of the lake are being addressed in the water quality management plan being prepared for Eagle Spring Lake which is located immediately downstream.

Lake Mary (Marie Lake): Refinement of the proposals relating to the Twin Lakes--Lakes Elizabeth and Mary--contained in the previous lake management plan for the lakes was undertaken with the financial assistance through a Chapter NR 119 Lake Management Planning Grant awarded to the Twin Lakes Protection and Rehabilitation District. The refined plan has been summarized above and recommends both in-lake and watershed-based protection actions be implemented by the District and surrounding units of government. The District undertakes regular water clarity monitoring of the lakes under the DNR Self-help Monitoring Program. All of the urban development around the lake is provided with a public sanitary sewer system.

North Lake (Walworth County): No recent data are available and no specific plan implementation activities have been documented for this lake as of 1993.

Pell Lake: A previously inactive lake association has been recently resurrected by lakeshore residents in response to growing concerns over aquatic plant growth in the waterbody. The Association has enrolled in the DNR Self-help Monitoring Program and is initiating the collection of Secchi disc transparency readings as of 1994. A sanitary district was formed of properties around the Lake and facility planning recommending a public sanitary sewer system for the urban development around the lake is completed.[26]

Peters Lake: No specific plan implementation activities have been documented for this Lake as of 1993.

Pewaukee Lake: This lake is a DNR Long-term Trends Monitoring Lake. The Lake Pewaukee Sanitary District conducts an aquatic plant harvesting operation in accordance with an approved aquatic plant management plan, and conducts lake-related environmental education outreach programs throughout the District. This District, and the Village and Town of Pewaukee, provide sewerage services to the larger part of the lakeshore as was recommended in the initial plan. The Lake Pewaukee Sanitary District also participates in the DNR Self-help Monitoring Program, and has received Chapter NR 119 Lake Management Planning Grant funding to assist in conducting studies of nutrient loading and boat traffic effects on

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[25]Wisconsin Department of Natural Resources Publication No. WR-340-93, op.cit.

[26]Baxter and Woodman, Inc., Pell Lake Sanitary District No. 1 Facilities Planning Report, June 1993.

the lake. A lake management plan for Pewaukee Lake has been prepared.[27] The lake is included in the Upper Fox River priority watershed planning area.

Pleasant Lake: Recently concerns have been raised about the presence of Myriophyllum spicatum, Eurasian water milfoil, in this lake, and the Wisconsin Department of Natural Resources has assisted residents in controlling this plant, including limiting its spread to other waterbodies. The Pleasant Lake Protection and Rehabilitation District conducts regular water clarity monitoring of the lake as part of the DNR Self-help Monitoring Program.

Potter Lake: The lakeshore area of Potter Lake is sewered by the Town of East Troy Sanitary District No. 2. Water quality monitoring in the lake is being conducted by the Potter Lake Protection and Rehabilitation District with funding assistance provided under Chapter NR 119. Compilation of an aquatic plant management plan has been completed, and a lake management plan will probably also be prepared as a result of these studies.[28] On-going water clarity monitoring through participation of the District in the DNR Self-help Monitoring Program is recommended.

Powers Lake: A recently completed lake management plan for Powers Lake[29] has been adopted and is being implemented. The plan recommended public acquisition and protection of environmentally valuable areas in the watershed, which is currently being carried out by the Powers Lake Management District. In addition, the plan includes recreational use management measures such as ordinance revisions and dissemination of information to the public. An approved aquatic plant management plan has also been prepared for this lake.[30] The Powers Lake Management District has received a Chapter NR 119 Lake Management Planning Grant to partially fund water quality studies on the lake; on-going water clarity monitoring is also being conducted under the DNR Self-help Monitoring Program. A detailed facility plan[31] was prepared considering alternatives for sewage disposal for the Powers, Benedict, and Tombeau Lakes area. That plan recommends the development of a public sanitary sewer system to serve the urban development around the Lake.

Silver Lake (Kenosha County): The eastern and western shores of the Lake are sewered. The Lake is enrolled in the DNR Self-help Monitoring Program.

Silver Lake (Walworth County): No specific plan implementation activities have been reported for the lake as of 1993.

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[27] SEWRPC Community Assistance Planning Report No. 58, A Water Quality Management Plan for Pewaukee Lake, Waukesha County, Wisconsin, March 1984.

[28] Aron & Associates, Potters Lake Plant Management Plan, 1992; Aron & Associates, Potters Lake Community Survey, March 1992.

[29] SEWRPC Community Assistance Planning Report No. 196, A Management Plan for Powers Lake, Kenosha and Walworth Counties, Wisconsin, November 1991.

[30] Aron & Associates, Powers Lake Plant Management Plan, March 1994.

[31] Crispell-Snyder, Inc., Powers-Benedict-Tombeau Lakes Facility Plan, May 1992.

Spring Lake (Waukesha County): Ongoing water clarity monitoring under the DNR Self-help Monitoring Program is being conducted. This lake is currently classified by the DNR as an "Outstanding Resource Water."

Upper and Lower Phantom Lakes: The Phantom Lakes Management District is considering preparation of a lake management plan and applying for funding under Chapter NR 119. The District has completed an aquatic plant management plan for these lakes.[32] The District is also enrolled in the DNR Self-help Monitoring Program for Upper Phantom Lake and is beginning to develop a water clarity data base. Lower Phantom lake was formerly enrolled in the program but is not currently participating. Re-enrollment is recommended. The eastern portion of the Lower Phantom Lake lakeshore is provided with a public sanitary sewer system which is part of the Village of Mukwonago sewerage system. Urban development around the remaining shoreline is recommended to be provided with a public sanitary sewer system.

Voltz Lake: Lake management plan elements being prepared for this lake with the assistance of Chapter NR 119 Lake Management Planning Grant funds provided to the Voltz Lake Management District include assessments of the lake's watershed and sediment characteristics. Watershed management measures aimed at reducing soil and contaminant losses were recommended, including the control of aquatic plants in the lake and watershed; mechanical and manual aquatic plan control was recommended for use within the lake.[33] Urban development on the lakeshore is provided with a public sanitary sewer system.

Wandawega Lake: No specific plan implementation activities have been reported for this lake as of 1993.

Waterford Impoundment: The Waterford Impoundment is made up of two waterbodies; namely, Buena Lake and Tichigan Lake. On-going involvement in the DNR Self-help Monitoring Program is conducted on Tichigan Lake. The Town of Waterford received a Chapter NR 119 Lake Management Planning Grant to partially fund regular monitoring of the lake's water quality and to prepare an aquatic plant management plan for the impoundment.[34] Urban development on the lakeshore is provided with a public sanitary sewer system as was recommended in the initial plan.

Waubeesee Lake: Waubeesee Lake is situated downstream from Kee Nong Go Mong Lake, and connected to that lake by the Anderson Canal. The recommended water use management plan prepared for the Canal and Waubeesee Lake[35] adopted many of the measures proposed in the 1979 plan, adding recreational use management and protection of environmentally sensitive areas. Urban development around the lake is provided with public sanitary sewer service by the Town of Norway Sanitary District No. 1, as was recommended in the initial plan. Tri-Lakes

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[32] SEWRPC Memorandum Report No. 81, An Aquatic Plant Management Plan for the Phantom Lakes, Waukesha County, Wisconsin, July 1993.

[33] Applied Ecological Services, Inc., Lake and Watershed Assessment and Management Recommendations Report: Voltz Lake Near Trevor, Wisconsin, May 1992.

[34] Aron & Associates, Waterford Impoundment Aquatic Plant Survey, May 1995; Aron & Associates, Town of Waterford Community Survey, 1994.

[35] SEWRPC Community Assistance Planning Report No. 182, op.cit.

Conservation, Inc, the lake organization covering Waubeesee Lake, Lake Denoon, and Kee Nong Go Mong Lake, is enrolled in the DNR Self-help Monitoring Program and conducts regular water clarity monitoring of the lake. The lake association is also conducting additional water quality studies on the lake with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program.

Wind Lake: Wind Lake is located downstream of Little Muskego and Big Muskego Lakes. The Muskego Canal discharges into Wind Lake on the north and is drained to the south by the Wind Lake Drainage Canal. It was recommended in the initial plan that additional urban nonpoint source contaminant control measures be employed together with livestock waste and construction erosion controls. This recommendation was reenforced by the recently completed lake management plan prepared for Wind Lake, which emphasized a watershed-based approach combined with in-lake measures, including nutrient inactivation, macrophytes harvesting, limited dredging and protection of environmentally sensitive areas.[36] This Lake, together with Big and Little Muskego Lakes, has been included in the Muskego-Wind Lakes Priority Watershed planning area.[37] The urban development along the Wind Lake shoreline has been provided with a public sanitary sewer system as recommended in the initial plan. While the Wind Lake Management District has previously been enrolled in the DNR Self-help Monitoring Program, on-going monitoring of the Lake is being conducted by the U.S. Geological Survey. Currently, the District has received Chapter NR 119 Lake Management Planning grants and U.S. Environmental Protection Agency grants for water quality restoration activities. An aquatic plant management plan has also been prepared and approved.

Current Plan Recommendations

Management measures recommended and in-lake measures which are considered potentially applicable and should be considered in more detail are shown in Table V-13 for the 42 major lakes in the Fox River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality and water budget monitoring programs for each lake are reaffirmed in the updated plan recommendations for the Fox River watershed. The management recommendations for the lakes are based upon review of the lake planning set forth in the initial plan and the current status of implementation of the recommendations, biological condition, as well as any subsequent local planning.

It is recognized that the preparation of comprehensive lake management plans may need to be conducted in a staged manner in order to best utilize available resources. In this regard, the water quality and biological condition monitoring, aquatic plant management, and watershed protection measure planning and implementation are considered to be logical components of the comprehensive plans which can be conducted under separate planning programs, if designed to be integrated into a comprehensive lake management plan.

In addition to the recommendations noted for the major lakes in the Fox River watershed, it is recommended that water quality planning and supporting

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[36] SEWRPC Community Assistance Planning Report No. 198, A Management Plan for Wind Lake, Racine County, Wisconsin, December 1991.

[37] Wisconsin Department of Natural Resources Publication No. WR-340-93, op.cit.

Table V-13

MANAGEMENT MEASURES TO BE CONSIDERED IN LOCAL MANAGEMENT PLANS FOR THE MAJOR LAKES IN THE FOX RIVER WATERSHED: 1993[a]

| Subwatershed Lake Name | Area (acre) | Water Quality Monitoring | Prepare Comprehensive Management Plan | Watershed-based Measures | | | | | | In-lake Management Measures | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Public Sanitary Sewer Service | Onsite Sewage System Mgmt | Rural NPS Mgmt | Urban NPS Mgmt | Construction Site NPS Mgmt | Live-Stock Mgmt | Macro-phyte Harvest | Aeration | Nutrient Inactiva-tion | Dredge | Sediment Cover | Water Level Mgmt | Fish Mgmt |
| FOX RIVER-UPPER | | | | | | | | | | | | | | | | |
| Pewaukee Lake | 2,493 | 0 | 0 | 0 | - | 0 | 0 | + | + | 0 | - | + | 0 | - | + | + |
| FOX RIVER-MIDDLE | | | | | | | | | | | | | | | | |
| Big Muskego Lake | 2,177 | 0 | 0 | 0 | - | 0 | 0 | 0 | + | - | - | - | + | + | - | 0 |
| Denoon Lake | 162 | + | 0 | 0 | - | + | + | 0 | + | + | - | + | + | + | - | + |
| Eagle Lake | 520 | 0 | 0 | 0 | - | + | + | + | + | 0 | - | - | - | + | - | + |
| Kee Nong Go Mong Lake | 88 | + | 0 | 0 | - | + | + | 0 | + | + | - | + | + | + | - | + |
| Little Muskego Lake | 506 | 0 | 0 | 0 | - | 0 | 0 | 0 | + | 0 | - | + | + | + | 0 | + |
| Long Lake (Racine Co.) | 102 | + | + | - | + | + | + | - | + | + | - | - | + | + | - | + |
| Spring Lake (Waukesha) | 105 | 0 | + | - | - | + | + | 0 | - | - | - | - | - | - | - | + |
| Waterford Impoundment | 1,233 | + | + | 0 | - | + | + | + | + | - | - | - | + | - | + | + |
| Waubeesee Lake | 129 | 0 | 0 | 0 | - | + | + | 0 | + | + | - | + | - | + | - | + |
| Wind Lake | 936 | + | 0 | 0 | - | 0 | 0 | 0 | + | 0 | - | + | 0 | - | - | + |
| FOX RIVER-LOWER | | | | | | | | | | | | | | | | |
| Bohner Lake | 135 | 0 | 0 | 0 | + | + | + | - | + | 0 | - | + | + | + | - | + |
| Browns Lake | 396 | 0 | + | 0 | - | + | + | + | + | + | - | + | + | + | - | + |
| Camp Lake | 461 | 0 | 0 | 0 | - | 0 | 0 | 0 | - | + | - | - | + | + | - | + |
| Center Lake | 129 | 0 | 0 | 0 | - | 0 | 0 | 0 | + | + | - | + | + | + | - | + |
| Cross Lake | 87 | 0 | + | 0 | - | + | + | 0 | - | - | - | + | - | + | - | + |
| Dyer Lake | 56 | + | + | - | + | + | - | - | + | + | - | - | + | + | - | + |
| Lilly Lake | 88 | 0 | + | + | + | + | + | - | - | - | - | + | + | + | - | + |
| Silver Lake (Kenosha) | 464 | + | 0 | 0 | - | + | + | 0 | + | + | - | + | + | + | - | + |
| Voltz Lake | 52 | 0 | 0 | 0 | - | + | + | 0 | - | + | - | + | + | + | - | + |
| HONEY/SUGAR CREEKS | | | | | | | | | | | | | | | | |
| Lauderdale Lakes | 841 | 0 | 0 | + | + | + | + | - | - | 0 | - | + | - | + | - | + |
| North Lake (Walworth) | 191 | + | + | - | + | + | + | - | + | + | - | - | + | + | - | + |
| Pleasant Lake | 155 | 0 | + | - | + | + | + | - | - | + | - | + | + | - | - | + |
| Potters Lake | 162 | 0 | 0 | 0 | - | - | + | + | - | 0 | - | + | + | + | - | + |
| Silver Lake (Walw) | 85 | + | + | - | + | + | + | - | - | - | - | - | + | + | - | + |
| Wandawega Lake | 119 | + | + | - | + | + | + | - | - | + | - | - | + | + | - | + |

Table V-13 (continued)

| Subwatershed Lake Name | Area (acre) | Water Quality Monitoring | Prepare Comprehensive Management Plan | Watershed-based Measures | | | | | | In-lake Management Measures | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Public Sanitary Sewer Service | Onsite Sewage System Mgmt | Rural NPS Mgmt | Urban NPS Mgmt | Construction Site NPS Mgmt | Live-Stock Mgmt | Macrophyte Harvest | Aeration | Nutrient Inactivation | Dredge | Sediment Cover | Water Level Mgmt | Fish Mgmt |
| MUKWONAGO RIVER | | | | | | | | | | | | | | | | |
| Army Lake | 78 | + | + | + | + | + | + | - | - | - | - | + | + | + | - | + |
| Beulah Lake | 834 | 0 | + | - | + | + | + | - | - | 0 | - | + | - | + | - | + |
| Booth Lake | 113 | 0 | + | + | + | + | + | - | + | - | - | + | - | + | - | + |
| Eagle Spring Lake | 311 | 0 | 0 | + | + | 0 | 0 | - | + | 0 | - | + | + | + | - | + |
| Lower Phantom Lake | 433 | + | 0 | + | + | + | + | 0 | - | 0 | - | + | + | + | - | + |
| Lulu Lake | 84 | + | 0 | - | - | 0 | 0 | - | + | + | - | + | - | + | - | + |
| Peters Lake | 64 | + | + | - | - | + | + | - | + | + | - | + | + | + | - | + |
| Upper Phantom Lake | 107 | 0 | 0 | + | + | + | - | - | - | 0 | - | - | - | - | - | + |
| WHITE RIVER/ NIPPERSINK CREEK | | | | | | | | | | | | | | | | |
| Benedict Lake | 78 | 0 | + | + | + | + | + | - | - | + | - | + | - | + | - | + |
| Como Lake | 946 | + | + | 0 | - | + | + | - | + | 0 | - | - | + | + | + | + |
| Echo Lake | 71 | + | + | 0 | - | + | + | + | + | - | - | - | - | - | + | + |
| Elizabeth Lake | 865 | 0 | 0 | 0 | - | + | + | + | + | - | - | + | - | + | - | + |
| Geneva Lake | 5,262 | 0 | 0 | 0 | - | + | + | + | - | - | - | - | - | - | - | + |
| Lake Mary | 315 | 0 | 0 | 0 | - | + | + | + | + | - | - | - | - | + | - | + |
| Pell Lake | 86 | + | + | 0 | - | + | + | - | + | - | - | + | - | - | - | + |
| Powers Lake | 459 | 0 | 0 | + | + | + | + | - | + | - | - | + | - | - | - | + |

0 = on-going management measures

+ = management measures proposed or recommended for further consideration

- = management measures not specifically recommended for further consideration

[a]Management measures recommended for further consideration in local management plans are summarized from those adopted in SEWRPC Planning Report No. 30, modified as necessary as the result of subsequent implementation actions, monitoring programs, and planning studies referenced in the text of this report.

Source: SEWRPC

monitoring be conducted for those lakes and similar water bodies in the watershed which are less than 50 acres in size, where such activities are deemed to be important for water quality protection. In such cases, management techniques similar to those recommended to be applicable for consideration on the major lakes in the watershed can be considered for lake management purposes.

## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; the 1966 through 1968 Commission and Wisconsin Department of Natural Resources (DNR) monitoring program for the Fox River watershed planning program; and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Fox River watershed included samplings at twenty-eight Commission stations--twelve on the Fox River main stem and sixteen on its tributaries; at one DNR station on the Nippersink Creek; and at four U.S. Geological Survey (USGS) stations--two on the Fox River main stem and one each on the Mukwonago and White Rivers tributary to the Fox River. One additional USGS sampling site was located on the Fox River in Lake County, Illinois, near Channel Lake, about 1.2 miles south of the Wisconsin-Illinois State line. The sampling station locations are shown on Map V-6.

Long-term post-1976 comparable water quality data have been collected at the current DNR sampling stations Fx-10 on the Fox River at CTH I and Fx-7 on the Fox River at Prairie Street just north of the City of Waukesha sewage treatment plant, and USGS sampling station Fx-27a on the Fox River just south of the Wisconsin-Illinois State line near Channel Lake, as shown on Map V-6. Water resource appraisal information including biological condition and water quality data collected by the DNR during 1991 through 1992 were also available for use in the assessment of current water quality conditions in the Upper Fox River watershed.[38] The DNR has collected water quality data on a short-term basis at 30 locations in the Fox River watershed. Some of these water quality sampling surveys were limited to one sample and in the number of parameters analyzed due to the specific purpose of the survey. Data collected at 25 sites from 1988 through 1993 were used, along with the long-term data previously noted, to characterize water quality conditions. These 25 sites are shown on Map V-6. Those data were used in this chapter to assess current water quality conditions as discussed in the next section and, where appropriate, to make a generalized comparison to historic conditions. Data on water quality and biological conditions were also collected for the Fox River main stem between the Village of Rochester and the Wilmot Dam for a University of Wisconsin-Stevens Point study in the summer of 1983. In addition to the data obtained since the preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000

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[38]Wisconsin Department of Natural Resources, Upper Fox River Priority Watershed Appraisal, February 1993.

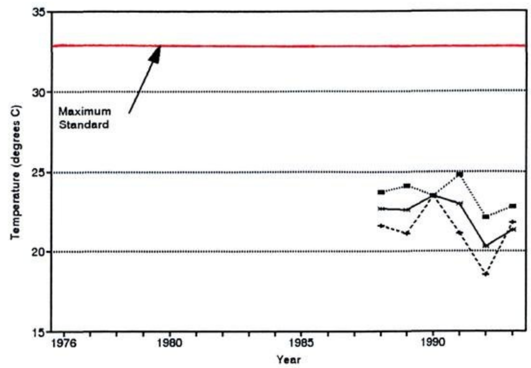
land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Fox River watershed.

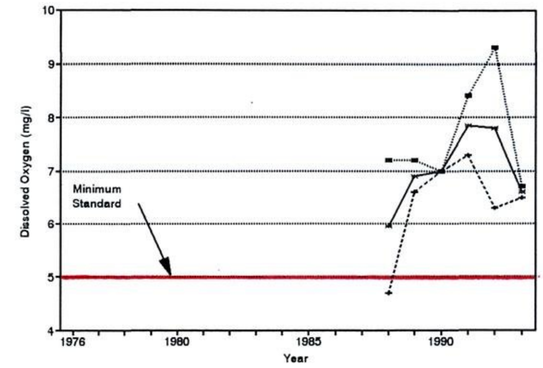
The long-term water quality data obtained at DNR stations Fx-7 and Fx-10 on the main stem of the Fox River at Prairie Street and CTH I, respectively, and at the USGS sampling station Fx-27a on the main stem of the Fox River near Channel Lake in Illinois, for the period 1976 through 1993, are summarized in Figures V-1 through V-3. The short-term data collected by the DNR and local units of government during the period 1988 through 1993 are summarized in Figures V-4 through V-8 and in Table V-14. Both the long-term and short-term sampling data have been used to assess current water quality conditions to evaluate water quality trends and the occurrence of changes over time, and to evaluate current conditions with respect to water quality standards. The water quality standards indicated in Figures V-1 through V-3 and in Table V-14 are those set forth for specific biological and recreational use objectives as described in Chapter II. The relationship of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria is discussed in detail in Chapter II.

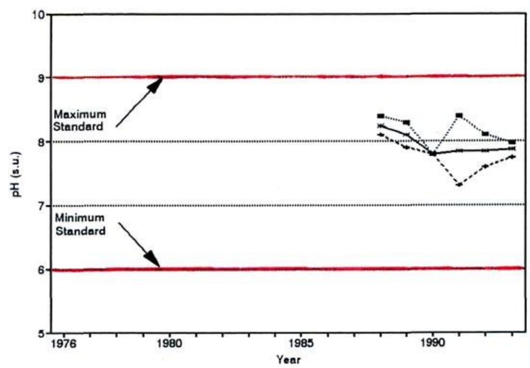
Review of those data for station Fx-7 and Fx-10 indicates that there appears to be an increase in dissolved oxygen levels at both stations since 1985; a decrease in phosphorus levels at station Fx-10 since 1982; and an improvement in un-ionized ammonia nitrogen levels at Fx-10 since 1979. No other significant changes in water quality conditions can be identified. These improvements may be attributed, in part, to the upgrading of the City of Waukesha sewage treatment plant in 1979; to the completion in 1985 of a major plant upgrading at the City of Brookfield sewage treatment plant; the abandonment of smaller existing public sewage treatment plants, including the Village of Pewaukee and the City of New Berlin Regal Manors plants between 1981 and 1985; and to the reduction in pollutant loadings from industrial point sources. Although phosphorus levels have declined over the sampling period, it should be noted that these levels still exceed the standard for streams with full recreational water use objectives, as set forth in Chapter II. Temperature, dissolved oxygen, pH, and chloride levels remained variable with no apparent trends, but were within the acceptable limits as defined by the water quality standards for the Fox River main stem set forth in Chapter II.

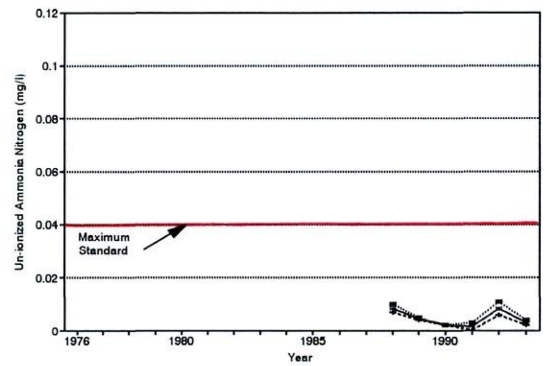
Review of the data at the USGS station Fx-27a, near Channel Lake just south of the Wisconsin-Illinois State Line, indicates no apparent significant changes in water quality conditions from 1976 through 1991 at that location, with the exception of chloride levels and the possible slight improvement in dissolved oxygen and phosphorus levels and a slight increase in un-ionized ammonia nitrogen levels. Chloride levels appear to have increased continuously. However, the levels are still within acceptable limits as defined by the standards associated with the water use objectives for the Fox River main stem set forth in Chapter II. The increase in chlorides may be the result of new urban development which has occurred in the watershed and the impacts of increased winter road maintenance, salt-spreading operations associated with urban development. The slight improvement in dissolved oxygen and phosphorus levels is likely due to the upstream treatment plant improvements noted above. The un-ionized ammonia nitrogen levels are still within acceptable limits. Chronic standards for some metals were also exceeded, as discussed in the next section.

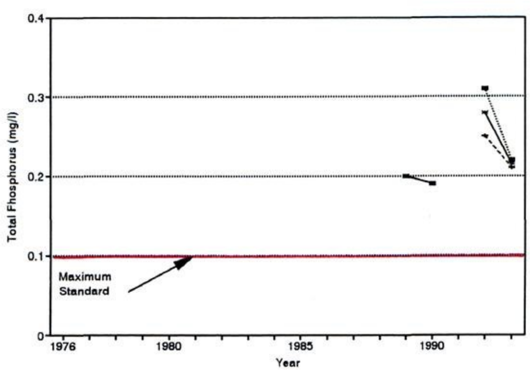
## Figure V-1
## WATER QUALITY DATA FOR THE FOX RIVER
## AT STATION Fx-7: 1976-1993

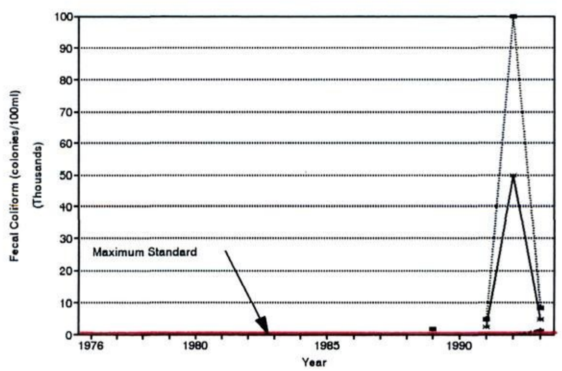


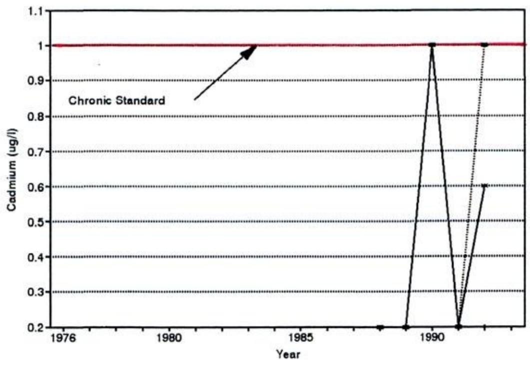



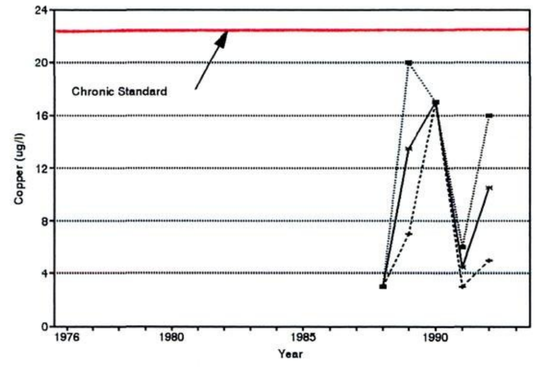




Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

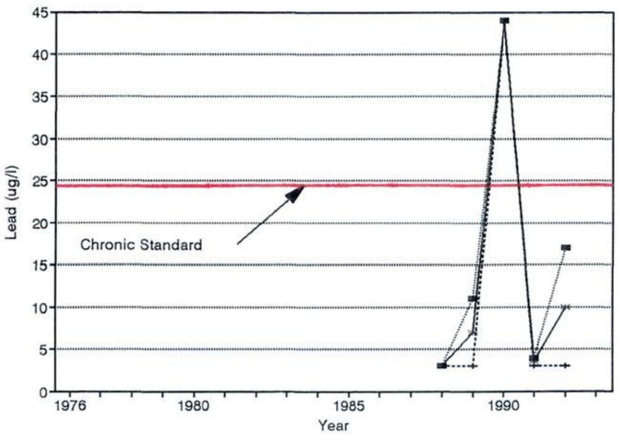



Note: The acute standard of 63.3 ug/l was not violated in any year.

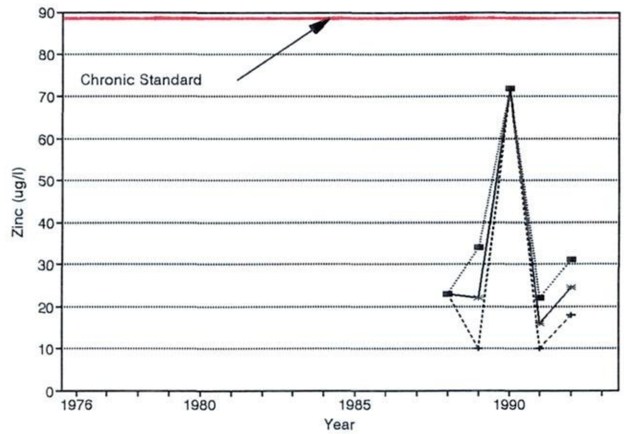



Note: The acute standard of 31.9 ug/l was not violated in any year.

# Figure V-1 (cont'd)




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The acute standard of 202.9 ug/l was not violated in any year.

LEGEND

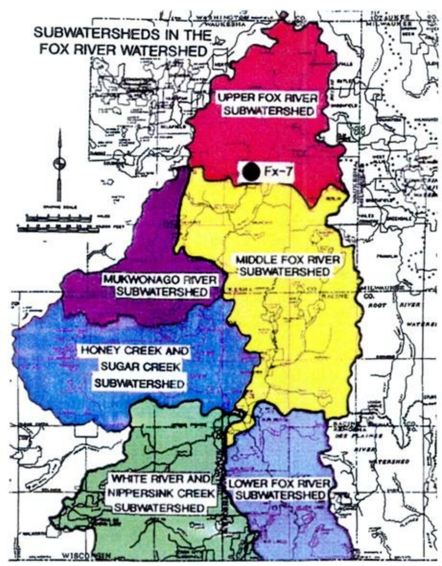
MAXIMUM VALUE

MINIMUM VALUE

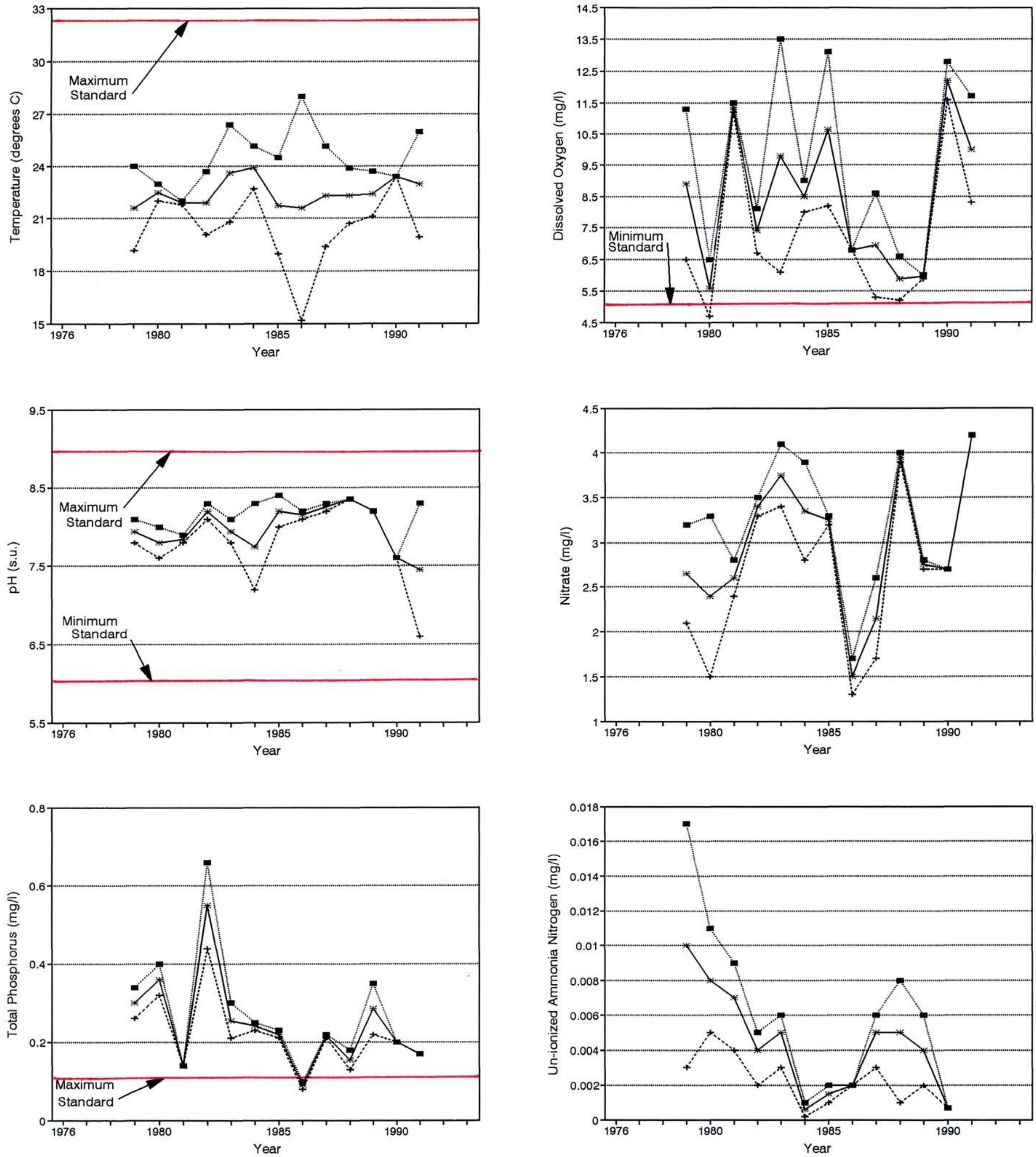
AVERAGE VALUE

Note: Graphs indicate maximum, minimum, and average values for July and August data.
Standards indicated are those established for warmwater sport fish and full recreational use objectives.
See chapter II for relationship of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Wisconsin Department of Natural Resources and SEWRPC.

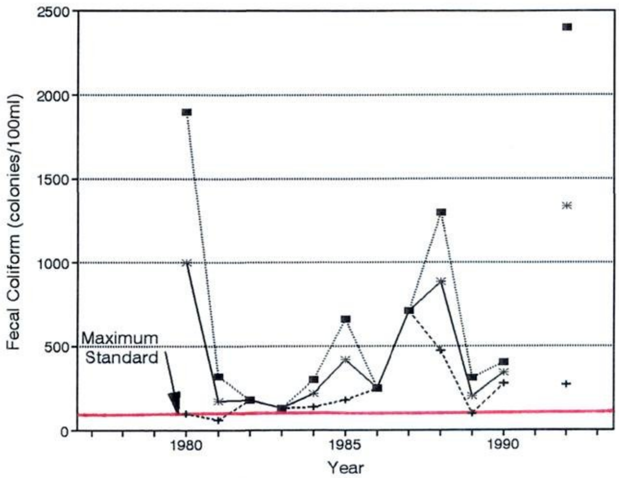


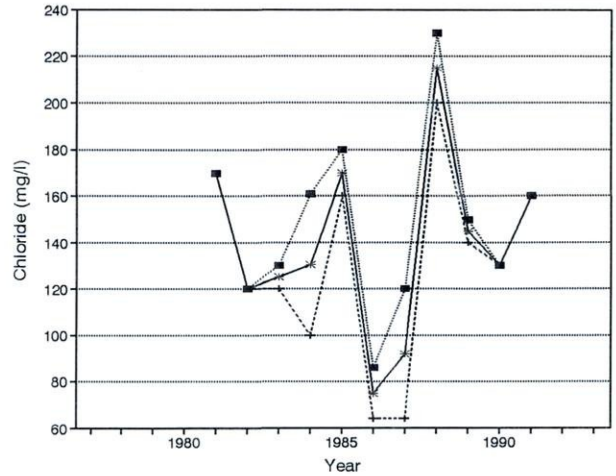
# Figure V-2
# WATER QUALITY DATA FOR THE FOX RIVER
# AT STATION Fx-10: 1976-1993



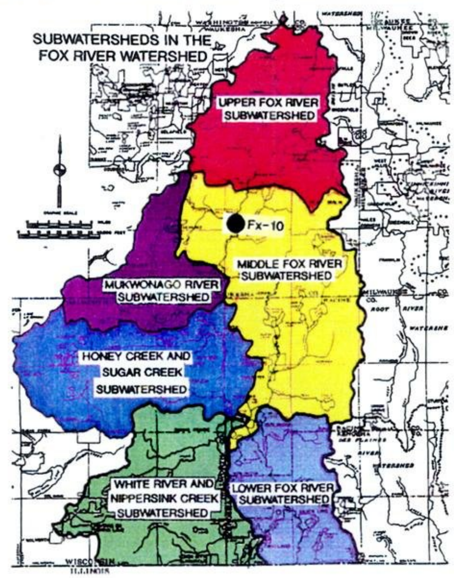

Note: The maximum standard of 0.04 mg/l was not violated in any year.

# Figure V-2 (Cont'd)




Note: The maximum standard of 1000 mg/l was not violated in any year.




## LEGEND

MAXIMUM VALUE

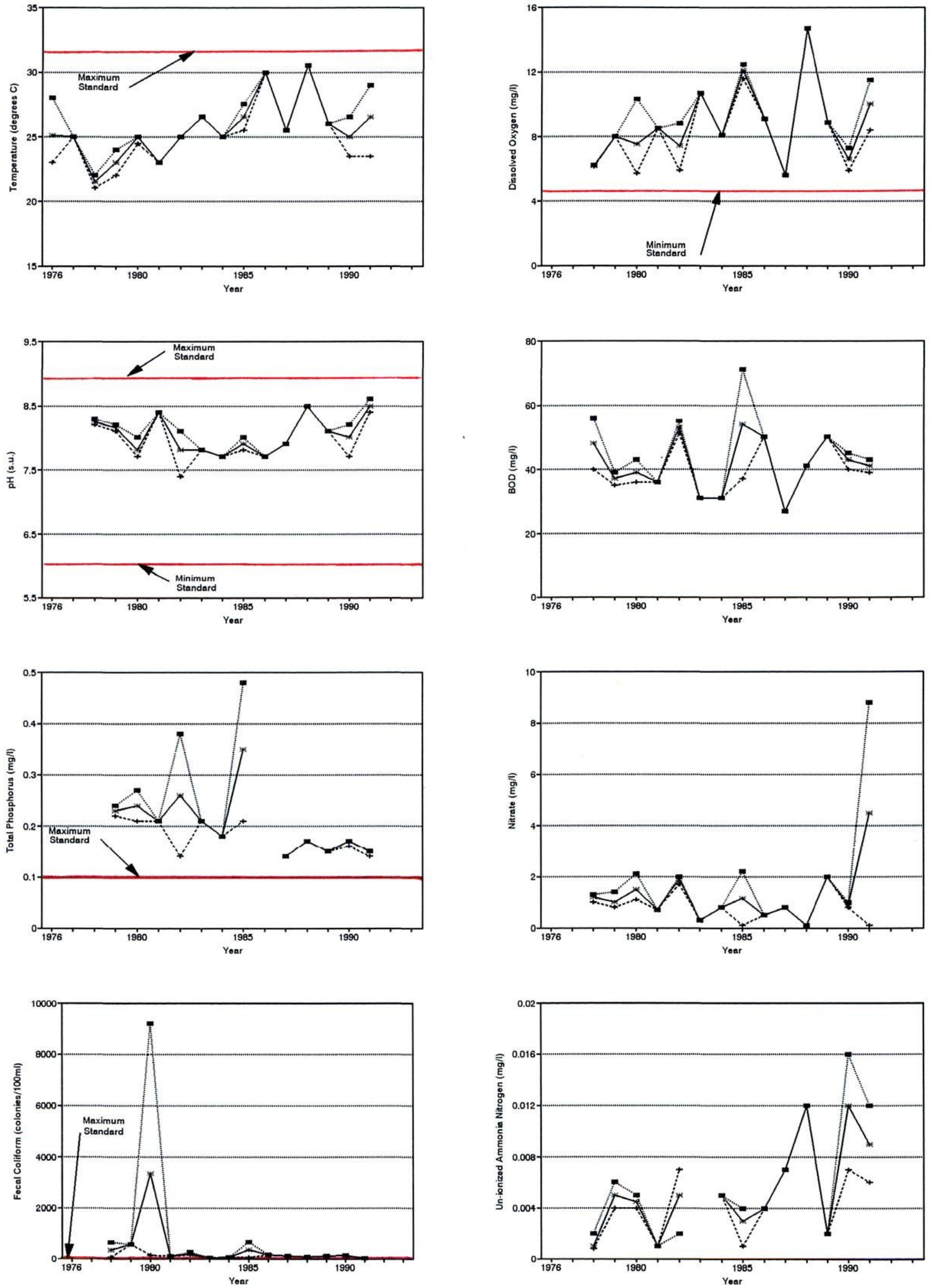
MINIMUM VALUE

AVERAGE VALUE

Note: Graphs indicate maximum, minimum and average values for
July and August data.
Standards indicated are those established for warm water sport fish and full recreational use objectives. See chapter II for relationships to these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Wisconsin Department of Natural Resources and SEWRPC.

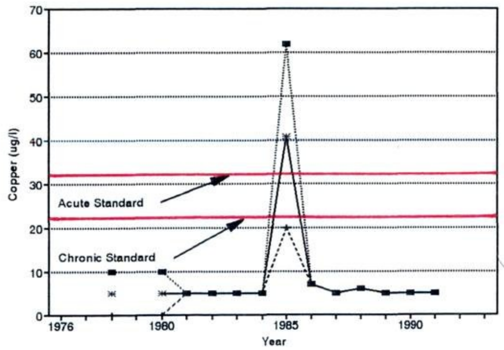
## Figure V-3
## WATER QUALITY DATA FOR THE FOX RIVER
## AT STATION Fx-27a: 1976-1993

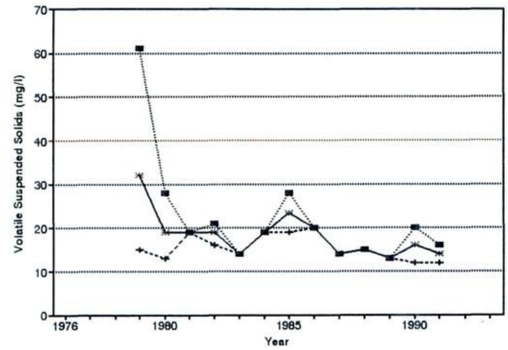



Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

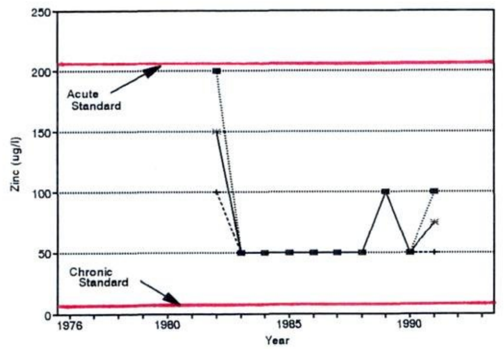
Note: The maximum standard of 0.04 mg/l was not violated in any year.

# Figure V-3 (cont'd)

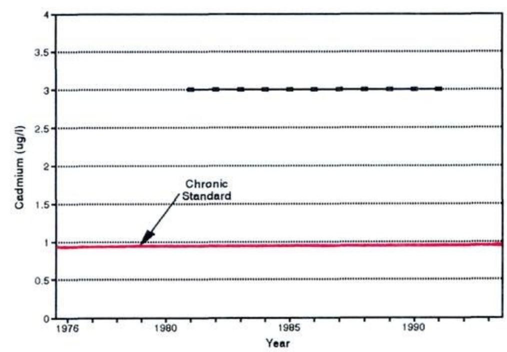


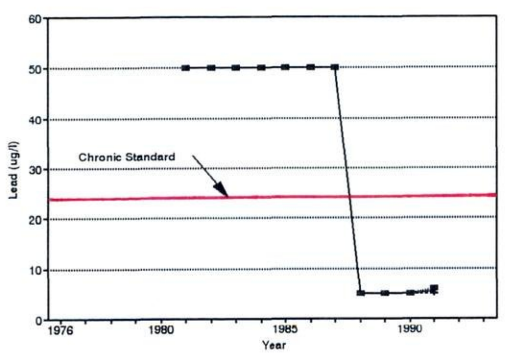

Note: Values graphed at 5.0 ug/l were indicated to be less than 5.0 ug/l.



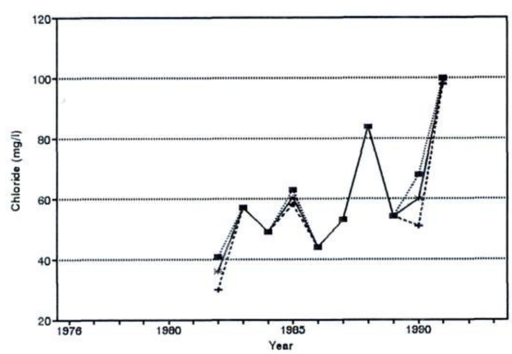

Note: Values graphed at 50 ug/l were indicated to be less than 50 ug/l.




Note: The acute standard of 63.3 ug/l was not violated in any year.
Values graphed at 3.0 ug/l were indicated to be less than 3.0 ug/l




Note: The acute standard of 409 ug/l was not violated in any year.
Values graphed at 50 ug/l prior to 1988 were indicated to be less than 50 ug/l and values graphed at 5.0 ug/l from 1988 to 1991 were indicated to be less than 5.0 ug/l.




Note: The maximum standard of 1000 mg/l was not violated in any year.

## LEGEND

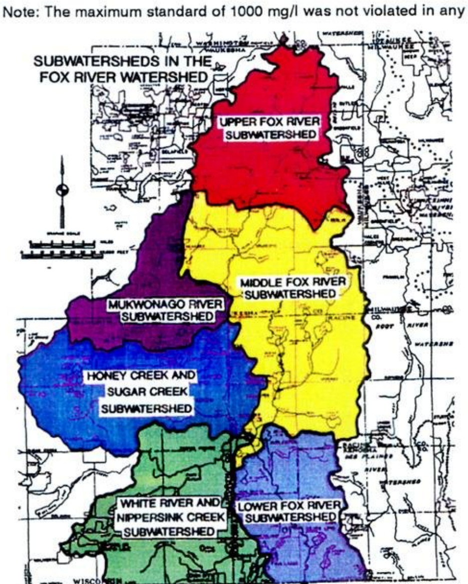
MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

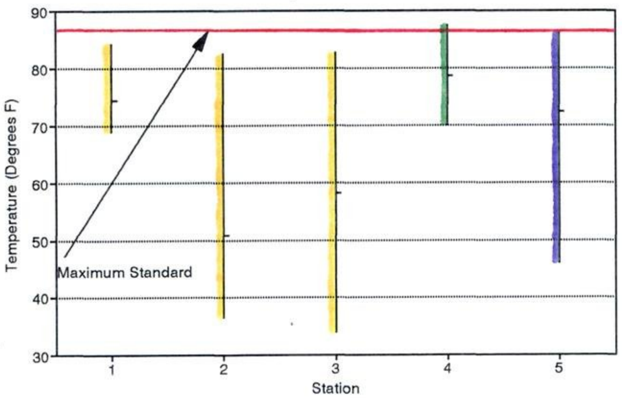
Note: Graphs indicate maximum, minimum, and average values for July and August data.
Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: U.S. Geological Survey and SEWRPC.

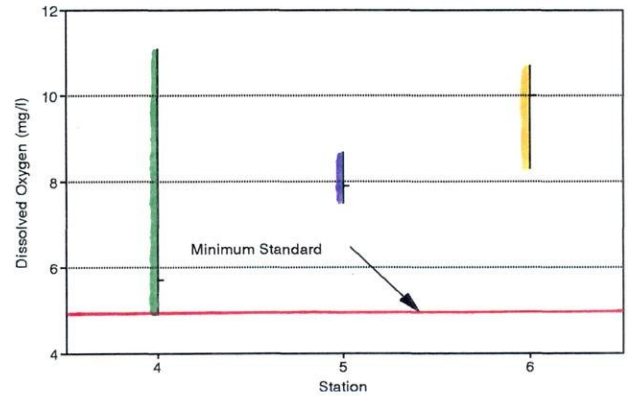


# Figure V-4
## Fox River Watershed Short-Term Water Quality Sampling Data: 1988

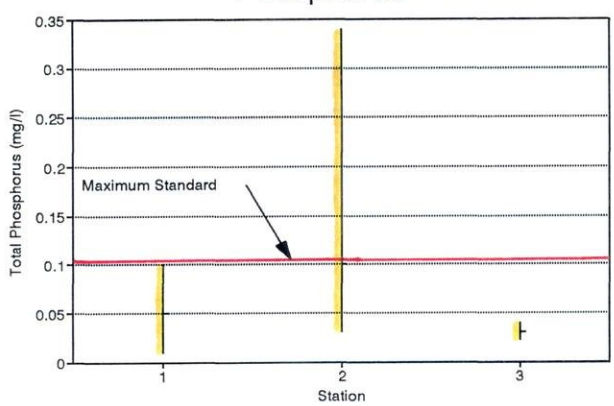
### Temperature



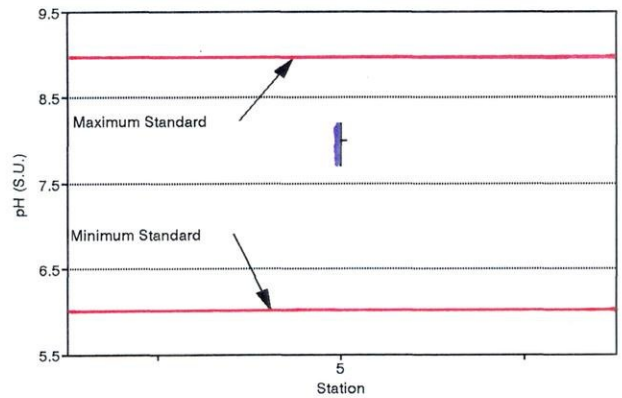

### Dissolved Oxygen




### Phosphorus




### pH




LEGEND

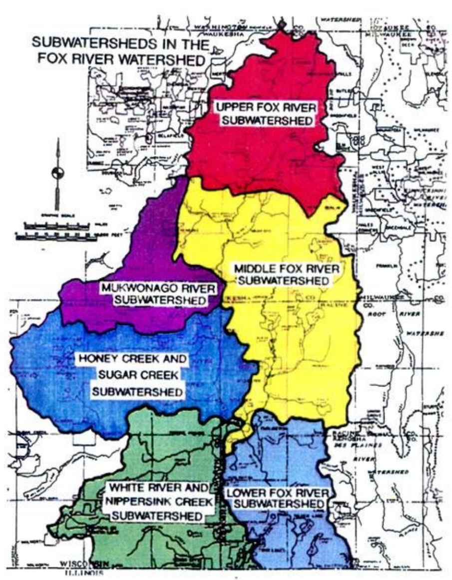
Maximum

Average

Minimum

Subwatershed Designation

- Upper Fox
- Middle Fox
- Lower Fox
- Honey/Sugar Creek
- Mukwonago River
- White/Nippersink Creek

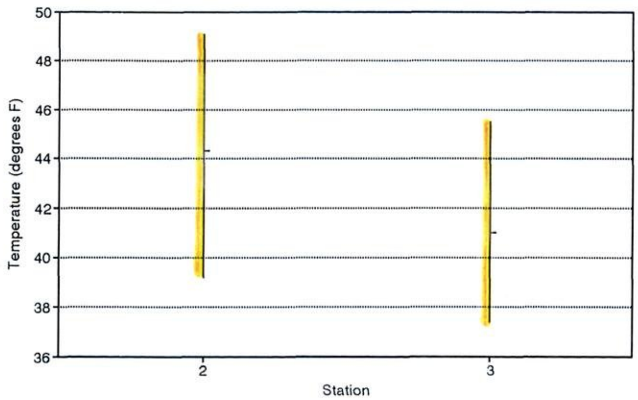



Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized water quality data.

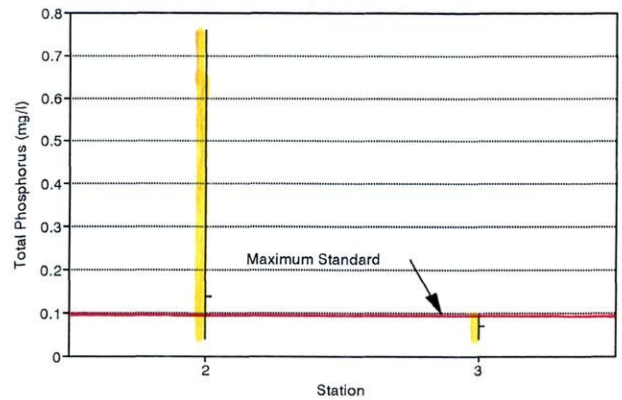
Source: Wisconsin Department of Natural Resources and SEWRPC.

# Figure V-5
# Fox River Watershed Short-Term Water Quality Sampling Data: 1989

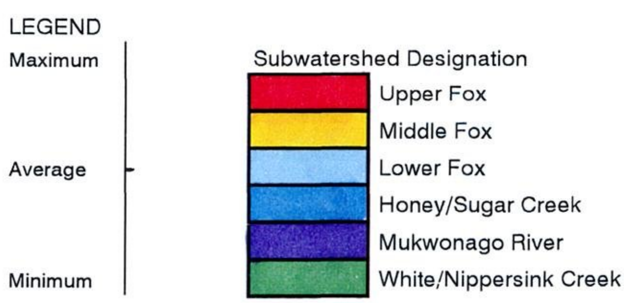
## Temperature

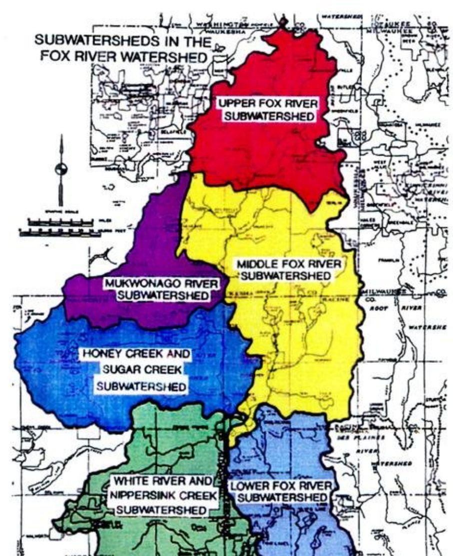



## Phosphorus




Note: The maximum standard of 89 degrees F was not violated in any sample



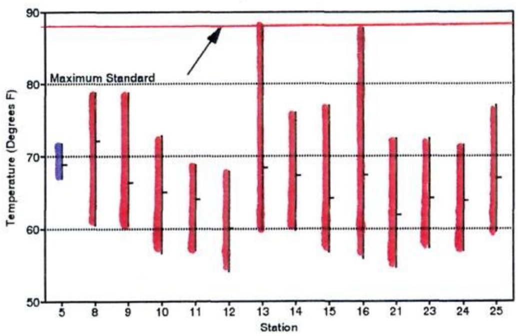




Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized water quality data.

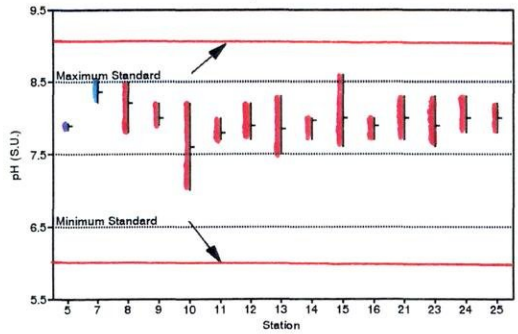
Source: Wisconsin Department of Natural Resources and SEWRPC.

## Figure V-6
## Fox River Watershed Short-Term Water Quality Sampling Data: 1990

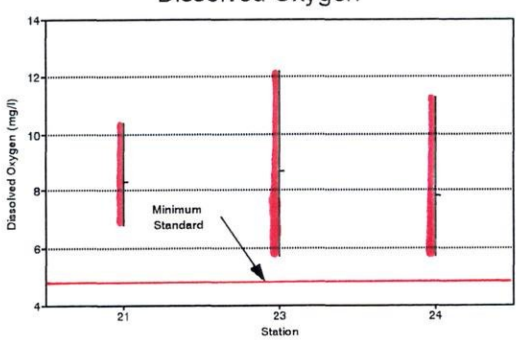
### Temperature



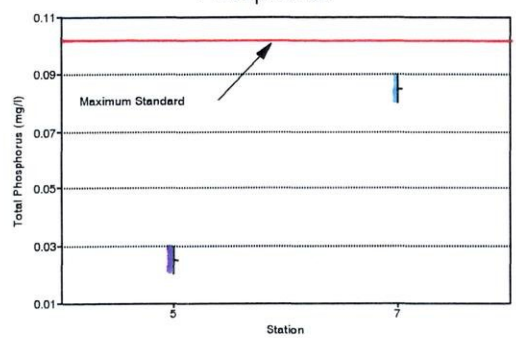

### pH



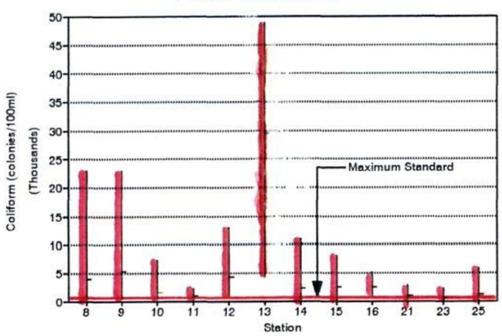

### Dissolved Oxygen



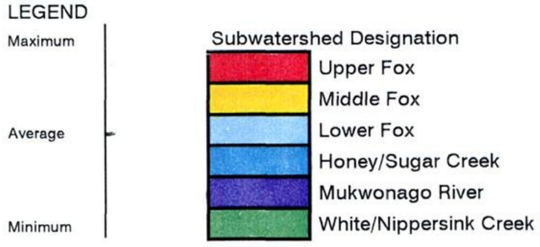

### Phosphorus

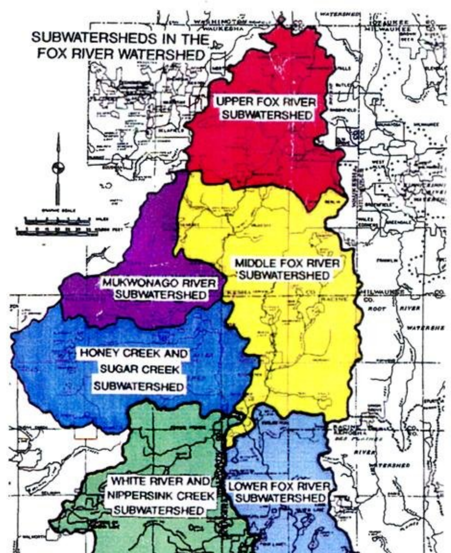



### Fecal Coliform




Note: The maximum standard of 200/400 colonies per 100ml was violated in all samples.

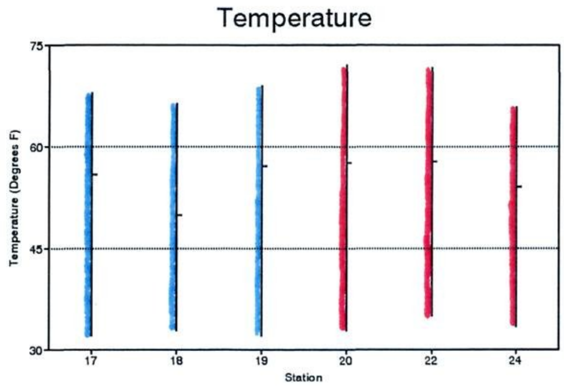


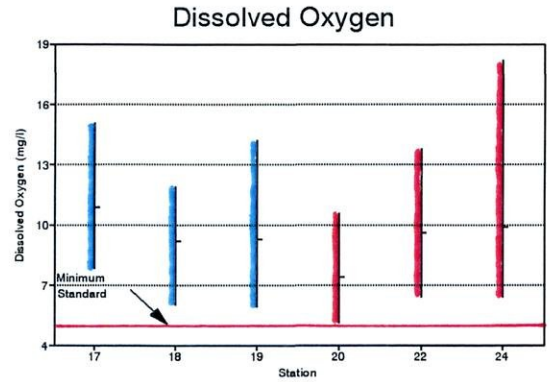




Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized water quality data.

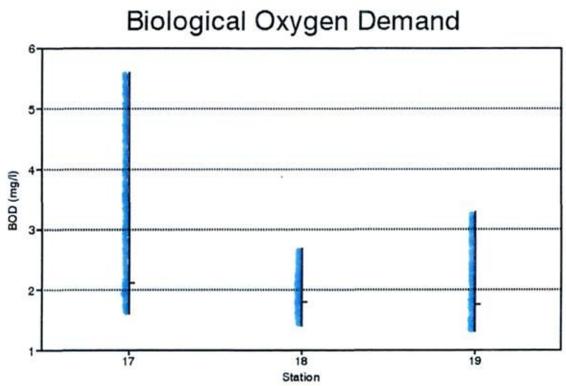
Source: Wisconsin Department of Natural Resources and SEWRPC.

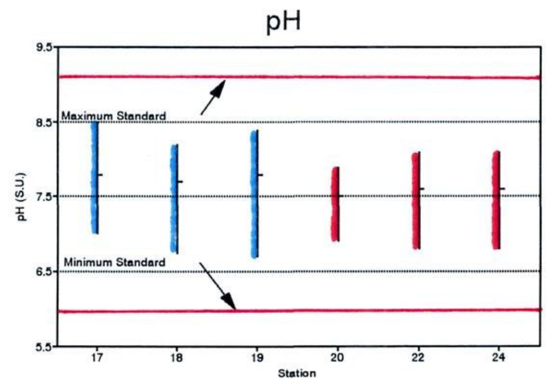
# Figure V-7
## Fox River Watershed Short-Term Water Quality Sampling Data: 1992

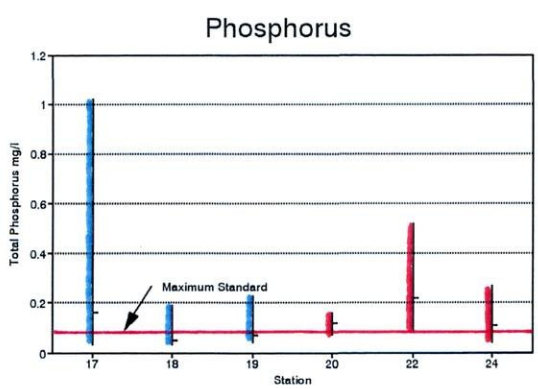


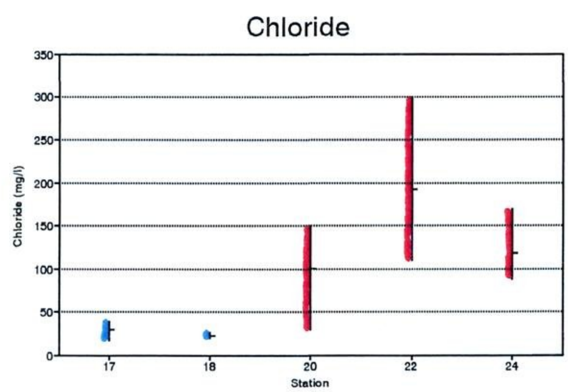




Note: The maximum standard of 89 degrees F was not violated in any sample.

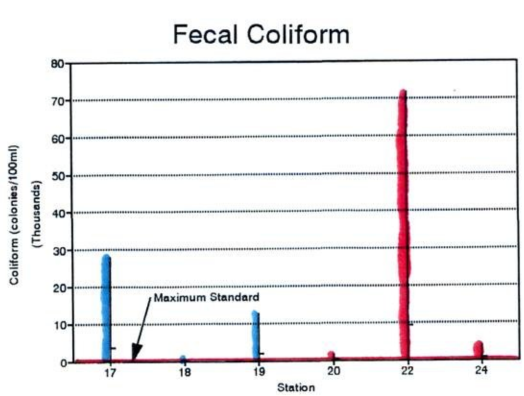


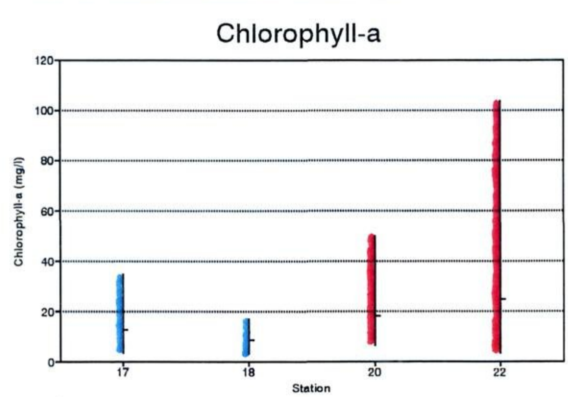




Note: The maximum standard of 1000 mg/l was not violated in any sample.

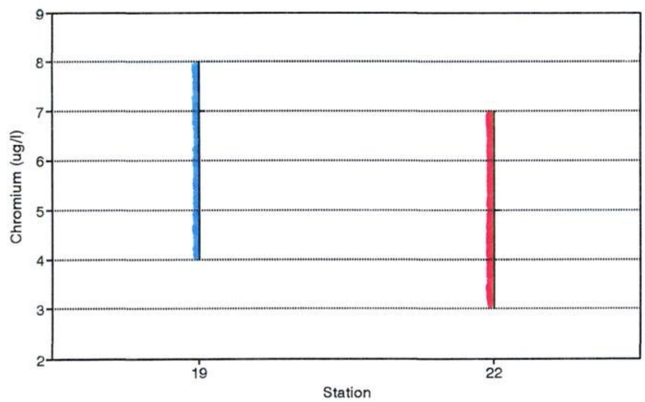


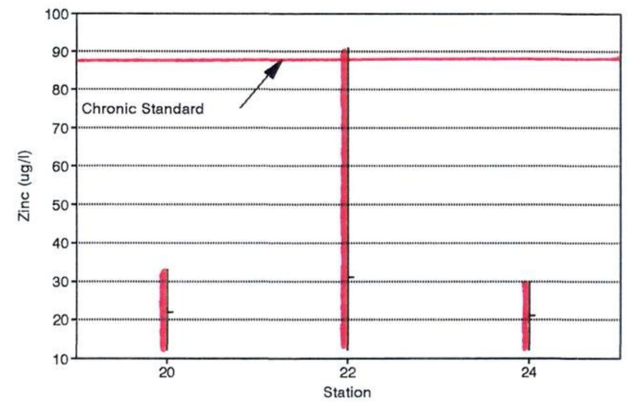

Note: The maximum standard of 200/400 colonies per 100ml was violated in all samples.

## Figure V-7 (cont'd)

### Chromium

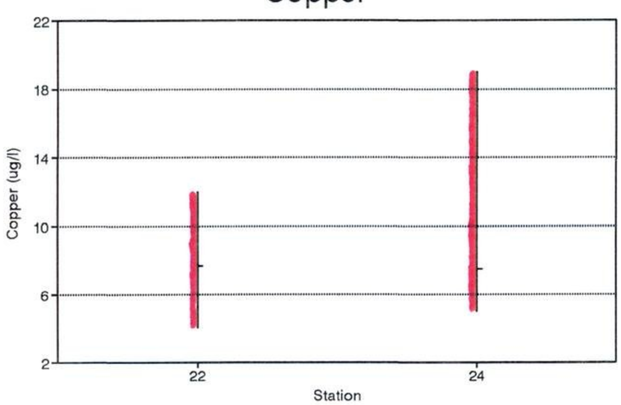



### Zinc




Note: The acute standard of 202.9 ug/l was not violated in any sample.

### Copper




Note: The chronic standard of 22.1 ug/l was not violated in any sample.
The acute standard of 31.9 ug/l was not violated in any sample.

LEGEND

Maximum

Average

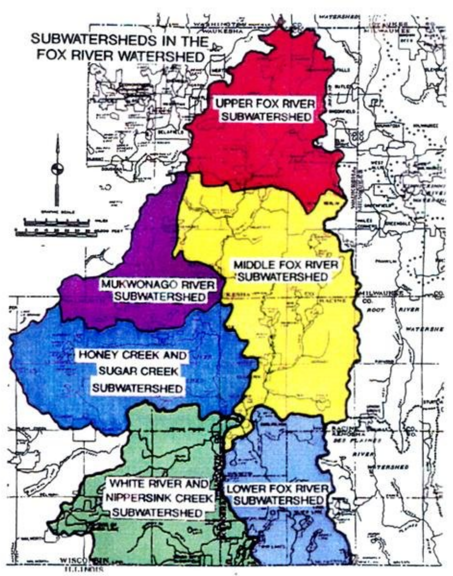
Minimum

Subwatershed Designation

- Upper Fox
- Middle Fox
- Lower Fox
- Honey/Sugar Creek
- Mukwonago River
- White/Nippersink Creek

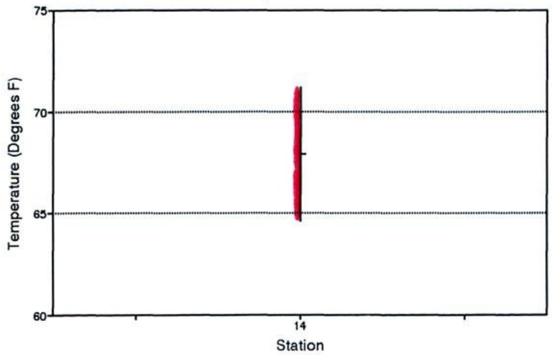
Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

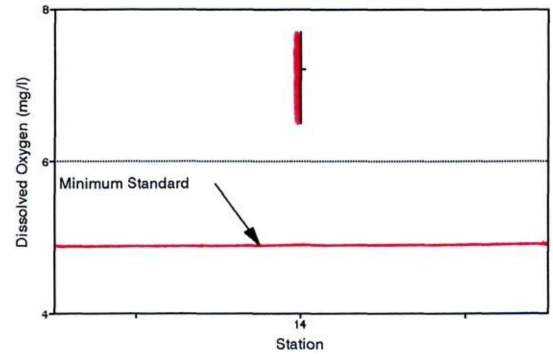


# Figure V-8
## Fox River Watershed Short-Term Water Quality Sampling Data: 1993

### Temperature

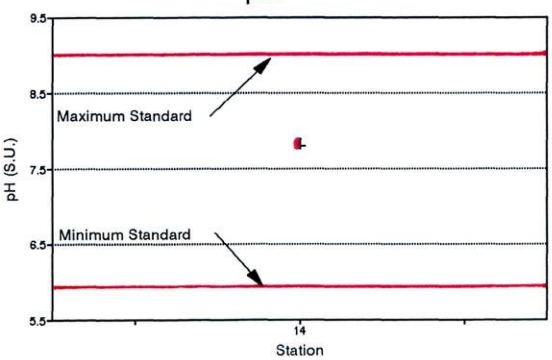



### Dissolved Oxygen

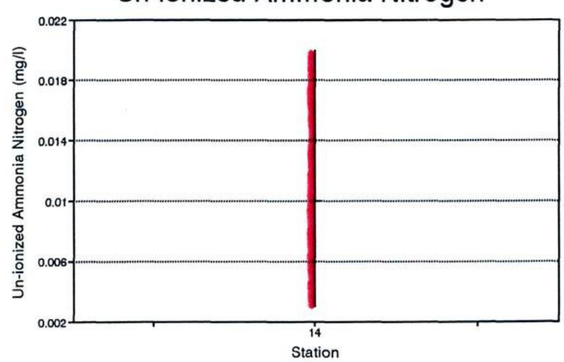



Note: The maximum standard of 89 degrees F was not violated in any year.

### pH

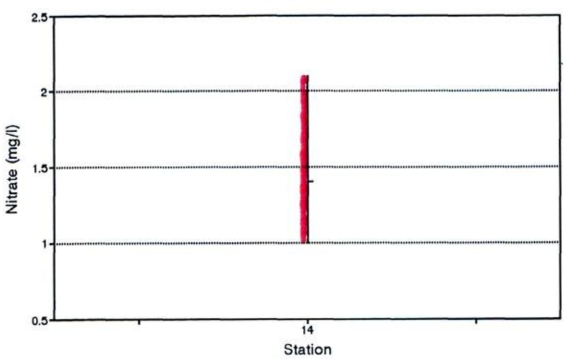



### Un-ionized Ammonia Nitrogen

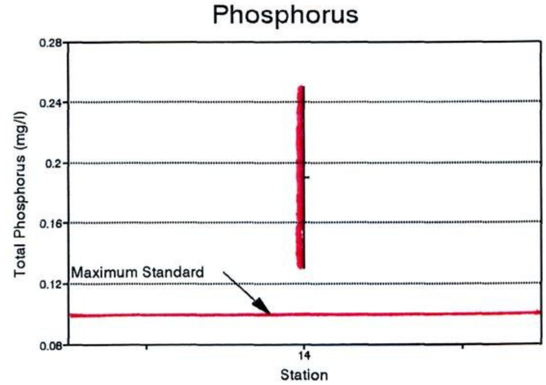



Note: The maximum standard of .04 mg/l was not violated in any sample.

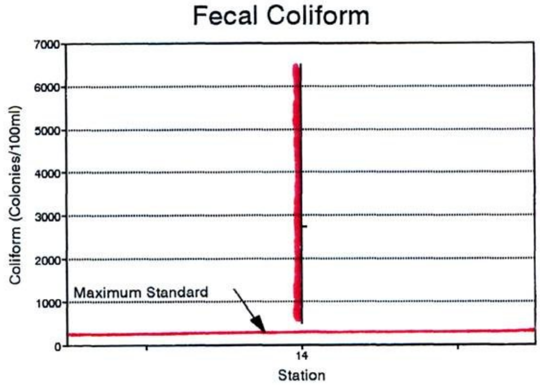
### Nitrate



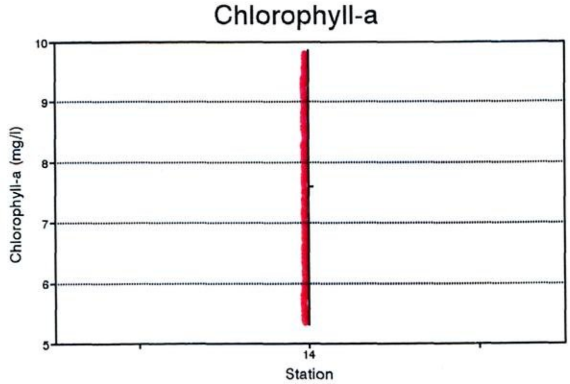

### Phosphorus




### Fecal Coliform




### Chlorophyll-a



# Figure V-8 (Cont'd)

LEGEND

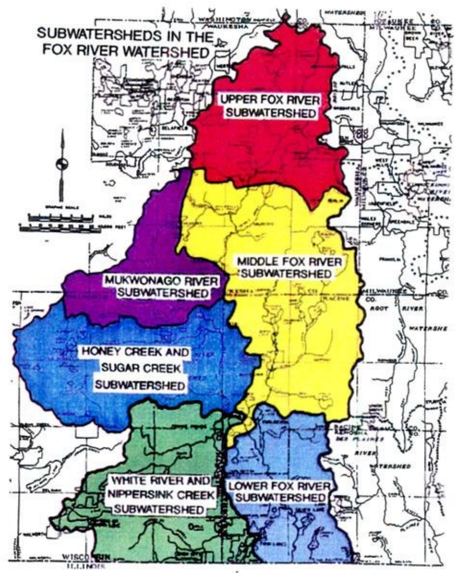
Maximum

Average

Minimum

Subwatershed Designation

- Upper Fox
- Middle Fox
- Lower Fox
- Honey/Sugar Creek
- Mukwonago River
- White/Nippersink Creek




Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table V-14

FOX RIVER WATERSHED SHORT-TERM STREAM WATER QUALITY SAMPLING DATA: 1988-1993

| Sampling Station Number and Subwatershed[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 1 MF | Temperature (°F) | Maximum of 89.0 | 68.9-84.2 | No | May-June 1988 | 3 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.09-0.15 | Yes | January-September 1988 | 13 |
| 2 MF | Temperature (°F) | Maximum of 89.0 | 36.5-82.6<br>39.2-49.1 | No<br>No | February-December 1988<br>February-April 1989 | 7<br>3 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.03-0.34<br>0.04-0.76 | Yes<br>Yes | January-December 1988<br>January-October 1989 | 31<br>20 |
| 3 MF | Temperature (°F) | Maximum of 89.0 | 33.8-82.8<br>37.4-45.5 | No<br>No | July-December 1988<br>February-April 1989 | 2<br>3 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.022-0.04<br>0.04-0.10 | No<br>Yes | January-December 1988<br>January-August 1989 | 8<br>9 |
| 4 WN | Temperature (°F) | Maximum of 89.0 | 70.0-87.4 | No | July 1988 | 2 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 4.9-11.1 | Yes | July 1988 | 2 |
| 5 MK | Temperature (°F) | Maximum of 89.0 | 45.9-86.2<br>66.9-71.8 | No<br>No | August 1988<br>July 1990 | 6<br>2 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.5-8.7 | No | August 1988 | 2 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.02-0.03 | No | June-July 1990 | 2 |
| | pH (s.u) | Maximum of 9.0;<br>Minimum of 6.0 | 7.7-8.2<br>7.83-7.93 | No<br>No | August 1988<br>June-July 1990 | 2<br>22 |
| 6 MF | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 8.3-10.7 | No | July-August 1988 | 2 |
| 7 HS | pH (s.u.) | Maximum of 9.0;<br>Minimum of 6.0 | 8.2-8.54 | No | June-July 1990 | 22 |
| | Ammonia (mg/l) | Maximum of 0.04 | 0.04-0.28 | Yes | June-July 1990 | 2 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.08-0.09 | No | June-July 1990 | 2 |
| 8 UF | Temperature (°F) | Maximum of 89.0 | 60.4-78.8 | No | August-September 1990 | 6 |
| | pH (s.u.) | Maximum of 9.0;<br>Minimum of 6.0 | 7.8-8.5 | No | August-September 1990 | 6 |

Table V-14 (continued)

| Sampling Station Number and Subwatershed[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 8 UF | Fecal Coliform (colonies per 100ml) | Maximum of 200/400 | 250-23,000 | Yes | August 1990 | 5 |
| 9 UF | Temperature (°F) | Maximum of 89.0 | 60.4-78.8 | No | August-September 1990 | 6 |
| | pH (s.u) | Maximum of 9.0; minimum of 6.0 | 7.9-8.2 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 370-23,000 | Yes | August-September 1990 | 5 |
| 10 UF | Temperature (°F) | Maximum of 89.0 | 56.5-72.9 | No | August-September 1990 | 6 |
| | pH (s.u) | Maximum of 9.0; minimum of 6.0 | 7.0-8.2 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 360-7,400 | Yes | August-September 1990 | 5 |
| 11 UF | Temperature (°F) | Maximum of 89.0 | 57.0-68.9 | No | August-September 1990 | 6 |
| | pH (s.u) | Maximum of 9.0; minimum of 6.0 | 7.7-8.2 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 170-2,300 | Yes | August-September 1990 | 5 |
| 12 UF | Temperature (°F) | Maximum of 89.0 | 54.0-68.0 | No | August-September 1990 | 6 |
| | pH (s.u) | Maximum of 9.0; minimum of 6.0 | 7.7-8.2 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100ml) | Maximum of 200/400 | 820-13,000 | Yes | August-September 1990 | 6 |
| 13 UF | Temperature (°F) | Maximum of 89.0 | 59.7-88.3 | No | August-September 1990 | 6 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 7.5-8.3 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 4,200-49,000 | Yes | August-September 1990 | 5 |
| 14 UF | Temperature (°F) | Maximum of 89.0 | 59.7-76.1<br>64.6-71.2 | No<br>No | August-September 1990<br>August-September 1993 | 6<br>2 |
| | pH (s.u.) | Maximum of 9.0; Minimum of 6.0 | 7.70-8.00<br>7.75-7.90 | No<br>No | August-September 1990<br>August-September 1993 | 6<br>2 |

Table V-14 (continued)

| Sampling Station Number and Subwatershed[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 40-11,000<br>49-6,500 | Yes<br>Yes | August-September 1990<br>August-September 1993 | 6<br>2 |
| | Nitrate (mg/l) | -- | 1.2-2.1 | -- | August-September 1993 | 3 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 6.5-7.7 | No | August-September 1993 | 2 |
| | Chlorophyll-a (mg/l) | -- | 5.3-9.8 | -- | August-September 1993 | 2 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | 0.003-0.020 | No | August-September 1993 | 3 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.13-0.25 | Yes | August-September 1993 | 3 |
| 15 UF | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 160-8,200 | Yes | August-September 1990 | 5 |
| | Temperature (°F) | Maximum of 89.0 | 56.7-77.0 | No | August-September 1990 | 7 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 7.6-8.6 | No | August-September 1990 | 7 |
| 16 UF | Temperature (°F) | Maximum of 89.0 | 55.8-87.8 | No | August-September 1990 | 6 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 7.7-8.0 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 650-5,200 | Yes | August-September 1990 | 5 |
| 17 HS | Temperature (°F) | Maximum of 89.0 | 32.0-68.0 | No | May-October 1992 | 10 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.8-15.1 | No | May-December 1992 | 10 |
| | Biological Oxygen Demand (mg/l) | -- | 1.6-5.6 | -- | May-December 1992 | 8 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 7.0-8.5 | No | May-December 1992 | 10 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.03-1.02 | Yes | May-December 1992 | 9 |
| | Chloride (mg/l) | Maximum of 1000.0 | 17.0-40.0 | No | May-December 1992 | 9 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 10-28,000 | Yes | May-December 1992 | 8 |
| | Chlorophyll-a (mg/l) | -- | 3.39-35.0 | -- | May-October 1992 | 7 |

Table V-14 (continued)

| Sampling Station Number and Subwatershed[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 18 HS | Temperature (°F) | Maximum of 89.0 | 32.7-66.4 | No | May-December 1992 | 7 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 6.0-11.9 | No | May-December 1992 | 7 |
| | Biological Oxygen Demand (mg/l) | -- | 1.4-2.7 | -- | May-December 1992 | 6 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 6.74-8.2 | No | May-December 1992 | 7 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.03-0.19 | Yes | May-December 1992 | 7 |
| | Chloride (mg/l) | Maximum of 1000.0 | 20.0-27.0 | No | May-December 1992 | 7 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 20-320 | No | May-December 1992 | 6 |
| | Chlorophyll-a (mg/l) | -- | 3.0-17.0 | -- | May-December 1992 | 7 |
| 19 HS | Temperature (°F) | Maximum of 89.0 | 32.0-69.1 | No | May-December 1992 | 11 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 5.9-14.2 | No | May-December 1992 | 11 |
| | Biological Oxygen Demand (mg/l) | -- | 1.3-3.3 | -- | May-October 1992 | 7 |
| | pH (s.u.) | Maximum of 9.0; Minimum of 6.0 | 6.7-8.4 | No | May-December 1992 | 9 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.04-0.23 | Yes | May-October 1992 | 7 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of200/400 | 30-13,000 | Yes | May-October 1992 | 8 |
| | Chromium (ug/l) | -- | 4.0-8.0 | -- | May-October 1992 | 7 |
| 20 UF | Temperature (°F) | Maximum of 89.0 | 32.7-71.8 | No | May-October 1992 | 11 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 5.1-10.6 | No | May-October 1992 | 11 |
| | pH (s.u.) | Maximum of 9.0; Minimum of 6.0 | 6.90-7.90 | No | June-December 1992 | 10 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.07-0.16<br>0.10-0.25 | Yes<br>Yes | June-November 1992<br>August-September 1993 | 7 |
| | Chloride (mg/l) | Maximum of 1000.0 | 30.0-150.0 | No | June-November 1992 | 7 |

Table V-14 (continued)

| Sampling Station Number and Subwatershed[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 20 UF | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 100-1,800 | Yes | June-November 1992 | 8 |
| | Chlorophyll-a (mg/l) | -- | 6.3-50.0 | -- | July-November 1992 | 7 |
| | Zinc (ug/l) | Chronic maximum of 89.2; acute maximum of 202.9 | 12.0-33.0 | No | July-November 1992 | 7 |
| 21 UF | Temperature (°F) | Maximum of 89.0 | 54.5-72.5 | No | August-September 1990 | 6 |
| | pH (s.u.) | Maximum of 9.0; Minimum of 6.0 | 7.7-8.3 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 260-2,900 | Yes | August-September 1990 | 6 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 6.8-10.4 | No | August-September 1990 | 6 |
| 22 UF | Temperature (°F) | Maximum of 89.0 | 34.9-71.8 | No | May-December 1992 | 12 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 6.4-13.8 | No | May-December 1992 | 12 |
| | pH (s.u.) | Maximum of 9.0; Minimum of 6.0 | 6.8-8.1 | No | May-December 1992 | 10 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.09-0.52 | Yes | May-December 1992 | 9 |
| | Chloride (mg/l) | Maximum of 1000.0 | 110.0-300.0 | No | May-December 1992 | 9 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 50-72,000 | Yes | May-December 1992 | 5 |
| | Chlorophyll-a (mg/l) | -- | 3.39-104.00 | -- | May-December 1992 | 9 |
| | Chromium (ug/l) | -- | 3.0-7.0 | -- | May-December 1992 | 9 |
| | Zinc (ug/l) | Chronic maximum of 89.2; acute maximum of 202.9 | 12.0-91.0 | Yes (chronic) | May-December 1992 | 9 |
| | Copper (ug/l) | Chronic maximum of 22.1; acute maximum of 31.9 | 4.0-12.0 | No | May-December 1992 | 9 |
| 23 UF | Temperature (°F) | Maximum of 89.0 | 57.2-72.5 | No | August-September 1990 | 6 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 7.6-8.3 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 110-2,300 | Yes | August-September 1990 | 6 |

Table V-14 (continued)

| Sampling Station Number and Subwatershed[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 23 UF | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 5.7-12.2 | No | August-September 1990 | 6 |
| 24 UF | Temperature (°F) | Maximum of 89.0 | 56.9-71.6<br>33.3-66.0 | No<br>No | August-September 1990<br>May-December 1992 | 6<br>10 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 7.8-8.3<br>6.8-8.1 | No<br>No | August-September 1990<br>May-December 1992 | 6<br>10 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 5.7-11.3<br>6.4-18.2 | No<br>No | August-September 1990<br>May-December 1992 | 6<br>10 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.04-0.27 | Yes | May-December 1992 | 9 |
| | Chloride (mg/l) | Maximum of 1000.0 | 88.0-170.0 | No | May-December 1992 | 8 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 100-4,300 | Yes | May-December 1992 | 9 |
| | Zinc (ug/l) | Chronic maximum of 89.2; acute maximum of 202.9 | 12.0-30.0 | No | May-December 1992 | 9 |
| | Copper (ug/l) | Chronic maximum of 22.1; acute maximum of 31.9 | 5.0-19.0 | No | May-December 1992 | 9 |
| 25 UF | Temperature (°F) | Maximum of 89.0 | 59.5-77.0 | No | August-September 1990 | 6 |
| | pH (s.u.) | Maximum of 9.0; minimum of 6.0 | 7.8-8.2 | No | August-September 1990 | 6 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 140-5,900 | Yes | August-September 1990 | 6 |

[a]Subwatershed codes are as follows: UF=Upper Fox, MF= Middle Fox, LF=Lower Fox, MK=Mukwonago River, HS=Honey/Sugar Creek, WN=White/Nippersink Creeks; see map V-6 for detailed locations.

[b]Standards indicated are those established for warmwater sport fish and full recreational use objectives. See Chapter II for relationships of these objectives and standards to current Wisconsin Department Of Natural Resources stream classifications and water quality criteria.

The remaining water quality data collected on a short-term basis throughout the watershed do not illustrate trends. However, these data do illustrate that the phosphorus standards are exceeded in the Upper and Middle Fox River and Honey/ Sugar Creek systems.

Toxic and Hazardous Substances: No known stream water or bottom sediment sampling for toxic and hazardous materials had been available for use in preparing the initial regional water quality management plan. Recent data on toxic and hazardous substances in the Fox River were collected by the Wisconsin Department of Natural Resources and the U.S. Geological Survey at stations Fx-7 and Fx-27a, respectively, as shown in Figures V-1 and V-3. These data indicate that levels of lead occasionally violated chronic toxicity level standards as established by the Wisconsin Department of Natural Resources for stations Fx-7 and Fx-27a. Levels of zinc and cadmium occasionally violated chronic toxicity level standards for station Fx-27a and levels of copper violated chronic and acute toxicity standards at station Fx-27a on one occasion.

In 1979, bottom sediment sampling was conducted by the Wisconsin Department of Natural Resources for three locations in the Fox River watershed. Results indicated that sediments within Honey Creek downstream of East Troy were moderately polluted by iron and heavily polluted by chromium and nickel. Fox River sediments in the City of Waukesha were moderately polluted by lead, zinc, iron, and nickel, and heavily polluted by copper.

Post-1976 data on toxic and hazardous substances present in stream sediments in the Fox River were collected by the Wisconsin Department of Natural Resources as part of the water quality appraisals for the Upper Fox River priority watershed plan and by the Regional Planning Commission in the Middle Fox River as part of a water level management plan refinement.[39] Data collected in 1993 at ten locations in the Upper Fox River subwatershed and seven locations in the Middle Fox River subwatershed indicated the presence of polycyclic aromatic hydrocarbons (PAHs) at 14 of the sampling stations, and polychlorinated biphenyls (PCBs) at six of the sampling stations as set forth in Table V-15. Higher levels of PAHs than stated in the lowest effect level (LEL) guidelines set forth in the draft screening criteria proposed by the Wisconsin Department of Natural Resources[40] were recorded in those sediments sampled in the Fox River downstream of IH 94, while higher levels of PCBs were observed in those sediments sampled in the Fox River and tributaries in the City of Waukesha. The data also indicated higher levels of heavy metals in the aforementioned river and tributary reaches than those levels recorded at other sampling stations. Concentrations of most metals included in the screening criteria also exceeded the Lowest Effect Level guidelines downstream of IH-94. Oil and grease concentrations also exceeded the LEL at four locations in the Middle Fox River downstream of IH 43, as set forth in Table 15. Copper concentrations exceeded the Severe Effect Level (SEL) guidelines at the Barstow Impoundment Recreational Center, Main Street and River Avenue, and in the Waterford Impoundment. Chromium concentrations exceeded the

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[39]SEWRPC Community Assistance Planning Report No. 5, Drainage and Water Level Control Plan for the Waterford-Rochester-Wind Lake Area of the Lower Fox River Watershed, May 1975.

[40]Wisconsin Department of Natural Resources, (Draft) Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System, June 1994.

Table V-15

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES
IN THE FOX RIVER WATERSHED: 1993-1994

| Substances Sampled | Sampling Stations-Upper Fox River Subwatershed | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fox River Main Stem | | | | | Fox River Tributaries at Frame Park | | Fox River Tributaries | | |
| | CTH Y | Springdale Road | Sunset Drive | Barstow Impoundment-Boat Landing | Barstow Impoundment-Recreation Center | Arcadian Avenue | Main Street | Deer Creek at IH 94 | Poplar Creek at Barker Road | Poplar Creek Tributary at CTH Y |
| Heavy Metals (mg/kg) | | | | | | | | | | |
| Arsenic . . . . . . . . . | 2.76 | 5.66 | 10.0 | 12.3 | 14.7 | 9.73 | 8.63 | 5.15 | 9.02 | 7.06 |
| Cadmium . . . . . . . . . . | 0.73 | 1.01 | 1.11 | 1.45 | 1.07 | 1.92 | 4.49 | 1.38 | 0.77 | 0.59 |
| Chromium . . . . . . . . . | 19.0 | 15.0 | 32.0 | 26.0 | 24.0 | 74.0 | 150.0 | 39.0 | 13.0 | 9.0 |
| Copper . . . . . . . . . . | 20.0 | 20.0 | 50.0 | 66.0 | 160.0 | 93.0 | 110.0 | 61.0 | 19.0 | 19.0 |
| Lead . . . . . . . . . . . | 17.0 | 19.0 | 26.0 | 68.0 | 46.0 | 110.0 | 290.0 | 53.0 | 23.0 | 24.0 |
| Mercury . . . . . . . . . . | 0.08 | 0.12 | 0.31 | 0.19 | 0.18 | 0.06 | 1.1 | 0.22 | 0.05 | 0.05 |
| Nickel . . . . . . . . . . | 13.0 | 12.0 | 15.0 | 19.0 | 22.0 | 120.0 | 150.0 | 22.0 | 12.0 | 10.0 |
| Zinc . . . . . . . . . . . | 120.0 | 94.0 | 170.0 | 200.0 | 180.0 | 280.0 | 350.0 | 260.0 | 96.0 | 120.0 |
| Total Polycyclic Aromatic Hydrocarbons (μg/kg) | 0.70 | 1.12 | 59.2 | 28.7 | 17.6 | -- | 11.0 | 34.5 | 1.6 | -- |
| Total Polychlorinated Biphenyls (μg/kg) | -- | -- | 150 | 50 | -- | 630 | 740 | -- | 240 | 160 |

Source: Wisconsin Department of Natural Resources

Table V-15 (continued)

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES
IN THE FOX RIVER WATERSHED: 1993-1994

| Substances Sampled | Sampling Stations-Middle Fox River Subwatershed | | | | | | |
|---|---|---|---|---|---|---|---|
| | Fox River Main Stem | | | | | | |
| | IH 43 | Center Road | East Troy Railroad | CTH LL | River Avenue | Edgewood Golf Course | Waterford Impoundment |
| Heavy Metals (mg/kg) | | | | | | | |
| Arsenic | 1.7 | 5.66 | 10.0 | 12.3 | 14.7 | 9.73 | 8.63 |
| Cadmium | 2.0 | 1.01 | 1.11 | 1.45 | 1.07 | 1.92 | 4.49 |
| Chromium | 10.0 | 15.0 | 32.0 | 26.0 | 24.0 | 74.0 | 150.0 |
| Copper | 6.0 | 20.0 | 50.0 | 66.0 | 160.0 | 93.0 | 110.0 |
| Lead | 13.0 | 19.0 | 26.0 | 68.0 | 46.0 | 110.0 | 290.0 |
| Mercury | 0.0 | 0.12 | 0.31 | 0.19 | 0.18 | 0.06 | 1.1 |
| Nickel | 6.0 | 12.0 | 15.0 | 19.0 | 22.0 | 120.0 | 150.0 |
| Zinc | 26.0 | 94.0 | 170.0 | 200.0 | 180.0 | 280.0 | 350.0 |
| Total Polycyclic Aromatic Hydrocarbons (μg/kg) | 45 | 48 | 148 | 50 | 7 | 0.0 | 80 |
| Total Polychlorinated Biphenyls (mg/kg) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Aldrin (μg/kg) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Chlordane | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total DDT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| op+pp DDT | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| pp DDD | -- | -- | -- | -- | -- | -- | -- |
| pp DDE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Mirex | -- | -- | -- | -- | -- | -- | -- |
| TCDD | -- | -- | -- | -- | -- | -- | -- |
| $NH_3$-N (mg/kg) | -- | -- | -- | -- | -- | -- | -- |
| O&G (mg/kg) | 15,900.0 | 360.0 | 1100.0 | 850.0 | 1,200.0 | 560.0 | 1,400.0 |
| CN (mg/kg) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

NOTE: Values recorded as 0.0 are below sthe limit of detection.

Source: Wisconsin Department of Natural Resources and SEWRPC.

SEL at Main Street and in the Waterford Impoundment. Lead and nickel concentrations exceeded the SEL in the Fox River Tributary at Frame Park and in the Waterford Impoundment. Sampling station locations are shown on Map V-6.

Surface water quality sampling data of non-agricultural volatile and semivolatile organic chemicals in the Fox River were collected by the U.S. Geological Survey in 1988.[41] The data were collected from one station on the Fox River near the Village of Big Bend, as indicated on Map V-6. Results of the analysis indicated that all of the chemicals sampled for were at concentrations below the minimum detection levels established for each chemical. Where toxicity criteria had been developed by the U.S. Environmental Protection Agency for selected chemicals, it should be noted that sampled concentrations were well below the levels of toxicity.

Since the completion of the initial regional water quality management plan, 15 spills of toxic substances into streams within the Fox River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, nine have occurred in the main stem of the Fox River, five in the City of Waukesha, two in the City of Burlington, and two in the Village of Waterford. The remaining spills have occurred in tributaries of the Fox River, including the White and Pewaukee Rivers, and Honey, Deer, Pebble, and Spring Creeks. The majority of the substances that were spilled into surface waters were gasoline or related petroleum products.

Water Quality Assessments: Based upon the recent available data, the water quality and biological characteristics of the Fox River and its major tributaries were assessed, with the results set forth in Table V-16. Fish populations and diversity range from fair to good throughout. The portions of Genesee Creek above STH 59, and Potawatomi and Van Slyke Creeks support Class I trout fisheries. A 2.5-mile reach of Genesee Creek immediately downstream of STH 59, and Southwick and Spring Brook Creeks support Class II trout fisheries.

Fish kills were documented in three streams in the Fox River watershed - Muskego Canal, Pebble Brook, and the Fox River main stem in the City of Waukesha. Fish kills are primarily related to seasonal fluctuations in water temperature and levels of dissolved oxygen as well as spawning activity. The specific causes and severity of each documented fish kill is shown in Table V-16.

Standards were not fully met for dissolved oxygen concentrations and fecal coliforms in the majority of the streams in the Upper Fox River subwatershed and in the Honey/Sugar Creeks subwatershed. In addition, fecal coliform levels exceeded the standard in the Fox River from the confluence with Pebble Creek to IH 43 and from Echo Lake to the State line; and in the majority of the stream reaches in the White River/Nippersink Creek subwatershed. Problems with phosphorus concentrations were also estimated to exceed standards in parts of the Upper Fox River subwatershed, in the Lower Fox River, and in Honey Creek.

Metals concentrations which exceeded standards set forth in Chapter II were identified during a 1989 sampling survey conducted by consultants for the City

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[41]U.S. Geological Survey, "Surface Water Quality Assessment of the Upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Data on Man-made Non-agricultural Volatile and Semivolatile Organic Chemicals in Water, May 1988 through March 1990," Open-File Report 92-46F, 1993.

Table V-16

**CHARACTERISTICS OF STREAMS IN SUBWATERSHEDS WITHIN THE FOX RIVER WATERSHED**

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| FOX RIVER UPPER | | | | | | | | | | | |
| a. Fox River u/s Mill Road | 5.2 | Fair | No | Yes | No | No | Yes | -- | Fair | Moderate (sand and silt) | Major |
| b. Fox River d/s Mill Road to Sussex Creek inflow | 4.7 | Fair | No | Yes | No | No | Yes | -- | Fair | Moderate (sand and silt) | Major |
| c. Sussex Creek | 7.7 | Fair | No | Yes | No | Yes | Yes | -- | Very poor | High (cobble, gravel, sand) | Moderate |
| d. Fox River d/s Sussex Creek to Watertown Road | 6.8 | Fair | No | Yes | No | Yes | Yes | -- | Fair | Moderate (cobble, gravel, silt) | Moderate |
| e. Fox River d/s Watertown Road to Prairie Avenue | 4.4 | Fair | Yes[e] | Yes | No | Yes | Yes | Yes | Fair[f] | Moderate (boulders, rubble, gravel, sand) | Major |
| f. Fox River d/s Prairie Ave. to Pebble Creek inflow | 2.7 | Fair | No | Yes | No | Yes | Yes | -- | Fair[f] | Moderate (boulders, rubble, gravel, sand) | Moderate |
| g. Deer Creek | 7.0 | Fair | No | Yes | No | Yes | Yes | -- | Fair | High (clay, silt and concrete) | Moderate |
| h. Pebble Creek and Brandy Brook) | 6.8 | Fair | No | Yes | No | No | Yes | -- | Fair | Moderate (sand, cobble, gravel, and silt) | High |
| i. Poplar Creek | 7.0 | Fair | No | Yes | No | Yes | Yes | No | Fair[f] | High (sand and gravel) | Moderate |
| j. Pewaukee River | 7.5 | Good | No | Yes | No | No | Yes | No | Poor | High (cobble and gravel) | Moderate |
| TOTAL | 59.8 | | | | | | | | | | |

Table V-16 (continued)

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[1] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| FOX RIVER MIDDLE | | | | | | | | | | | |
| a. Fox River d/s Pebble Creek inflow to I-43 | 13.3 | Fair to good | No | No | No | Yes | Yes | -- | -- | Moderate (silt and sand) | None |
| b. Fox River d/s I-43 to Waterford Impoundment | 13.7 | Fair to good | No | No | No | No | No | -- | -- | Moderate (silt and sand) | Moderate |
| c. Fox River d/s Waterford Impoundment to Echo Lake inflow | 10.6 | Fair to good | No | Yes | No | No | No | -- | -- | Low to moderate (silt and sand) | Moderate |
| d. Fox River d/s Echo Lake inflow to Spring Brook inflow | 1.3 | Fair | No | No | No | No | No | -- | -- | Moderate (sand and silt) | Low |
| e. Muskego Canal | 2.4 | -- | Yes[g] | No | No | Yes | No | -- | -- | High (silt and sand) | Major |
| f. Wind Lake Drainage Canal | 12.8 | -- | No | No | No | No | No | -- | -- | High (silt and sand) | Major |
| g. Genesee Creek and Spring Creek | 11.2 | Good[h] | No | No | No | No | No | -- | -- | Low to moderate (silt) | Low |
| h. Eagle Creek | 5.5 | -- | No | No | No | No | Yes | -- | -- | Low to moderate (silt) | Low |
| i. Pebble Brook, Mill Brook, and Mill Creek | 13.7 | Good | Yes | Yes | No | No | Yes | -- | -- | Low to moderate (silt, gravel, sand) | Low |
| TOTAL | 84.5 | | | | | | | | | | |
| FOX RIVER LOWER | | | | | | | | | | | |
| a. Fox River d/s Spring Brook Creek inflow to CTH JB | 9.8 | Fair | No | No | No | Yes | Yes | -- | -- | Moderate (sand and silt) | Low |
| b. Fox River d/s CTH JB to State Line | 14.1 | Fair | No | No | No | Yes | Yes | Yes | -- | Moderate (sand and silt) | Low |
| c. Hoosier, Palmer, and Peterson Creeks | 21.8 | Fair[i] | No | -- | -- | -- | -- | -- | -- | Moderate (silt) | Moderate |
| d. Bassett Creek | 5.1 | Fair | No | No | No | No | No | -- | -- | Moderate (silt and sand) | Low |
| e. New Munster Creek | 4.7 | -- | No | No | No | No | No | -- | -- | Moderate (sand and silt) | Low |
| TOTAL | 55.5 | | | | | | | | | | |
| HONEY/SUGAR CREEKS | | | | | | | | | | | |
| a. Honey Creek and Spring Creek | 34.8 | Honey Creek -fair | No | Yes | No | Yes | Yes | -- | -- | High (silt) | Moderate |
| b. Sugar Creek and Spring Brook Creek | 34.1 | Fair[j] | No | Yes | No | Yes | Yes | -- | -- | Moderate (sand and silt) | Moderate |
| TOTAL | 68.9 | | | | | | | | | | |

Table V-16 (continued)

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[l] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| MUKWONAGO RIVER | | | | | | | | | | | |
| a. Mukwonago River u/s Eagle Spring Lake | 6.3 | Good | No | No | No | No | No | -- | -- | Moderate (silt and sand) | None |
| b. Mukwonago River d/s Eagle Spring L. to Phantom Lakes | 9.7 | Good | No | No | No | No | No | -- | -- | Low (sand and silt) | None |
| c. Mukwonago River d/s Phantom Lakes | 2.3 | Good | No | No | No | No | No | No | Excellent | Low (sand, silt) | None |
| d. Jericho Creek | 6.9 | Fair | No | No | No | No | No | -- | -- | Low (silt, sand) | None |
| TOTAL | 25.2 | | | | | | | | | | |
| WHITE RIVER/NIPPERSINK CREEK | | | | | | | | | | | |
| a. White River | 22.5 | Fair to good | No | No | No | No | Yes | -- | -- | Low to moderate (sand and silt) | Moderate |
| b. Como Creek | 3.6 | -- | No | No | No | No | Yes | -- | -- | -- | Moderate |
| c. Ore Creek | 11.5 | -- | No | No | No | No | Yes | -- | -- | Moderate (sand, silt) | Moderate |
| d. Lake Ivanhoe outlet | 8.4 | -- | No | No | No | No | Yes | -- | -- | Light (sand) | Low |
| e. Nippersink Creek | 21.6 | -- | No | No | No | No | Yes | -- | -- | Moderate (sand and silt) | Moderate |
| f. Potawatomi, Van Slyke, and Southwick Creeks | 3.1 | Good[k] | No | -- | -- | -- | -- | -- | -- | Moderate (sand and silt) | None |
| TOTAL | 70.7 | | | | | | | | | | |

[a]Based upon stream appraisal documentation set forth in the November 1993 Upper Fox River Priority Watershed Plan and professional judgement of area fish managers.
[b]Unless otherwise noted, fish kills are assumed to be the result of natural fluctuations in water conditions.

[c]The most recent water quality data available as described in Figures V-1 through V-10 were used to evaluate water quality in the Fox River system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for Fox River watershed stream reaches based upon simulated year 2000 land use conditions and current level of pollutant control, if appropriate.

[d]Except where otherwise indicated, biotic index ratings are based upon the Index of Biotic Integrity (IBI) discussed in U.S. Department of Agriculture, Forest Service, General Technical Report NC-149, "Using the Index of Biotic Integrity (IBI) To Measure Environmental Quality in Warmwater Streams of Wisconsin," Lyons, April 1992.

[e]Undetermined cause.

[f]Biotic index rating is based upon the Hilsenhoff Biotic Index (HBI) discussed in Wisconsin Department of Natural Resources Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality in Streams," Hilsenhoff, 1982.

[g]Due to decreased water discharge from dam.
[h]Genesee Creek is a Class I trout stream upstream of STH 59, and a Class II trout stream downstream of STH 59.
[i]Palmer Creek is a Class III trout stream.
[j]Spring Brook Creek is a Class II trout stream.
[k]Potawatomi and Van Slyke Creeks are Class I trout streams. Southwick Creek is a Class II trout stream.
[l]Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

of Waukesha at locations both upstream and downstream of the Waukesha sewage treatment plant. The metals concentrations were variable and exceeded the standards for chromium, lead, and zinc on occasions. Only limited data were available on water column toxic pollutants at additional locations in the watershed, as noted in Table V-16. Additional data collected by the U. S. Geological Survey at station Fx-27a suggest that the standards for toxicity for copper and zinc have been occasionally exceeded only on very limited occurrences and generally metal concentrations appear to be within the acceptable levels, as defined in Chapter II.

The biotic index ratings, which are biological indicators of water quality within a stream system, were fair except for Pewaukee River which had a poor rating, Sussex Creek which had a very poor rating, and Mukwonago River downstream of Phantom Lakes which had an excellent rating. High levels of streambed sedimentation were noted in selected sections of the Fox River between IH 43 and the Waterford Impoundment, the upper reaches of the Pewaukee River, Poplar Creek, Honey Creek, Sussex Creek, Deer Creek, and in the Wind Lake and Muskego Canals. Elsewhere, the levels were generally low to moderate.

Table V-17 sets forth water quality index classifications[42] used in the initial plan for 1964, 1974-75, and for 1990-92 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table V-17, recent comparative water quality data were available for four stations on the Fox River main stem; one in the City of Waukesha, Fx-7; one just downstream of the City of Waukesha, Fx-10; one just upstream of the Village of Big Bend, Fx-13; and one just downstream of the Wisconsin-Illinois State Line, Fx-27a; and for four stations on tributaries of the Fox River: two on the Pewaukee River, one on Poplar Creek, and one on Honey Creek. These stations and additional locations where water quality data were collected by the Wisconsin Department of Natural Resources are shown on Map V-6. The data obtained for USGS sampling station Fx-27a, just downstream of the Wisconsin-Illinois State Line, were used for comparative purposes in conjunction with earlier data from station Fx-27, located on the Fox River just upstream of the State line. The limited data available indicate that water quality conditions from 1974-75 through 1990-92 have remained "fair" at stations Fx-6, Fx-7, and Fx-10, and have remained "good" at stations Fx-13 and Fx-27. Improvements in water quality conditions were indicated at station Fx-5 from where the classification was "poor" in 1974-75 and was "fair" in 1990-92. These improvements can be attributed, in part, to the abandonment of the Village of Pewaukee sewage treatment plant which occurred in 1981. Water quality improvements from a classification of "fair" in 1974-75 to "good" in 1990-92 were also noted at station Fx-21, located downstream of the Village of East Troy sewage treatment plant which was upgraded in 1982. Water quality conditions at station Fx-3 on Poplar Creek decreased from "fair" to "poor" from 1974-75 to 1990-92, most likely as a result of increased urban development and associated construction site erosion in the tributary area.

A summary of potential pollution sources in the Fox River watershed by stream reach is shown in tabular summary in Table V-18. Review of the data indicate the majority of the conversion of lands from rural to urban uses has occurred in

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[42]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table V-17

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS
OF THE FOX RIVER WATERSHED 1964, 1974-1975, AND 1990-92

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, and September 1990-1992 |
|---|---|---|---|
| Main Stem Stations | | | |
| Fx-1 | Fair | Fair | -- |
| Fx-4 | Poor | Fair | -- |
| Fx-7 | Fair | Fair | Fair |
| Fx-8 | Poor | Fair | -- |
| Fx-9 | Poor | Fair | -- |
| Fx-10 | Poor | Fair | Fair |
| Fx-11 | Fair | Fair | -- |
| Fx-13 | Good | Good | Good[b] |
| Fx-14 | Good | Good | -- |
| Fx-17 | Good | Good | -- |
| Fx-24 | Fair | Fair | -- |
| Fx-27 | Good | Good | Good |
| Tributary Stations | | | |
| Fx-2 | Fair | Fair | -- |
| Fx-3 | Fair | Fair | Poor |
| Fx-5 | Poor | Poor | Fair |
| Fx-6 | Good | Fair | Fair |
| Fx-12 | Excellent | Excellent | -- |
| Fx-15 | Poor | Fair | -- |
| Fx-16 | Good | Good | -- |
| Fx-18 | Fair | Fair | -- |
| Fx-19 | Fair | Fair | -- |
| Fx-20 | Fair | Fair | -- |
| Fx-21 | Good | Fair | Good |
| Fx-22 | Good | Good | -- |
| Fx-23 | Good | Fair | -- |
| Fx-25 | Poor | Fair | -- |
| Fx-26 | Fair | Fair | -- |
| Fx-28 | Good | Fair | -- |
| Watershed Average | Fair | Fair | Fair |

[a]See Map V-6 for sampling station locations.

[b]Recent short-term water quality data available for these stations were used to calculate 1990-1992 water quality indices.

Source: SEWRPC.

Table V-18

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE FOX RIVER WATERSHED: 1990

| Subwatershed Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| **UPPER FOX RIVER** Fox River upstream Mill Road | insignificant | insignificant | -- | x | x | -- | -- | -- | Industrial Waste Corp. landfill (abandoned) | | 1,2 |
| Fox River downstream Mill Road to Sussex Creek inflow | insignificant | insignificant | -- | x | x | -- | -- | -- | Martha Zaretzke landfill[e] (inactive)<br>Mill Lands, Inc. landfill (abandoned)<br>Unnamed landfills in Village of Menomonee Falls, Sec. 30 (inactive) and Sec. 28 (inactive) | Willow Springs Mobile Home Park private sewage treatment plant recommended for abandonment | 1,2 |
| Sussex Creek | significant | insignificant | -- | x | x | 1 | -- | 2 | Milwaukee Road landfill (inactive)<br>Vulcan Materials landfill (inactive) | | 1,2 |
| Fox River d/s Sussex Creek to Watertown Road | moderate | moderate | -- | x | x | 1 | -- | 3 | Unnamed landfill in City of Brookfield Sec. 17 (inactive)<br>Master Disposal Sanitary Landfill[f] (inactive)<br>Fly ash disposal site in City of Brookfield Sec. 5 (inactive) | | 1,2,3 |
| Fox River d/s Watertown Road to Prairie Avenue (Waukesha) | moderate[d] | moderate[d] | 1978 - gasoline<br>1984 - petroleum product<br>1986 - unknown<br>1988 - unknown<br>1988 - petroleum | x | -- | 1 | -- | 14 | Johnson Sand and Gravel landfill (abandoned)<br>Unnamed Landfill Town of Waukesha, Sec. 1 (abandoned) | | 1,2 |
| Fox River d/s Prairie Avenue to Pebble Creek inflow | moderate[d] | moderate[d] | -- | x | -- | -- | -- | 3 | City of Waukesha sanitary landfill (abandoned) | | 1,2,3 |
| Deer Creek | moderate[d] | significant[d] | -- | x | -- | -- | -- | 5 | -- | City of New Berlin-Regal Manor private sewage treatment plant abandoned in 1984. | 1,2 |

Table V-18 (continued)

| Subwatershed Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b]: Historical 1976-1990 | Extent of Conversion of Lands from Rural to Urban[b]: Expected 1990-2010 | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources: Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pebble Creek and Brandy Brook | significant | moderate | -- | x | x | -- | -- | 1 | -- | | 1,2 |
| Poplar Creek | significant | moderate | -- | x | x | -- | 1 | 2 | United Waste Systems Landfill (abandoned)<br>Bodus Landfill (abandoned)[h]<br>Industrial Waste Corp. landfill (active) | Cleveland Heights Elementary School private sewage treatment plant abandoned in 1986<br>New Berlin-West High School private sewage treatment plant recommended for abandonment | 1,2 |
| Pewaukee River | significant | moderate | 1984 - unknown<br>1986 - oil | x | x | -- | -- | 4 | -- | Village of Pewaukee public sewage treatment plant abandoned in 1981 | 1,2 |
| **MIDDLE FOX RIVER**<br>Fox River d/s Pebbel Creek inflow | moderate | significant | -- | x | x | -- | -- | 3 | | | 2 |
| Fox River d/s IH 43-Waterford Impoundment | insignificant | significant | -- | -- | x | -- | -- | -- | | | 2 |
| Fox River d/s Waterford Impoundment to Echo Lake inflow | insignificant | significant | 1978-Kerosene Solvent<br>1990-Diesel Fuel | x | x | -- | -- | -- | | | -- |
| Fox River d/s Echo Lake Inflow to Spring Brook inflow | insignificant[d] | | 1978-Oil<br>1990-Petroleum Product | x | x | 1 | 1 | 4 | | Packaging Corporation of America private sewage treatment plant recommended for abandonment | -- |
| Muskego Canal | moderate | significant | -- | -- | x | -- | -- | 2 | | | 2,4 |
| Wind Lake Drainage Canal | insignificant | insignificant | -- | -- | x | 1 | 1 | 1 | West Shore Pipeline Company-Broken pipeline remediation efforts permitted to discharge treated wastewater to Wind Lake Drainage Canal Tributary | | 2,4 |

Table V-18 (continued)

| **Subwatershed** Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] Historical 1976-1990 | Expected 1990-2010 | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources: Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Genesee Creek and Spring Creek | major | moderate | -- | -- | x | -- | -- | -- | | | 2 |
| Eagle Creek | insignificant | insignificant | -- | -- | x | 1 | -- | -- | | | -- |
| Pebble Brook, Mill Brook, and Mill Creek | major | moderate | -- | x | x | -- | -- | 1 | | | 2 |
| **LOWER FOX RIVER** Fox River d/s Spring Brook Creek to CTH JB | insignificant | significant | -- | x | x | -- | -- | 2 | | | 2 |
| Fox River d/s CTH JB to State Line | insignificant | moderate | -- | -- | x | 2 | 1 | -- | | | 2 |
| Hoosier, Palmer and Peterson Creeks | insignificant | insignificant | -- | -- | x | -- | 1[g] | 2 | | | 2 |
| Bassett Creek | significant | significant | -- | -- | x | 1 | -- | -- | | | 2 |
| New Munster Creek | insignificant | insignificant | -- | -- | x | -- | -- | -- | | | 2 |
| **MUKWONAGO RIVER** Mukwonago River u/s of Eagle Spring Lake | insignificant | insignificant | -- | -- | x | -- | -- | -- | | | 2 |
| Mukwonago River Eagle Spring Lake to Phantom Lakes | significant | significant | -- | -- | x | -- | 1 | -- | | Classified as an Exceptional Resource Water<br>Rainbow Springs private sewage treatment is currently not in operation | 2 |
| Mukwonago River d/s Phantom Lakes | significant | significant | -- | x | x | 1 | -- | -- | | | 2 |
| Jericho Creek | major | significant | -- | -- | x | -- | -- | -- | | | 2 |

Table V-18 (continued)

| Subwatershed Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| **HONEY/SUGAR CREEKS** Honey Creek | insignificant | significant | -- | x | x | 1 | -- | 4 | Leaking Underground Storage Tank site permitted to discharge remediation wastewater to Honey Creek | | 2 |
| Sugar Creek and Spring Brook Creek | insignificant | insignificant | -- | -- | x | -- | 1 | -- | | | 2 |
| **WHITE RIVER / NIPPERSINK CREEK** White River | insignificant | significant | 1984-Gas-oil mixture 1988-Diesel fuel 1986-Gasoline | x | x | 2 | 1 | 1 | | | 2 |
| Como Creek | insignificant | significant | -- | x | x | -- | -- | -- | | | 2 |
| Ore Creek | insignificant | significant | -- | -- | x | -- | -- | -- | | Country Estates mobile home park private sewage treatment plant abandoned in 1988 | 2 |
| Lake Ivanhoe Outlet | insignificant | insignificant | -- | -- | x | -- | -- | -- | | | 2 |
| Nippersink Creek | insignificant | significant | -- | -- | x | 1 | 1 | 1 | | Wisconsin Dairies Cooperative private sewage treatment plant was abandoned in 1979 | 2 |
| Potawatomi, Van Slyke and Southwick Creeks | significant | significant | -- | x | x | -- | -- | 1 | | | 2 |

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] Letter codes refer to the following ongoing pollution abatement efforts:

1. Upper Fox River Priority Watershed Nonpoint Source Plan Implementation Underway
2. Construction Erosion Control Ordinances in place
3. Sewage Treatment Plant Upgrading Underway
4. Muskego-Wind Lakes Priority Watershed Nonpoint Source Plan Implementation Underway

Footnotes continue.

Table V-18 (continued)

[d] Considerable urban development existing pre-1976.

[e] Landfill identified for State action.

[f] Superfund site

[g] The private sewage treatment plant serving the Bong Recreational Area is located in the Des Plaines River watershed. Treated effluent from the plant is discharged to Peterson Creek in the Fox River watershed.

[h] Bodus landfill was determined to have collected mixed industrial wastes during its operation and is considered by the U.S. Environmental Protection Agency to have potentially accepted hazardous wastes.

Source: Wisconsin Department of Natural Resources and SEWRPC.

the Upper Fox River and Mukwonago River subwatersheds. It should also be noted that a majority of the documented spills of toxic substances and the majority of the permitted industrial discharges have occurred in streams in the Upper Fox and Middle Fox River subwatersheds. Data on nonpoint source pollution, public and private sewage treatment plants discharging to surface waters, and additional potential impacts to surface water quality are included in Table V-18.

Lakes
Lake water quality data available for use in preparing the initial regional water quality management plan were obtained from the Wisconsin Department of Natural Resources quarterly lake monitoring program for selected lakes; U.S. Environmental Protection Agency (EPA) national eutrophication survey--reports on Browns Lake, Como Lake, Geneva Lake, Middle Lake, Pewaukee Lake, and Tichigan Lake; and Southeastern Wisconsin Regional Planning Commission and Wisconsin Department of Natural Resources lake use reports. Post-1975 data on phosphorus and chlorophyll concentrations and water clarity for major lakes in the Fox River watershed, where available, are presented in Table V-19.

Toxic and Hazardous Substances: A number of the lakes in this watershed were subjected to substance spills. These include Big Muskego Lake, Lake Como, Geneva Lake, Powers Lake, Pewaukee Lake, and Phantom Lakes. The majority of the substances that were spilled into these surface waters were gasoline or related petroleum products.

Water Quality Assessments: Data from Table V-19 were used in the calculation of trophic state indices for each of the major lakes where data were available. Trophic states, indicating degrees of nutrient enrichment in the lakes, were assigned using the Wisconsin Trophic State Index[43] for each major lake in the Fox River watershed where data were available, as indicated in Table V-20. The available trophic state index values using the Carlson Trophic State Index are also provided for current and historic conditions, as shown in Table V-21. These data are presented using the Carlson Trophic State Index[44] in order to present the newer data on a comparable basis to the historic data which used that Index.

The data available, as shown in Table V-20 indicate that all of the lakes may be classified in the mesotrophic to eutrophic range. Mesotrophic lakes have moderate levels of nutrient enrichment whereas eutrophic lakes are nutrient-rich lakes. Beulah, Bohner, Eagle Spring, Geneva, the three Lauderdale Lakes, Pewaukee, Powers, Silver-Kenosha, Spring, Lower Phantom, and Waubeesee Lakes are all drainage lakes classified in the mesotrophic range. Booth, Peters, and Pleasant Lakes are mesotrophic seepage lakes and Browns, Center, and Upper Phantom Lakes are mesotrophic spring lakes. Benedict/Tombeau Lake and Lake Mary are also mesotrophic, and are classified as drained lakes. Elizabeth and Wandawega Lakes, drainage and seepage lakes respectively, are currently classified as meso-eutrophic lakes.

[43]The Wisconsin State Index is set forth in "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," R.A. Lillie et al, Research Management Findings, No. 35, May 1993.

[44]The Carlson Trophic State Index is set forth in "A Trophic State Index for Lakes," Robert E. Carlson, Limnology and Oceanography, Vol. 22(2), March 1977.

Table V-19

**WATER QUALITY OF THE MAJOR LAKES IN THE FOX RIVER WATERSHED**

| | | Total Phosphorus (mg/l) | | | | | Chlorophyll-a (µg/l) | | | | | Secchi Disk (feet) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SUBWATERSHED** Lake Name | Area (acre) | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] |
| **FOX RIVER-UPPER** | | | | | | | | | | | | | | | | |
| Pewaukee Lake | 2,439 | 0.36 | 0.016 | 0.058(67) | 1986-87 | LTT | 15.0 | 2.0 | 9.95(22) | 1986-87 | LTT | 19.7 | 2.8 | 6.64(33) | 1986-87 | LTT |
| **FOX RIVER-MIDDLE** | | | | | | | | | | | | | | | | |
| Big Muskego Lake | 2,177 | 0.31 | 0.03 | 0.11(30) | 1989-93 | USGS | 100.0 | 31.0 | 48.7(15) | 1989-93 | USGS | 5.5 | 1.0 | 2.18(61) | 1989-93 | SELF-HELP |
| Denoon Lake | 162 | 0.35 | 0.01 | 0.11(16) | 1991-92 | USGS | 22.0 | 4.0 | 9.4(8) | 1991-92 | USGS | 8.9 | 4.9 | 6.5(8) | 1991-92 | USGS |
| Eagle Lake | 520 | 0.12 | <0.01 | 0.06(41) | 1975-92 | LSF | 44.0 | 1.0 | 14.8(73) | 1976-92 | SEWRPC | 11.0 | 1.75 | 4.66(18) | 1991-92 | SELF-HELP |
| Kee Nong Go Mong | 88 | 0.55 | 0.01 | 0.07(33) | 1989-92 | USGS | 31.0 | 5.9 | 12.5(24) | 1988-92 | USGS | 7.2 | 2.0 | 5.1(25) | 1988-92 | USGS |
| Little Muskego Lake | 506 | 0.99 | 0.01 | 0.09(132) | 1987-90 | USGS | 81.0 | 3.0 | 23.8(53) | 1987-90 | USGS | 7.0 | 3.5 | 4.39(7) | 1991 | SELF-HELP |
| Long Lake (Racine Co.) | 102 | 0.07 | 0.03 | 0.05(8) | 1977-78 | LSF | -- | -- | -- | -- | -- | 4.0 | 1.3 | 2.5(4) | 1977-78 | LSF |
| Spring Lake (Waukesha County) | 105 | -- | -- | -- | -- | -- | -- | -- | 6.0(1) | 1980 | STORET | 10.0 | 4.5 | 7.0(23) | 1980 | SELF-HELP |
| Waterford Impoundment | | | | | | | | | | | | | | | | |
| Buena Lake | 241 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tichigan Lake | 892 | 1.33 | 0.05 | 0.28(41) | 1973-80 | LSF | -- | -- | -- | -- | -- | 9.0 | 2.5 | 4.88(33) | 1986-89 | SELF-HELP |
| Waubeesee Lake | 129 | 0.19 | <0.01 | 0.43(32) | 1988-92 | USGS | 5.0 | 1.0 | 2.9(16) | 1988-92 | USGS | 19.5 | 7.5 | 12.3(31) | 1989-92 | SELF-HELP |
| Wind Lake | 936 | 0.87 | 0.01 | 0.18(119) | 1985-90 | USGS | 65.0 | 1.8 | 22.7(40) | 1985-90 | USGS | 10.25 | 2.0 | 5.49(20) | 1988-89 | SELF-HELP |
| **FOX RIVER-LOWER** | | | | | | | | | | | | | | | | |
| Bohner Lake | 135 | 0.09 | 0.01 | 0.04(14) | 1977-78 | LSF | 5.2 | 1.0 | 3.1(2) | 1977-78 | LSF | 10.0 | 4.75 | 7.65(23) | 1989-91 | SELF-HELP |
| Browns Lake | 396 | 0.23 | 0.012 | 0.033(53) | 1986-87 | LTT | 1.00 | 2.0 | 5.18(18) | 1986-87 | LTT | 16.4 | 1.7 | 6.88(33) | 1986-87 | LTT |
| Camp Lake | 461 | 0.07 | <0.01 | 0.04(20) | 1975-78 | LSF | -- | -- | -- | -- | -- | 5.0 | 5.0 | 5.0(1) | 1989 | SELF-HELP |
| Center Lake | 129 | 0.75 | 0.03 | 0.08(3) | 1977 | LSF | -- | -- | -- | -- | -- | 30.0 | 1.0 | 14.0(10) | 1989-92 | SELF-HELP |
| Cross Lake | 87 | 0.16 | 0.01 | 0.07(3) | 1977 | LSF | -- | -- | -- | -- | -- | 11.5 | 4.0 | 5.94(26) | 1989-92 | SELF-HELP |
| Dyer Lake | 56 | 0.11 | 0.04 | 0.06(3) | 1977 | LSF | -- | -- | -- | -- | -- | -- | -- | 10.0(1) | 1977 | LSF |
| Lilly Lake | 88 | 4.76 | <0.01 | 0.11(358) | 1978-82 | STORET | 33.0 | 2.0 | 7.9(139) | 1978-81 | STORET | 6.0 | 3.0 | 5.5(11) | 1975-78 | LSF |
| Silver Lake (Kenosha) | 464 | 0.07 | <0.01 | 0.03(28) | 1973-77 | LSF | -- | -- | -- | -- | -- | 11.25 | 5.0 | 8.4(33) | 1987-91 | SELF-HELP |
| Voltz Lake | 52 | 0.37 | 0.09 | 0.20(3) | 1977 | LSF | -- | -- | -- | -- | -- | 5.5 | 2.5 | 4.06(4) | 1989 | SELF-HELP |
| **HONEY/SUGAR CREEKS** | | | | | | | | | | | | | | | | |
| Lauderdale Lakes | | | | | | | | | | | | | | | | |
| Green | 311 | -- | -- | -- | -- | -- | 11.0 | 3.0 | 6.3(3) | 1980-81 | STORET | 27.9 | 6.9 | 14.3(3) | 1980-81 | STORET |
| Middle | 259 | -- | -- | -- | -- | -- | 6.0 | 5.0 | 5.3(3) | 1980-81 | STORET | 18.4 | 6.9 | 12.0(3) | 1980-81 | STORET |
| Mill | 271 | -- | -- | -- | -- | -- | 6.0 | 5.0 | 5.5(2) | 1980-81 | STORET | -- | -- | -- | -- | -- |
| North Lake (Walworth) | 191 | -- | -- | 0.33(1) | 1978 | STORET | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pleasant Lake | 155 | 0.02 | 0.01 | 0.02(3) | 1978 | LSF | -- | -- | 5.0(2) | 1980-81 | STORET | 19.25 | 4.25 | 9.7(130) | 1986-92 | SELF-HELP |
| Potter Lake | 162 | 0.34 | 0.05 | 0.27(3) | 1975-78 | LSF | 20.00 | 10.0 | 15.0(2) | 1980-81 | STORET | 3.9 | 2.3 | 3.1(2) | 1980-81 | STORET |
| Silver Lake (Walworth) | 85 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Wandawega Lake | 119 | 0.07 | <0.01 | 0.03(10) | 1978-79 | LSF | -- | -- | -- | -- | -- | 7.0 | 2.9 | 4.8(5) | 1978-79 | LSF |

Table V-19 (continued)

| SUBWATERSHED Lake Name | Area (acre) | Total Phosphorus (mg/l) Maximum | Minimum | Average[a] | Date of Data | Source[b] | Chlorophyll-a (µg/l) Maximum | Minimum | Average[a] | Date of Data | Source[b] | Secchi Disk (feet) Maximum | Minimum | Average[a] | Date of Data | Source[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MUKWONAGO RIVER** | | | | | | | | | | | | | | | | |
| Army Lake | 78 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Beulah Lake | 834 | -- | -- | -- | -- | -- | -- | -- | <5.0(1) | 1980 | STORET | 14.0 | 4.5 | 8.43(26) | 1991 | SELF-HELP |
| Booth Lake | 113 | 0.01 | <0.01 | 0.01(3) | 1978 | LSF | -- | -- | 5.0(1) | 1980 | STORET | 10.5 | 7.5 | 9.31(4) | 1991 | SELF-HELP |
| Eagle Spring Lake | 311 | 0.09 | <0.01 | 0.02(27) | 1975-92 | LSF/USGS | 10.0 | 4.0 | 6.6(9) | 1980-92 | USGS | 6.2 | 3.9 | 4.8(9) | 1980-92 | USGS |
| Lulu Lake | 84 | -- | -- | -- | -- | N/A | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Peters Lake | 64 | 0.18 | 0.03 | 0.08(3) | 1978 | LSF | -- | -- | 16.1(1) | 1978 | LSF | -- | -- | 5.0(1) | 1978 | LSF |
| Upper Phantom Lake | 107 | 0.03 | <0.01 | 0.02(14) | 1977-80 | LSF | 9.8 | 9.8 | 5.5(3) | 1977-80 | LSF | 17.5 | 7.0 | 11.7(5) | 1991-92 | SELF-HELP |
| Lower Phantom lake | 433 | 0.14 | <0.01 | 0.03(15) | 1975-80 | LSF | -- | -- | 3.9(1) | 1980 | LSF | 11.0 | 11.0 | 11.0(8) | 1986 | SELF-HELP |
| **WHITE RIVER/ NIPPERSINK CREEK** | | | | | | | | | | | | | | | | |
| Benedict Lake | 78 | 0.04 | 0.03 | 0.037(3) | 1977 | LSF | -- | -- | -- | -- | -- | 4.0 | 14.0 | 8.63(43) | 1989-92 | SELF-HELP |
| Lake Como | 946 | 0.15 | 0.01 | 0.062(30) | 1975-79 | LSF | 62.48 | 61.0 | 61.7(2) | 1976-77 | LSF | 6.0 | 0.85 | 2.25(13) | 1975-79 | LSF |
| Echo Lake | 71 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Elizabeth Lake | 865 | 0.10 | <0.01 | 0.03(76) | 1973-91 | LSF | 14.7 | 4.0 | 8.6(11) | 1976-78 | LSF | 9.0 | 4.5 | 6.28(35) | 1991-92 | SELF-HELP |
| Geneva Lake | 5262 | 0.127 | 0.007 | 0.023(129) | 1975-90 | STORET | 8.0 | 2.0 | 4.2(20) | 1988-90 | STORET | 27.89 | 6.56 | 14.2(50) | 1986-89 | SELF-HELP |
| Lake Mary | 315 | 0.09 | <0.01 | 0.021(69) | 1973-91 | LSF | 6.06 | 3.0 | 4.7(7) | 1976-78 | LSF | 8.5 | 5.5 | 7.3(20) | 1987-91 | SELF-HELP |
| Pell Lake | 86 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4.0 | 2.0 | 3.16(3) | 1988 | SELF-HELP |
| Powers Lake | 459 | 0.055 | <0.005 | 0.02(56) | 1986-92 | USGS | 13.0 | 1.0 | 3.3(26) | 1986-92 | USGS | 18.0 | 5.5 | 10.31(94) | 1986-92 | SELF-HELP |

[a] Number in parentheses refers to number of samples taken

[b] The following sources were cited:

LSF..........Wisconsin Department of Natural Resources, Lake Survey Forms
LTT..........Long Term Trends Lake Monitoring Program Data: 1986-1987
SELF-HELP.....Wisconsin Self-Help Lake Monitoring Program Data: 1986-1992
SEWRPC........SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, 1978
STORET........U.S. Environmental Protection Agency, Water Inforamtion Storage and Retrieval System
USGS.........U.S. Geological Survey, Water Resources Data - Wisconsin (annual)

Source: SEWRPC.

Table V-20

TROPHIC STATE INDEX VALUES FOR MAJOR LAKES WITHIN THE FOX RIVER WATERSHED[a]

| Subwatershed Lake Name | Wisconsin Trophic State Index Values[b] | | | |
|---|---|---|---|---|
| | Total-P | Chlorophyll-a | Secchi | Mean |
| **FOX RIVER UPPER** | | | | |
| Pewaukee Lake | 57.4 | 50.1 | 51.8 | 53.1 |
| **FOX RIVER MIDDLE** | | | | |
| Big Muskego Lake | 64.7 | 64.1 | 50.4 | 59.7 |
| Lake Denoon | 64.5 | 51.7 | 50.1 | 55.5 |
| Eagle Lake | 61.0 | 60.8 | 54.9 | 58.9 |
| Kee Nong Go Mong Lake | 63.5 | 53.9 | 53.6 | 57.0 |
| Little Muskego Lake | 63.2 | 58.5 | 55.8 | 59.2 |
| Long Lake | 58.6 | -- | -- | 58.6 |
| Spring Lake (Waukesha County) | -- | 45.2 | 44.1 | 44.7 |
| Waterford Impoundment | | | | |
| Buena Lake | -- | -- | -- | -- |
| Tichigan Lake | 72.0 | -- | 54.3 | 63.2 |
| Waubeesee Lake | 64.8 | 42.8 | 40.9 | 49.5 |
| Wind Lake | 68.6 | 58.2 | 60.0 | 62.3 |
| **FOX RIVER LOWER** | | | | |
| Bohner Lake | 56.8 | 43.3 | 44.7 | 48.3 |
| Browns Lake | 54.3 | 47.1 | 44.4 | 48.6 |
| Camp Lake | 56.8 | -- | 54.2 | 55.5 |
| Center Lake | 62.2 | -- | 39.1 | 50.7 |
| Cross Lake | 61.2 | -- | 52.4 | 56.8 |
| Dyer Lake | 60.0 | -- | -- | 60.0 |
| Lilly Lake | 64.7 | 50.3 | 52.6 | 55.9 |
| Silver Lake (Kenosha County) | 54.6 | -- | 48.8 | 51.7 |
| Voltz Lake | 69.4 | -- | 56.9 | 63.2 |
| **HONEY/SUGAR CREEK** | | | | |
| Lauderdale Lakes | | | | |
| Green Lake | -- | 48.6 | 38.9 | 43.8 |
| Middle Lake | -- | 47.3 | 41.4 | 44.4 |
| Mill Lake | -- | 47.5 | -- | 47.5 |
| North Lake (Walworth County) | 73.3 | -- | -- | 73.3 |
| Pleasant Lake | 51.5 | 46.8 | 42.4 | 46.9 |
| Potter Lake | 71.7 | 55.1 | 43.7 | 56.8 |
| Silver Lake (Walworth County) | -- | -- | -- | -- |
| Wandawega Lake | 56.4 | -- | 54.6 | 55.5 |

Table V-20 (continued)

| Subwatershed Lake Name | Wisconsin Trophic State Index Values[b] | | | |
|---|---|---|---|---|
| | Total-P | Chlorophyll-a | Secchi | Mean |
| **MUKWONAGO RIVER** | | | | |
| Army Lake | -- | -- | -- | -- |
| Beulah Lake | -- | <46.8 | 46.5 | 46.7 |
| Booth Lake | 46.1 | 46.8 | 44.9 | 45.9 |
| Eagle Spring Lake | 52.9 | 49.7 | 54.5 | 52.3 |
| Lulu Lake | -- | -- | -- | -- |
| Peters Lake | 62.2 | 55.6 | 36.8 | 51.5 |
| Lower Phantom Lake | 54.6 | 45.0 | 42.6 | 47.4 |
| Upper Phantom Lake | 51.5 | 47.5 | 44.7 | 47.9 |
| **WHITE RIVER/NIPPERSINK CREEK** | | | | |
| Benedict Lake | 56.2 | -- | 45.9 | 51.1 |
| Lake Como | 60.3 | 65.7 | 65.6 | 63.9 |
| Echo Lake | -- | -- | -- | -- |
| Elizabeth Lake | 55.6 | 51.9 | 50.6 | 52.7 |
| Geneva Lake | 52.5 | 45.5 | 39.2 | 45.7 |
| Lake Mary | 52.5 | 46.6 | 48.5 | 49.2 |
| Pell Lake | -- | -- | 60.4 | 60.4 |
| Powers Lake | 51.5 | 43.8 | 43.5 | 46.8 |

[a] Wisconsin Trophic State Index Values were calculated using water chemistry data shown in Table V-19.

[b] Wisconsin Trophic State Index ranges:
below 44 = oligotrophic
44 - 53 = mesotrophic
54 - 75 = eutrophic
above 75 = hypertrophic

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table V-21

COMPARISON OF TROPHIC STATE INDEX VALUES FOR MAJOR LAKES
IN THE FOX RIVER WATERSHED[a]

| **SUBWATERSHED** Lake Name | Carlson Trophic State Index Values[b] | | |
|---|---|---|---|
| | Satellite Information 1979-1981 | Water Chemistry Pre - 1981 | Water Chemistry 1981-1991 |
| **FOX RIVER UPPER** | | | |
| Pewaukee Lake | 49 | -- | 59 |
| **FOX RIVER MIDDLE** | | | |
| Big Muskego Lake | 59 | -- | 70 |
| Lake Denoon | 47 | -- | 49 |
| Eagle Lake | 55 | 65 | 52 |
| Kee Nong Go Mong Lake | 50 | -- | 55 |
| Little Muskego Lake | 48 | -- | 62 |
| Long Lake | -- | 61 | -- |
| Spring Lake (Waukesha County) | 51 | -- | 51 |
| Waterford Impoundment | | | |
| Buena Lake | 56 | 85 | -- |
| Tichigan Lake | 54 | 72 | 54 |
| Waubeesee Lake | 50 | -- | 46 |
| Wind Lake | 55 | -- | 69 |
| **FOX RIVER LOWER** | | | |
| Bohner Lake | 52 | 49 | 45 |
| Browns Lake | 49 | 53 | 51 |
| Camp Lake | 52 | 54 | 54 |
| Center Lake | 50 | 61 | 35 |
| Cross Lake | 49 | 57 | 52 |
| Dyer Lake | 50 | 53 | -- |
| Lilly Lake | -- | 57 | -- |
| Silver Lake (Kenosha County) | 50 | 48 | 50 |
| Voltz Lake | 51 | 73 | 57 |
| **HONEY/SUGAR CREEK** | | | |
| Lauderdale Lakes | | | |
| Green Lake | 48 | 53 | 49 |
| Middle Lake | 46 | 53 | 51 |
| Mill Lake | 48 | 52 | -- |
| North Lake (Walworth County) | 56 | 88 | -- |
| Pleasant Lake | 48 | 46 | 45 |
| Potter Lake | 52 | 85 | 78 |
| Silver Lake (Walworth County) | -- | -- | -- |
| Wandawega Lake | 50 | 61 | -- |

Table V-21 (continued)

| SUBWATERSHED<br>Lake Name | Carlson Trophic State Index Values[b] | | |
|---|---|---|---|
| | Satellite Information 1979-1981 | Water Chemistry Pre - 1981 | Water Chemistry 1981-1991 |
| **MUKWONAGO RIVER** | | | |
| Army Lake | 48 | -- | -- |
| Beulah Lake | 46 | 52 | 46 |
| Booth Lake | 47 | 48 | 45 |
| Eagle Spring Lake | 49 | 56 | 49 |
| Lulu Lake | 48 | -- | -- |
| Peters Lake | 48 | -- | -- |
| Lower Phantom Lake | 46 | 50 | 43 |
| Upper Phantom Lake | 48 | 50 | 44 |
| **WHITE RIVER/NIPPERSINK CREEK** | | | |
| Benedict Lake | 46 | 59 | 44 |
| Lake Como | 62 | 73 | -- |
| Echo Lake | 55 | -- | -- |
| Elizabeth Lake | 50 | 56 | 52 |
| Geneva Lake | 50 | -- | 48 |
| Lake Mary | 48 | 55 | 47 |
| Pell Lake | 53 | -- | 60 |
| Powers Lake | 48 | -- | 45 |

[a] Carlson TSI values were calculated from available data from spring measurements for phosphorus and from summer measurements for chlorophyll-a and water clarity. Water Chemistry Values were calculated from data shown in Table V-19. Satellite Information Values were determined from Wisconsin's Lakes- A Trophic Assessment Using Landsat Digital Data, 1983.

[b] Carlson Trophic State Index Ranges:
- below 40 = oligotrophic
- 40 - 50 = mesotrophic
- 50 - 60 = eutrophic
- above 60 = hypertrophic

Source: Wisconsin Department of Natural Resources, U.S. Environmental Protection Agency and SEWRPC.

Big Muskego, Camp, Como, Cross, Dyer, Eagle, Kee Nong Go Mong, Little Muskego, Long, Buena, Tichigan, Voltz, and Wind Lakes are all drainage lakes classified in the eutrophic range. Lilly, Pell, and Potter Lakes are classified as eutrophic seepage lakes. North Lake (Walworth County), also a seepage lake, is considered very eutrophic or slightly hypertrophic. No current data are available to make assessments of trophic status for Echo and Lulu Lake, drainage and drained lakes respectively, or for Army, Denoon, and Silver (Walworth County) Lakes, classified as seepage lakes. Based upon a comparison of available TSI data, few conclusions regarding changes in water quality conditions between 1976 and 1991 can be drawn based upon the limited data available, although slight improvements in water quality may have occurred in the Waterford Impoundment--Tichigan and Buena Lakes; Eagle Lake, Center Lake, Voltz Lake, and Benedict Lake.

In addition, periodic fish kills primarily related to seasonal fluctuations in water temperature and levels of dissolved oxygen as well as spawning activity have occurred on Beulah Lake in 1985, Lake Como in 1991, Geneva Lake in 1981 and 1985, Little Muskego Lake in 1981, Wandawega Lake in 1988, and Wind Lake in 1981 and 1987. However, these occurrences do not appear to be chronic. Thus, despite the obvious concern that those episodes create among lake users, they do not appear to warrant special planning consideration at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches studied in the Fox River watershed are generally recommended for warmwater sport fish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. Potawatomi, Van Slyke, Southwick, Pebble, Brandy, and Spring Brook Creeks, and Genesee Creek upstream of Spring Creek are recommended for coldwater communities and full recreational uses because of their potential to support trout populations. Van Slyke and Potawatomi Creeks and a portion of Genesee Creek have been designated as Class I trout streams, and Southwick Creek and portions of Genesee and Spring Brook Creeks are designated as Class II trout streams. The remaining portion of Spring Brook Creek is designated as a Class III trout stream.[45] Sussex Creek has limitations for sport fish habitat and is recommended for warmwater forage fish and full recreational use. However, Sculpins, a coldwater fish species, have been found in the stream, indicating the potential for upgrading--perhaps through habitat reconstruction projects. The remaining streams are recommended for warmwater sport fish and full recreational uses. In addition, as noted in Chapter II, special designations as "Outstanding Resource Waters" have been given to Potawatomi and Van Slyke Creeks in Walworth County. In addition, Genesee Creek above STH 59 and the Mukwonago River from Eagle Springs Lake to Upper Phantom Lake, both in Waukesha County, have been designated as "Exceptional Resource Waters".

Based upon the available data for sampling stations in the watershed, the main stem of the Fox River and most of its major tributaries did not meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. As part of the Upper Fox River priority watershed planning program, the DNR staff conducted field inspections and limited sampling in order to assess the water quality and biological conditions on all of the streams in the Upper Fox River subwatershed. Those

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[45]Wisconsin Department of Natural Resources Publication No. FM-213-72, reissued as Publication No. 6-3600(80), Wisconsin Trout Streams, 1980.

investigations indicated that during 1990 and 1991 none of the streams in the Upper Fox River watershed fully met the recommended water use objectives. Based upon a review of the data summarized in Figures V-1 through V-10 and in Table V-14, and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the fecal coliform and phosphorus standards also occur along the entire main stem of the Fox River and the recommended water use objectives continue to be partially met in the majority of the major streams in the watershed. However, the recommended water use objectives are likely to be met in the Mukwonago River where the only significant source of pollution which existed in 1975--the Village of Mukwonago sewage treatment plant discharge--has been removed and now discharges to the Fox River downstream of the Mukwonago River. In addition, Genesee, Spring, Potawatomi, Van Slyke, Southwick, and Palmer Creeks may also potentially be meeting the water use objectives based upon the observed uses in those streams. It is also expected that selected tributaries of the Middle and Lower Fox subwatersheds may largely meet the standards associated with the recommended water use objectives.

There are currently three stream reaches for which the water use objectives set forth herein are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. These include Eagle Creek, Deer Creek, and Poplar Creek. Chapter NR 104 classifies portions of Poplar and Eagle Creeks as capable of supporting limited forage fish communities and Deer Creek and the remaining portions of Poplar and Eagle Creeks as capable of supporting only limited aquatic life communities, while the objectives set forth herein recommend a warmwater sport fish objective for all three streams. Under the Upper Fox River Priority Watershed Planning Program, the necessary stream appraisals have been conducted by the DNR staff to support upgrading the objectives for Deer Creek and Poplar Creek. It is recommended that a stream appraisal to further assess the potential for a higher use objective be conducted for Eagle Creek. It is further recommended that a stream appraisal to evaluate the potential for a higher use objective be conducted for Sussex Creek, due to the recording of Sculpins, a coldwater species, in the creek. Sussex Creek is currently recommended for warmwater forage fish. These stream appraisals are recommended to be part of the next one-year monitoring period envisioned to be carried out in the Fox River watershed.

The waters of the lakes in the Fox River watershed--excepting Lakes Geneva, Echo, Kee Nong Go Mong, and the Waterford Impoundment--are recommended for the maintenance of a warmwater sport fishery and full recreational use. Geneva Lake is recommended for maintenance of coldwater sport fish and full recreational use. Echo Lake, Lake Kee Nong Go Mong, and the Waterford Impoundment--only the Buena Lake portion--are recommended for maintenance of a warmwater sport fishery and limited recreational use as a result of high levels of fecal coliform or total phosphorus. In addition, as discussed in Chapter II, special designation as "Outstanding Resource Waters" has been given to Lulu Lake in Walworth County and Spring Lake in Waukesha County. All of the lakes for which water quality data were available between 1965 and 1975, except for Booth and Browns Lakes, violated the standards for total phosphorus of 0.02 mg/l recommended by the Commission. Pleasant and Silver (Walworth County) Lakes were also estimated to meet the standard based upon modeling data developed in the initial plan. In addition, over half of the lakes for which data were available during this period--13, or 59 percent--violated the dissolved oxygen standard on at least one occasion between 1965 and 1975.

As shown in Table V-19, recent monitoring data were available for most lakes in this watershed from the DNR Self-help Monitoring Program data base or from monitoring studies conducted under the auspices of the Chapter NR 119 Lake Management Planning Grant Program. These data were used to assess compliance with water quality standards for the major lakes in the Fox River watershed. Based upon these data, as summarized in the Carlson TSI values set forth in Table V-21, most lakes in the watershed could be expected to have average total phosphorus concentration in excess of the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47. Waubeesee, Bohner, Center, Pleasant, Beulah, Booth, Lower Phantom, Upper Phantom, Benedict, and Powers Lakes have TSI values of less than 47, based upon water quality monitoring data obtained between 1981 and 1991, and thus, would be expected to meet the standard.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon local facility planning, land use decisions, and identified onsite sewerage system problems, there is a need to conduct subsequent subregional sewerage system evaluations for six specific areas in the Fox River watershed. These areas include the Village of North Prairie and environs in Waukesha County; the Benedict, Tombeau, and Powers Lakes area in Kenosha County; the Pell Lake area in Walworth County; the Village of Big Bend and Town of Vernon areas in Waukesha County; and the Town of Wheatland-Silver Lake area in Kenosha County. Subregional studies potentially leading to formal amendments to the regional water quality management plan are recommended to be conducted as budgeting and local support becomes available. In addition, an amendment to the regional water quality management plan for the Bohner Lake area was under preparation early in 1994. That amendment would add the urban development around Bohner Lake to the planned sewer service area of the City of Burlington based upon local facility planning studies.

In addition to the issues noted above relating to sewerage system planning, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological condition survey of Eagle Creek and Sussex Creek in order to reevaluate the current water use objectives.

### Village of North Prairie Sewage Treatment Plant Evaluation

Based upon the findings of a facility plan prepared for the Village of North Prairie,[46] it is recommended that the public sewer service recommendation for the Village of North Prairie be reevaluated in a subsequent planning study which would include the connection of the Village to the Village of Mukwonago or City of Waukesha sewerage systems.

### Powers, Benedict, and Tombeau Lakes Area and Pell Lake Area Sewerage System Evaluation

Recommendations for new sewerage systems to serve the Powers, Benedict, and Tombeau Lakes area, and the Pell Lake area were documented in local facility plans.[47,48] The facility plans recommended that these areas be served by a

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[46] Ruekert & Mielke, Inc., Village of North Prairie Wastewater Facility Plan, Phase One, July 1986; Phase Two, December 1989.

[47] Crispell-Snyder, Inc., Powers, Benedict, and Tombeau Lakes Facility Plan, May 1992.

new public sewage treatment plant to be located in the Town of Bloomfield west of the Powers, Benedict, and Tombeau Lakes area and east of Pell Lake. A regional plan amendment evaluation of these recommendations, as well as the potential for interconnection to existing plants is required and will be documented in a separate plan amendment. The amendment would include cost effectiveness analyses.

Town of Wheatland Sewerage System Evaluation
A local facility plan prepared for the Town of Wheatland[49] recommends the installation of a public sanitary sewerage system for a portion of the Town. A regional plan amendment evaluation is needed to determine the best means of providing treatment plant capacity for the area.

Town of Vernon-Big Bend Sewerage System Evaluation
Land use developments and local initiatives have indicated a need to consider further the potential need for a public sanitary sewerage system to serve the Village of Big Bend and portions of the Town of Vernon. The alternatives to be considered would include the use of a public sanitary sewer system and the continued use of onsite systems. If a public sanitary sewerage systems is found to be the best alternative for all or portions of the study area, construction of a new treatment plant as well as connection to the Village of Mukwonago and/or to the City of Waukesha sewerage system would be considered in this subsequent subregional study. That subsequent study would include a cost-effectiveness analysis of the alternatives.

Bohner Lake Sewerage System
Recommendations have been made in a local facility plan[50] for a new sewerage system to serve the Bohner Lake area in Racine County. The facility plan recommended the development of a public sanitary sewerage system for the urban development surrounding Bohner Lake and the connection of that system to the City of Burlington sewerage system for treatment purposes. Review of the facility plan indicates no new cost-effectiveness issue will have to be explored and the recommendations of the facility plan are proposed to be incorporated into an amendment to the regional plan.

Stream Reclassification Evaluations
Eagle Creek, Deer Creek, and Poplar Creek are currently included under the limited forage fish or limited aquatic life classifications in Chapter NR 104 of the Wisconsin Administrative Code. However, it is recommended that the objective for these streams be upgraded to provide for a warmwater sport fish classification. The necessary surveys and stream appraisals needed to support this change have been conducted by the Wisconsin Department of Natural Resources for Deer Creek and Poplar Creek as part of the Upper Fox River Priority Watershed Planning Program. It is recommended that the Department include further stream appraisals for Eagle Creek as part of the monitoring program for the Fox River watershed during the next period when the Department is devoting its monitoring efforts in the Fox River watershed as is envisioned within the next five years.

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[48]Baxter & Woodman, Inc., Pell Lake Sanitary Facilities Planning Report, June 1993.

[49]Ruekert & Mielke, Inc., Town of Wheatland Facility Plan, September 1992.

[50]Crispell-Snyder, Inc., Bohner Lake Facilities Plan, May 1992.

Chapter VI

# KINNICKINNIC RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

## INTRODUCTION

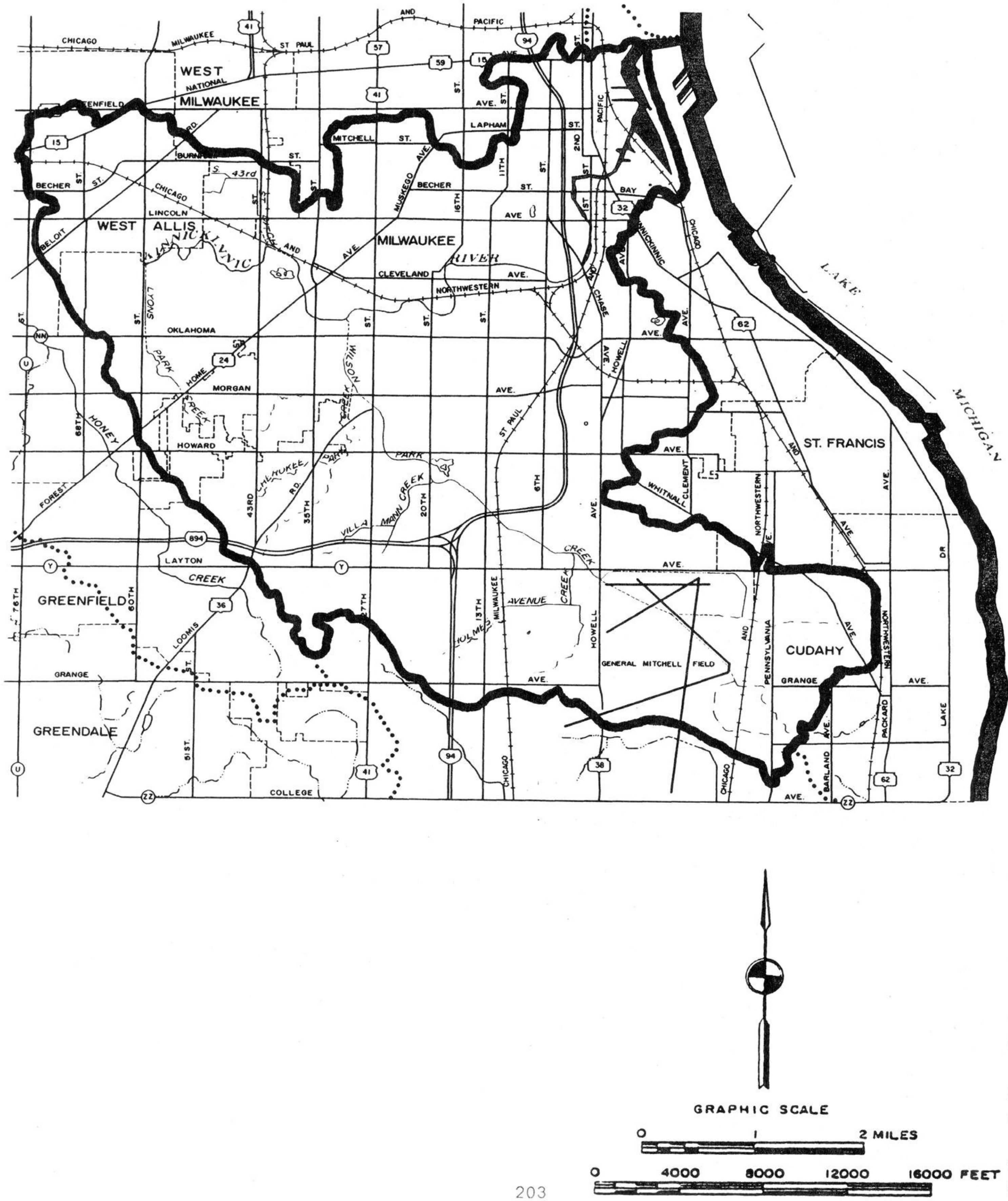
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--to 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Kinnickinnic River watershed through 1993, where available. Finally, this chapter presents a description of any substantive water quality management issues that remain to be addressed in the Kinnickinnic River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a brief separate section on lake management is included, which is limited for the Kinnickinnic River watershed as there are no major lakes located within the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Kinnickinnic River watershed is located in the south central portion of Milwaukee County and covers an area of approximately 26 square miles. The Kinnickinnic River, approximately 8.0 miles in length and receiving discharge from approximately 8.2 miles of perennial stream tributaries, discharges into Lake Michigan through the Milwaukee Harbor estuary. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Kinnickinnic River and its principal tributaries, are shown on Map VI-1. The Kinnickinnic River watershed contains no lakes with a surface area of 50 acres or more.

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan implementation, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Kinnickinnic River watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data is presented for the watershed in order to permit consideration

# Map VI-1
# KINNICKINNIC RIVER WATERSHED



of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table VI-1 summarizes the existing land uses in the Kinnickinnic River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. The watershed is almost completely developed for urban uses, with 8 percent of the watershed in open space uses in 1990. Existing land uses in the Kinnickinnic River watershed are shown in graphic summary on Map VI-2.

The Kinnickinnic River watershed lies completely within Milwaukee County and includes lands located in the Cities of Cudahy, Greenfield, Milwaukee, Oak Creek, St. Francis, West Allis, and West Milwaukee. There are four major industrial centers, Milwaukee South, Milwaukee Near South, West Milwaukee, and West Allis, a major commercial retail center, the Southgate-Point Loomis centers, and the General Mitchell International Airport are all located within the watershed.

As shown in Table VI-1, from 1975 to 1990, urban land uses in the watershed increased from about 14,700 acres, or 23.0 square miles, to about 15,100 acres or 23.6 square miles, or by less than 3 percent. As shown in Table VI-1, urban-residential and urban-transportation lands represent the largest urban land use in the watershed. Residential use has increased within the watershed, from about 5,600 acres in 1975 to about 5,700 acres in 1990, an increase of about 1 percent. Commercial land uses increased from about 500 acres to about 570 acres, an increase of 13 percent.

Table VI-2 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Kinnickinnic River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban lands are anticipated to remain relatively constant, with some urban redevelopment expected to occur in the already urbanized portions of the watershed.

It is important to note that a portion of the watershed is comprised of primary environmental corridor lands consisting of the best remaining natural resource features and, as recommended in the year 2010 land use plan, is proposed to be preserved through joint State-local zoning or public acquisition.

## POINT SOURCE POLLUTION CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Kinnickinnic River watershed--including points of public sanitary sewage

Table VI-1

**LAND USE IN THE KINNICKINNIC RIVER WATERSHED: 1975 and 1990**[a]

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 5,608 | 34.2 | 5,676 | 34.6 | 68 | 1.2 |
| Commercial | 505 | 3.1 | 569 | 3.5 | 64 | 12.6 |
| Industrial | 988 | 6.0 | 977 | 5.9 | - 11 | - 1.1 |
| Transportation, Communication, and Utilities[b] | 5,757 | 35.1 | 6,010 | 36.6 | 253 | 4.4 |
| Governmental and Institutional | 1,199 | 7.3 | 1,152 | 7.0 | - 47 | - 3.9 |
| Recreational | 678 | 4.1 | 699 | 4.2 | 21 | 3.1 |
| Subtotal | 14,735 | 89.8 | 15,083 | 91.9 | 348 | 2.4 |
| Rural | | | | | | |
| Agricultural and Related | 131 | 0.8 | 111 | 0.7 | - 20 | - 15.3 |
| Lakes, Rivers, Streams and Wetlands | 194 | 1.2 | 192 | 1.2 | - 2 | - 1.0 |
| Woodlands | 83 | 0.5 | 92 | 0.6 | 9 | 10.8 |
| Open Lands,[c] Landfills, Dumps, and Extractive | 1,266 | 7.7 | 931 | 5.7 | - 335 | - 26.5 |
| Subtotal | 1,674 | 10.2 | 1,326 | 8.1 | - 348 | - 20.8 |
| Total | 16,409 | 100.0 | 16,409 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

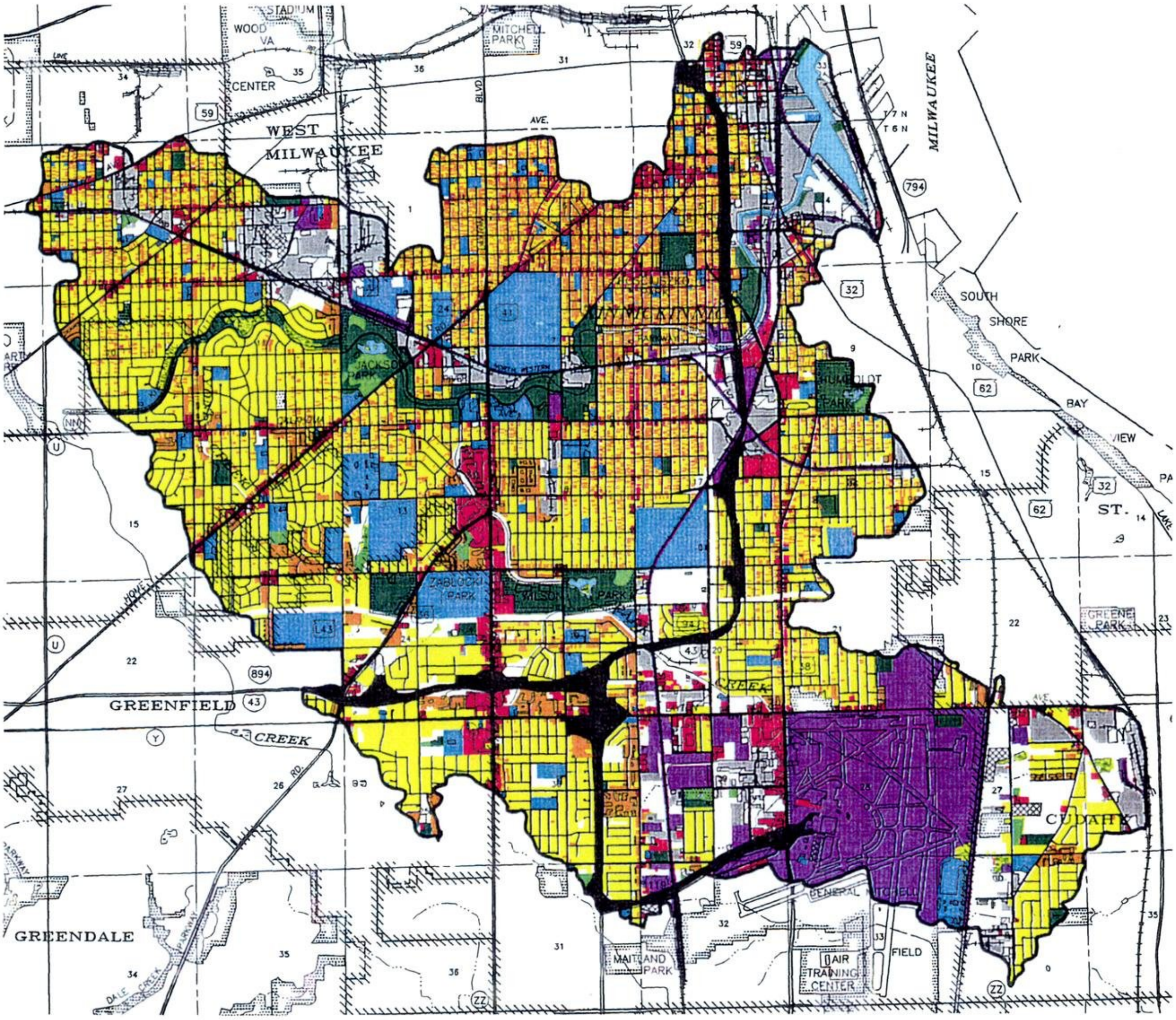
[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

# MAP VI-2

## LAND USES IN THE KINNICKINNIC RIVER WATERSHED: 1990




—LEGEND—

- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREETS AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION, COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

0 1/2 1
GRAPHIC SCALE IN MILES

The Kinnickinnic River watershed is about 26 square miles in areal extent, or about 1 percent of the total Region.

In 1990, the watershed was almost entirely in urban land uses.

Source: SEWRPC

Table VI-2

EXISTING AND PLANNED LAND USE IN THE KINNICKINNIC RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 5,676 | 34.6 | 5,699 | 34.7 | 23 | 0.4 | 5,659 | 34.5 | - 17 | - 0.3 |
| Commercial | 569 | 3.5 | 537 | 3.3 | - 32 | - 5.6 | 540 | 3.3 | - 29 | - 5.1 |
| Industrial | 977 | 5.9 | 1,039 | 6.3 | 62 | 6.3 | 1,074 | 6.5 | 97 | 9.9 |
| Transportation, Communication, and Utilities[b] | 6,010 | 36.6 | 5,958 | 36.3 | - 52 | - 0.9 | 5,961 | 36.3 | - 49 | - 0.8 |
| Governmental and Institutional | 1,152 | 7.0 | 1,213 | 7.4 | 61 | 5.3 | 1,211 | 7.4 | 59 | 5.1 |
| Recreational | 699 | 4.2 | 690 | 4.2 | - 9 | - 1.3 | 688 | 4.2 | - 11 | - 1.6 |
| Subtotal | 15,083 | 91.9 | 15,136 | 92.2 | 53 | 0.4 | 15,133 | 92.2 | 50 | 0.3 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 111 | 0.7 | 116 | 0.7 | 5 | 4.5 | 116 | 0.7 | 5 | 4.5 |
| Lakes, Rivers, Streams, and Wetlands | 192 | 1.2 | 191 | 1.2 | - 1 | - 0.5 | 191 | 1.2 | - 1 | - 0.5 |
| Woodlands | 92 | 0.6 | 83 | 0.5 | - 9 | - 9.8 | 83 | 0.5 | - 9 | - 9.8 |
| Open Lands,[c] Landfills, Dumps, Extractive | 931 | 5.7 | 883 | 5.4 | - 48 | - 5.2 | 886 | 5.4 | - 45 | - 4.8 |
| Subtotal | 1,326 | 8.1 | 1,273 | 7.8 | - 53 | - 4.0 | 1,276 | 7.8 | - 50 | - 3.8 |
| Total | 16,409 | 100.0 | 16,409 | 100.0 | 0 | -- | 16,409 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

collection system overflows and industrial wastewater treatment systems and discharges. This section also includes a status report on the public sanitary sewer service areas within the watershed.

With regard to the point source plan element related to the Kinnickinnic River, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District's water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants; provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of a solids management program; and provision of trunk sewers to serve the various communities comprising the District area. As of 1993, the District pollution abatement program was nearing completion, with the deep tunnel system expected to be on line during 1994.

It should be noted that during 1995, the Milwaukee Metropolitan Sewerage District initiated work on an update of its Section 201 sewerage facility plan[1] for the entire Milwaukee metropolitan service area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that that facility plan re-examine certain system level decisions that were made in the past including trunk sewer needs, and the retention of the one remaining small sewage treatment plan in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant facilities plan update is intended, then, upon its adoption by all of the agencies concerned to constitute an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Kinnickinnic River watershed.

Public and Private Wastewater Treatment Systems and Sewer Services Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were no public or private sewage treatment plants located in or discharging into the Kinnickinnic River watershed. As of 1990, no new sewage treatment plants had been constructed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. As indicated on Map VI-3, the entire Kinnickinnic River watershed, approximately 26 square miles, is served by sanitary sewer and is part of the larger Milwaukee Metropolitan Sewerage District service area which is currently unrefined.

Current Plan Recommendations: The current point source plan element includes the recommendation to prepare a refinement of the Milwaukee Metropolitan Sewerage District sewer service area.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 23 combined sewer outfalls and 29 known sanitary sewer flow relief devices located

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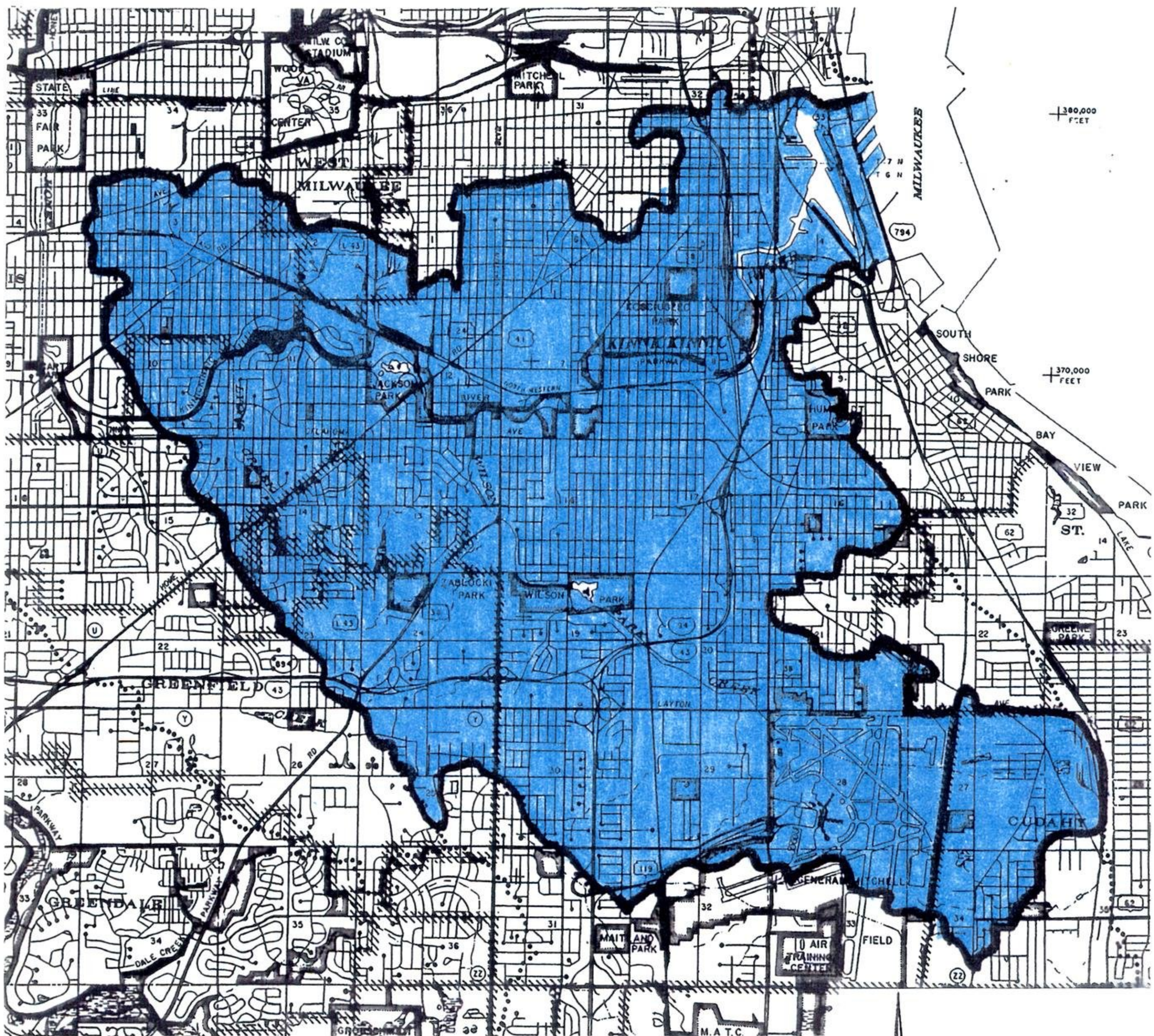
[1]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan; June 1980.

# Map VI-3

## SEWER SERVICE AREAS IN THE KINNICKINNIC RIVER WATERSHED: 1990 AND 2010




LEGEND

SANITARY SEWER SERVICE AREA (EXISTING)

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

Source:SEWRPC

in the Kinnickinnic River watershed. Of the latter, four were sanitary sewerage system bypasses; two were relief pumping stations; four were portable pumping stations; and the remaining 19 were crossovers. Of the total 52 flow relief devices and combined sewer outfalls, 40 discharged directly to the main stem of the Kinnickinnic River; seven discharged directly to Wilson Park Creek; two discharged directly to the S. 43rd Street ditch; two discharged directly to Lyons Park Creek; and one discharged directly to Cherokee Park Creek.

By 1993, work was completed by the Milwaukee Metropolitan Sewerage District on a system-wide upgrade of its sewerage conveyance and storage facilities, including completion of the Inline Storage System and major relief sewers. As a result of this work, many of the flow relief devices within the watershed have been eliminated. Those which remain include combined sewer overflows, selected bypasses and crossovers, and portable pumping station sites which physically remain in the sewerage system but are expected to function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table VI-3, 39 points of sanitary sewer system flow relief--including 24 combined sewer overflows--were reported to exist during 1993 in the Kinnickinnic River watershed. These flow relief points were located in three sewerage systems. With the completion of the Inline Storage System, bypassing of sewage from the combined sewer overflows is expected to occur an average of about one to two times per year. The Milwaukee Harbor estuary study[2] documented that this level of reduction in combined sewer overflow discharges would be adequate to meet water quality standards in the estuary portion of the Kinnickinnic River, assuming other water quality improvement measures recommended were carried out. Bypassing from the other sanitary sewer flow relief devices is expected to be further eliminated over time as additional sewerage system upgrading is completed by the Cities of Milwaukee[3] and West Allis and the Milwaukee Metropolitan Sewerage District.

Current Plan Recommendations: It is recommended that the Cities of Milwaukee and West Allis and the Milwaukee Metropolitan Sewerage District continue to monitor the sewerage system operations to ensure that the use of the existing sanitary sewer system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system upgrading be conducted with the assumption that there will be no planned bypasses of untreated sewage from the sanitary sewerage system and that the use of all flow relief devices within the sanitary sewerage system will ultimately be eliminated, with the only bypasses remaining designed to

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[2]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, December 1987.

[3]During 1994, the City of Milwaukee developed specific preliminary plans to eliminate 52 of the 106 crossovers in the City's sanitary sewer system. In most cases, the crossovers were conveyed to other locations in the Milwaukee Intercepting Sewer System where adequate capacity was available. These plans were being refined and reviewed with the Milwaukee Metropolitan Sewerage District staff at years end.

Table VI-3

KNOWN SEWAGE FLOW RELIEF DEVICES
IN THE KINNICKINNIC RIVER WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | Total | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Combined Sewer Overflow | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | | |
| City of Milwaukee | -- | -- | 10[a] | -- | -- | -- | 10 | Used only in case of extreme wet weather |
| City of West Allis | -- | -- | -- | -- | -- | 1 | 1 | Used only in case of extreme wet weather |
| Milwaukee Metropolitan Sewerage District | -- | 24 | 1 | -- | 3 | -- | 28 | Used only in case of extreme wet weather, CSO bypassing expected about one to two times per year |
| TOTAL | -- | 24 | 11 | -- | 3 | 1 | 39 | |

[a] Nine of these crossovers are equipped with electric pumps to facilitate bypassing.

Source: SEWRPC.

protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: No intercommunity trunk sewers were recommended for construction in the initial regional water quality management plan.

Current Plan Recommendations: The current regional water quality management plan recommends the continued maintenance of existing intercommunity trunk sewers in the Kinnickinnic River watershed. No additional trunk sewers are recommended for construction.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of 30 known point sources of pollution identified in the Kinnickinnic River watershed other than public and private sewage treatment plants. These sources discharged industrial cooling, process, rinse, wash, and filter backwash waters through 60 outfalls directly or indirectly to the surface water system. Of these point source outfalls, 30 were identified as discharging only cooling water and 30 were identified as discharging other types of wastewaters. The initial regional plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System (WPDES) permit process.

As of 1990, there were 50 such point sources of wastewater discharging to the Kinnickinnic River and its major tributaries or to the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table VI-4 summarizes selected characteristics of these other point sources and Map VI-4 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of such wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 43 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Kinnickinnic River watershed. These point sources of wastewater discharge primarily industrial cooling, process, rinse, and wash water directly, or following treatment, to the groundwater or the surface waters of the Kinnickinnic River watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

Because the entire Kinnickinnic watershed was served by sanitary sewer prior to 1975, there were no enclaves of unsewered urban development located outside of the then recommended year 2000 or currently recommended year 2010 sewer service area.

Table VI-4

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
WATER POLLUTION IN THE KINNICKINNIC RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID No.[b] | Permit Type | Permit Number | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Acme Galvanizing, Inc. | Milwaukee | 1 | General | 0044938-3 | 9-30-95 | 3471 | Plating and polishing metal | Kinnickinnic River | -- |
| Advance Boiler & Tank Co. | Milwaukee | 2 | General | 0044938-3 | 9-30-95 | 3443 | Fabricated plate work | Kinnickinnic River Canal | -- |
| Behmke Residence | Milwaukee | 3 | General | HEAT PUMP | -- | 8811 | Private household | Holmes Avenue Creek | -- |
| Columns Tennis & Swim Club | Milwaukee | 4 | General | 0046523-2 | 9-30-95 | 7997 | Membership sports & rec. club | Villa Mann Creek via storm sewer | -- |
| The Grand Hotel | Milwaukee | 5 | General | 0046523-2 | 9-30-95 | 7011 | Hotels and motels | Wilson Park Creek | -- |
| Grebe Bakeries, Inc. | Milwaukee | 6 | General | 0044938-3 | 9-30-95 | 2051 | Bread, cake, etc. products | West Milwaukee Ditch | -- |
| Howard Johnson's Motor Lodge | Milwaukee | 7 | General | 0046523-1 | 9-30-95 | 7011 | Hotels & motels | Wilson Park Cr. via storm sewer | -- |
| Joy-Mark, Inc. | Milwaukee | 8 | General | 0044938-3 | 9-30-95 | 3297 | Nonclay refractories | Wilson Park Cr. via storm sewer | -- |
| Magnetek, Inc.-Louis Allis Division | Milwaukee | 9 | General | 0044938-3 | 9-30-95 | 3621/3625 | Motors, generators, relays, etc. | Kinnickinnic River | -- |
| Maynard Steel Casting Co. | Milwaukee | 10 | General | 0044938-3 | 9-30-95 | 3325 | Steel foundry | Kinnickinnic River | -- |
| Midway Motor Lodge Airport | Milwaukee | 11 | General | 0046523-2 | 9-30-95 | 7011 | Hotels and motels | Holmes Avenue Creek | -- |
| Milwaukee School Dist: Pulaski H.S. | Milwaukee | 12 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Kinnickinnic River | -- |
| Milwaukee Boys and Girls Club | Milwaukee | 13 | General | 0046523-2 | 9-30-95 | 7999 | Amusement & Recreation | Kinnickinnic River via storm sewer | -- |
| Milw. Cty. PR&C: Pulaski Pool | Milwaukee | 14 | General | 0046523-1 | 9-30-95 | -- | Municipal pool | Kinnickinnic River | -- |
| Milw. Cty. PR&C: Holler Park Pool | Milwaukee | 15 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Holmes Ave. Creek via storm sewer | -- |
| Milw. Cty. PR&C: Jackson Park Pool | Milwaukee | 16 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Kinnickinnic River | -- |
| Milw. Cty. PR&C: Kosciuszko Pk. Pool | Milwaukee | 17 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Kinnickinnic River via storm sewer | -- |
| Milw. Cty. PR&C: Wilson Park Pools | Milwaukee | 18 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Wilson Park Creek | -- |
| Milw. Malleable & Gray Iron Works | Milwaukee | 19 | General | 0044938-2 | 9-30-95 | 3321/3322 | Iron foundries | Kinnickinnic River via storm sewer | -- |
| Milwaukee Marble Company | Milwaukee | 20 | General | 0046515-1 | 9-30-95 | 3281 | Cut stone and stone products | West Milw. Ditch via storm sewer | -- |
| Milwaukee Metro. Sewerage District | Milwaukee | 21 | General | 0046566-1 | 9-30-95 | 4952 | Sewerage systems | Kinnickinnic River Canal | -- |
| Milwaukee Wilbert Vault Co. | Milwaukee | 22 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| Moore Oil Container Corp. | Milwaukee | 23 | General | 0044938-2 | 9-30-95 | -- | -- | Edgerton Channel via ditch | -- |
| Pelton Casteel, Inc. | Milwaukee | 24 | General | SPEC PERM | -- | 3325 | Steel foundry | Kinnickinnic River via ditch | -- |
| Raytec (Bruner) Corp. | Milwaukee | 25 | General | 0044938-2 | 9-30-95 | 3589 | Service industry machinery | Kinnickinnic R. via storm sewer | -- |
| Rex Works, Inc. | Milwaukee | 26 | General | 0044938-3 | 9-30-95 | 3531 | Construction machinery | Kinnickinnic R. via storm sewer | -- |
| St. Lukes Medical Center | Milwaukee | --[d] | General | 0044938-3 | 9-30-95 | 8062 | General med. & surgical hospital | Wilson Park Creek | -- |
| Southeastern Wisconsin Products Co. | Milwaukee | 28 | General | 0044938-3 | 9-30-95 | 2099 | Food preparation | Holmes Ave. Creek via storm sewer | -- |
| Spinweld Division-Coating, Inc. | Milwaukee | 29 | General | 0044938-3 | 9-30-95 | 3471/3479 | Plating, polishing, coating, etc. | West Milw. Ditch via storm sewer | -- |
| Super America, Inc. | Milwaukee | --[d] | General | 0046566-1 | 9-30-95 | 5541 | Gasoline service station | West Milw. Ditch via storm sewer | -- |

Table VI-4 (continued)

| Facility Name | County | Map ID No.[b] | Permit Type | Permit Number | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Support Terminal Services, Inc. | Milwaukee | 31 | General | 0046531-1 | 9-30-95 | -- | -- | Lake Michigan | -- |
| Teledyne Wisc. Motors-Plant No. 1 | Milwaukee | 32 | General | 0044938-3 | 9-30-95 | 3519 | Internal combustion engines | West Milw. Ditch via storm sewer | -- |
| Uno-ven Co.-Mitchell Field | Milwaukee | 33 | General | 0046531-1 | 9-30-95 | 5171 | Petroleum bulk stations & term. | Wilson Park Creek via storm sewer | -- |
| West Shore Pipeline Co.-Jones Island | Milwaukee | 34 | General | 0046531-1 | 9-30-95 | 5171 | Petroleum bulk stations & term. | Lake Michigan | -- |
| Wisconsin Gas Co.-35th Street Plant | Milwaukee | 35 | General | SPEC PERM | -- | 4923 | Gas transmission & distribution | Kinnickinnic R. via storm sewer | -- |
| Briggs & Stratton Corp. W. Allis/68th | Milwaukee | 1A | Specific | 0000493 | 03-31-92 | 3519 | Internal combustion engines | West Milw. Ditch via storm sewer | None |
| Chrysler Motors Corp. | Milwaukee | 2A | Specific | 0026557 | 06-30-92 | 3714 | Motor vehicle parts | Kinnickinnic R. via storm sewer | None |
| Dillingham Construction - KK-2 NA | Milwaukee | 3A | Specific | 0047414 | 08-31-94 | 1622 | Bridge, tunnel, elevated hwys. | Kinnickinnic River | 1, 2, 3, 4 |
| Dillingham Const. - KK-3 NA Inc. | Milwaukee | 4A | Specific | 0047406 | 08-31-94 | 1622 | Bridge, tunnel, elevated hwys. | Kinnickinnic River | 1, 2, 3, 4 |
| Fleischmann Kurth Malting Co. | Milwaukee | 5A | Specific | 0027693 | 03-31-89 | 2083 | Malt | West Milwaukee Ditch | None |
| Froedtert Malting Corp. FMC | Milwaukee | 6A | Specific | 0026166 | 12-31-89 | 2083 | Malt | West Milwaukee Ditch | None |
| General Electric Co. - Hotpoint | Milwaukee | 7A | Specific | 0027499 | 03-31-90 | 3639 | Household appliances | West Milwaukee Ditch | None |
| General Electric Co. - Med. Sys. | Milwaukee | 8A | Specific | 0027791 | 12-31-89 | 3829 | Measuring & controlling devices | West Milw. Ditch via storm sewer | 4 |
| JF Shea Co., Inc. - KK LM Tunnel | Milwaukee | 9A | Specific | 0047601 | 01-31-95 | 1422 | Crushed and broken limestone | Kinnickinnic River | 5, 6 |
| Motor Casting Co. - Plt. 2 Milw. | Milwaukee | 10A | Specific | 0001431 | 09-30-88 | 3321 | Grey & ductile iron foundry | West Milw. Ditch via storm sewer | None |
| Patrick Cudahy Inc. | Milwaukee | 11A | Specific | 0001660 | 06-30-94 | 2011 | Meat packing plants | Edgerton Channel | None |
| Pelton Casteel Inc. | Milwaukee | 12A | Specific | 0001481 | 09-30-90 | 3325 | Steel foundries | Kinnickinnic River via ditch | None |
| Rexworks Inc. | Milwaukee | 13A | Specific | 0001627 | 06-30-90 | 3531 | Construction machinery | Kinnickinnic R. via storm sewer | None |
| Unit Drop Forge Co., Inc. | Milwaukee | 14A | Specific | 0026484 | 12-31-89 | 3312 | Blast furnaces and steel mills | West Milw. Ditch via storm sewer | 4 |
| WI University Great Lakes Research | Milwaukee | 15A | Specific | 0045942 | 03-31-89 | 0921 | Fish hatcheries and preserves | Kinnickinnic R. via storm sewer | None |

[a] Table VI-4 includes 50 known, permitted sources of wastewater discharging to the Milwaukee River and its tributaries, or to the groundwater system in the Kinnickinnic River watershed. As of 1993, there were 43 known, permitted point sources of pollution.

[b] See Map VI-4, Point Sources of Pollution Other Than Sewage Treatment Facilities in the Kinnickinnic River Watershed: 1990.

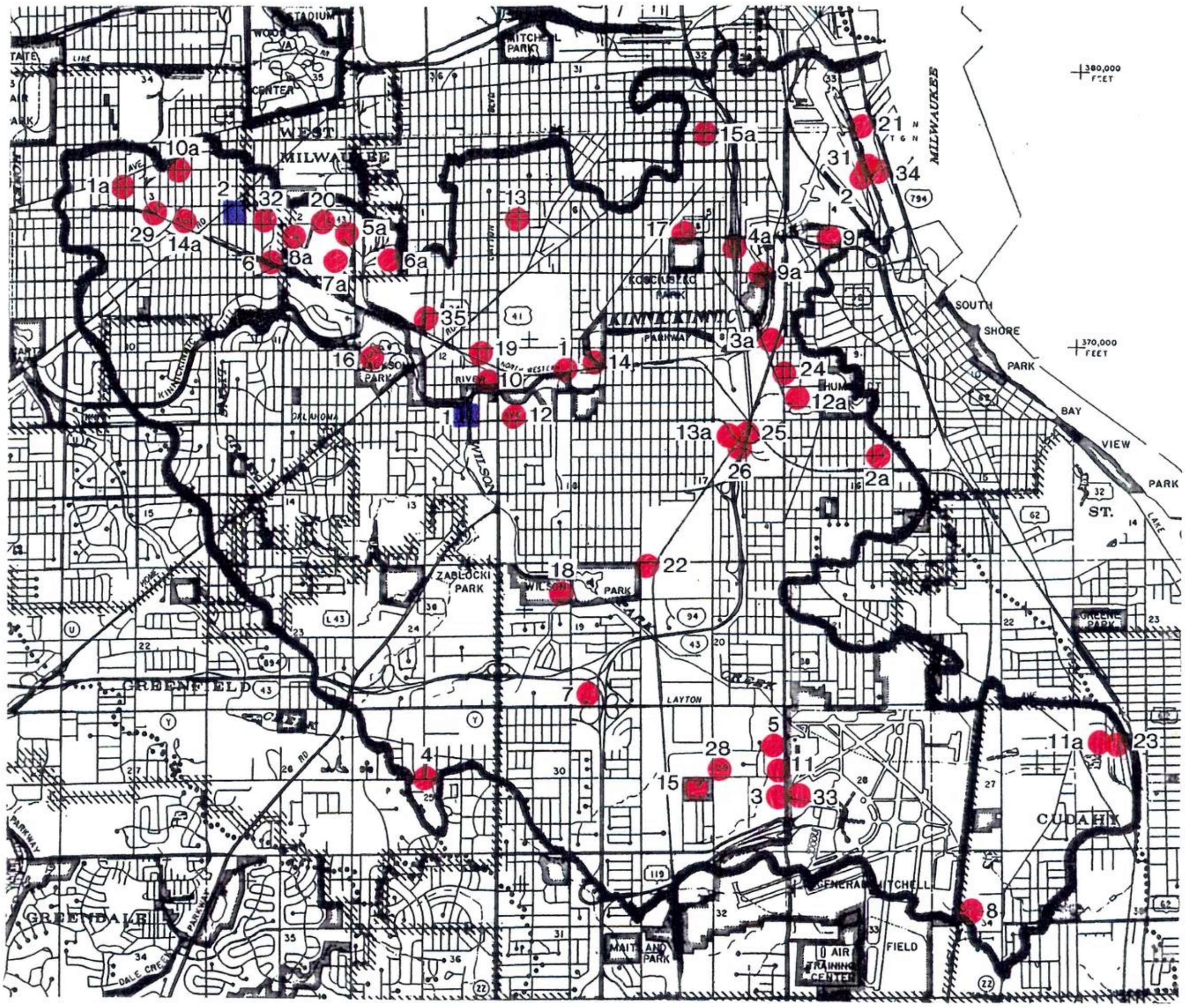
[c] The number code refers to the following treatment systems:

1. Chemical conversion/addition
2. Coagulation flocculation
3. Gravity sedimentation
4. Oil and grease removal
5. Solids Treatment/Removal
6. Tube/Plate settlers

[d] Permitted as Leaking Underground Storage Tank (LUST) remediation sites discharging to surface waters as of 1990. As of 1993, there was one addition LUST remediation site discharging to a surface water in the Kinnickinnic River watershed. See Table VI-5, "Miscellaneous Potential Pollution Sources in the Kinnickinnic River Watershed: 1990", for map identification numbers.

Source: Wisconsin Department of Natural Resources and SEWRPC.

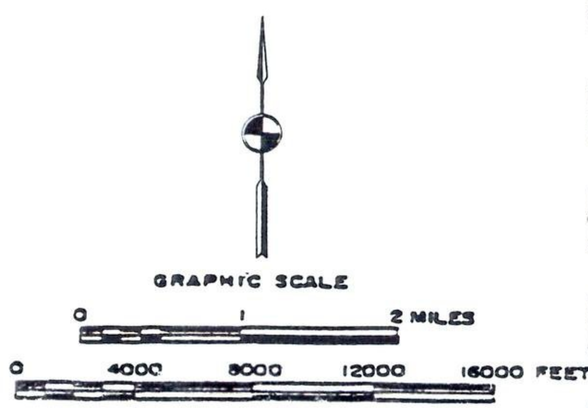
## Map VI-4
## POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE KINNICKINNIC RIVER WATERSHED: 1990




LEGEND

POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

LEAKING UNDERGROUND STORAGE TANKS DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER



Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Kinnickinnic River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills generally contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can be subsequently transported to surface waters.

There are currently no active landfills and ten abandoned landfills located in the Kinnickinnic River watershed. None of the abandoned landfills in the Kinnickinnic River watershed, through 1993, have been reported as negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Kinnickinnic River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were two known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters in the Kinnickinnic River watershed, as indicated in Table VI-5 and shown on Map VI-4. As of 1993, there was one additional leaking underground storage tank in the Kinnickinnic River watershed whose remediation wastewaters were permitted to discharge to a surface water, as shown in Table VI-5.

As of 1993, there were 222 additional leaking underground storage tanks in the Kinnickinnic River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leading underground storage tanks may have the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters. As of 1993, there were no permitted sites discharging to surface or ground waters.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse

Table VI-5

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE KINNICKINNIC RIVER WATERSHED: 1990

| Map Identification Number[a] | Landfills Indicated to be Potential Pollution Sources | Civil Division Location | Surface Water Potentially Impacted |
|---|---|---|---|
| | None | | |
| | Leaking Underground Storage Tank Sites[b],[c] | | |
| 1 | St. Luke's Medical Center | City of Milwaukee | Kinnickinnic River |
| 2 | SuperAmerica, Inc. | City of West Allis | Kinnickinnic River |
| | Additional Groundwater Contamination Sites[b] | | |
| | None | | |

[a] Refers to Map VI-4, "Point Sources of Pollution Other than Sewage Treatment Facilities in the Kinnickinnic River Watershed: 1990"

[b] Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters.

[c] As of 1993, there was one additional leaking underground storage tank site in the Kinnickinnic River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Industrial Refrigeration in the City of Greenfield, Milwaukee County, which is permitted to discharge to the Kinnickinnic River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Kinnickinnic River watershed, the adopted plan generally recommended urban nonpoint source pollution control practices designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control and streambank erosion control. However, the plan did not specifically recommend the application of control practices in the northern portion of the watershed where the deep tunnel combined sewer overflow abatement plan has been implemented and where a relatively high level of nonpoint source control will be achieved by the conveyance of most of the stormwater to the Milwaukee Metropolitan Sewerage District sewerage system.

In 1978 the Commission prepared a comprehensive watershed plan[4] for the Kinnickinnic River watershed in cooperation with various Federal, State, and local authorities. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas in the watershed. Such subsequent planning was and will continue to be directed toward reducing nonpoint source pollutant loadings as well as providing for local drainage needs in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved in the Kinnickinnic River watershed on a limited basis through local regulation and programs. In the area of construction site erosion control, significant progress has been made. As of January 1993, the Cities of Cudahy, Greenfield, Milwaukee, and West Allis, and the Village of West Milwaukee had adopted construction erosion control ordinances based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. It should be noted that the ordinance for the City of Cudahy applies only to subdivisions.

While the local programs described above have probably resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program, is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for the cost of an individual project or land management

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[4]See SEWRPC Planning Report No. 32, A Comprehensive Plan for the Kinnickinnic River Watershed, December 1978.

practice to local governments and private landowners upon completion of the detailed plans. The funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources.

The Kinnickinnic River watershed was designated a "priority watershed" in 1990. Planning for the Kinnickinnic River Priority watershed project was completed in 1994, and implementation of practices began in September 1994 and will continue for eight years.

The Kinnickinnic River priority watershed project established nonpoint source pollutant reduction goals to obtain an overall nonpoint source pollutant loading reduction of 25 percent for the subareas considered, and to achieve a high level of nonpoint source sediment and toxic pollution reduction in areas deemed "critical," such as older, highly industrialized lands. The nonpoint source pollutant reductions set forth in the Kinnickinnic River priority watershed plan are consistent with the recommendations of the initial plan and of the Milwaukee Harbor estuary study.

To achieve these pollutant reduction goals, the Kinnickinnic River priority water shed project includes recommendations and funding eligibility for the following urban nonpoint source control measures. The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for implementation of construction erosion controls; the institution of a public information and education program on nonpoint source pollution abatement; and institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers. The plan further recommends the development of a "segmented program" providing for the stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices is also recommended. Specific core and segmented programs include:

- Provision of construction site erosion control practices for all new urban development and redevelopment in the watershed.
- The installation of erosion control measures for 4,200 feet of eroding streambank.
- Provision of nonpoint source control practices on about 4,600 acres of urban land targeted for nonpoint source control. Possible urban nonpoint source pollution control practices including wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.
- Preparation of detailed stormwater management plans be prepared to determine the best practices to be installed in the urban areas.

Current Plan Recommendations

It is recommended that construction site erosion control and streambank erosion control, plus land management practices, designed to provide about a 25 percent reduction in nonpoint source pollutant loadings, and the implementation of construction site erosion control be carried out throughout the Kinnickinnic River watershed, as was recommended in the initial plan and in the Kinnickinnic River priority watershed plan. In addition, the recommendations regarding critical area nonpoint source controls directed toward toxic pollutants be implemented as set forth in the Kinnickinnic River priority watershed plan noted above. The type of practices recommended to be considered for this level of nonpoint source control are summarized in Appendix A.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous section, the most direct measure of impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program. As of 1993, long-term monitoring has been carried out in the Kinnickinnic River watershed on a sustained basis by the Milwaukee Metropolitan Sewerage District for five stations along the main stem of the Kinnickinnic River. Data from three of these stations were used to document current long-term water quality conditions in the watershed, as shown on Map VI-5.

Short-term monitoring was also conducted at one site in the Kinnickinnic River watershed by the Wisconsin Department of Natural Resources during the period 1988 through 1993, as described later in this chapter.

### Current Plan Recommendation

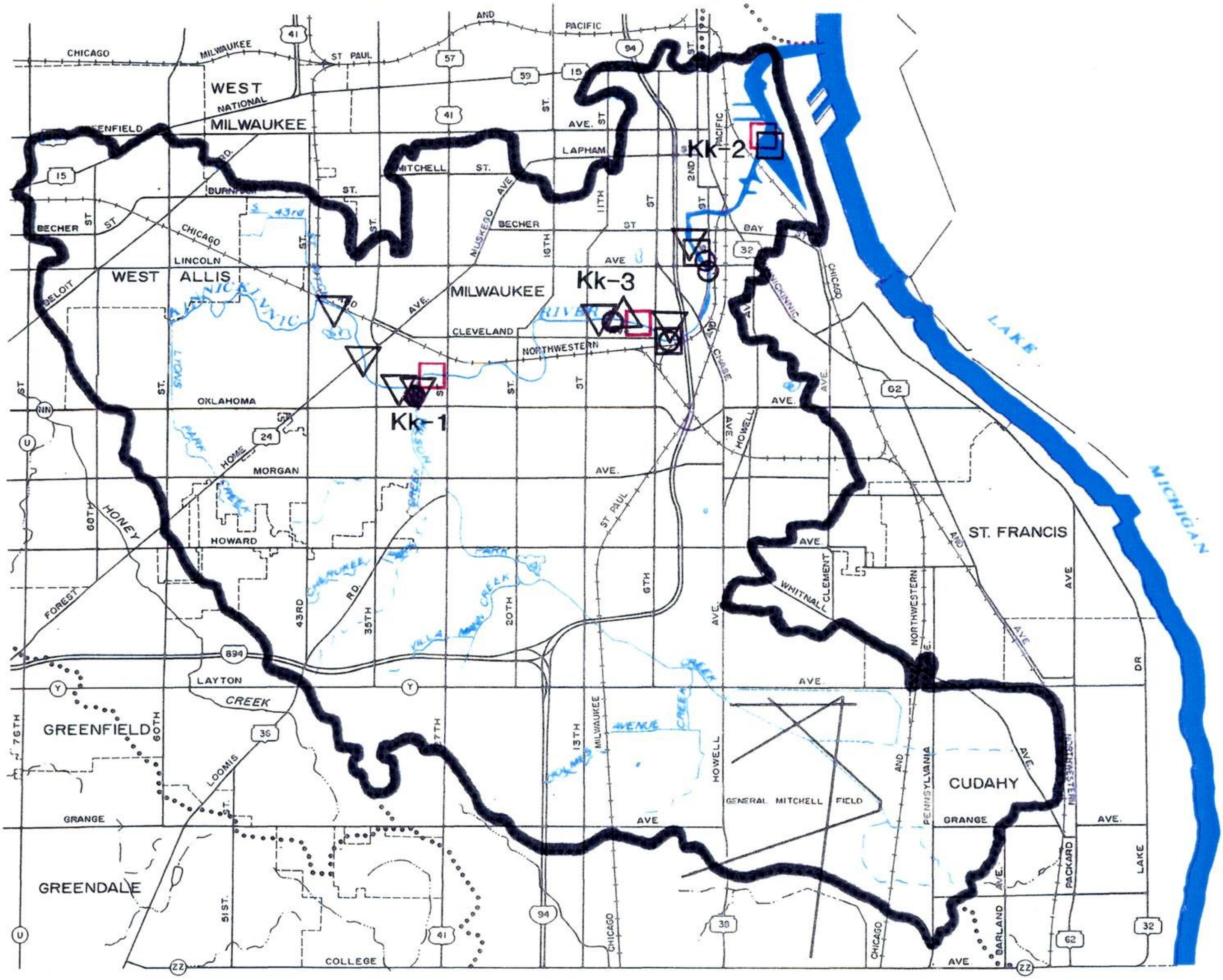
Continued water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that present water quality data collection be continued by the Milwaukee Metropolitan Sewerage District at the current stations on the Kinnickinnic River. Such data represents an adequate program for purposes of characterizing water quality conditions and assessing changes in those conditions. It is also recommended that an intensive biological conditions monitoring survey be conducted by the Wisconsin Department of Natural Resources as part of its next survey period focusing on the Kinnickinnic River, which is expected in the next five to seven years. This program should include monitoring at one station each on Wilson Park Creek and Lyons Creek.

## LAKES MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological condition monitoring programs to be established.

As noted above, there are no major lakes in the Kinnickinnic River watershed. However, there are smaller water bodies such as park-oriented ponds in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality

# Map VI-5
# LOCATION OF WATER QUALITY SAMPLING STATIONS IN THE KINNICKINNIC RIVER WATERSHED




LEGEND

Sampling stations used in preparation of initial plan

- △ USGS
- ▽ DNR
- □ MMSD
- ● SEWRPC
- ○ CITY OF MILWAUKEE HEALTH DEPARTMENT

Post-1976 sampling stations

- □ MMSD Long Term

Source: SEWRPC.

protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are applicable for management purposes.

## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study, the 1965 through 1975 Commission stream water quality management planning effort, the 1976 Commission monitoring program conducted under the regional water quality management planning effort, and the Wisconsin Department of Natural Resources (DNR) sampling programs in 1973 and 1976. Available data collected in those programs for the Kinnickinnic River watershed included samplings at two Commission stations, both on the main stem of the Kinnickinnic River; at seven DNR stations; at one U.S. Geological Survey (USGS) station; and at four City of Milwaukee Health Department stations. The sampling station locations are shown on Map VI-5.

Long-term post-1976 comparable water quality data were collected by the Milwaukee Metropolitan Sewerage District for five stations on the Kinnickinnic River. The DNR has also collected water quality data on a short-term basis at one location in the Kinnickinnic River watershed on the main stem at 7th Street. Water resource appraisal information including biological condition and water quality data collected by the DNR were also available for use in the assessment of current water quality conditions in the Kinnickinnic River watershed.[5] In addition to the data obtained since the preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Kinnickinnic River watershed.

Long-term water quality data collected by the Milwaukee Metropolitan Sewerage District at three sampling stations on the Kinnickinnic River--at Kk-1 on the main stem of the Kinnickinnic River at 27th Street, at Kk-2 in the inner harbor at Greenfield Avenue, and at Kk-3 on the main stem at 7th Street, for the period 1976 through 1993, are summarized in Figures VI-1 through VI-3. The data have been used to assess current water quality trends and the occurrence of changes over time, and to evaluate current conditions with respect to water quality standards. Review of those data indicates that there were no apparent trends in water quality conditions. The water quality standard for dissolved oxygen was generally met at stations Kk-1 and Kk-3 in the free flowing reaches of the river, and the standard for pH was achieved at stations Kk-1 and Kk-2, but violations were reported at station Kk-3. The dissolved oxygen standard was violated at

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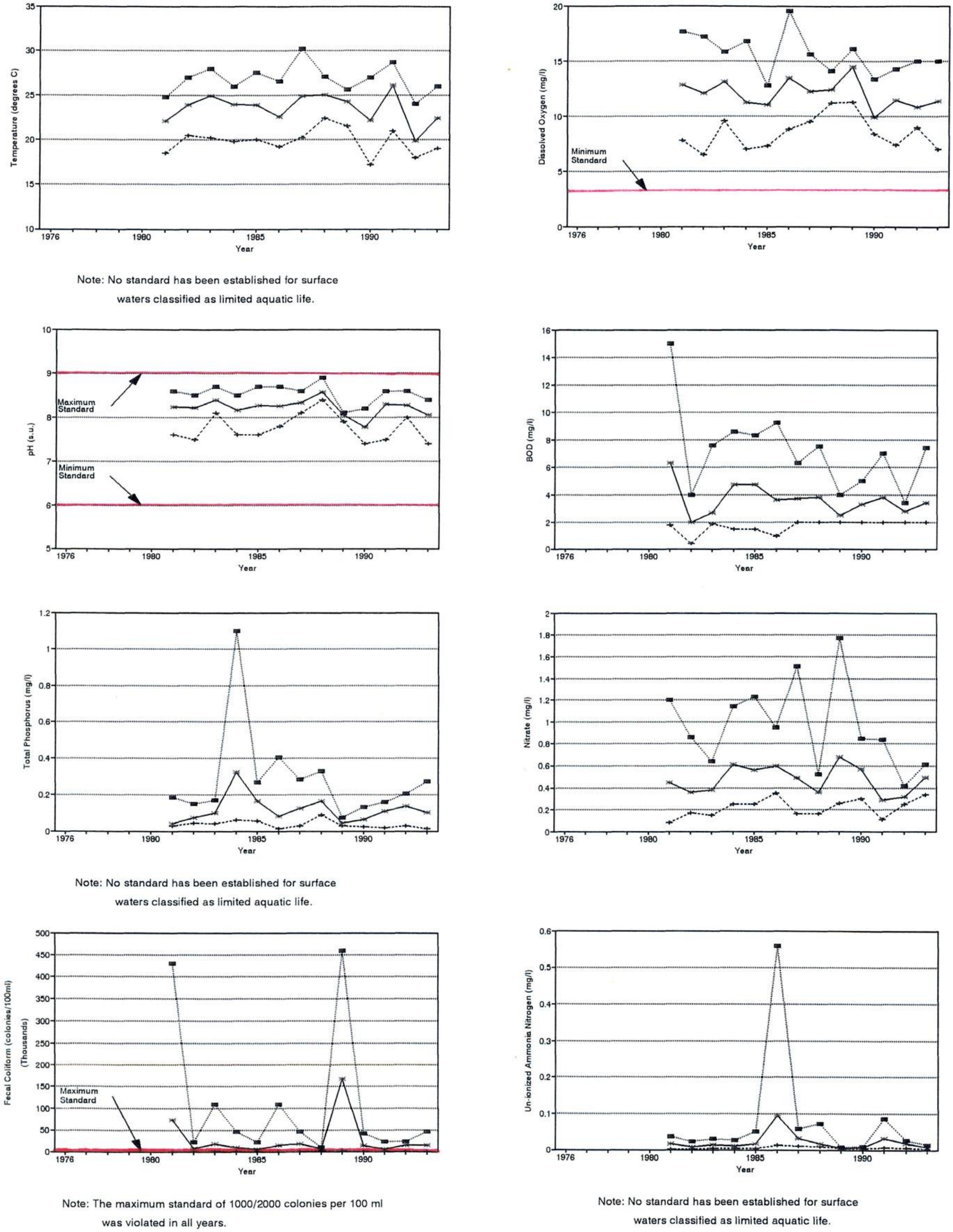
[5]Wisconsin Department of Natural Resources, Kinnickinnic River Stream Appraisals, November 1984.

Figure VI-1
WATER QUALITY DATA FOR THE KINNICKINNIC RIVER
AT STATION Kk-1: 1976-1993



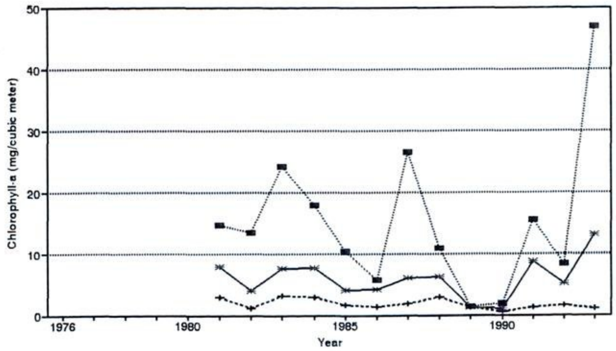

Note: No standard has been established for surface waters classified as limited aquatic life.

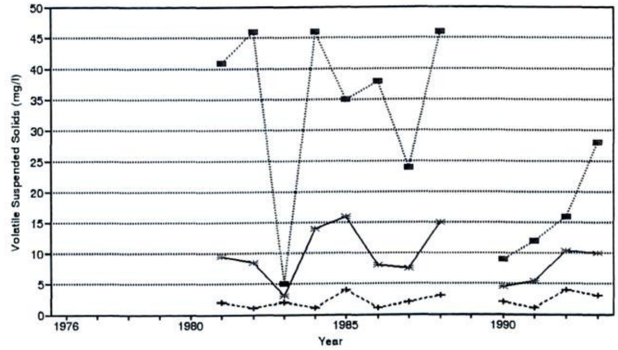
Note: No standard has been established for surface waters classified as limited aquatic life.

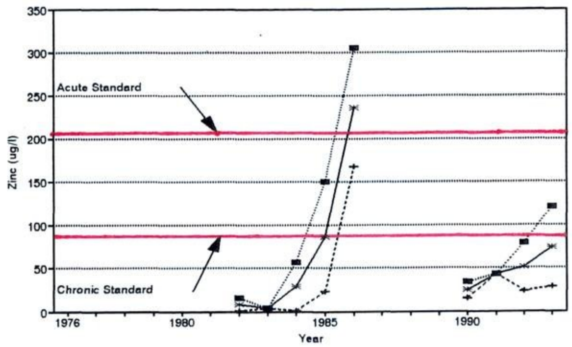
Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

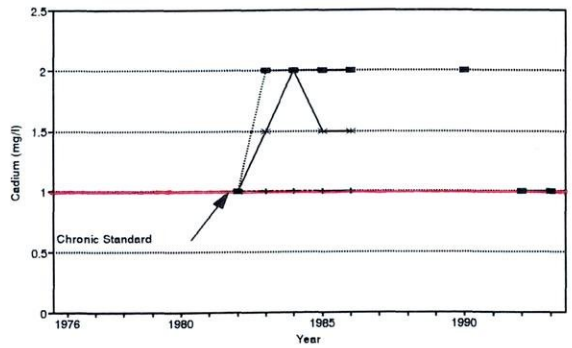
Note: No standard has been established for surface waters classified as limited aquatic life.

## Figure VI-1 (cont'd)

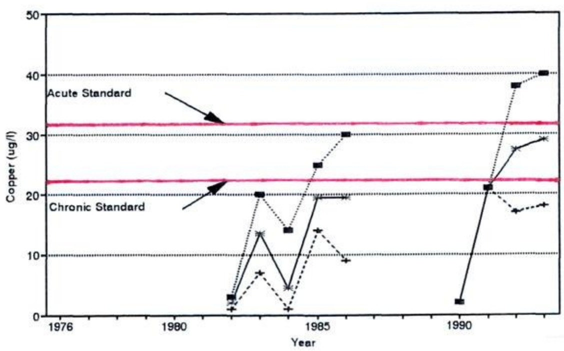


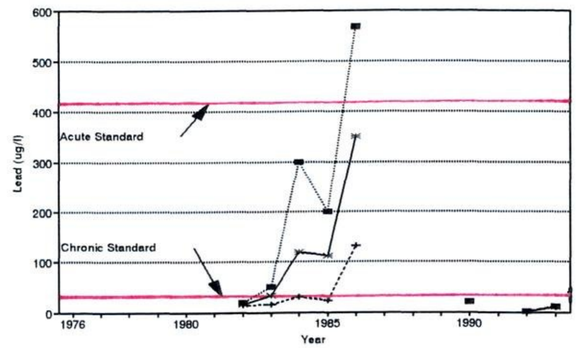



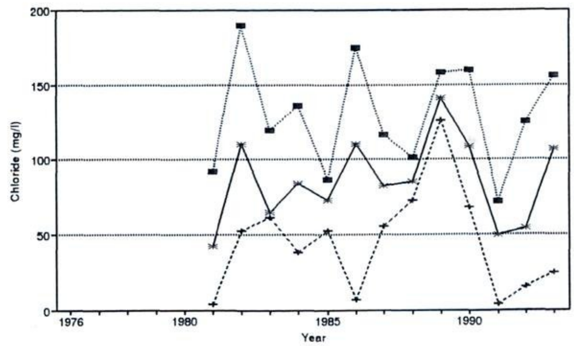




Note: The acute standard of 63.3 ug/l was not violated in any year.

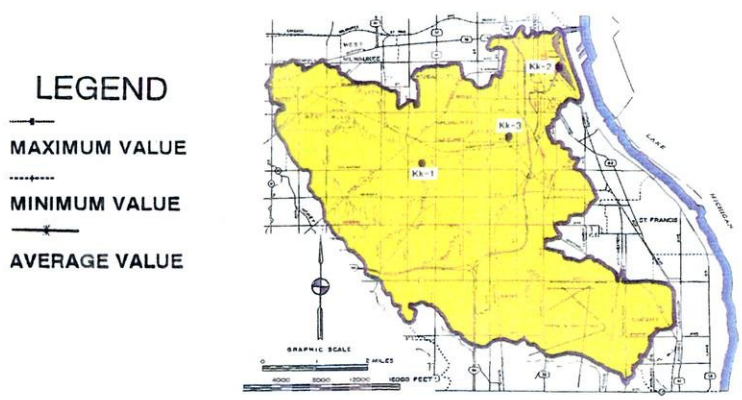



Note: No standard has been established for surface waters classified as limited aquatic life.

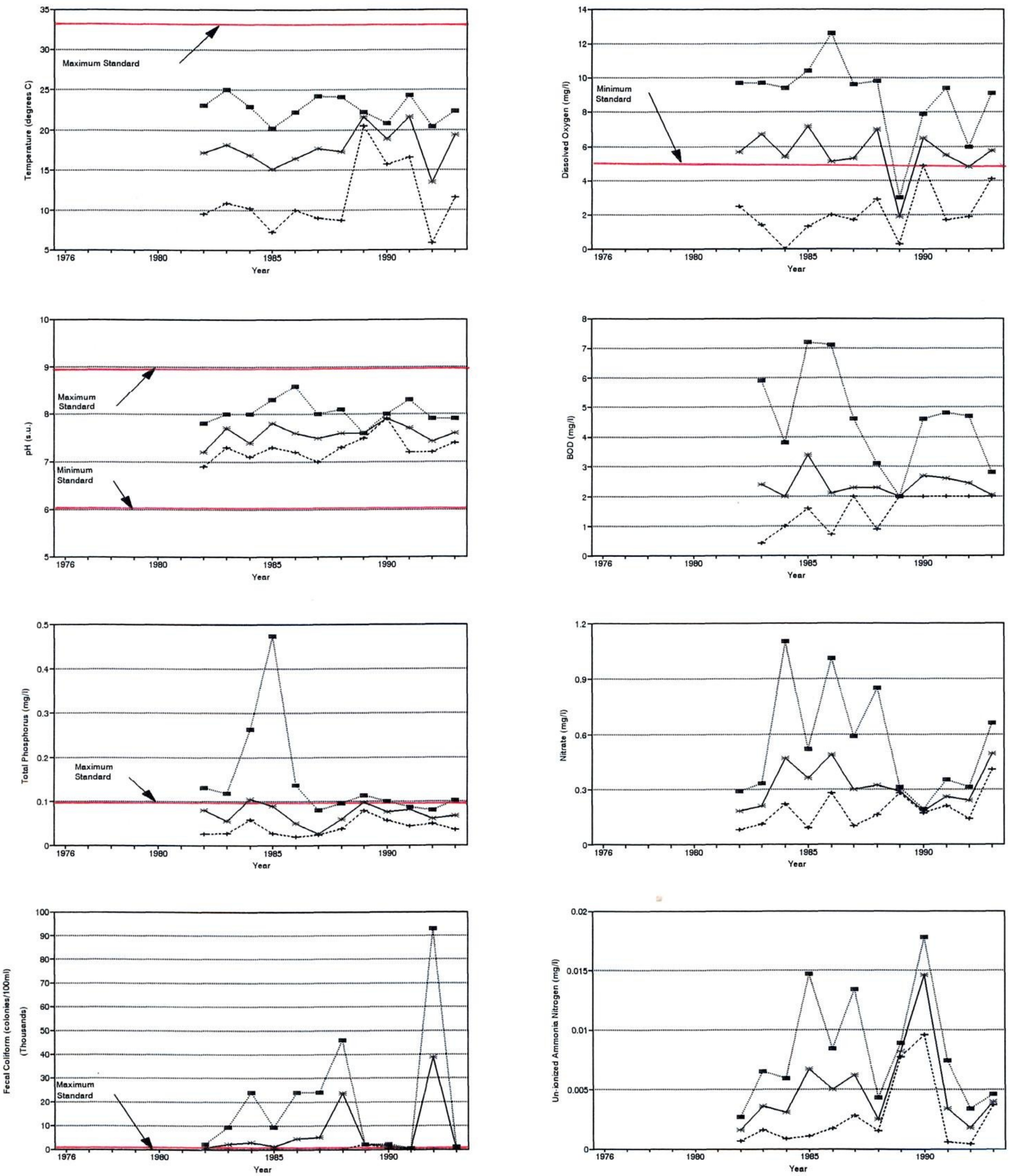
KINNICKINNIC RIVER WATERSHED




Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for limited aquatic life and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

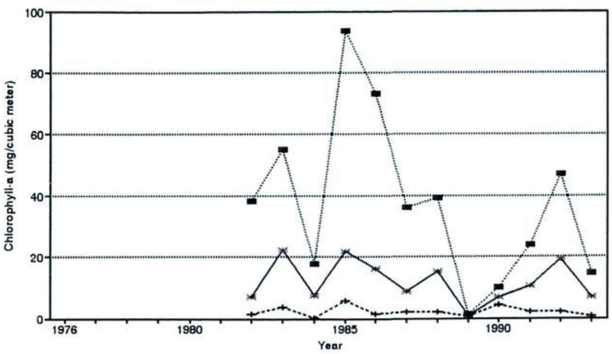
## Figure VI-2
## WATER QUALITY DATA FOR THE KINNICKINNIC RIVER AT STATION Kk-2: 1976-1993

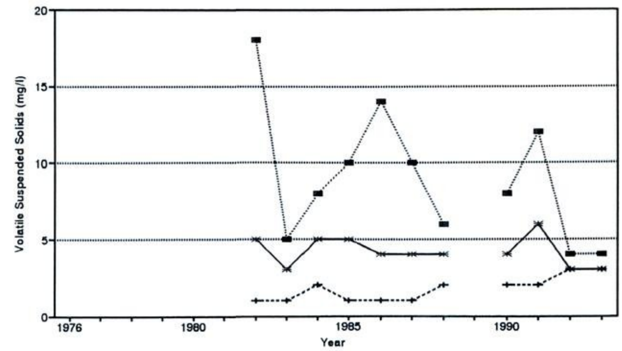


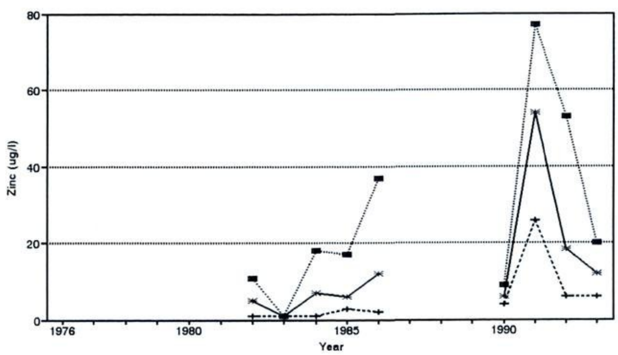

Note: The maximum standard of 200/400 colonies per 100ml was violated in all years.

Note: The maximum standard of 0.04 mg/l was not violated in any year.

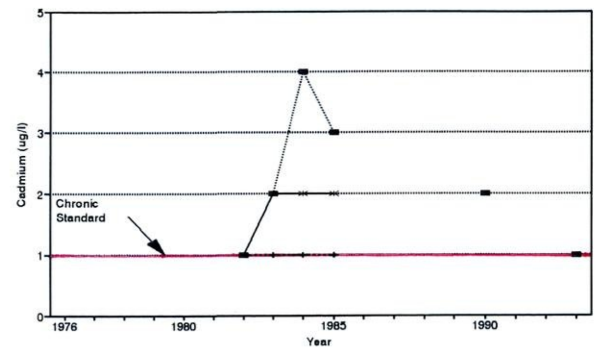
Figure VI-2 (cont'd)



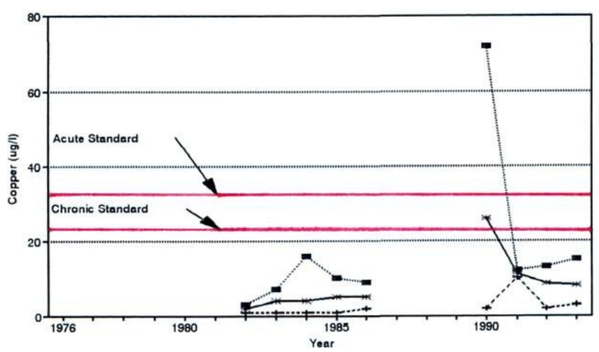



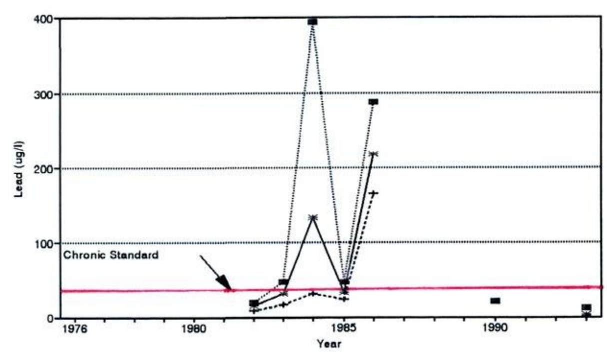




Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.

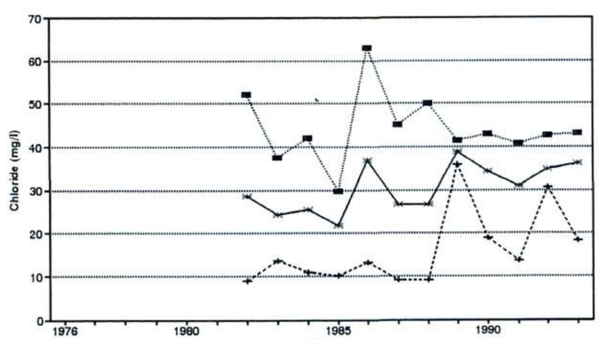



Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

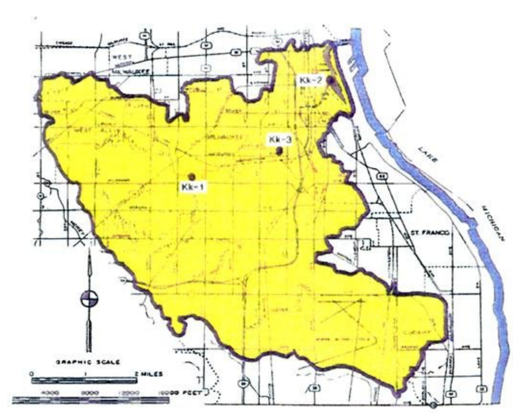
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

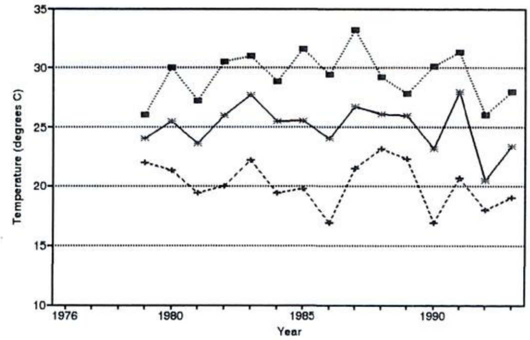
KINNICKINNIC RIVER WATERSHED

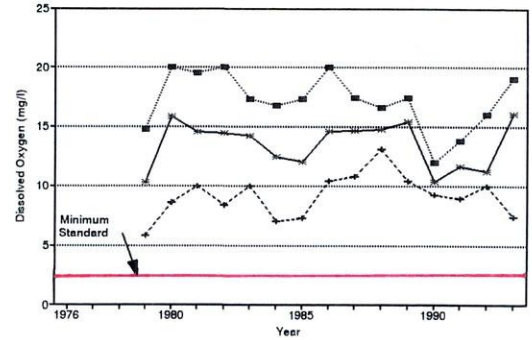



Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

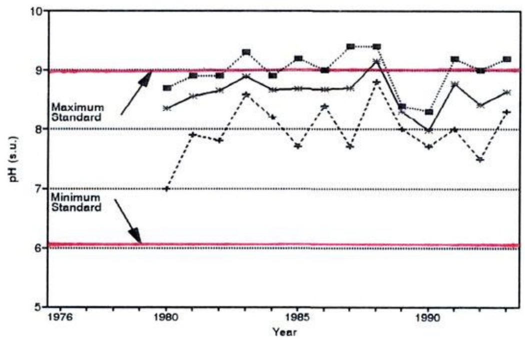
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

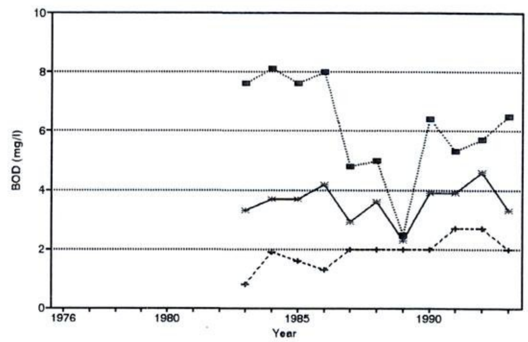
# Figure VI-3
## WATER QUALITY DATA FOR THE KINNICKINNIC RIVER AT STATION Kk-3: 1976-1993

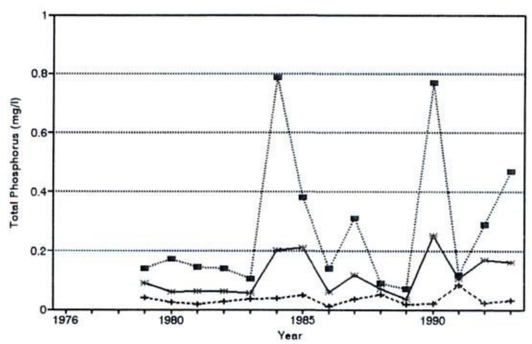


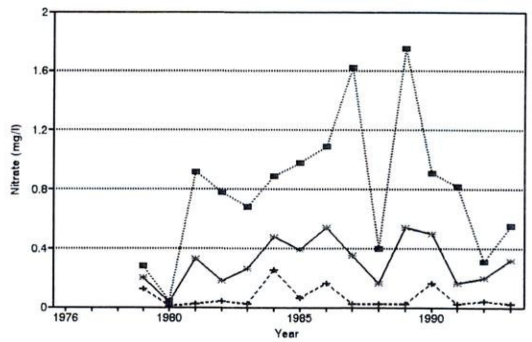




Note: No standard has been established for surface waters classified as limited aquatic life.

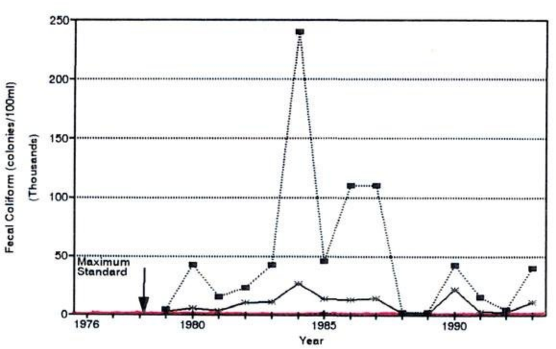


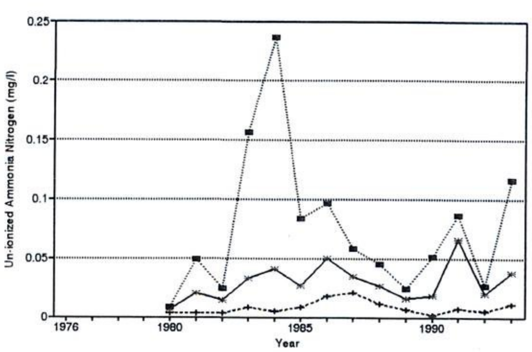




Note: No standard has been established for surface waters classified as limited aquatic life.

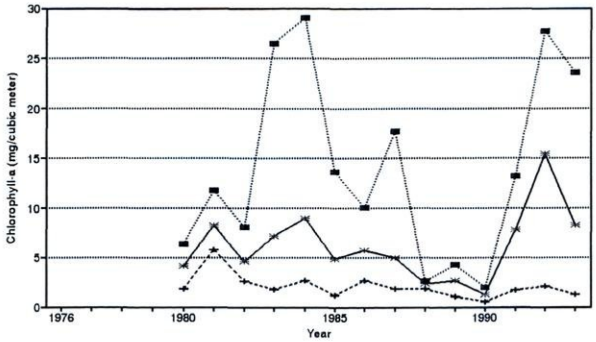


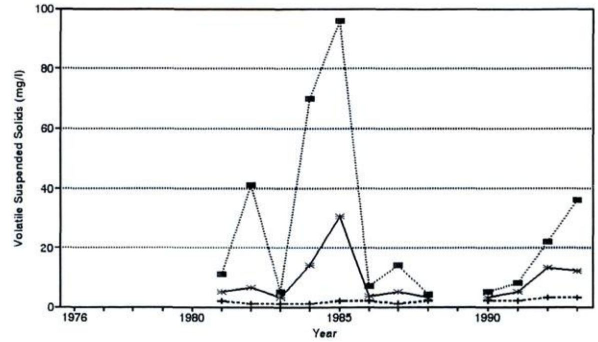



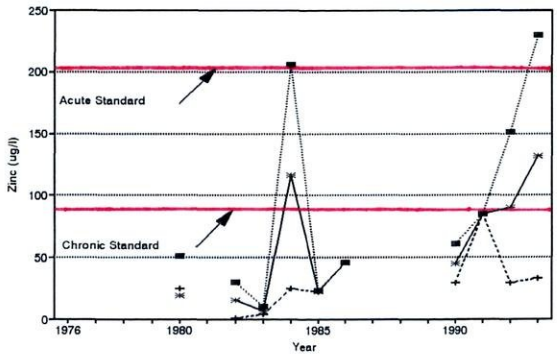

Note: The maximum standard of 1000/2000 colonies per 100ml was violated in all years.

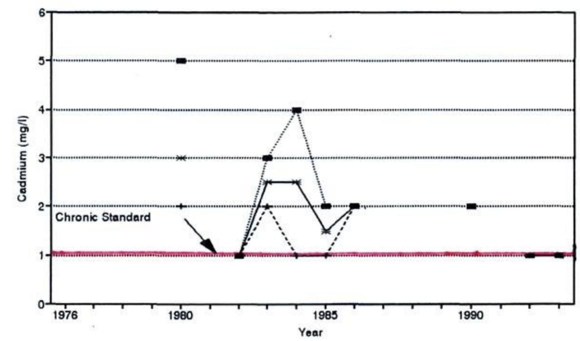
Note: No standard has been established for surface waters classified as limited aquatic life.

## Figure VI-3 (cont'd)

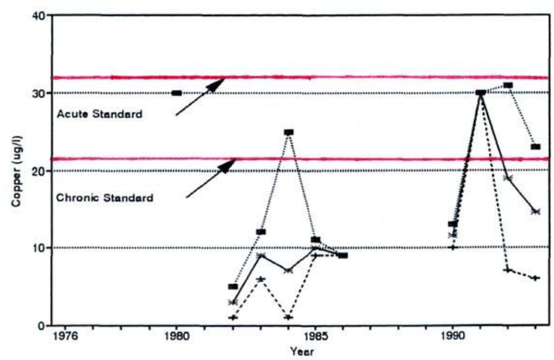


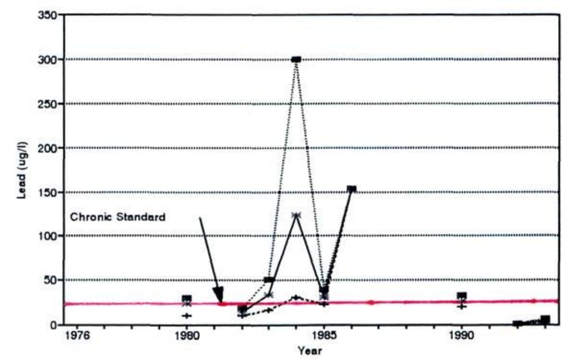



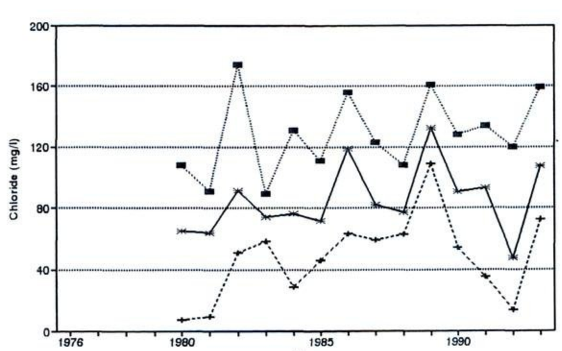




Note: The acute standard of 63.9 ug/l was not violated in any year.




Note: The acute standard of 408.6 was not violated in any year.




Note: No standard has been established for surface waters classified as limited aquatic life.

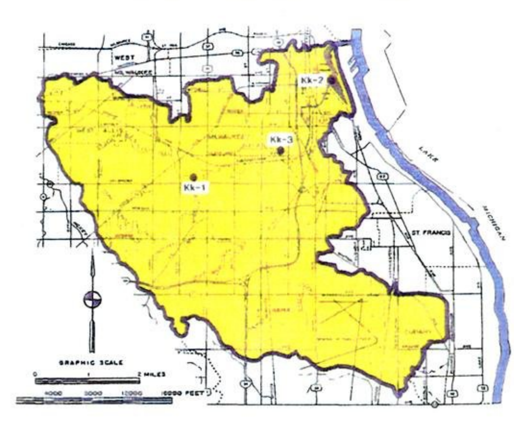
### LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

KINNICKINNIC RIVER WATERSHED




Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for limited aquatic life and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

station Kk-2 in the inner harbor. Fecal coliform levels exceeded the standard at all three locations. As noted in the subsequent section, standards for metals are also exceeded at all stations.

Toxic and Hazardous Substances

Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Kinnickinnic River watershed from 1973 through 1977. The analyses indicated that recommended levels of mercury were exceeded in four of 73 samples, and that recommended PCB levels were exceeded in one out of 12 water quality samples. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, DDT, DDE, DDD, aldrin, heptachlor, heptachlor epoxide, lindane, dieldrin, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels. Sampling and analyses of bottom sediments were conducted on the Kinnickinnic River, and detectable levels of cadmium, chromium, copper, lead, mercury, nickel, zinc, and PCBs were observed; however, no criteria were established to assess the recorded concentrations.

Recent data on metals in the Kinnickinnic River watershed were collected by the Milwaukee Metropolitan Sewerage District, as shown in Figures VI-1 through VI-3. Available data collected from stations Kk-1, 2, and 3 from 1976 to 1993 indicated that lead, copper, and cadmium concentrations at all stations violated chronic toxicity level standards as established by the Wisconsin Department of Natural Resources. Levels of zinc also violated chronic toxicity standards at two stations, Kk-1 and Kk-3.

Sediment contamination with PAHs is a general problem in the sediments of the Kinnickinnic River portions of the Milwaukee Harbor estuary, as documented in the Milwaukee Harbor estuary study[6] and the remedial action plan for the Milwaukee Harbor estuary.[7] Additional data on the sediment chemistry of the Kinnickinnic River are reported by Ni, Gun, and Christensen[8] and by Masterson and Bannerman.[9] Both studies report PAH concentrations that exceed the Lowest Effect Level (LEL) guidelines proposed as screening criteria for contaminated sediments by the Wisconsin Department of Natural Resources.[10] In addition, data on copper and oil

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[6]SEWRPC Planning Report No. 37, op.cit.

[7]Wisconsin Department of Natural Resources, Milwaukee Estuary, Remedial Action Plan, March 1991.

[8]Fay Ni, Michael F. Gun, and Erik R. Christensen, Toxic Organic Contaminants in the Sediments of the Milwaukee Harbor Estuary; Final Report, Milwaukee Metropolitan Sewerage District, March 1992.

[9]John P. Masterson and Roger T. Bannerman, "Impacts of Stormwater Runoff on Urban Streams in Milwaukee County, Wisconsin;" in Proceedings of the National Symposium on Water Quality, AWRA, November 1994; pp. 123-133.

[10]Wisconsin Department of Natural Resources (Draft) Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System, June 1994.

and grease concentrations in the Kinnickinnic River sediments reported by Masterson and Bannerman also exceeded the proposed LEL guidelines.

Since the completion of the initial regional water quality management plan, 34 spills of toxic substances into streams within the Kinnickinnic River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 29 have occurred in the main stem of the Kinnickinnic River, all within the City of Milwaukee. The remaining five spills occurred in the Wilson Park Creek tributary. The majority of the substances that were spilled into surface waters were oil or related petroleum products.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Kinnickinnic River and its major tributaries were assessed with the results set forth in Table VI-6. Fish populations and diversity are poor throughout much of the watershed due largely to the conversion of the natural stream channel to a concrete channel. Downstream of the location where the concrete channel ends on the Kinnickinnic River downstream of 5th Street, the fish population and diversity are rated as good. No reported fish kills have been recorded in the Kinnickinnic River watershed.

Standards were not expected to be fully met for fecal coliform for all stations considered in the Kinnickinnic River watershed. Problems with dissolved oxygen concentrations occurred in the Kinnickinnic River downstream of First Street. For those stream reaches recommended for warmwater sport fish and limited recreational uses, standards were not met for concentrations of un-ionized ammonia nitrogen or total phosphorus. Problems with water column toxic pollutants were noted in the Kinnickinnic River downstream of 27th Street and in Wilson Park Creek. Where data were available, the biotic index ratings, which are biological indicators of water quality within a stream system, were poor. High levels of streambed sedimentation were noted in Wilson Park Creek and the Kinnickinnic River upstream of 27th Street. Moderate levels of streambed sedimentation were noted in the Kinnickinnic River downstream of First Street.

Table VI-7 sets forth the water quality index classifications[11] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table VI-7, recent data were used from the Milwaukee Metropolitan Sewerage District for three stations on the Kinnickinnic River: at 27th Street, at 7th Street, and at Greenfield Avenue. These stations are shown on Map VI-5. The data from the station at 27th Street were used for comparative purposes in conjunction with earlier data from station Kk-1, located on the Kinnickinnic River at 29th Street. The limited comparative data available indicate that water quality conditions have generally remained "fair" from 1964 to 1974-75 and to 1990-91.

A summary of potential pollution sources in the Kinnickinnic River watershed by stream reach is shown in tabular summary in Table VI-8. Review of the data indicate the majority of the conversion of lands from rural to urban uses

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[11]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table VI-6

CHARACTERISTICS OF STREAMS IN THE KINNICKINNIC RIVER WATERSHED

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating[c] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| a. Kinnickinnic River upstream 27th Street | 3.9 | Poor | No | No | -- | -- | Yes | -- | Poor | High (gravel, sand, silt, concrete) | Major |
| b. Kinnickinnic River downstream 27th Street to 5th Street | 2.2 | Poor | No | No | -- | -- | Yes | Yes | -- | -- (concrete) | Major |
| c. Kinnickinnic River downstream 5th Street to 1st Street | 1.3 | Good | No | No | Yes | Yes | Yes | Yes | Poor | -- (gravel, sand) | Major |
| d. Kinnickinnic River downstream 1st Street | 1.4 | Good | No | Yes | Yes | Yes | Yes | Yes | Poor | Moderate (gravel, sand) | Major |
| e. Lyons Creek | 1.4 | -- | No | No | -- | -- | Yes | -- | -- | -- | Major |
| f. Wilson Park Creek | 5.1 | Poor | No | No | -- | -- | Yes | Yes | Poor | High (gravel, sand, silt) | Major |
| TOTAL | 15.3 | | | | | | | | | | |

[a] Based upon stream appraisal documentation set forth in Wisconsin Department of Natural Resources Kinnickinnic River Stream Appraisals, November 1984, and professional judgement of area fish managers.

[b] The most recent water quality data available as described in Figures VI-1 through VI-3 were used to evaluate water quality in the Kinnickinnic River system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for Kinnickinnic River watershed stream reaches based upon simulated year 2000 land use conditions and current level of pollutant control, if appropriate.

[c] Biotic index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in Wisconsin Department of Natural Resources Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality in Streams," Hilsenhoff, 1982.

[d] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VI-7

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE KINNICKINNIC RIVER WATERSHED 1964, 1974-1975, AND 1990-1991

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Main Stem Stations | | | |
| Kk-1 | Fair | Fair | Fair |
| Kk-2 | -- | -- | Fair/Good |
| Kk-3 | -- | -- | Fair |
| Watershed Average | Fair | Fair | Fair |

[a] See Map VI-5 for sampling station locations.

Source: SEWRPC.

Table VI-8

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE KINNICKINNIC RIVER WATERSHED: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b]: Historical 1976-1990 | Extent of Conversion of Lands from Rural to Urban[b]: Expected 1990-2010 | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources: Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|
| Kinnickinnic River upstream 27th Street | Insignificant[d] | Insignificant[d] | 1978-oil<br>1983-unknown<br>1983-gelatinous scum<br>1986-unknown | X | -- | -- | -- | 15 | Leaking Underground Storage Tank (LUST) site permitted to discharge remediation wastewater to the Kinnickinnic River | 1,2 |
| Kinnickinnic River downstream 27th Street to 5th Street | Insignificant[d] | Insignificant[d] | 1978-foundary sand<br>1982-green liquid<br>1983-unknown<br>1983-gelatinous scum<br>1984-oil<br>1984-oil<br>1986-oil<br>1986-milky substance<br>1991-Water with cement floor grindings | X | -- | -- | -- | 4 | -- | 1,2 |
| Kinnickinnic River downstream 5th Street to 1st Street | Insignificant[d] | Insignificant[d] | 1985-fuel oil<br>1992-diesel fuel | X | -- | -- | -- | 10 | -- | 1,2 |
| Kinnickinnic River downstream 1st Street to Jones Island Ferry | Insignificant[d] | Insignificant[d] | 1978-oil<br>1982-light oil<br>1985-oil cutting<br>1985-coal dust<br>1987-waste oil<br>1987-hydraulic oil<br>1987-gasoline<br>1987-waste oil<br>1988-heavy dark oil residue<br>1988-ground seepage<br>1989-lube oil<br>1989-oil-based paint<br>1990-oil-based paint<br>1991-diesel fuel | X | -- | -- | -- | 6 | -- | 1,2 |
| Lyons Creek | Insignificant[d] | Insignificant[d] | -- | X | -- | -- | -- | 0 | -- | 1,2 |

Table VI-8 (continued)

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | |
| Wilson Park Creek | Insignificant[d] | Insignificnt[d] | 1986-oil substance<br>1990-diesel fuel<br>1990-petroleum product<br>1990-petroleum product<br>1991-petroleum (sheen) | X | -- | -- | -- | 12 | LUST site permitted to discharge remediation wastewater to the Kinnickinnic River | 1,2 |

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:
major > 20%
moderate 10 - 20%
significant 5 - 10%
insignificant 0 - 5%

[c] Number codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place
2. Kinnickinnic Priority Watershed Nonpoint Source Plan implementation underway.

[d] Considerable urban development existing pre-1976.

Source: Wisconsin Department of Natural Resources and SEWRPC.

occurred prior to 1976. It should be noted that the majority of the documented spills of toxic substances occurred in the Kinnickinnic River main stem from 27th Street to 5th Street and downstream of 1st Street. The majority of the permitted industrial discharges occur in the Kinnickinnic River upstream of 27th Street and in Wilson Park Creek. Data on nonpoint source pollution and additional potential impacts to surface water quality are included in Table VI-8.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Kinnickinnic River watershed, as of 1993, are generally recommended for limited aquatic life and limited recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. The Kinnickinnic River downstream of 5th Street, which is not concrete-lined, is recommended for warmwater sport fish and limited recreational uses.

Based upon the available data for sampling stations in the watershed, the main stem of the Kinnickinnic River did not fully meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. More recent data available for the period of 1976 through 1991 indicate that the dissolved oxygen standards associated with the recommended water use objective are largely met, while the fecal coliform standards continue to be violated. As shown in Figures VI-1 through VI-3, and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the fecal coliform levels also occur along the entire main stem of the Kinnickinnic River and in Wilson Park and Lyons Creeks. In addition, metals standards were noted to be violated for all stations except for the main stem above 27th Street and for Lyons Park Creek.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of pollution abatement planning and land use decisions, there are no major water quality issues remaining to be addressed specific to the Kinnickinnic River watershed. A potential future amendment to the regional plan for the Kinnickinnic River watershed may potentially be developed under the facility plan update initiated by the Milwaukee Metropolitan Sewerage District in 1995. That plan update is anticipated to institute an amendment to the regional plan once it is adopted by all of the agencies involved.

## Chapter VII

## MENOMONEE RIVER WATERSHED REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

### INTRODUCTION

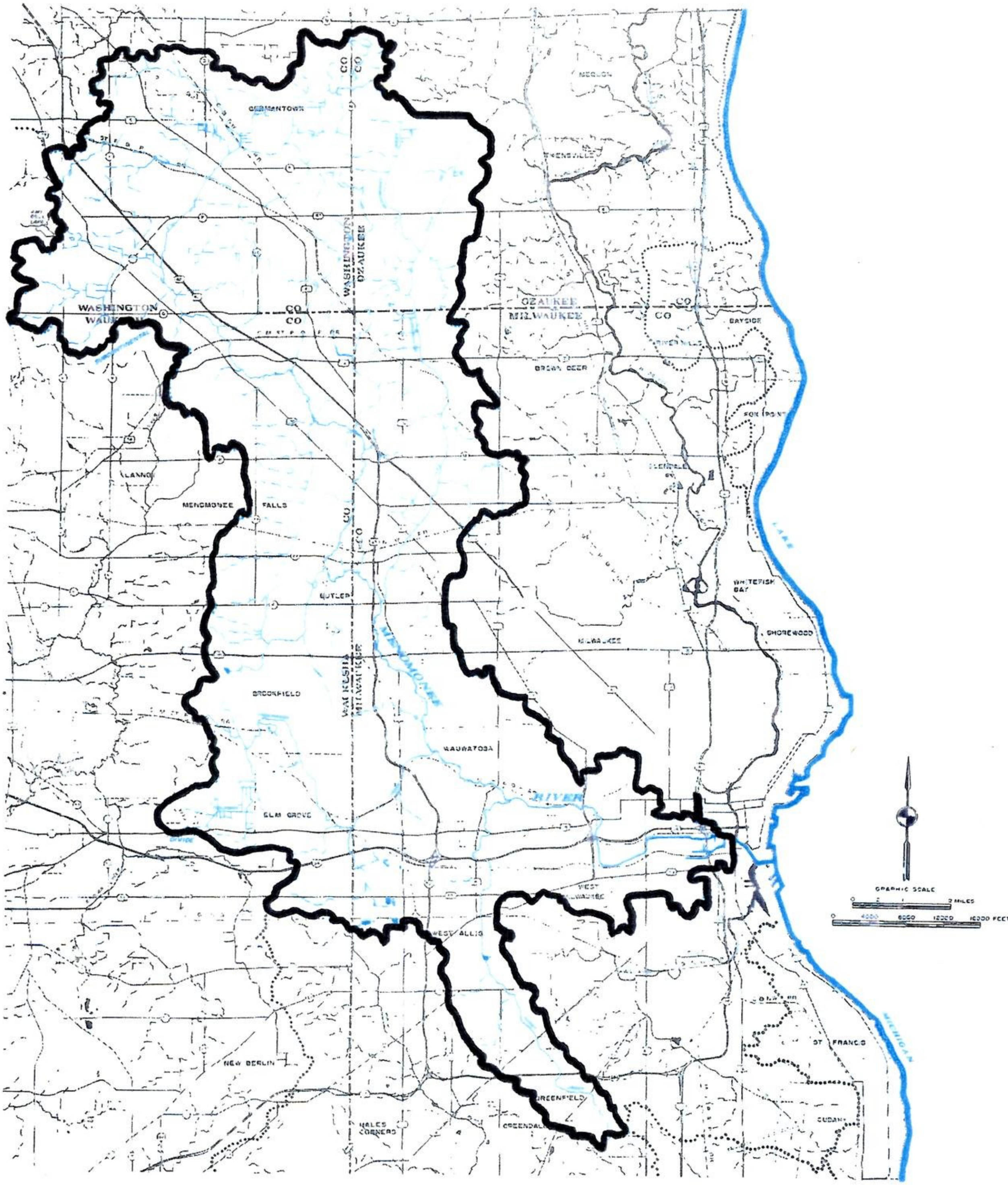
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto, and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plant update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Menomonee River watershed through 1993, where available. Finally, this chapter presents a description of any substantive water quality management issues that remain to be addressed in the Menomonee River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a brief separate section on lake management is included which is limited for the Menomonee River watershed as there are no major lakes in the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Menomonee River watershed is located in the east central portion of the Region and covers an area of approximately 135 square miles. The Menomonee River originates in southeastern Washington County, and flows approximately 28 miles through the northeastern corner of Waukesha County and through western and central Milwaukee County to its confluence with the Milwaukee River. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Menomonee River watershed and its principal tributaries, are shown on Map VII-1. The Menomonee River watershed contains no lakes with a surface area of 50 acres or more.

### LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendation, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Menomonee River watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution

## Map VII-1
## MENOMONEE RIVER WATERSHED



discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table VII-1 summarizes the existing land uses in the Menomonee River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed is largely urbanized, 41 percent of the watershed was still in rural and other open space land uses in 1990. These rural and open space uses included about 22 percent of the total area of the watershed in agricultural and related rural uses, about 2 percent in woodlands, about 8 percent in surface water and wetlands, and about 9 percent in other open lands. The remaining approximately 59 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map VII-2.

Urban development exists in much of the Menomonee River watershed, with concentrated development generally occurring in portions of Milwaukee, Washington, and Waukesha Counties. Concentrations of urban-related land use are located in and around the Village of Menomonee Falls, particularly along the STH 175 corridor, in the Villages of Elm Grove and Germantown, and in the Cities of Brookfield, Greenfield, Wauwatosa, West Allis, and Milwaukee. The watershed contains two major commercial centers, Blue Mound Road and Mayfair, and five major industrial centers, Milwaukee Granville, Butler, West Allis West, Menomonee Valley East, and Menomonee Valley West.

As shown in Table VII-1, from 1975 to 1990, urban land uses in the watershed increased from about 46,000 acres, or about 72 square miles, to about 51,000 acres, or 79 square miles, or by about 10 percent. As shown in Table VII-1, residential land represents the largest urban land use in the watershed. Residential use has increased within the watershed, from about 22,000 acres, or about 34 square miles in 1975 to about 24,000 acres, or about 38 square miles in 1990, a 10 percent increase. Commercial and industrial land uses increased significantly, from about 3,400 acres, or about 5.3 square miles, to about 4,300 acres, or about 6.8 square miles, an increase of 28 percent.

The 79-square miles of urban land uses in the watershed as of 1990 approximate the same amount under the staged 1990 planned urban land envisioned in the adopted year 2000 land use plan. The current status of development in the Menomonee River watershed and in adjacent portions of Milwaukee, Ozaukee, Washington, and Waukesha Counties was considered in developing the new, year 2010 land use plan element described in Chapter III for the Region as a whole.

Table VII-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Menomonee River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban land uses are expected to increase in the Villages of Butler and Menomonee Falls, in the southern portion of the Village of Germantown, and in the northwestern portion of Milwaukee County. In addition, some urban re-development is anticipated to occur in portions of the already urbanized areas in and around Milwaukee County. The year 2010 land use plan additionally proposes two major commercial centers to be located in the

Table VII-1

LAND USE IN THE MENOMONEE RIVER WATERSHED: 1975 AND 1990[a]

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 22,139 | 25.6 | 24,247 | 29.1 | 2,108 | 9.5 |
| Commercial | 1,314 | 1.5 | 1,618 | 1.9 | 304 | 23.1 |
| Industrial | 2,072 | 2.4 | 2,719 | 3.2 | 647 | 31.25 |
| Transportation, Communication, and Utilities[b] | 14,423 | 16.7 | 15,835 | 18.3 | 1,412 | 9.8 |
| Governmental and Institutional | 3,198 | 3.7 | 3,220 | 3.7 | 22 | 0.7 |
| Recreational | 2,861 | 3.3 | 2,966 | 3.4 | 105 | 3.7 |
| Subtotal | 46,007 | 53.2 | 50,605 | 58.6 | 4,598 | 10.0 |
| Rural | | | | | | |
| Agricultural and Related | 24,528 | 28.4 | 19,035 | 22.0 | -5,493 | - 22.4 |
| Lakes, Rivers, Streams and Wetlands | 6,720 | 7.8 | 7,077 | 8.2 | 357 | 5.3 |
| Woodlands | 2,326 | 2.7 | 2,185 | 2.5 | - 141 | - 6.1 |
| Open Lands, Landfills, Dumps, and Extractive[c] | 6,798 | 7.9 | 7,477 | 8.7 | 679 | - 10.1 |
| Subtotal | 40,372 | 46.8 | 35,774 | 41.4 | -4,598 | - 11.4 |
| Total | 86,379 | 100.0 | 86,379 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

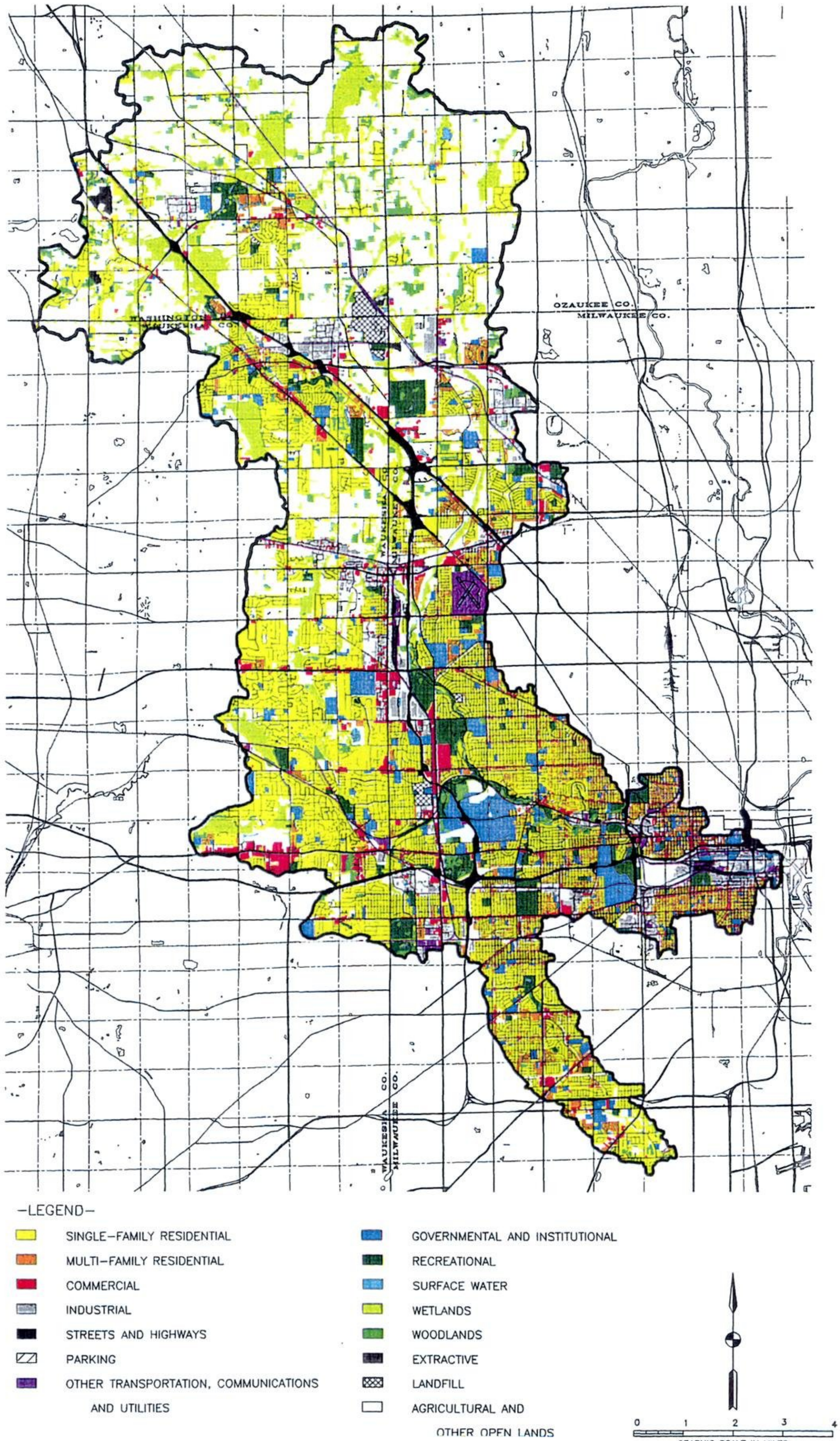
[b] Includes all off-street parking.

[c] Includes both rural and urban lands.

Source: SEWRPC.

## MAP VII-2

## LAND USES IN THE MENOMONEE RIVER WATERSHED: 1990




The Menomonee River watershed is about 135 square miles in areal extent, or about 5 percent of the total Region. In 1990 about 79 square miles, or about 59 percent of the watershed, was in urban land uses.

Source: SEWRPC

Table VII-2

EXISTING AND PLANNED LAND USE IN THE MENOMONEE RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 24,247 | 28.1 | 26,529 | 30.7 | 2,282 | 9.4 | 30,177 | 34.9 | 5,930 | 24.5 |
| Commercial | 1,618 | 1.9 | 1,677 | 2.0 | 59 | 3.6 | 1,788 | 2.1 | 170 | 10.5 |
| Industrial | 2,719 | 3.2 | 3,109 | 3.6 | 390 | 14.3 | 3,381 | 3.9 | 662 | 24.3 |
| Transportation, Communication, and Utilities[b] | 15,835 | 18.3 | 16,707 | 19.3 | 872 | 5.5 | 18,048 | 20.9 | 2,213 | 14.0 |
| Governmental and Institutional | 3,220 | 3.7 | 3,374 | 3.9 | 154 | 5.2 | 3,486 | 4.0 | 266 | 8.3 |
| Recreational | 2,966 | 3.4 | 3,450 | 4.0 | 484 | 16.3 | 3,563 | 4.1 | 597 | 20.1 |
| Subtotal | 50,605 | 58.6 | 54,846 | 63.5 | 4,241 | 8.4 | 60,443 | 69.9 | 9,838 | 19.4 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 19,035 | 22.0 | 18,156 | 21.0 | - 879 | - 4.6 | 13,431 | 15.6 | -5,604 | - 29.4 |
| Lakes, Rivers, Streams, and Wetlands | 7,077 | 8.2 | 6,531 | 7.6 | - 546 | - 7.7 | 6,531 | 7.6 | - 546 | - 7.7 |
| Woodlands | 2,185 | 2.5 | 2,184 | 2.5 | - 1 | 0.0 | 2,111 | 2.4 | - 74 | - 3.4 |
| Open Lands,[c] Landfills, Dumps and Extractive | 7,477 | 8.7 | 4,662 | 5.4 | -2,815 | -37.6 | 3,863 | 4.5 | -3,614 | - 48.3 |
| Subtotal | 35,774 | 41.4 | 31,533 | 36.5 | -4,241 | -11.8 | 25,936 | 30.1 | -9,838 | - 27.5 |
| Total | 86,379 | 100.0 | 86,379 | 100.0 | 0 | -- | 86,379 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

Menomonee River watershed. The plan proposes a research park to be located in the southwestern portion of the City of Wauwatosa in the vicinity of the Milwaukee County Institutions grounds, and a major commercial office center--Park Place--which was largely completed as of 1990 and is located in the northwestern portion of Milwaukee County.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Menomonee River watershed, as indicated in Table VII-2, is projected to increase from the 1990 total of about 79 square miles, or about 59 percent of the total area of the watershed, to about 86 square miles, or about 64 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 94 square miles, or about 70 percent of the total watershed by year 2010. It is important to note that the 30 to 37 percent of the watershed remaining in rural and other open space uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and, as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 56 square miles in 1990 to about 49 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 41 square miles under the high growth-decentralized land use plan, decreases of about 13 to 25 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Menomonee River watershed--including consideration of public and private sewage treatment plants, points of public sanitary sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary sewer service areas located in the watershed.

With regard to the point source plan element related to the Menomonee River, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants;

provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of a solids management program; and provision of trunk sewers to serve the various communities comprising the District service area. As of 1993, the District's pollution abatement program was nearing completing, with the deep tunnel system expected to be online during 1994.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on an update of its Section 201 sewerage facility plan[1] for the entire Milwaukee metropolitan service area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that that facility plan re-examine certain system level decisions that were made in the past, including trunk sewer needs, and the retention of the one remaining small sewage treatment plant in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewerage facilities plan update is intended, then, upon its adoption by all of the agencies concerned, to constitute an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Menomonee River watershed

Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were three public sewage treatment facilities located in the Menomonee River watershed, as shown on Map VII-3. All three plants, the Village of Germantown Old Village Plant and the Village of Menomonee Falls Pilgrim Road and Lilly Road plants, discharged treated effluent directly to the main stem of the Menomonee River. All three plants were abandoned after 1975 and the attendant service areas were connected to the Milwaukee metropolitan sewerage system for treatment purposes, as recommended in the initial water quality plan. The status of implementation in regard to the abandonment of public and private sewage treatment plants in the Menomonee River watershed, as recommended in the initial regional water quality management plan, is summarized in Table VII-3. Currently, the Milwaukee Metropolitan Sewerage District's Jones Island and South Shore plants serve the existing sewered portions of the Menomonee River watershed. It should be noted that in 1975, the base year of the initial plan, and in 1990, there were no privately owned sewage treatment plants discharging to the stream system of the Menomonee River watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were eight sewer service areas identified within, or partially within, the Menomonee River watershed: Mequon, Germantown, Menomonee Falls, Butler, Brookfield East, Elm Grove, New Berlin, and the Milwaukee Metropolitan Sewerage District. Currently, all of the sewer service areas within the watershed have undergone refinements as recommended, with the exception of the Milwaukee Metropolitan Sewerage District which is currently almost entirely served by sewer. The boundaries of the sewer service areas in the watershed, through 1993, are shown on Map VII-3. Table VII-4 lists the plan amendment prepared for each refinement and the date the Commission

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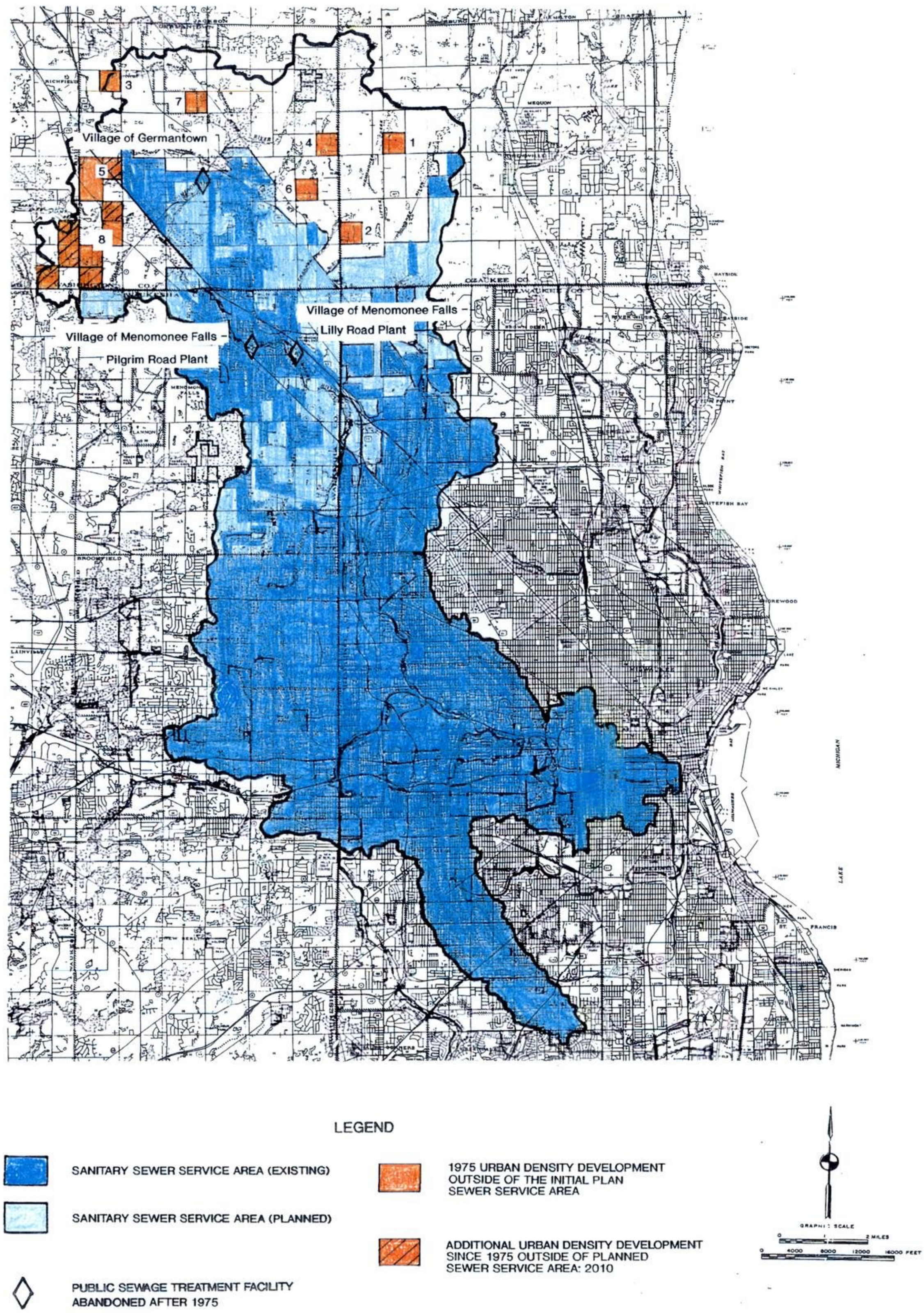
[1]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1990.

Map VII-3

## SEWER SERVICE AREAS IN THE MENOMONEE RIVER WATERSHED: 1990 AND 2010




Source: SEWRPC

Table VII-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR PUBLIC SEWAGE TREATMENT PLANTS IN THE MENOMONEE RIVER WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| Village of Germantown | Menomonee River | Abandon plant | Plant abandoned (1986) |
| Village of Menomonee Falls-Pilgrim Road | Menomonee River | Abandon plant | Plant abandoned (1981) |
| Village of Menomonee Falls-Lilly Road | Menomonee River | Abandon plant | Plant abandoned (1981) |

Source: SEWRPC.

Table VII-4

PLANNED SANITARY SEWER SERVICE AREAS IN THE MENOMONEE RIVER WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Refined Sanitary Sewer Service Area | | | | |
| Brookfield East<br>Elm Grove<br>Brookfield West | 22.6 | Brookfield East<br><br>Brookfield West | December 4, 1991 | SEWRPC CAPR No. 109, Sanitary Sewer Service Area for the City and Town of Brookfield and the Village of Elm Grove, Waukesha County, Wisconsin |
| Butler | 0.8 | Butler | March 1, 1984 | SEWRPC CAPR No. 99, Sanitary Sewer Service Area for the Village of Butler, Waukesha County, Wisconsin |
| Germantown | 8.0 | Germantown | September 8, 1983 | SEWRPC CAPR No. 70, Sanitary Sewer Service Area for the Village of Germantown, Washington County, Wisconsin |
| Menomonee Falls | 17.3 | Menomonee Falls<br>Lannon | June 16, 1993 | SEWRPC CAPR No. 208, Sanitary Sewer Service Areas for the Villages of Lannon and Menomonee Falls |
| Mequon<br>Thiensville | 3.3 | Mequon-Thiensville | January 15, 1992 | SEWRPC CAPR No. 188, Sanitary Sewer Service Area for the City of Mequon and the Village of Thiensville, Ozaukee County, Wisconsin |
| New Berlin | 0.7 | New Berlin | December 7, 1989 | SEWRPC CAPR No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin |
| Subtotal | 52.7 | | | |
| Unrefined Sanitary Sewer Service Areas | | | | |
| Milwaukee Metropolitan Sewerage District | 56.3 | -- | -- | -- |
| Subtotal | 56.3 | | | |
| Total | 109.0 | | | |

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service area names following the refinement process. The planned sewer service area in the Menomonee River watershed, as refined through 1993, totals about 53 square miles, or about 39 percent of the total watershed area, as shown in Table VII-4.

Current Plan Recommendations: The current planned sanitary sewer service areas in the Menomonee River watershed are shown on Map VII-3. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. All or portions of the following these sewer service areas are located in the Menomonee River watershed: Brookfield East and West, Butler, Germantown, Menomonee Falls, Mequon, the Milwaukee Metropolitan Sewerage District, and New Berlin. Together, the planned service areas within the watershed total about 109 square miles, or about 81 percent of the Menomonee River watershed.

As noted above, all of the service areas within the watershed have been refined as part of the ongoing regional water quality management plan updating process, with the exception of the Milwaukee Metropolitan Sewerage District sewer service area. The refinement of the Milwaukee Metropolitan Sewerage District service area is recommended to be conducted during 1995 and 1996. It is also recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

Sewer Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 26 combined sewer outfalls and 140 known separate sewer system flow relief devices located in the Menomonee River watershed. Of the latter, 73 were crossovers, seven were bypasses, 28 were relief pumping stations, and 32 were portable pumping stations. Of the total of 166 flow relief devices, six discharged to the Burnham Canal from the City of Milwaukee; two discharged to the South Menomonee Canal Branch from the City of Milwaukee; 106 discharged to the Menomonee River, 45 from the City of Milwaukee, 41 from the City of Wauwatosa, two from the Village of Butler, and 18 from the Village of Menomonee Falls; one discharged to Butler Ditch from the City of Brookfield; 15 discharged to Underwood Creek, two from the City of Brookfield, five from the City of West Allis, and eight from the City of Wauwatosa; and 36 discharged to Honey Creek, 18 from the City of West Allis, 12 from the City of Wauwatosa, and six from the City of Milwaukee.

By 1993, work was completed by the Milwaukee Metropolitan Sewerage District on its Water Pollution Abatement Program, including construction of the Inline Storage System and major relief sewers. As a result of this project, many of the flow relief devices within the watershed have recently been eliminated. Those which remain include combined sewer overflows, selected bypasses and crossovers, and portable pumping station sites which physically remain in the sewerage system but are expected to function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table VII-5, 89 points of sanitary sewer system flow relief--including

Table VII-5

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE MENOMONEE RIVER WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Combined Sewer Overflow | Cross-overs | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| Village of Germantown | -- | -- | -- | -- | -- | 3 | 3 | Used only in case of equipment failure or extreme wet weather conditions |
| Village of Menomonee Falls | -- | -- | -- | -- | -- | 3 | 3 | Used only in case of extreme wet weather conditions |
| City of Milwaukee | -- | -- | 18[a] | -- | -- | -- | 18 | Used only in case of extreme wet weather conditions |
| City of Brookfield | -- | -- | -- | -- | 1 | 8 | 9 | Used only in case of equipment failure or extreme wet weather conditions |
| City of Wauwatosa | -- | -- | 9 | -- | -- | -- | 9 | Used only in case of extreme wet weater conditions |
| Village of Elm Grove | -- | -- | -- | -- | -- | 2 | 2 | Used only in case of extreme wet weather conditions |
| City of West Allis | -- | -- | -- | -- | -- | 6 | 6 | Used only in case of extreme wet weather conditions |
| Milwaukee Metropolitan Sewerage District | -- | 30 | 4 | -- | 5 | -- | 39 | Used only in cases of extreme wet weather, CSO bypassing expected about twice per year |
| TOTAL | -- | 30 | 31 | -- | 6 | 22 | 89 | |

[a] Ten of these crossovers are equipped with electric pumps to facilitate bypassing.

Source: SEWRPC.

30 combined sewer overflows--were reported to exist as of 1993 in the Menomonee River watershed. These flow relief points were located in eight sewerage systems. With the completion of the Inline Storage System, bypassing of sewage from the combined sewer overflows is expected to occur an average of about one to two times per year. The Milwaukee Harbor estuary study[2] documented that this level of reduction in combined sewer overflow discharges would be adequate to meet water quality standards in the estuary portion of the Menomonee River, assuming the other water quality improvement measures recommended are carried out. Bypassing from other sanitary sewer flow relief devices is expected to be further reduced over time as additional system upgrading is completed by the Milwaukee Metropolitan Sewerage District and the other local units of government operating sanitary sewer systems.[3]

Current Plan Recommendations: It is recommended that the Cities of Brookfield, Milwaukee, Wauwatosa, and West Allis; the Villages of Elm Grove, Germantown, and Menomonee Falls; and the Milwaukee Metropolitan Sewerage District continue to monitor the sewerage system operations to ensure that the use of the existing sanitary sewer system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading be conducted with the assumption that there will be no planned bypasses of untreated sewage from the sanitary sewerage system and that the use of all flow relief devices within the sanitary sewerage system will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of four intercommunity trunk sewers in the Menomonee River watershed, as shown in Table VII-6. One trunk sewer would connect portions of the City of Brookfield and Village of Menomonee Falls to the Milwaukee Metropolitan sewerage system. One trunk sewer would connect the Village of Germantown to the Milwaukee Metropolitan Sewerage system, permitting the abandonment of the Germantown sewage treatment plant. The Menomonee River and the Underwood Creek sewers would provide needed additional capacity to convey wastewater from the Villages of Menomonee Falls and Elm Grove, and the Cities of Brookfield and Wauwatosa to the Milwaukee Metropolitan sewerage system.

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[2]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, December 1987.

[3]During 1994, the City of Milwaukee developed specific preliminary plans to eliminate 52 of the 106 crossovers in the City's sanitary sewer system. In most cases, the crossovers were conveyed to other locations in the Milwaukee intercepting sewer system where adequate capacity was available. These plans were being refined and reviewed with the Milwaukee Metropolitan Sewerage District staff at years end.

Current Plan Recommendations: As noted in Table VI-6, all four trunk sewers recommended in the initial plan have been constructed. No new intercommunity trunk sewers are planned for construction.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of 48 known point sources of pollution identified in the Menomonee River watershed other than public and private sewage treatment plants. These sources discharged industrial cooling, process, rinse, and wash waters through 78 outfalls directly, or indirectly, to the surface water system. Of these point sources outfalls, 37 were identified as discharging only cooling water. The remaining 41 were discharging other types of wastewater. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 132 such point sources of wastewater discharging to the Menomonee River and its major tributaries or to the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table VII-7 summarizes selected characteristics of these other point sources and Map VII-4 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 120 known point sources of wastewater discharging to surface waters other than public and private sewage treatment plants in the Menomonee River watershed. These point sources of wastewater discharge primarily industrial cooling, process, rinse, and wash water directly, or following treatment, to the groundwater or the surface waters of the Menomonee River watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

In 1975, there were eight enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area in the Menomonee River watershed. As of 1990, none of these areas had been added to the planned 2010 sewer service area. Due to increased urban growth within the watershed since 1975, two of the urban development enclaves identified in the initial plan have been expanded, as indicated on Map VII-3. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table VII-8. As shown in Table VII-8, three of the eight areas are covered by soils and have lot sizes which indicate a high probability of meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. The remaining five areas have soils and lot sizes having a high probability of not meeting these criteria and alternative wastewater disposal methods should be considered. Thus, for these five areas,

Table VII-6

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE MENOMONEE RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Brookfield-Menomonee Falls | Completed (1981) |
| Germantown | Completed (1986) |
| Menomonee River | Completed (1977) |
| Underwood Creek | Completed (1983) |

Source: SEWRPC

Table VII-7

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
WATER POLLUTION IN THE MENOMONEE RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Advance Metal Treating, Inc. | Waukesha | 1 | General | 0044938-3 | 9-30-95 | 3398 | Metal heat treating | Menomonee River via storm sewer | -- |
| Aldrich Chemical Co. - St. Paul | Milwaukee | 2 | General | 0044938-3 | 9-30-95 | 2819 | Industrial inorganic chemicals | Menomonee River Canal | -- |
| Aldrich Chemical Co. - Ember | Milwaukee | 3 | General | 0044938-3 | 9-30-95 | 2819 | Industrial inorganic chemicals | Menomonee River Canal | -- |
| Amoco Oil Company - Milwaukee Term. | Milwaukee | 4 | General | 0046531-1 | 9-30-95 | 5171 | Petroleum bulk stations & terminals | Lt. Menomonee R. via unnamed trib. | -- |
| Ampco Metal Manufacturing, Inc. | Milwaukee | 5 | General | 0044938-3 | 9-30-95 | 3351 | Copper rolling and drawing | Groundwater discharge | -- |
| APITECH/Division of Applied Power | Waukesha | 6 | General | 0044938-3 | 9-30-95 | 3531 | Construction machinery | Menomonee River | -- |
| Arcron Ltd. - Menomonee Falls | Waukesha | 7 | General | 0044938-3 | 9-30-95 | 3499 | Fabricated metal products | Nor-X-Way Channel | -- |
| Borden Dairy Div. - Borden, Inc. | Milwaukee | 8 | General | 0044938-3 | 9-30-95 | 2021-26 | Dairy products | Underwood Creek via storm sewer | -- |
| Briggs & Stratton | Waukesha | 9 | General | 0044938-3 | 9-30-95 | 3519 | Internal combustion engines | Menomonee River via storm sewer | -- |
| C&NW Transportation Co., Butler Yd. | Milwaukee | 10 | General | 0046531-1 | 9-30-90 | 4013 | Switching & terminal services | Menomonee River | -- |
| Chris Hansen's Lab., Inc. | Milwaukee | 11 | General | SPEC PERM | 9-30-95 | 2869 | Industrial inorganic chemicals | Honey Creek via storm sewer | -- |
| Citgo Petroleum Corp. - Granville | Milwaukee | 12 | General | 0046531-1 | 9-30-90 | 5171 | Petroleum bulk stations & term. | Lt. Menomonee R. via unnamed trib. | -- |
| Clark Oil & Refining Corp.-Granville | Milwaukee | 13 | General | 0046531-1 | 9-30-90 | 5171 | Petroleum bulk stations & term. | Lt. Menomonee R. via unnamed trib. | -- |
| Concrete Molded Products, Inc. | Washington | 14 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| Continental Equipment Corp. | Milwaukee | 15 | General | 0044938-3 | 9-30-95 | 3452 | Bolts, nuts, rivets, & washers | Noyes Creek via storm sewer | -- |
| Cronin Enterprises - Cronin Oil Term. | Milwaukee | 16 | General | 0046531-1 | 9-30-90 | 5171 | Petroleum bulk stations & term. | Underwood Creek via unnamed trib. | -- |
| Eaton Corp. - Controls Div. | Milwaukee | 17 | General | 0044938-3 | 9-30-95 | 3494 | Valves and pipe fittings | Menomonee River via storm sewer | -- |
| Elite Fitness & Racquet Club | Milwaukee | 18 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Underwood Creek via unnamed trib. | -- |
| Elm Grove Municipal Pool | Waukesha | 19 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Underwood Creek | -- |
| Empire Level Mfg. Corp. | Milwaukee | 20 | General | 0044938-3 | 9-30-95 | 3423 | Hand and edge tools | Underwood Creek | -- |
| Enerpac Group Applied Power, Inc. | Waukesha | 21 | General | 0044938-3 | 9-30-95 | 3492/3714 | Fluid power valves/mtr. parts | Menomonee River | -- |
| Falk Corp. R&D Center | Milwaukee | 22 | General | 0044938-3 | 9-30-95 | 3566 | Speed changers, drives & gears | Menomonee River Canal | -- |
| Falk Corp. - Plant #2 | Milwaukee | 23 | General | 0044938-3 | 9-30-95 | 3566 | Speed changers, drives & gears | Menomonee River via storm sewer | -- |
| Fulton Manufacturing Corp. | Milwaukee | 24 | General | 0044938-3 | 9-30-95 | 3568 | Power transmission equipment | Honey Creek via storm sewer | -- |
| Gebhardt-Vogel Tanning Co. | Milwaukee | 25 | General | 0044938-3 | 9-30-95 | 3111 | Leather tanning and finishing | Menomonee River Canal | -- |
| Germantown Sewage Utility | Washington | --[d] | General | 0046566-2 | 9-30-95 | 4952 | Sewerage systems | Menomonee River | -- |
| The Godfrey Company | Milwaukee | 27 | General | 0046566-1 | 9-30-95 | 2033 | Canned fruits/vegetables, etc. | Menomonee River via storm sewer | -- |
| Great Lakes Concrete Products | Waukesha | 28 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Nor-X-Way Channel | -- |
| Grede Foundries, Inc. - Wauwatosa | Milwaukee | 29 | General | 0044938-3 | 9-30-95 | 3321/3325 | Gray & ductile iron, steel foundry | Menomonee River | -- |
| Greenfield High School (Pool) | Milwaukee | 30 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Honey Creek | -- |
| Handschy Ind. | Waukesha | 31 | General | 0044938-3 | 9-30-95 | 2893 | Printing ink | Menomonee River | -- |
| Harley Davidson Motors | Milwaukee | 32 | General | 0044938-3 | 9-30-95 | 3751 | Motorcycles, bicycles, parts | Menomonee R. via storm sewer | -- |
| Hentzen Coatings, Inc. | Milwaukee | 33 | General | 0044938-3 | 9-30-95 | 2851 | Paints and allied products | Noyes Ck. via storm sewer | -- |
| Inland Diesel, Inc. | Waukesha | 34 | General | 0044938-3 | 9-30-95 | 3519 | Internal compustion engines | Menomonee River | -- |
| J. W. Speaker Corp. | Washington | 35 | General | 0044938-3 | 9-30-95 | 3647 | Vehicular lighting equipment | Menomonee River | -- |
| James Mews Companies, Inc. | Milwaukee | 36 | General | 0046507-2 | 9-30-95 | -- | | Groundwater discharge | -- |
| John's Oil Company | Milwaukee | 37 | General | 0046566-2 | 9-30-95 | 5171 | Petroleum bulk stations & term. | Underwood Ck. via unnamed trib. | -- |
| Koch Refining Company | Milwaukee | 38 | General | 0046531-1 | 9-30-90 | 5171 | Petroleum bulk stations & term. | Lt. Menomonee R. via unnamed trib. | -- |
| Kraft Food Service Corp. | Waukesha | --[a] | General | SPEC PERM | 9-30-95 | -- | -- | Nor-X-Way Channel | -- |
| L. T. Hampel Corp. | Washington | 40 | General | 0044938-3 | 9-30-95 | 3089 | Plastics products | West Branch Menomonee River | -- |

Table VII-7 (continued)

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Longfellow Jr. High School | Milwaukee | 41 | General | 0046523-2 | 9-30-95 | 8211 | Secondary School | Menomonee R. via storm sewer | -- |
| M. A. Gerett Div. of Western Ind. | Waukesha | 42 | General | 0044938-3 | 9-30-95 | 3469 | Metal stampings | Menomonee R. via storm sewer | -- |
| Marathon Oil Company | Milwaukee | 43 | General | 0046531-1 | 9-30-90 | 5171 | Petroleum bulk stations & term. | Ltl. Meno. R. via unnamed trib. | -- |
| Materson Company | Milwaukee | 44 | General | SPEC PERM | 9-30-95 | -- | -- | Menomonee R. via storm sewer | -- |
| McCarty Park Pool | Milwaukee | 45 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Honey Creek | -- |
| Menomonee Falls School District | Waukesha | 46 | General | 0046523-2 | 9-30-95 | 8299 | Schools & educational services | Menomonee River via storm sewer | -- |
| Meno. Falls Sch. Dist.: South H.S. | Waukesha | 47 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River via storm sewer | -- |
| Meno. Falls Sch. Dist.: Middle Sc. | Waukesha | 48 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River | -- |
| Mid City Foundry Co. | Milwaukee | 49 | General | 0044938-2 | 9-30-95 | 3321 | Gray & ductile iron foundry | Meno.R. Canal v/ Burnhams Canal | -- |
| Milwaukee Board of Schools | Milwaukee | 50 | General | 0046523-2 | 9-30-95 | 8299 | Schools & educational services | Menomonee River via storm sewer | -- |
| Milw. Bd. of Sch.: Hamilton H.S. | Milwaukee | 51 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Honey Creek | -- |
| Milw. Bd. of Sch.: Juneau Jr/Sr. H.S. | Milwaukee | 52 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River via storm sewer | -- |
| Milw. Bd. of Sch.: Vincent Harold | Milwaukee | 53 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Lt. Menomonee River | -- |
| Milwaukee Brush Mfg. Co. | Waukesha | 54 | General | 0044938-3 | 9-30-95 | 3496/3991 | Fabricated wire prod., brushes | Nor-X-Way Channel | -- |
| Milwaukee Cold Storage Co. | Milwaukee | 55 | General | 0044938-3 | 9-30-95 | 5142 | Packaged frozen foods | Meno. R. Canal via Burnham Canal | -- |
| Milwaukee County Parks, Rec.& Culture | Milwaukee | 56 | General | 0046523-2 | 9-30-95 | 9199 | General government | Menomonee River | -- |
| Milwaukee Co. PR&C: Noyes Park Pool | Milwaukee | 57 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Noyes Creek | -- |
| Milw. Co. PR&C: Washington Park Pool | Milwaukee | 58 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Menomonee River via storm sewer | -- |
| Milwaukee Electric Tool Corp. | Waukesha | 59 | General | 0044938-3 | 9-30-95 | 3546 | Power driven hand tools | Menomonee R. via unnamed trib. | -- |
| Milwaukee Faucets, Inc. | Milwaukee | 60 | General | 0044938-3 | 9-30-95 | 3432 | Plumbing fixtures fittings & trim | Menomonee R. via storm sewer | -- |
| Milwaukee Lutheran H.S. | Milwaukee | 61 | General | 0045623-2 | 9-30-95 | 8211 | Secondary school | Menomonee River via storm sewer | -- |
| Mobil Oil Corp. | Milwaukee | --[a] | General | 0046566-2 | 9-30-95 | 5171 | Petroleum bulk station & terminal | Honey Creek via storm sewer | -- |
| Mohawk Cold Storage Div.-Wiscold Inc. | Milwaukee | 63 | General | 0044938-3 | 9-30-95 | 5142 | Packaged frozen foods | Menomonee River via unnamed trib. | -- |
| The Neilson Wheel Company | Milwaukee | 64 | General | 0044938-3 | 9-30-95 | 3499 | Fabricated metal products | Little Menomonee River | -- |
| Orchard Business Park | Milwaukee | 65 | General | 0046531-1 | 9-30-90 | 6512 | Non-residential bldg. operators | Menomonee River via storm sewer | -- |
| Perlick Corporation | Milwaukee | 66 | General | 0044938-3 | 9-30-95 | 3585 | Refrigeration & heating equipment | Noyes Creek | -- |
| Rainbow Park Pool | Milwaukee | 67 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Underwood Creek via unnamed trib. | -- |
| Reuben Residence | Waukesha | 68 | General | HEAT PUMP | 9-30-95 | 8811 | Private household | Underwood Creek via storm sewer | -- |
| Safer Drycleaning Center | Waukesha | 69 | General | 0044938-3 | 9-30-95 | 7216 | Drycleaning, exc. rugs | Butler Ditch | -- |
| School District of Elmbrook | Waukesha | 70 | General | 0046523-2 | 9-30-95 | 8299 | Schools & educational services | Butler Ditch | -- |
| Sch. Dist. Elmbrook: Brkfd.Central HS | Waukesha | 71 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Dousman Ditch via storm sewer | -- |
| Sch. Dist. Elmbrook: Brkfd.East HS | Waukesha | 72 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Underwood Creek via drainage ditch | -- |
| Service Heat Treating Inc. | Milwaukee | 73 | General | 0044938-3 | 9-30-95 | -- | -- | Little Meno. R. via unnamed trib. | -- |
| Silgan Containers Corp. | Waukesha | 74 | General | 0044938-3 | 9-30-95 | 3411 | Metal cans | Nor-X-Way Channel | -- |
| Smith & Nephew Roylan Inc. | Waukesha | 75 | General | 0044938-3 | 9-30-95 | 3086/3089 | Plastics, foam products | Nor-X-Way Channel | -- |
| Stone Container Corp. | Washington | 76 | General | 0044938-2 | 9-30-95 | 2653 | Corrugated and solid fiber boxes | Groundwater discharge | -- |
| Super Excavators | Waukesha | 77 | General | 0046531-1 | 9-30-90 | 1794 | Excavation work | Lilly Creek | -- |
| Super Steel Products Corp.-Tower Ave. | Milwaukee | 78 | General | 0044983-3 | 9-30-95 | 3441/3499 | Fab. struc. metal & products | Little Meno. R. via storm sewer | -- |
| Tews Lime & Cement Co. | Milwaukee | 79 | General | 0046507-1 | 9-30-95 | 3274/3273 | Lime and Ready-mix concrete | Menomonee River via storm sewer | -- |
| Thiele Tanning Company | Milwaukee | 80 | General | 0044938-3 | 9-30-95 | 3111 | Leather tanning and finishing | Menomonee River Canal | -- |

Table VII-7 (continued)

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| U.S. Oil Co.-Milw. Petro. Prod. Term. | Milwaukee | 81 | General | 0046531-1 | 9-30-90 | 2992/2911/2899 | Chem preps., petro. refining, etc. | Little Meno. R. via unnamed trib. | -- |
| USA Concrete | Waukesha | 82 | General | 0046507-1 | 9-30-95 | 3273 | Ready-mix concrete | Lilly Creek | -- |
| Uno-ven Company-Granville Term | Milwaukee | 83 | General | 0046531-1 | 9-30-90 | 5171 | Petroleum bulk stations & term. | Little Meno. R. via unnamed trib. | -- |
| Waco Oil Company | Milwaukee | --[d] | General | 0046566-1 | 9-30-95 | 5171 | Petroleum bulk station & term. | Menomonee River | -- |
| Washington High School (Pool) | Washington | 85 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River | -- |
| Wauwatosa School District | Milwaukee | 86 | General | 0046523-2 | 9-30-95 | 8299 | Schools & educational services | Underwood Creek via unnamed trib. | -- |
| Wauwatosa Sch. Dist. East HS Pool | Milwaukee | 87 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River via storm sewer | -- |
| Wauwatosa Sch. Dist. West HS Pool | Milwaukee | 88 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River via storm sewer | -- |
| Wauwatosa Sch. Dist. Whitman Jr. HS | Milwaukee | 89 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River via storm sewer | -- |
| West Allis Central H.S. (Pool) | Milwaukee | 90 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Honey Creek via storm sewer | -- |
| West Milwaukee H.S. (Pool) | Milwaukee | --[d] | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Menomonee River via storm sewer | -- |
| West Shore Pipeline Co. | Milwaukee | --[e] | General | 0046566-2 | 9-30-95 | 5171 | Petroleum bulk station & terminal | Underwood Creek | -- |
| West Shore Pipeline Co., Granville | Milwaukee | 93 | General | 0046531-1 | 9-30-90 | 5171 | Petroleum bulk station & terminal | Little Meno. R. via unnamed trib. | -- |
| West Surburban Branch YMCA | Milwaukee | 94 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Underwood Creek via unnamed trib. | -- |
| Wirth Park Swimming Pool | Waukesha | 95 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Dousman Ditch | -- |
| Wisconsin Lintel Company | Washington | 96 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Absorption-gravel driveway | -- |
| Wright Junior H.S. (Pool) | Milwaukee | 97 | General | 0046523-2 | 9-30-95 | 8211 | Secondary schools | Honey Creek via storm sewer | -- |
| YMCA of of Metro Milw. Tri-Co. Branch | Waukesha | 98 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Menomonee River via storm sewer | -- |
| A-C Reorganization Trust | Milwaukee | 1A | Specific | 0026778 | 9-30-89 | 3523 | Farm machinery & equipment | Honey Creek via storm sewer | 3,6 |
| American Concrete Pipe Co., Inc. | Milwaukee | 2A | Specific | 0044181 | 3-31-85 | 3272 | Concrete products | Menomonee River via storm sewer | None |
| Aqua-Tech, Inc. (Thiem-Beazer East) | Milwaukee | 3A | Specific | 0041688 | 9-30-87 | 2891 | Adhesives and sealants | Underwood Creek via storm sewer | None |
| Bradley Corp. | Waukesha | 4A | Specific | 0041734 | 9-30-87 | 3432 | Plumbing fixtures, fittings, trim | Nor-X-Way Channel | None |
| Briggs & Stratton Corp-Wauwatosa | Milwaukee | 5A | Specific | 0026514 | 12-31-89 | 3519 | Internal combustion engines | Menomonee River via storm sewer | 5 |
| Briggs & Stratton Corp-W Allis/83rd | Milwaukee | 6A | Specific | 0000507 | 6-30-92 | 3321 | Gray and ductile iron foundries | Honey Creek | None |
| Chicago Milwaukee Corp. | Milwaukee | 7A | Specific | 0027057 | 3-31-90 | 4013 | Switching and terminal services | Menomonee River | 6, 2, 4 |
| Falk Corporation | Milwaukee | 8A | Specific | 0001139 | 9-30-86 | 3566 | Speed changers, drives, and gears | Menomonee River | 7, 3, 4 |
| Gehl Guernsey Farms, Inc. | Washington | 9A | Specific | 0033219 | 12-31-90 | 2022/2023/2099 | Cheese, dry/evap prod., food prep. | Menomonee River | None |
| Harnischfeger Corp. | Milwaukee | 10A | Specific | 0025321 | 9-30-86 | 3536 | Hoists, cranes, and monorails | Menomonee River via storm sewer | None |
| J.F.Shea Co. Inc.:Crosstown Coll 5/6 | Milwaukee | 11A | Specific | 0047155 | 6-30-93 | 1622 | Bridge, tunnel & elev. hwy. const. | Menomonee River Canal | 3,6 |
| J.F.Shea Co. Inc.:Crosstown Coll 7 | Milwaukee | 12A | Specific | 0047163 | 6-30-93 | 1622 | Bridge, tunnel & elev. hwy. const. | Menomonee River Canal | 3,6 |
| Kearney & Trecker Corp. | Milwaukee | 13A | Specific | 0033146 | 3-31-89 | 3541 | Machine tools, metal cutting types | Underwood Creek via storm sewer | None |
| Lakeview Hospital | Milwaukee | 14A | Specific | 0044105 | 3-31-90 | 8069 | Specialty hosp, exc. psychiatric | Underwood Creek via unnamed trib. | None |
| Masterson Company | Milwaukee | 15A | Specific | 0068951 | 9-30-90 | -- | -- | Menomonee River via storm sewer | None |
| Miller Brewing Company | Milwaukee | 16A | Specific | 0000744 | 3-31-91 | 2082 | Malt beverage | Menomonee River via storm sewer | None |
| The Neilson Wheel Co., Inc. | Milwaukee | 17A | Specific | 0048542 | -- | 3499 | Fabricated metal products | Little Meno. R. via storm sewer | None |
| Pressed Steel Tank Co., Inc. | Milwaukee | 18A | Specific | 0045705 | 1-31-96 | 3443 | Fabricated plate work(boiler shops) | Menomonee River via storm sewer | 6 |
| Rexnord Corp. - Milwaukee Factory | Milwaukee | 19A | Specific | 0026573 | 9-30-89 | 3714 | Motor vehicle parts, accessories | Menomonee River via storm sewer | None |
| Sears Roebuck & Co. (Brookfield Sq.) | Waukesha | 20A | Specific | 0048178 | -- | 5311 | Department store | Dousman Ditch via drainage ditch | None |
| Soo Line Railroad Co. | Milwaukee | 21A | Specific | 0045993 | 3-31-88 | 4013 | Switching and terminal services | Menomonee River | 6 |
| Stroh Die Casting Co., Inc. | Milwaukee | 22A | Specific | 0042285 | 9-30-92 | 3364 | Nonferrous die casting excl. alum. | Menomonee River via unnamed trib. | None |

Table VII-7 (continued)

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Sunlite Plastics, Inc. | Washington | 23A | Specific | 0047465 | -- | 3089 | Plastics products | Menomonee River via Willow Creek | None |
| United Parcel Service, Inc. | Waukesha | 24A | Specific | 0042030 | 3-31-96 | 4212 | Local trucking without storage | Underwood Creek | 8 |
| Universal Foods Corp. | Milwaukee | 25A | Specific | 0042137 | 9-30-89 | 2022/2099 | Cheese and Food preparation | Menomonee River via storm sewer | 9 |
| Veterans Administration Med. Center | Milwaukee | 26A | Specific | 0044199 | 12-31-89 | 8069 | Specialty hosp exc. psychiatric | Menomonee River via storm sewer | None |
| Waste Mgmt. of WI - Controlled Basin | Waukesha | 27A | Specific | 0047635 | -- | 4953 | Refuse systems | Menomonee River via unnamed trib. | None |
| Waste Mgmt. of WI - MF/N.Am.Reg./EMD | Waukesha | 28A | Specific | 0044440 | 12-31-90 | 4953 | Refuse systems | Menomonee River via unnamed trib. | 3 |
| Waste Mgmt. of WI - Omega Hills | Washington | 29A | Specific | 0045381 | 12-31-90 | 4953 | Refuse systems | Menomonee River via unnamed trib. | 3 |
| Western Metal Spec. Div. | Milwaukee | 30A | Specific | 0039004 | 3-31-90 | 344 | Sheet metal work | Menomonee River | None |
| WI Electric Power Co. - Germantown | Washington | 31A | Specific | 0042757 | 6-30-93 | 4911 | Electric services | Menomonee River via unnamed trib. | 6 |
| WI Electric Power Co. - Milw Htg.Plt. | Milwaukee | 32A | Specific | 0001686 | 12-31-92 | 4961 | Steam and air conditioning supply | Menomonee River Canal | None |
| WI Elec. Power Co. - Valley Pwr. Plt. | Milwaukee | 33A | Specific | 0000931 | 12-31-91 | 4911 | Electric services | Menomonee River Canal | 3, 1, 7, 10 |
| Zignego Ready-mix: West Allis Plant | Milwaukee | 34A | Specific | 0057185 | 12-31-93 | 3273 | Ready-mix concrete | Underwood Creek via unnamed trib. | None |

[a] Table VII-7 includes 132 such point sources of waste water discharging to the Menomonee River and its tributaries, or to the groundwater system in the Menomonee River watershed. As of 1993, there were 120 known, permitted point sources of water pollution.

[b] See Map VII-4, "Point Sources of Pollution Other Than Sewage Treatment Facilities in the Menomonee River Watershed: 1990".

[c] The number code refers to the following treatment systems:

1. Chemical conversion/addition
2. Dissolved air flotation
3. Gravity sedimentation
4. Gravity thickening
5. Holding pond
6. Oil and grease removal
7. pH control
8. Screening
9. Spray Irrigation
10. Tube/Plate settlers

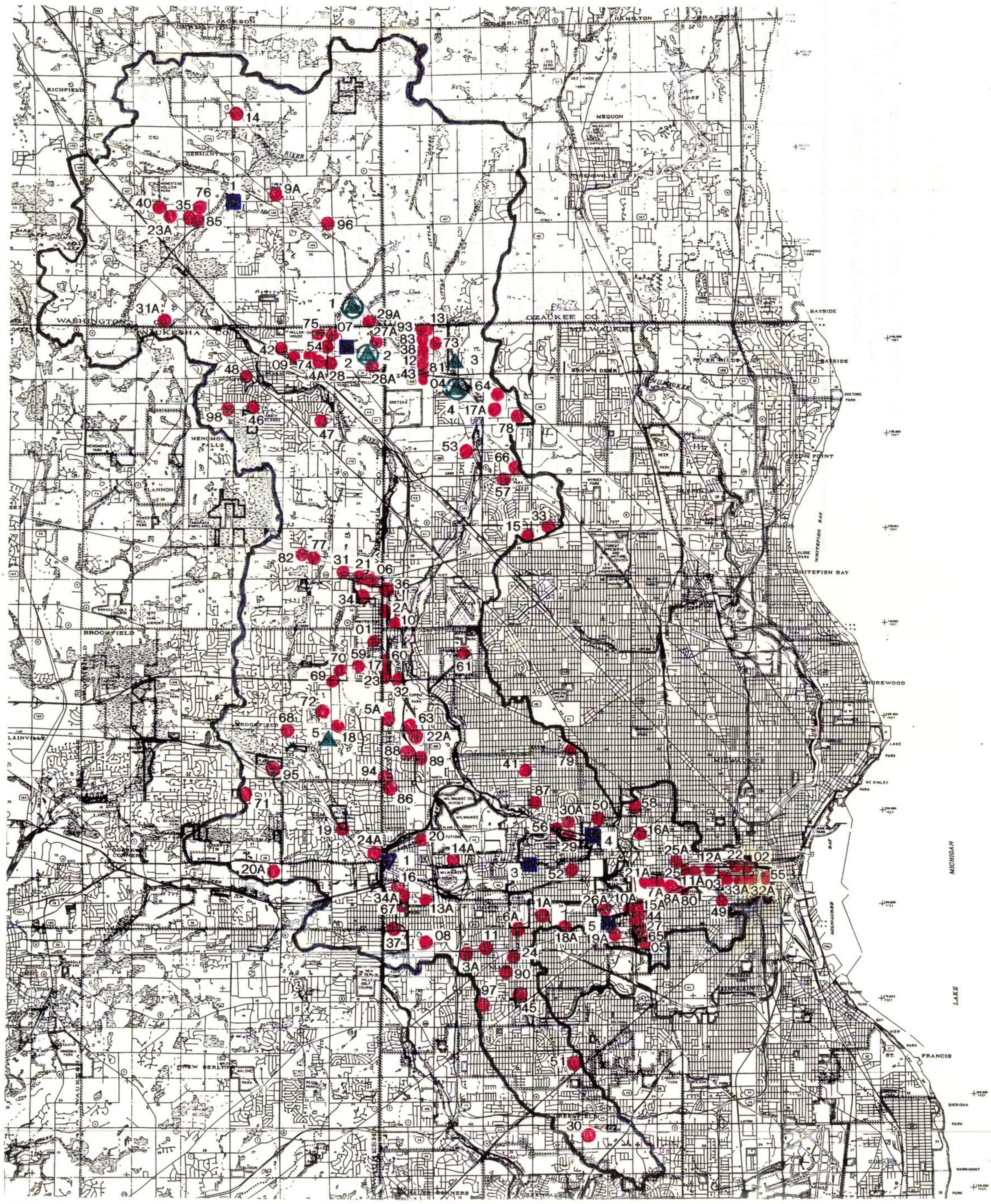
[d] Permitted as Leaking Underground Storage Tanks (LUST) remediation site discharging to surface or ground waters as of 1990. As of 1993, there were 11 additional LUST remediation sites discharging to surface or ground waters in the Menomonee River watershed. See Table VII-9, "Miscellaneous Potential Pollution Sources in the Menomonee River Watershed: 1990" for map identification numbers.

[e] Reported as a groundwater contamination site as of 1990. Remediation wastewater from site is permitted to discharge to surface waters. As of 1993, there was one additional LUST remediation site discharging to surface or ground waters in the Menomonee River watershed. See Table VII-9 for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

## Map VII-4

# POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE MENOMONEE RIVER WATERSHED: 1990




LEGEND

- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES
- LEAKING UNDERGROUND STORAGE TANKS DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER
- ADDITIONAL GROUNDWATER CONTAMINATION SITES DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER
- LANDFILLS DESIGNATED AS SUPERFUND SITES LANDFILLS IDENTIFIED FOR STATE ACTION
- ADDITIONAL LANDFILLS THAT POTENTIALLY IMPACT SURFACE WATER QUALITY

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

Source: SEWRPC.

Table VII-8

EXISTING URBAN DEVELOPMENT OUTSIDE OF THE PLANNED PUBLIC SANITARY SEWER SERVICE AREA IN THE MENOMONEE RIVER WATERSHED: 2010

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| | Ozaukee County | | |
| 1[c] | City of Mequon - Section 17 | 127 | 1.0 |
| 2[c] | City of Mequon - Section 30 | 163 | 1.0 |
| | Washington County | | |
| 3 | Village of Germantown - Section 7 | 152 | 1.3 |
| 4 | Village of Germantown - Section 13 | 154 | 1.1 |
| 5[c] | Village of Germantown - Section 19 | 453 | 0.1 |
| 6 | Village of Germantown - Section 24 | 120 | 0.5 |
| 7[c] | Dhiensville-Rockfield | 148 | 0.8 |
| 8[c] | Willow Creek | 1155 | 0.4 |
| | Total | 2472 | -- |

[a] See Map VII-3

[b] Urban development is defined in this context as concentrations of urban land uses within any given U.S. Public Land Survey quarter section that has at least 32 housing units, or an average of one housing unit per five gross acres, and is not served by public sanitary sewers.

[c] Based upon consideration of soils, lot sizes, and density, further site-specific planning should be conducted during the planning period to determine the best means of providing for wastewater management.

Source: SEWRPC.

it is recommended an inspection and maintenance program for the onsite sewage disposal systems be instituted and that further site-specific planning be conducted to determine the best wastewater management practice at such time as significant problems become evident.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Menomonee River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can be subsequently transported to surface waters.

There are currently two active landfills and 55 abandoned landfills located in the Menomonee River watershed. Two of the abandoned landfills--the Boundary Road landfill (formerly known as Lauer I sanitary landfill) in the Village of Menomonee Falls and the Omega Hills North landfill in the Village of Germantown--were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean-up of hazardous waste sites. The location of these sites and other landfills which are potentially impacting surface or groundwater in the Menomonee River watershed are shown on Map VII-4 and listed in Table VII-9. In addition, the Moss American Company, a former creosote treatment facility site located in the City of Milwaukee adjacent to the Little Menomonee River, is designated as a high priority Superfund site.

The Boundary Road landfill is located west of the Milwaukee-Waukesha County line and south of the Wisconsin Southern Railroad Company railway in the northeast corner of the Village of Menomonee Falls. The 58-acre landfill site was in operation from 1959 to 1972. Waste Management of Wisconsin, Inc. is the site owner. Surface water may run off the site by way of drainage ditches located immediately to the west of the site and to the east across Boundary Road. A pond and wetland are located immediately to the south of the site. The surface drainage of the lands in the vicinity of the landfill is to the south and east to the Dretzka Park tributary of the Menomonee River. Contaminants detected in the groundwater include chlorinated and non-chlorinated volatile organic compounds. Surface water samples taken in the vicinity show low levels of contaminants. Further feasibility studies have been prepared to evaluate cleanup alternatives. The preliminary recommended plan provides for regrading of the landfill cover, the addition of a new composite cover system, installing a landfill gas extraction system, continuing and expanding the leachate extraction system, and continued monitoring.

The Omega Hills North landfill is located in the southeast corner of the Village of Germantown just north of the Waukesha-Washington County line and just west of the Wisconsin and Southern Railroad Company railway. The site covers 83 acres and was licensed to accept hazardous wastes from 1977 until 1982. The site stopped accepting hazardous wastes in 1982 and liquid wastes in 1983. In 1989, the site stopped accepting all wastes and a clay cover was installed. The surface drainage in the vicinity of the landfill drains largely to the south and

Table VII-9

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE MENOMONEE RIVER WATERSHED: 1990

| Map Identification Number[a] | Landfills Indicated to be Potential Pollution Sources | Civil Division Location | Surface Water Potentially Impacted |
|---|---|---|---|
| 1[b] | Omega Hills North | Village of Germantown | Little Menomonee River |
| 2[b] | Lauer I Sanitary Landfill[c] | Village of Menomonee Falls | Tributary to Menomonee River |
| 3 | Geipel Landfill[d] | City of Milwaukee | Little Menomonee River |
| 4[b] | Moss American | City of Milwaukee | Little Menomonee River |
| 5 | City of Brookfield[d] | City of Brookfield | Underwood Creek |
| | Leaking Underground Storage Tank Sites[e,f] | | Receiving Water |
| 1 | Germantown Sewage Utility | Village of Germantown | Menomonee River |
| 2 | Kraft Food Service Corp. | Village of Menomonee Falls | Nor-X-Way Channel |
| 3 | Mobil Oil Corporation | City of Wauwatosa | Honey Creek |
| 4 | Waco Oil Company | City of Milwaukee | Menomonee River |
| 5 | West Milwaukee High School | Village of West Milwaukee | Menomonee River |
| | Additional Groundwater Contamination Sites[e,g] | | Receiving Water |
| 1 | West Shore Pipeline Company | City of Wauwatosa | Underwood Creek |

[a] Refers to Map VII-4, "Point Sources of Pollution Other Than Sewage Treatment Facilities in the Menomonee River Watershed: 1990."
[b] SuperFund site.
[c] Also referred to as Boundary Road Landfill.
[d] Indicated to be potential pollution source in DNR Water Resource Appraisal for the Menomonee River Watershed dated August 1992.
[e] Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters.
[f] As of 1993, there were 11 additional LUST sites in the Menomonee River watershed whose remediation discharges were permitted under the WPDES: Auto Service Association in City of Brookfield discharges to Dousman Ditch; CDS Investments in the City of New Berlin discharges to the Menomonee River, Speedy Lube gas station in the City of Wauwatosa discharges to Underwood Creek; Fleming Companies, Inc. in the City of Milwaukee discharges to the Menomonee River; John's Oil Company in the City of West Allis discharges to Underwood Creek, M & I Northern Bank in the City of Brookfield discharges to the Menomonee River; Moser's Automotive in the Village of Menomonee Falls discharges to Butler Ditch; Murphy Oil USA, Inc. in the Village of Menomonee Falls discharges to the Little Menomonee River; Sprinkman Sons Corp. in the City of Milwaukee discharges to the Little Menomonee River; and Tenley Automotive in the City of Milwaukee discharges to the Little Menomonee River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

east to the Dretzka Park tributary of the Menomonee River, with the area west of the landfill draining to the Nor-X-Way Channel tributary of the Menomonee River. Currently, leachate at the site is being collected and treated, while investigations leading to the selection of final cleanup remedies for the landfill are taking place.

In 1984, the Moss-American site was designated as a high-priority site for the Superfund program. During its operation--from 1921 to 1976, the Moss-American factory treated railroad ties with a creosote and fuel oil mixture. Various analyses which have been conducted over the years since the operation ceased, have indicated the presence of creosote and other chemicals in the area soil and groundwater, and in the Little Menomonee River. There have been documented cases of chemical skin burns by persons from the sediments in the Little Menomonee River. Alternative and recommended plans were set forth in the Menomonee River watershed plan[4] for resolving the identified problem. That plan recommended that the residual creosote pollution problem in the Little Menomonee River within Milwaukee County be resolved by excavating a new parallel channel, filling the existing channel, and restoring the site. The recommended pollution abatement measure would be applied along a 3.46-mile-long reach of the Little Menomonee River and would result in a significant reduction in creosote exposure hazard. Following additional site investigations and feasibility studies, the previous site operator, under U.S. Environmental Protection Agency and Wisconsin Department of Natural Resources supervision, is in the initial phases of designing the pollution abatement program for the site. The project, which was identified by the Superfund remedial action plans after evaluation of alternatives, includes:

- Rerouting of the Little Menomonee River from the Moss-American site to its mouth.
- Removal and biological treatment of highly contaminated soil and river sediment using an onsite treatment system.
- Burial of remaining sediments in the current streambed with soil excavated from the new channel.
- Burial of the untreated soil and the treated material from the treatment system onsite under a soil cover.
- Collection and treatment of contaminated groundwater with discharge to the sanitary sewerage system.
- Treatment of the landfilled soil onsite and disposal of it onsite in a specially designed landfill.

The recommended remedial action plan is consistent with recommendations contained in the adopted Menomonee River watershed plan.

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[4]SEWRPC Planning Report No. 26, A Comprehensive Plan for the Menomonee River Watershed, Volume 1, Inventory Findings, Volume 2, Alternative Plans and Recommended Plan, October 1976.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Menomonee River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were five known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters, as indicated in Table VII-9 and shown on Map VII-4. As of 1993, there were 11 additional leaking underground storage tanks in the Menomonee River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table VII-9.

As of 1993, there were 526 additional leaking underground storage tanks in the Menomonee River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks may have detrimental effects on water quality.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the WPDES program to discharge remediation wastewater to surface or ground waters. As of 1990, there was one permitted site discharging to surface water. As of 1993, there was one additional such site known to be discharging to surface water in the Menomonee River watershed, as indicated in Table VII-9.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the adopted regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

### Existing Conditions and Status of Plan Implementation

For the Menomonee River watershed, the adopted plan generally recommended nonpoint source controls for both rural and urban lands designed to reduce the pollutant loadings from nonpoint sources by 25 percent, in addition to construction erosion control, septic system management, and streambank erosion control. No nonpoint source controls were recommended in the portion of the watershed where the deep tunnel combined sewer overflow abatement plan has been implemented and where a relatively high level of nonpoint source control will be achieved by the conveyance of most of the stormwater to the Milwaukee Metropolitan Sewerage District sewerage system.

In 1976, the Commission prepared a comprehensive watershed plan[5] for the Menomonee River watershed in cooperation with various Federal, State and local authorities. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas in the watershed. Such subsequent planning was and will continue to be directed toward reducing nonpoint source pollutant loadings as well as providing for local drainage needs in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Menomonee River watershed through local regulation and programs. In the area of construction site erosion control measures, significant progress has been made. As of January 1993, Waukesha County; the Cities of Brookfield, Mequon, Milwaukee, and New Berlin; and the Villages of Germantown, Elm Grove, Menomonee Falls, and West Milwaukee had adopted construction erosion control ordinances based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and the League of Wisconsin Municipalities. In addition, Washington County and the Village of Butler had ordinances which pre-dated the model.

While new development is largely being served by sanitary sewer, the existing unsewered development within the watershed is regulated by onsite sewage disposal system programs administered by the City of Mequon and the Villages of Germantown and Menomonee Falls. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of new systems, and for problem resolution of failing systems where they are identified. Since the completion of the adopted regional water quality management plan, public sewer systems have been installed for the urban development within portions of the Village of Menomonee Falls and Germantown, as recommended in the regional plan, thereby reducing onsite system pollutant discharges to the surface water and groundwater systems in the watershed.

With regard to rural nonpoint source control implementation actions, programs such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts. Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances, or T-values, which are the maximum average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection, as priority counties for soil erosion control.

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[5]See SEWRPC Planning Report No. 26, A Comprehensive Plan for the Menomonee River Watershed, Volume One: Inventory Findings and Forecast, Volume Two: Alternative Plans and Recommended Plan.

The Commission has prepared agricultural soil erosion control plans for Washington, Ozaukee, and Waukesha Counties. Thus, all of the rural areas in the Menomonee River watershed have been addressed through such planning. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While the local programs described above have probably resulted in some reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for the cost of an individual project or land management practice to local governments and private landowners upon completion of the detailed plans. The funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. The Menomonee River watershed was designated a "priority watershed" in 1984. Planning for the Menomonee River priority watershed project[6] was completed in 1991, and implementation of practices began in October 1991 and will continue for eight years.

The Menomonee River priority watershed program established nonpoint source pollutant control reduction goals of 50 percent for sediment and 50 to 70 percent for phosphorus for the subareas considered. Additional goals of 50 percent for heavy metal nonpoint source pollutant loadings were also established. These loading reductions were based primarily upon field inventories of the streams in the Menomonee River watershed. Observations were made of the sediment imbeddedness and biological conditions of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. In addition, the pollutant reduction goals were based upon a qualitative consideration of the toxicity of metals in urban runoff. The recommendations of the priority watershed plan for the rural areas are generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. Certain components of the plan

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[6]Wisconsin Department of Natural Resources, Publication No. WR-300-92, A Nonpoint Source Control Plan for the Menomonee River Priority Watershed Project, March 1992.

recommendations for the urban and urbanizing areas, such as construction erosion control, are expected to be readily implemented. However, other components of the recommended plan, such as retrofitting urban land management practices in developed areas are costly and full implementation will be difficult. The plan also recommends that further detailed stormwater management planning and assessments be carried out as part of the subsequent plan implementation actions in order to refine the recommendations.

To achieve these objectives, the Menomonee River priority watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

Rural Land Management:

- Provision of streambank erosion control practices for about 1,200 feet of eroding streambank.

- Development of detailed conservation plans to develop best management practices for about 5,300 acres of cropland.

- Installation of management practices for six barnyards.

- Installation of facilities and management practices for ten livestock operations in the watershed.

- Obtaining easements along streams in selected areas.

Urban Land Management: The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for implementation of construction erosion controls; the institution of a public information and education program on nonpoint source pollution abatement; and institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers. The plan further recommends the development of a "segmented program" providing for the stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices is also recommended. Specific core and segmented programs include:

- Provision of construction site erosion control ordinances and implementation actions for control of about 7,000 acres of new urban development which is expected in the watershed during the planning period.

- Provision of nonpoint source control practices on about 32,000 acres of existing urban land and about 7,400 acres of new urban land are targeted for nonpoint source control. Possible urban nonpoint source pollution control practices include wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.

- Provision of erosion control measures for about 7,300 lineal feet of streambank.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban areas. These plans address water quantity and water quality problems in developed and developing urban areas.

<u>Current Plan Recommendations</u>

It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, in addition to land management practices that would provide at least a 25 percent reduction in nonpoint source loadings be carried out throughout the Menomonee River watershed. It is further recommended that rural land management measures needed to achieve the levels of control set forth in the Menomonee River priority watershed study for sediment control from rural areas be carried out. It is also recommended that the urban land management practices set forth in the Menomonee River priority watershed plan be utilized as the initial basis for stormwater management planning and project eligibility under the State priority watershed program. These levels of reduction in the urban areas are recommended to be refined based upon subsequent detailed stormwater management planning, and based upon additional monitoring and quantitative analyses which are recommended to be conducted during the plan implementation period. These data and consideration of estimated costs and available funds for the urban practices are recommended to be evaluated to refine the recommended final level of control. Such refinement would include further consideration of toxics reduction requirements.

The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

## WATER QUALITY MONITORING PLAN ELEMENT

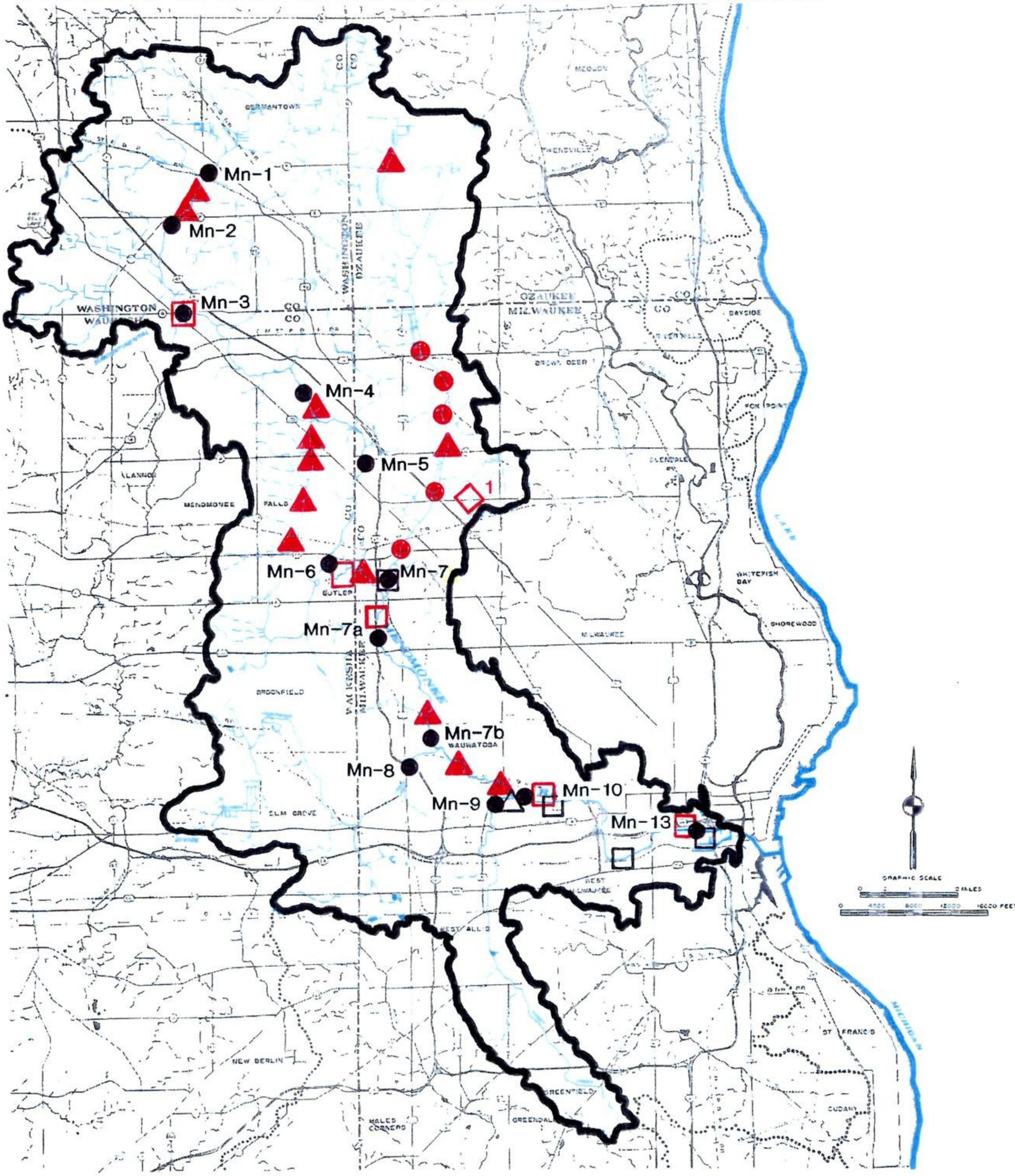
<u>Existing Conditions and Status of Implementation</u>

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program. As of 1993, long-term monitoring has been carried out in the Menomonee River watershed on a sustained basis by the Milwaukee Metropolitan Sewerage District for eight stations located on the Menomonee River main stem. Data from five of these stations were used to document current long-term water quality conditions in the watershed, as shown on Map VII-5. Short-term monitoring has also been conducted at one site by the Wisconsin Department of Natural Resources and at one site by the U.S. Geological Survey during the period 1988 through 1993, as described later in this chapter.

<u>Current Plan Recommendations</u>

Continued water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the Milwaukee Metropolitan Sewerage District for all current stations on the Menomonee River on a continuing long-term basis. In addition, it is recommended an intensive water quality and biological condition monitoring program be conducted over a one-year period at five selected additional stations, with one station each located on Little Menomonee River, Little Menomonee Creek, Butler Ditch, Underwood Creek, and Honey Creek. This monitoring program would

## Map VII-5
## LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE MENOMONEE RIVER WATERSHED




LEGEND

Sampling station used in preparation of initial plan

- ● SEWRPC
- △ USGS
- □ MMSD

Post-1976 sampling stations used in preparation of plan update

- ◇ USGS-Short Term
- □ MMSD-Long Term
- ● DNR-Sediment Samples
- ▲ USGS-Sediment Samples

Source: SEWRPC.

also include biological monitoring at stations on the Menomonee River main stem at locations currently being sampled by the Milwaukee Metropolitan Sewerage District. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated with, and are consistent with, the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five- to seven-year rotating cycle.

## LAKES MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological condition monitoring programs to be established.

As noted above, there are no major lakes in the Menomonee River watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study, the 1965 through 1975 Commission stream water quality monitoring effort, the 1976 Commission monitoring program conducted under the regional water quality management planning effort, and the 1964 through 1974 U.S. Geological Survey (USGS) and Milwaukee Metropolitan Sewerage District (MMSD) sampling programs. Available data collected in those programs for the Menomonee River watershed included samplings at 14 Commission stations: 11 on the main stem of the Menomonee River, one on Underwood Creek, one on Honey Creek, and one on the Little Menomonee River; and at one USGS station and four MMSD sampling stations, all on the main stem of the Menomonee River. The sampling station locations are shown on Map VII-5.

Long-term 1976 comparable water quality data have been collected by the Milwaukee Metropolitan Sewerage District for eight stations on the Menomonee River. Water resource appraisal information including biological condition and water quality data collected by the Wisconsin Department of Natural Resources (DNR) for the Menomonee River Nonpoint Source Priority Watershed Project were also available for use in the assessment of current water quality conditions. Water quality data has also been collected on a short-term basis at two locations in the Menomonee

River watershed. Data collected at one short-term site, along with long-term data from five MMSD stations, are shown on Map VII-5. These data were used in this chapter to assess current water quality conditions as discussed in the next section and, where appropriate, to make a generalized comparison to historic conditions. In addition to the data obtained since preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then-current 1975 land use conditions and under planned year 2000 land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Menomonee River watershed.

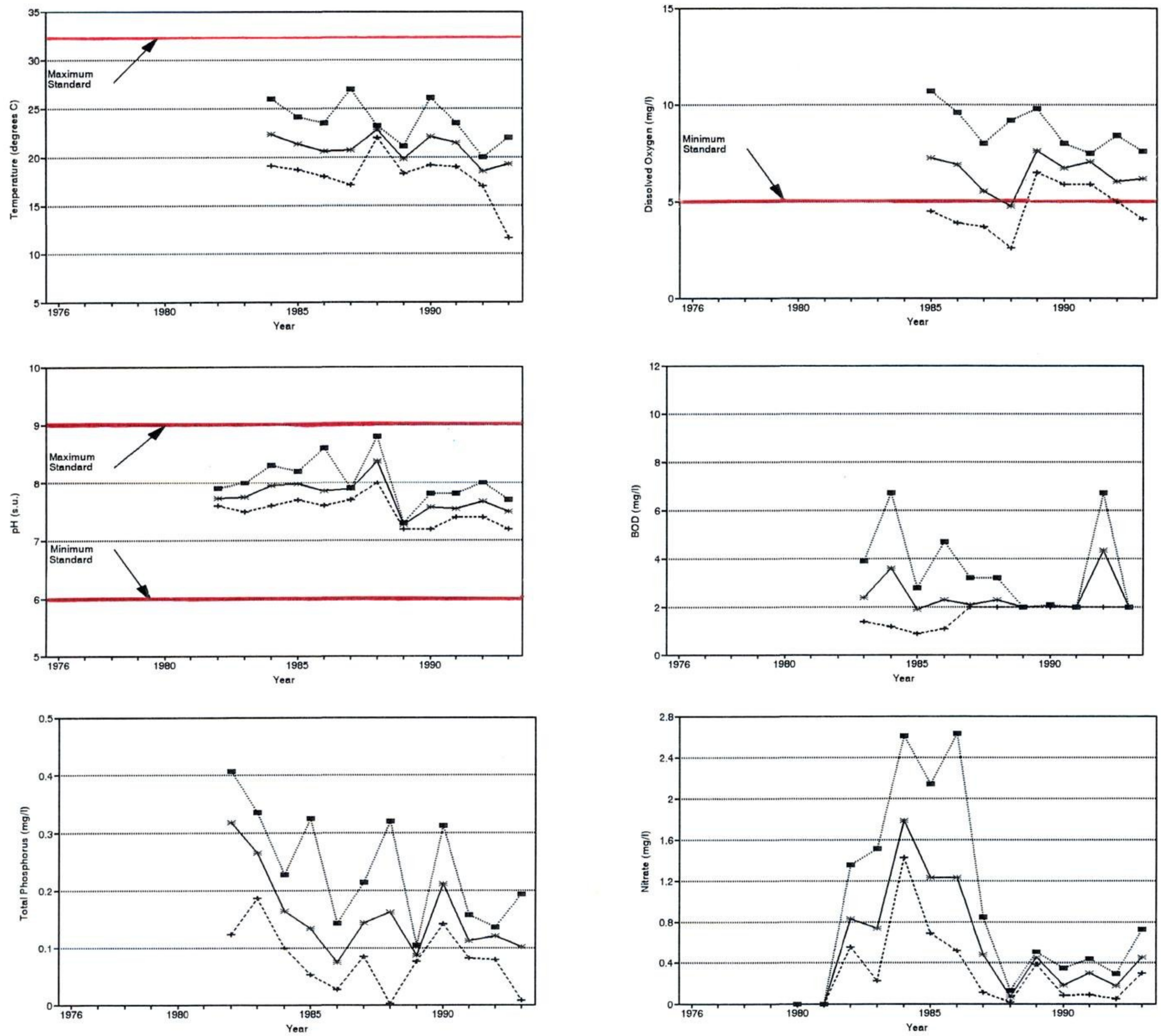
Long-term water quality data collected by the MMSD at five sampling stations on the main stem of the Menomonee River--Mn-3, at County Line Road; Mn-6, at 127th Street; Mn-7a, at Hampton Avenue; Mn-10, at N. 70th Street; and Mn-13, at Muskego Avenue--are summarized in Figures VII-1 through VII-5. The short-term data collected by the USGS in 1990 are summarized in Figure VII-1 through VII-6 and in Table VII-10. The water quality standards indicated in Figures VII-1 through VII-6 and in Table VII-10 are those set forth for specific biological and recreational use objectives as described in Chapter II. The relations of these objectives and standards to current DNR stream classifications and water quality criteria is discussed in detail in Chapter II.

Review of those data indicate general decreases in levels of chlorophyll-a for all five stations. Both stations Mn-3 and Mn-6 indicate decreases in phosphorus, un-ionized ammonia nitrogen, nitrate nitrogen, and chlorides. In addition, the variability of most of the measured constituents at these two stations was reduced. These improvements are likely due at least in part to the abandonment of the three public sewage treatment plants operated by the Villages of Menomonee Falls and Germantown and to the reduction in the bypassing of sewage through flow relief devices. Levels of dissolved oxygen, un-ionized ammonia nitrogen, and fecal coliform remained variable at all stations, with occasional violations of the dissolved oxygen and un-ionized ammonia nitrogen water quality standards, and frequent violations of the fecal coliform water quality standards associated with the water use objectives for the Menomonee River main stem set forth in Chapter II. Temperature and pH levels remained variable with no apparent trends, but were generally within acceptable limits at all stations. As noted in the subsequent section, the levels of most metals exceeded chronic toxicity standards at all stations.

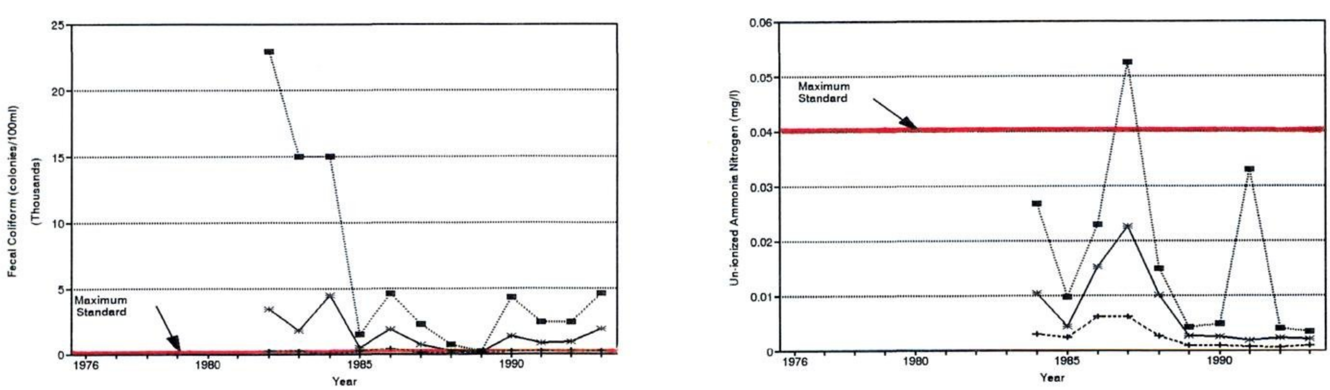
Toxic and Hazardous Substances

Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Commission and the Wisconsin Department of Natural Resources at three sampling stations in the Menomonee River from 1973 through 1974. Specifically, 21 of 105, or 20 percent, of the samples collected violated the recommended criteria for lead. Sample analyses for cadmium, cobalt, copper, mercury, nickel, and zinc uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels.

## Figure VII-1
## WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-3: 1976-1993

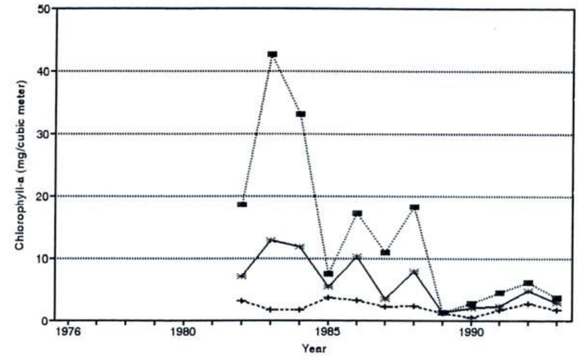


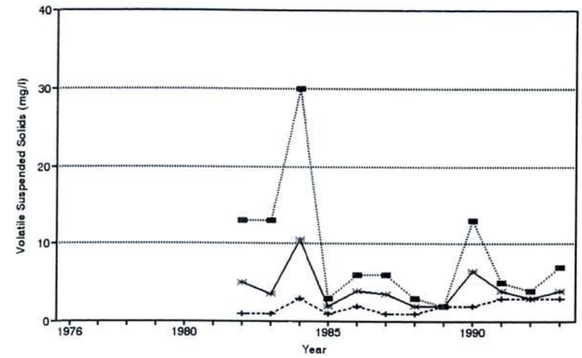

Note: No standard has been established for surface waters classified as limited recreational use.

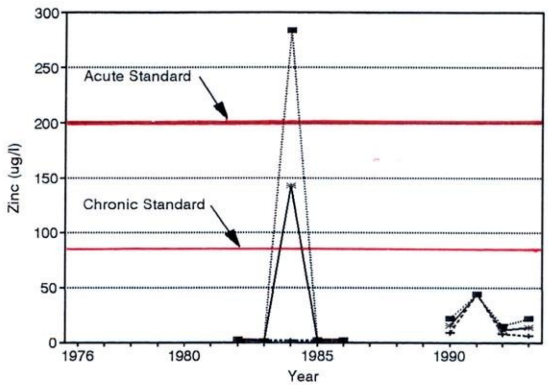


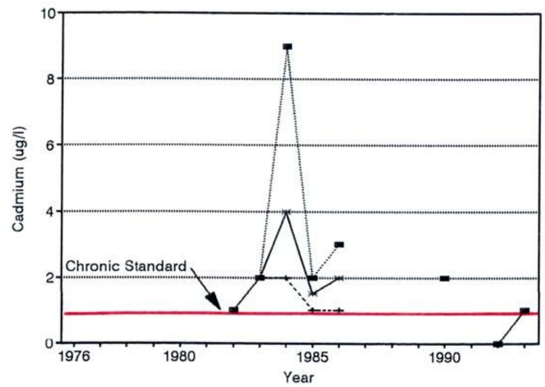

Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

## Figure VII-1 (cont'd)

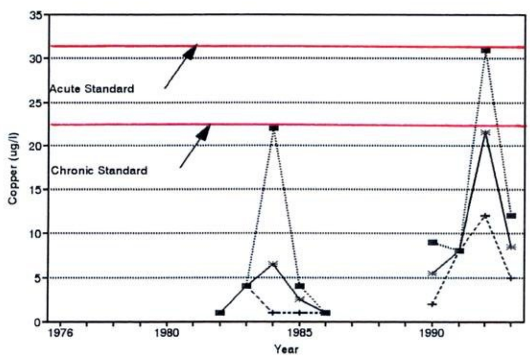


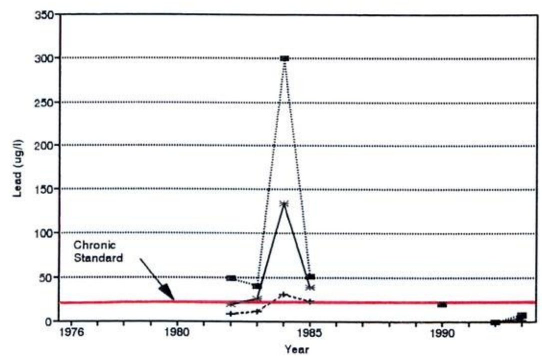



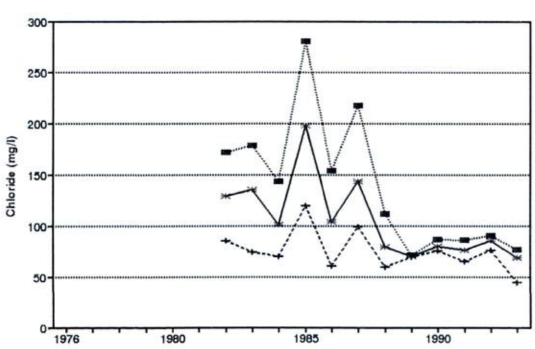




Note: The acute standard of 63.3 was not violated in any year.

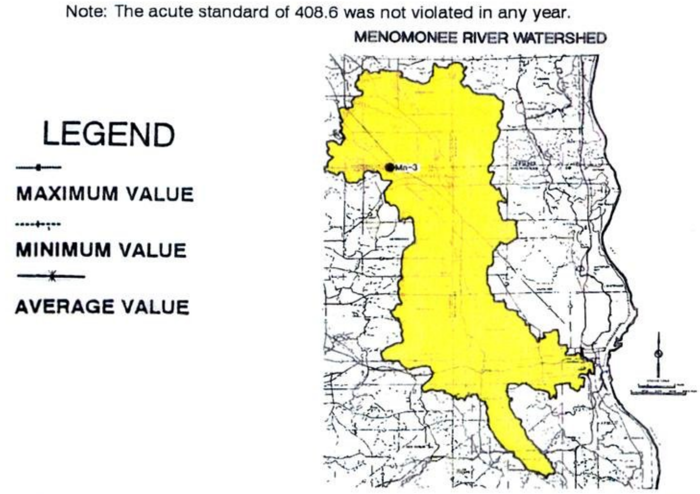



Note: The acute standard of 408.6 was not violated in any year.



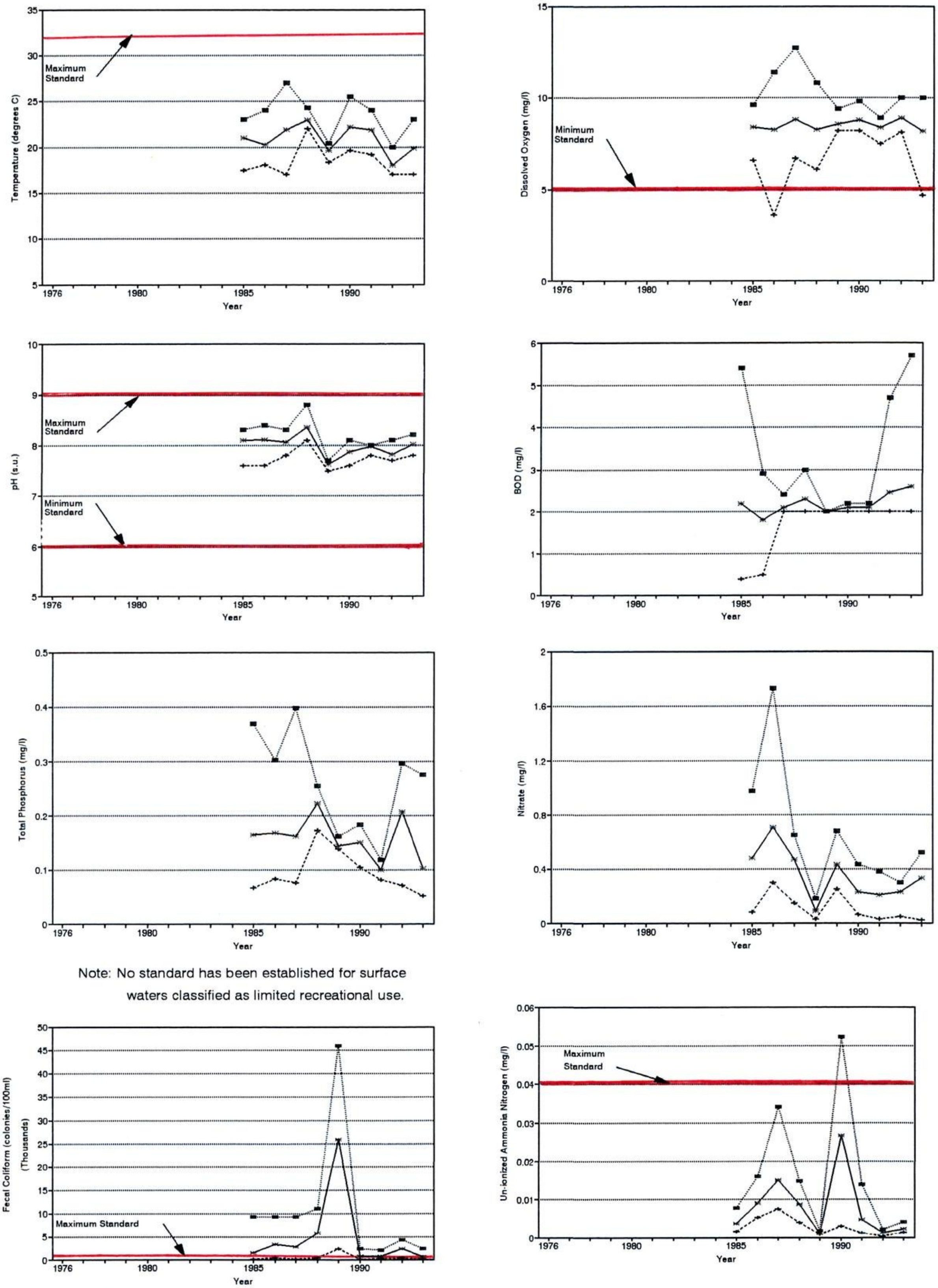

Note: The maximum standard of 1000mg/l was not violated in any year.




Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

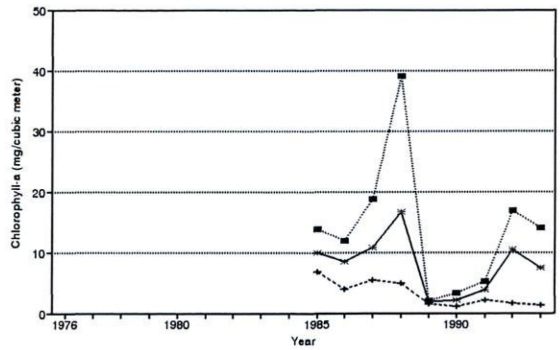
# Figure VII-2
# WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-6: 1976-1993

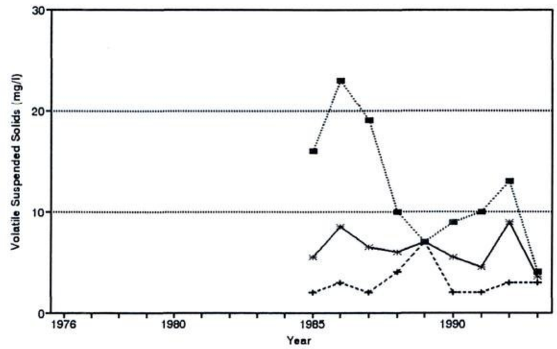


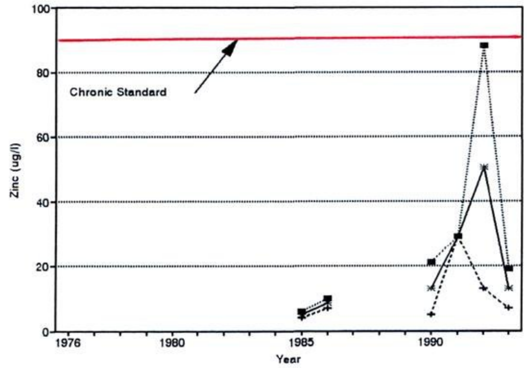

Note: No standard has been established for surface waters classified as limited recreational use.

Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

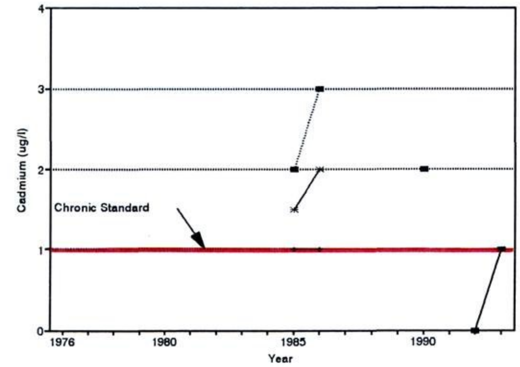
# Figure VII-2 (cont'd)



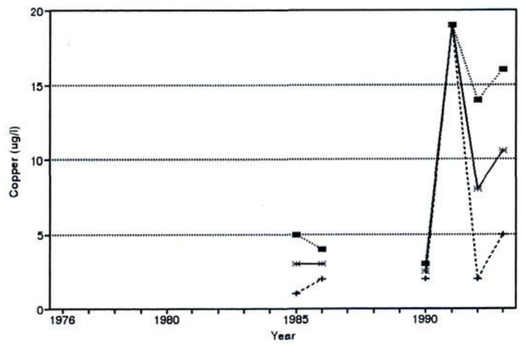




Note: The acute standard of 202.9 was not violated in any year.

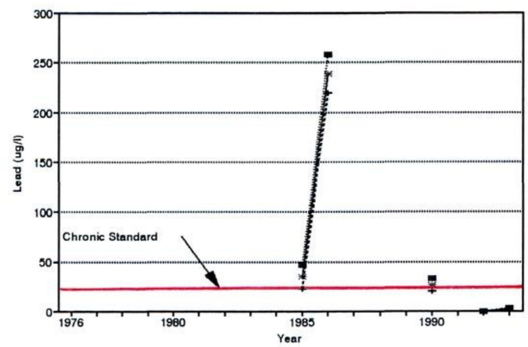



Note: The acute standard of 63.3 was not violated in any year.

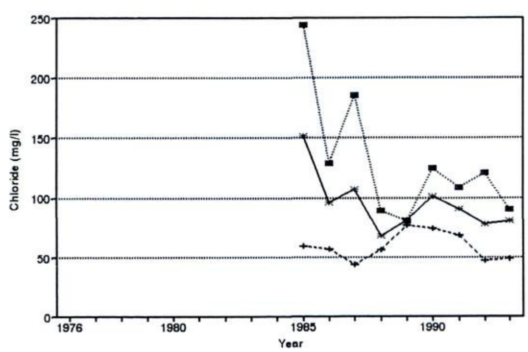



Note: The acute standard of 31.9 ug/l was not violated in any year.

Note: The chronic standard of 22.1 ug/l was not violated in any year.




Note: The acute standard of 408.6 was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

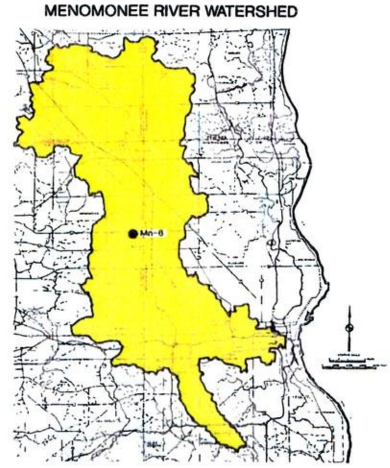
## LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

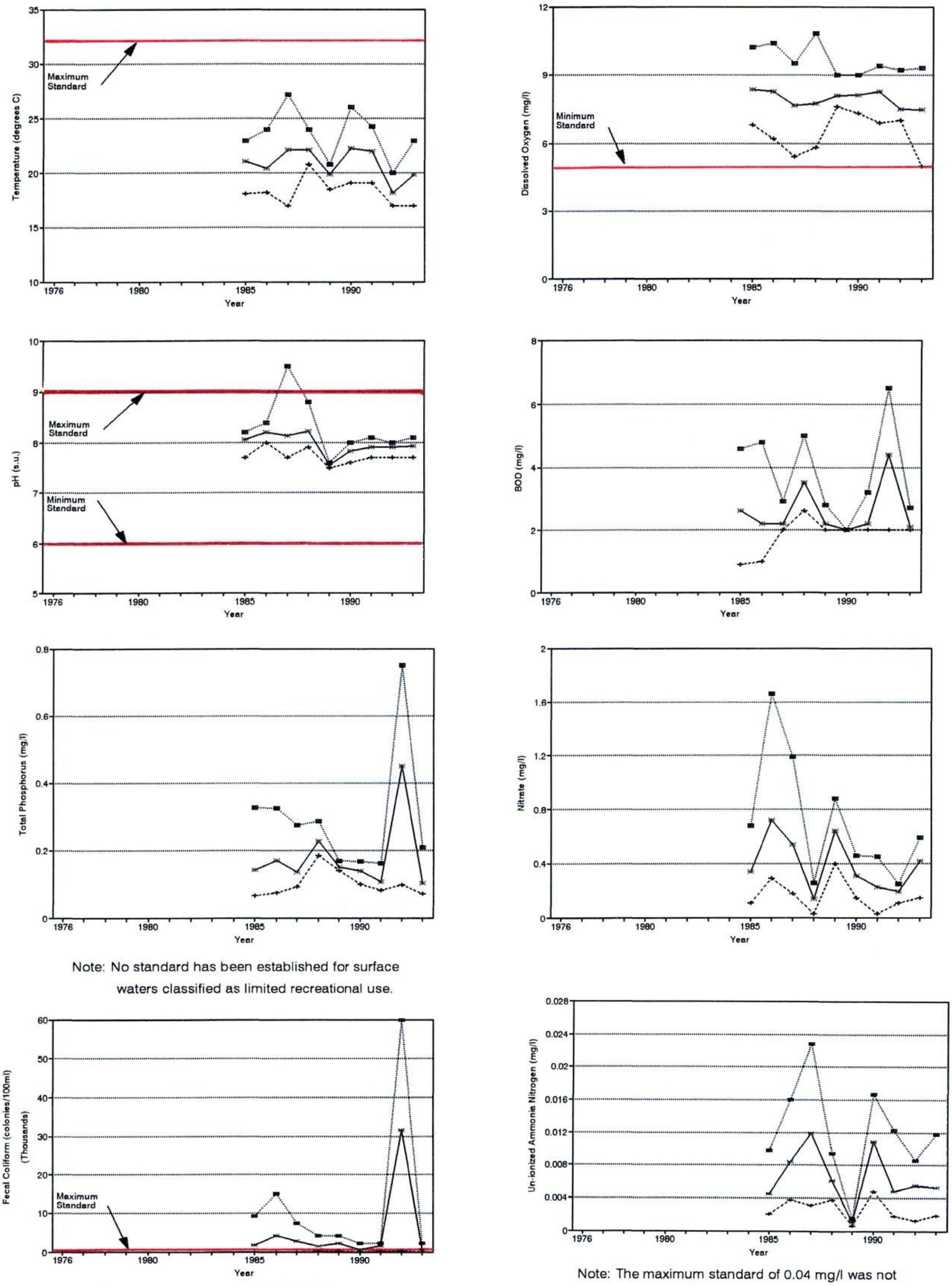
MENOMONEE RIVER WATERSHED




Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

## Figure VII-3
## WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-7a: 1976-1993

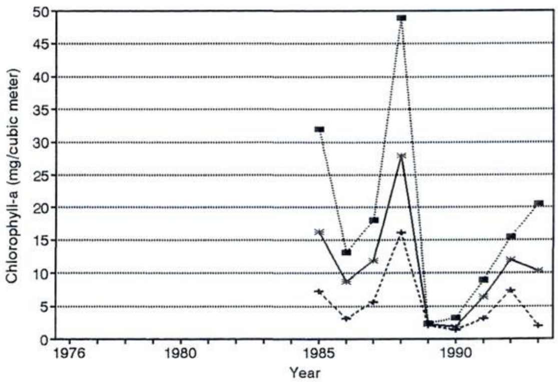


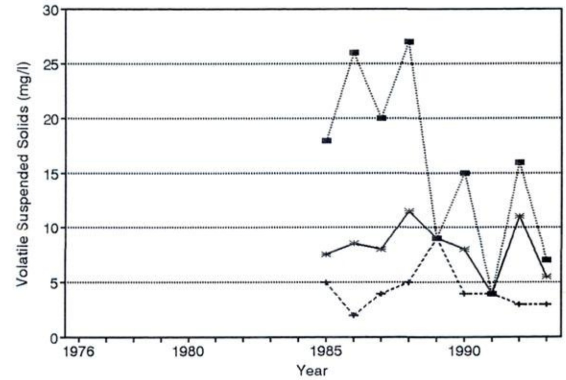

Note: No standard has been established for surface waters classified as limited recreational use.

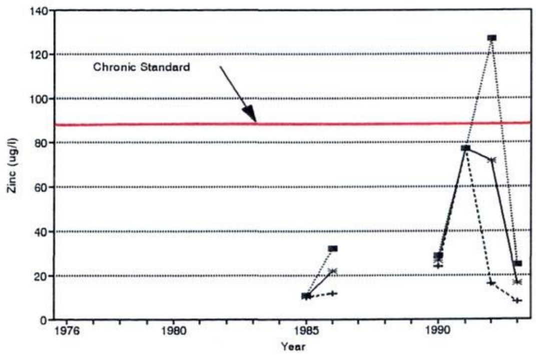
Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

Note: The maximum standard of 0.04 mg/l was not violated in any year.

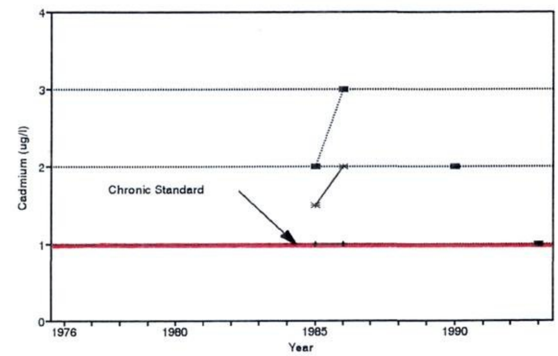
# Figure VII-3 (cont'd)



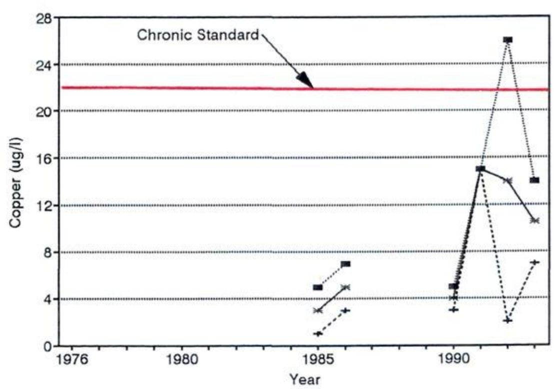



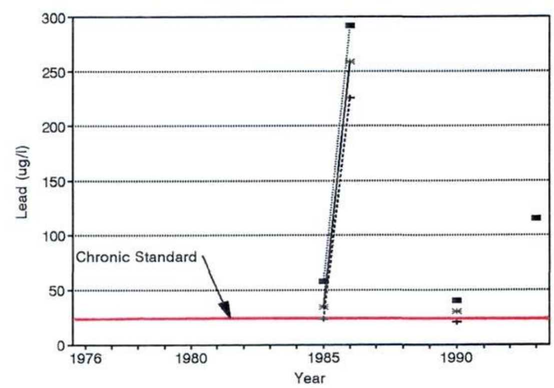

Note: The acute standard of 202.9 ug/l was not violated in any year.



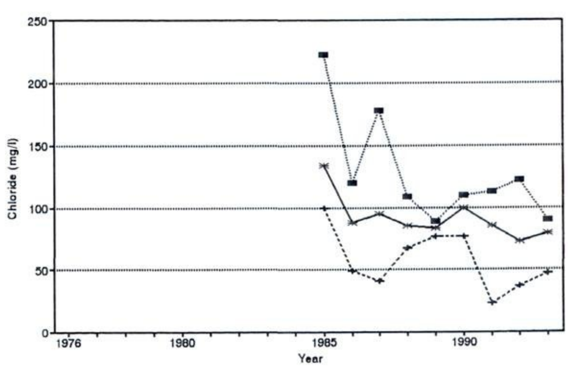

Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The standard of 1000 mg/l was not violated in any year.

**Source: Milwaukee Metropolitan Sewerage District and SEWRPC.**

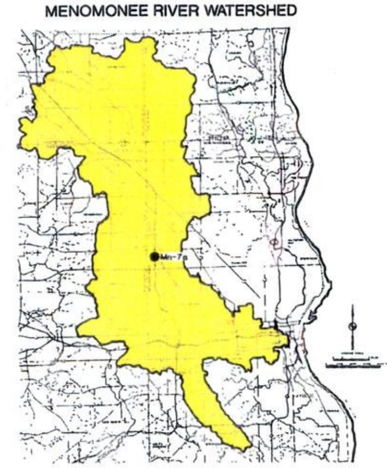
## LEGEND

**MAXIMUM VALUE**

**MINIMUM VALUE**

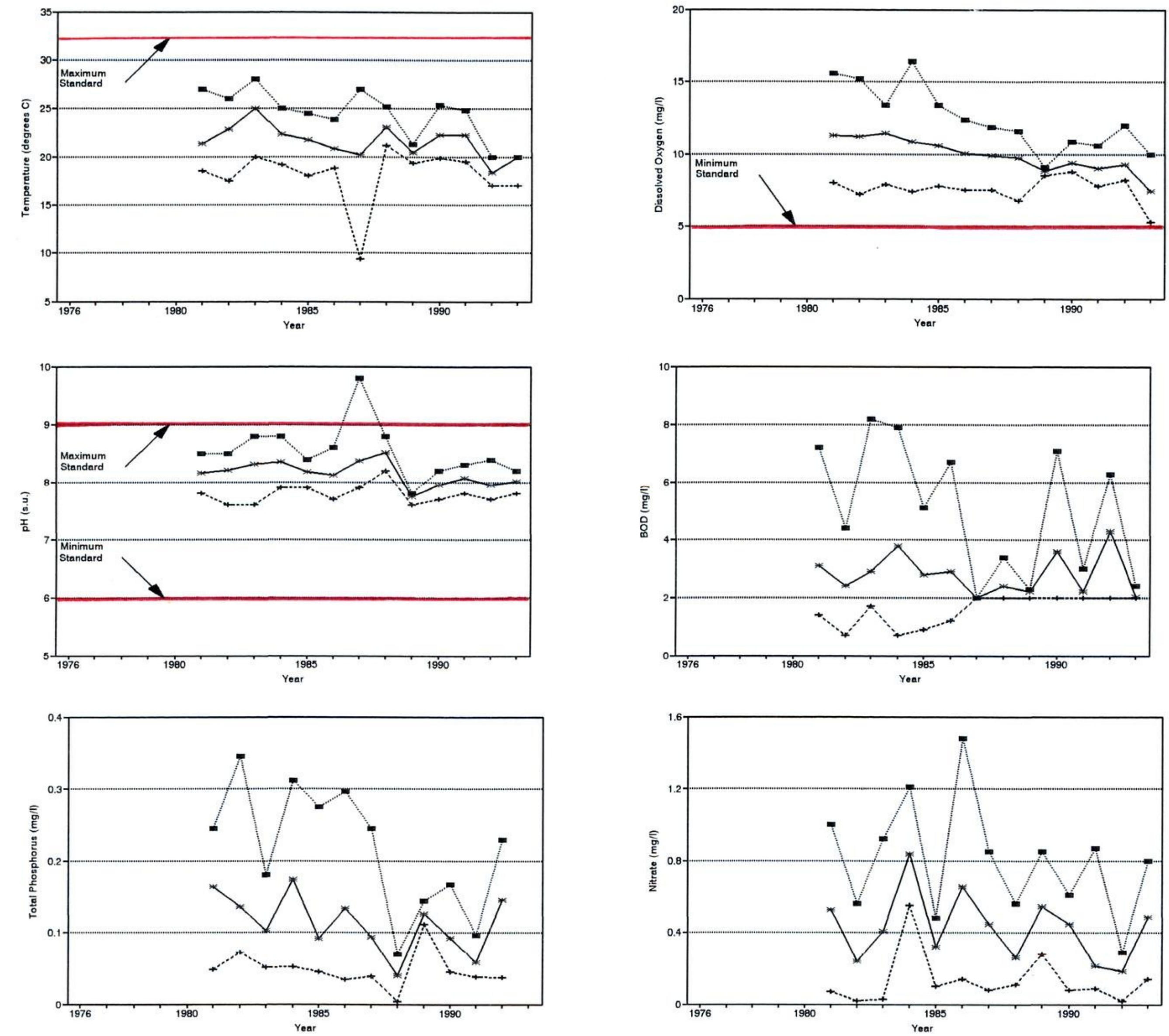
**AVERAGE VALUE**

**MENOMONEE RIVER WATERSHED**

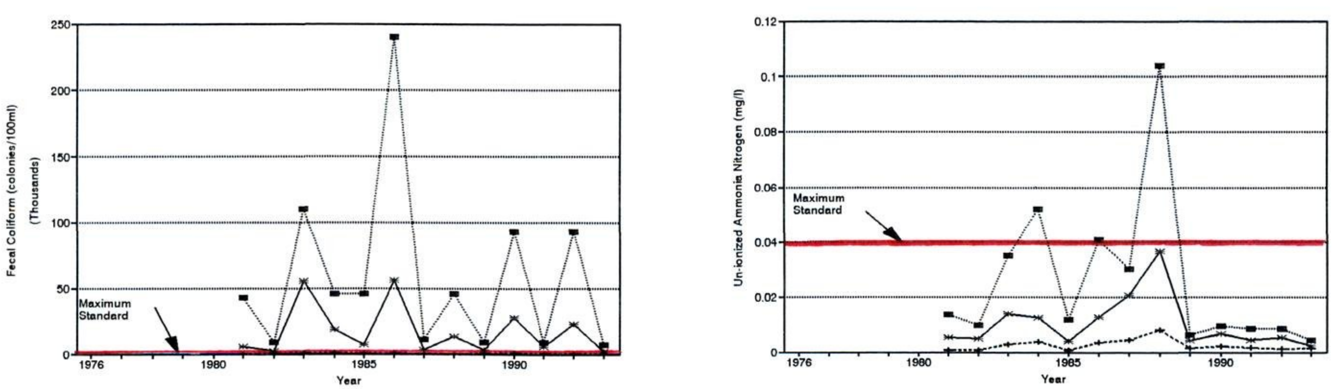


Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

## Figure VII-4
## WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-10: 1976-1993

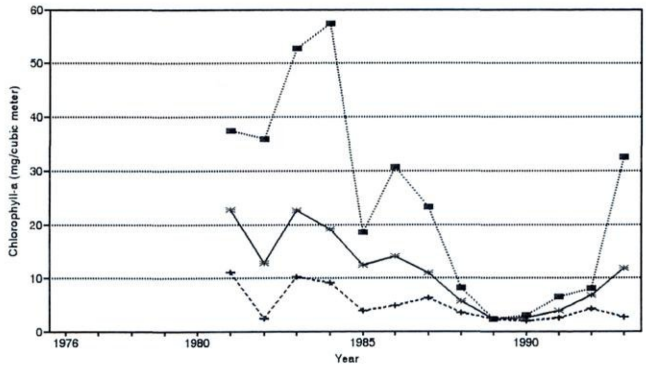


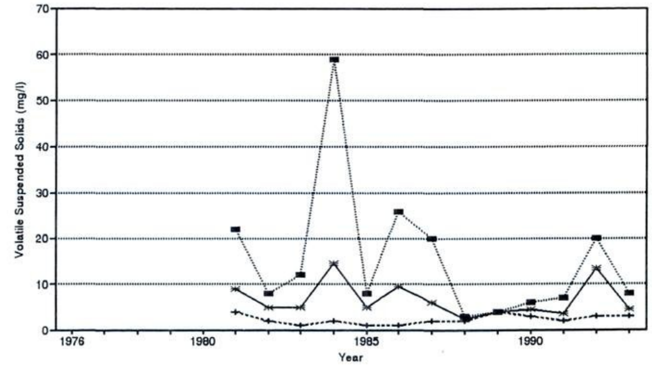

Note: No standard has been established for streams classified as limited recreational use.

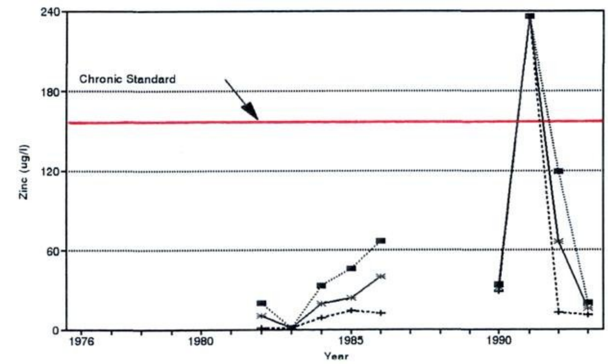



Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

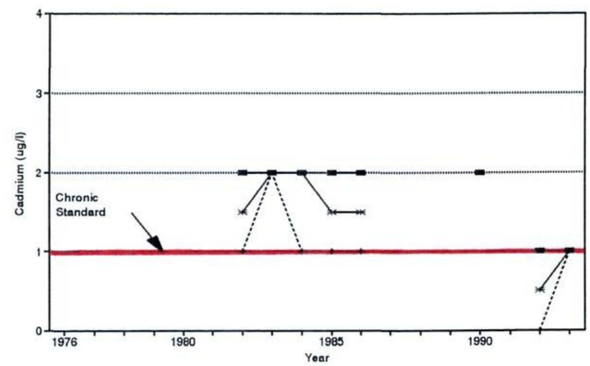
## Figure VII-4 (cont'd)



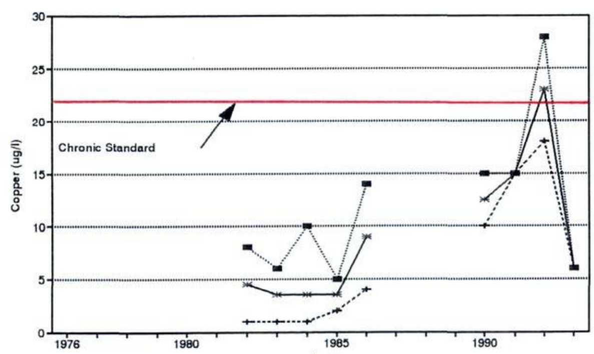



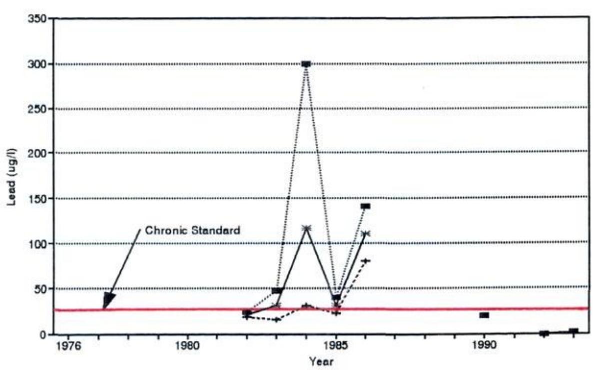

Note: The acute standard of 202.9 was not violated in any year.



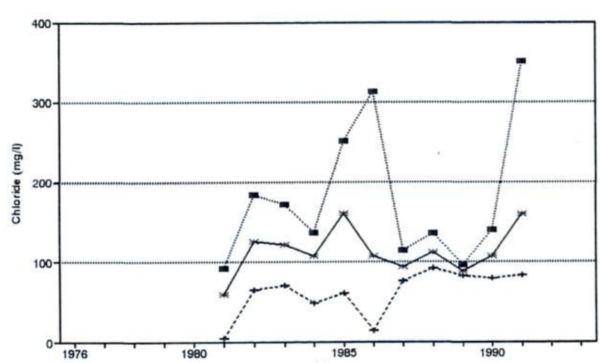

Note: The acute standard of 63.3 was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.

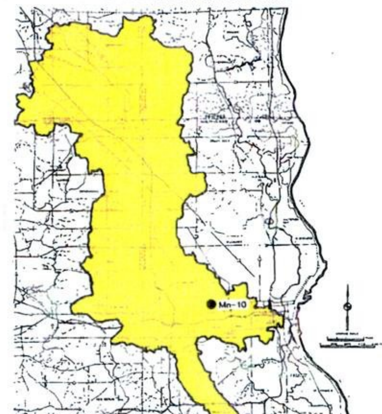



Note: The acute standard of 408.6 was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

MENOMONEE RIVER WATERSHED




LEGEND

MAXIMUM VALUE

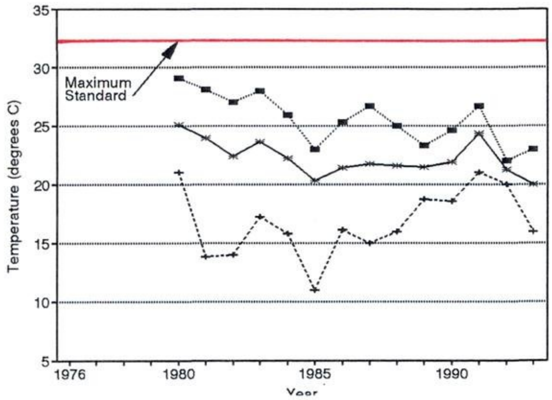
MINIMUM VALUE

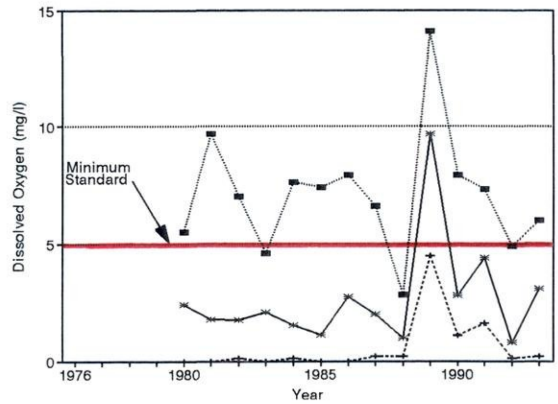
AVERAGE VALUE

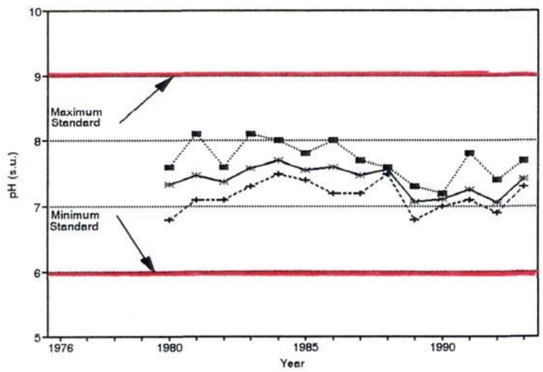
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

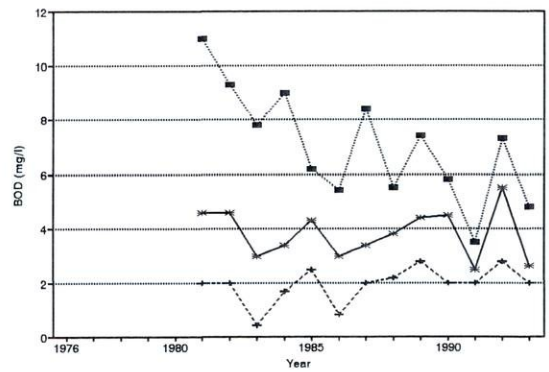
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

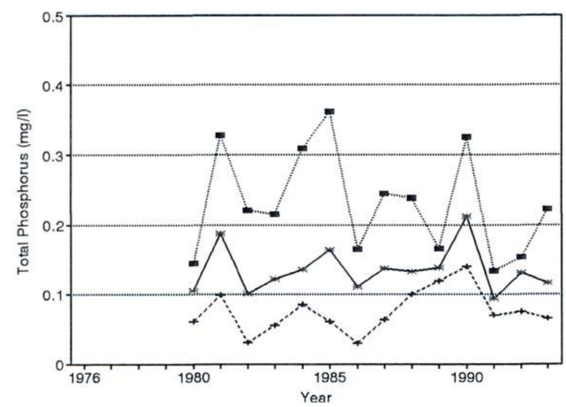
# Figure VII-5
# WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-13: 1976-1993



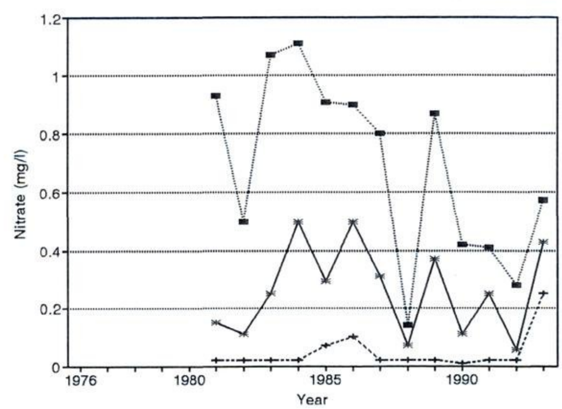



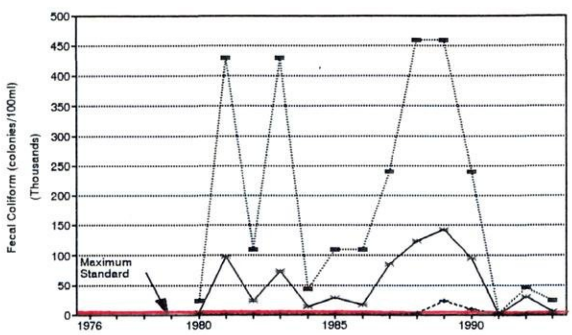



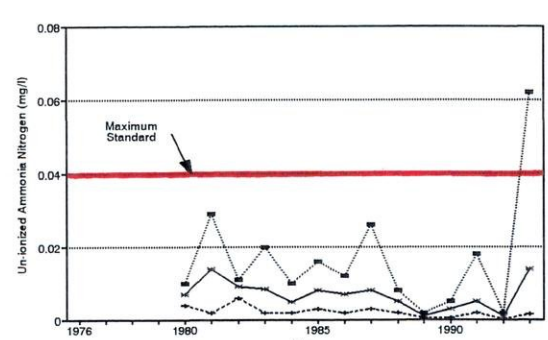




Note: No standard has been established for streams classified as limited recreational use.

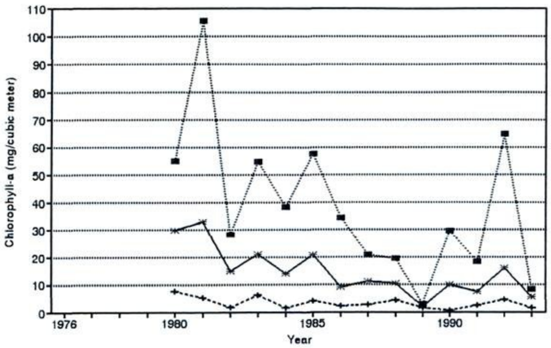


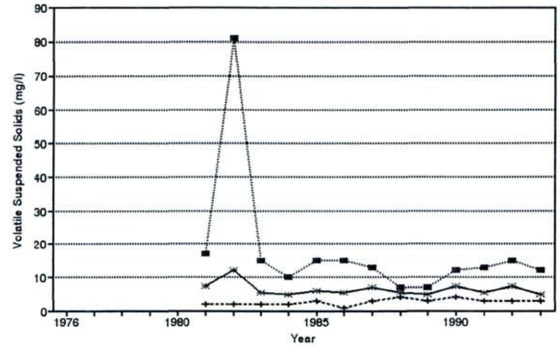



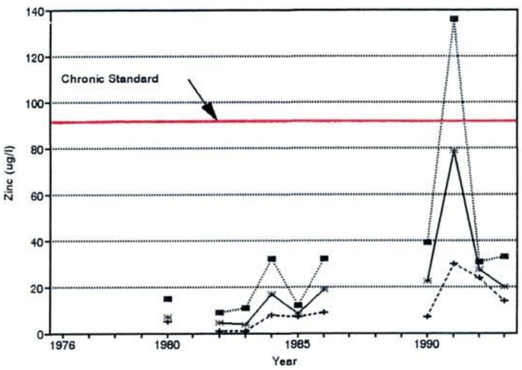

Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.



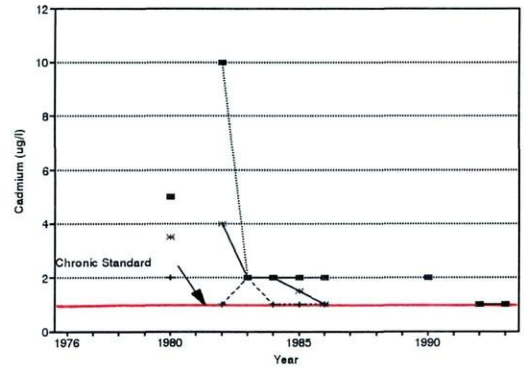
## Figure VII-5 (Cont'd)



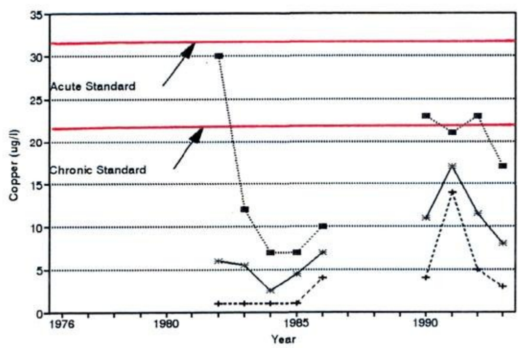



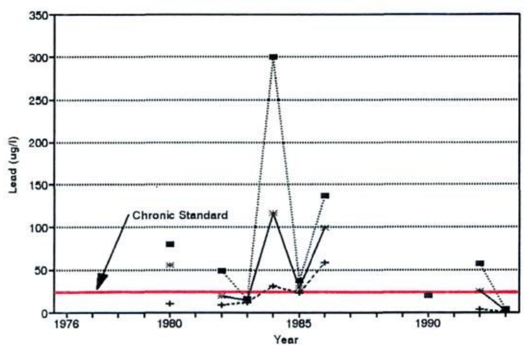




Note: The acute standard of 202.9 was not violated in any year.

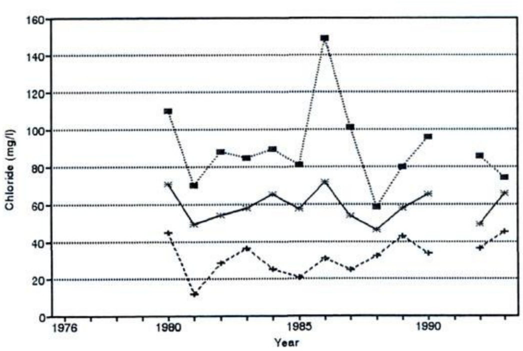



Note: The acute standard of 63.3 was not violated in any year.




Note: The acute standard of 408.6 was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

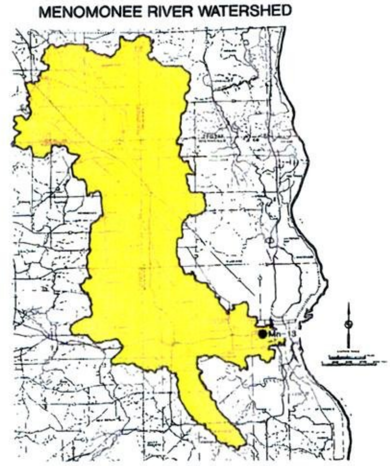
## LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

MENOMONEE RIVER WATERSHED

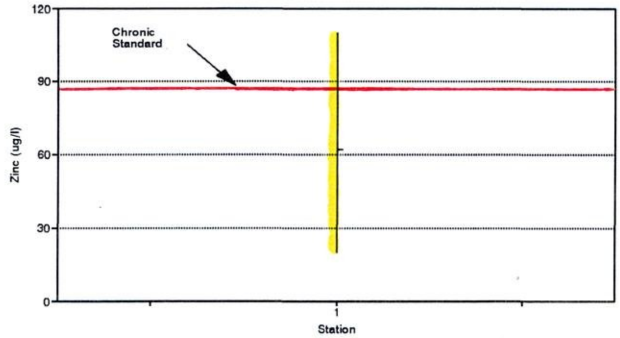


Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

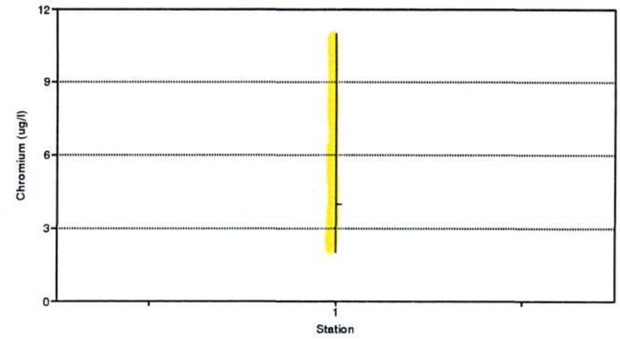
## Figure VII-6
## Menomonee River Watershed Short-Term Water Quality Sampling Data: 1990

### Zinc

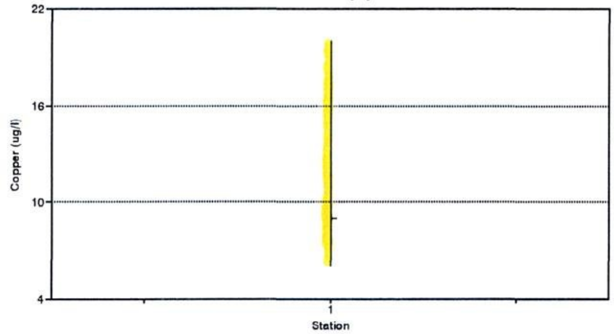



Note: The acute standard of 202.9 ug/l was not violated in any year.

### Chromium



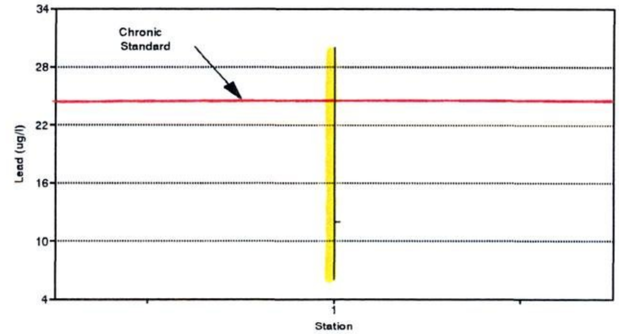

### Copper




Note: The chronic standard of 22.1 ug/l was not violated in any year.

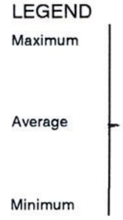
Note: The acute standard of 31.9 ug/l was not violated in any year.

### Lead

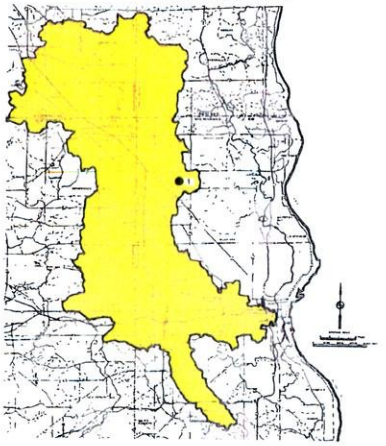



Note: The acute standard of 408.6 ug/l was not violated in any year.

Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table VII-10 for summarized water quality data.




MENOMONEE RIVER WATERSHED



Source: U.S. Geological Survey and SEWRPC.

Table VII-10

MENOMONEE RIVER WATERSHED SHORT-TERM
STREAM WATER QUALITY SAMPLING DATA: 1990

| Sampling Station Number | Parameter (Units) | Applicable Standards[a] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 1 | Zinc (ug/l) | Chronic maximum of 89.2;<br>Acute maximum of 202.9 | 20 - 110 | Yes<br>No | May - June 1990 | 7 |
| | Chromiumm (ug/l) | -- | 2 - 11 | -- | May - June 1990 | 7 |
| | Copper (ug/l) | Chronic maximum of 22.1;<br>Acute maximum of 31.9 | 6 - 20 | No<br>No | May - June 1990 | 7 |
| | Lead (ug/l) | Chronic maximum of 24.4;<br>Acute maximum of 408.6 | 6 - 30 | Yes<br>No | May - June 1990 | 7 |

[a] Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See Chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: U.S. Geological Survery, Wisconsin Department of Natural Resources and SEWRPC.

Recent data on metals substances in the Menomonee River were collected by the Milwaukee Metropolitan Sewerage District at stations Mn-3, Mn-6, Mn-7a, Mn-10, and Mn-13; and by the Wisconsin Department of Natural Resources at a station inthe Little Menomonee River, as shown in Figures VII-1 through VII-6. These data indicate that levels of zinc, cadmium, copper, and lead consistently violated chronic toxicity level standards as established by Department of Natural Resources for all stations on the Menomonee River main stem, with the exception of zinc and copper levels at station Mn-6, which remained within the acceptable limits. Short-term data collected in a tributary to the Little Menomonee River in 1990 indicated that levels of zinc and lead violated the chronic toxicity level standards.

Post-1976 data on toxic and hazardous substances present in stream sediments were collected in the Menomonee River portion of the Milwaukee Harbor estuary as part of the Milwaukee Harbor estuary study[7] and the remedial action plan for the Milwaukee Harbor estuary,[8] reported sediments contaminated with organics and metals. Sediment concentrations of ammonia, lead, zinc, and cadmium exceeded the proposed DNR Severe Effect Level (SEL) guidelines[9] at most sites sampled; copper concentrations exceeded the Lowest Effect Level guidelines. Further studies of sediment chemistry have been reported by Palmer,[10] and Ni, Gin, and Christensen.[11] In these studies, total PCB concentrations in the sediments of the Lower Menomonee River exceeded the Lowest Effect Level (LEL) guidelines proposed by the Department of Natural Resources at both stations, with extremely high values being reported from the two additional Menomonee Canal stations. Similarly, PAH concentrations exceeded the LEL guidelines, with the most severe contamination being reported from the Lower Menomonee River.

Additional data collection by the U.S. Geological Survey and the Wisconsin Department of Natural Resources between 1989 and 1992, and set forth in Table VII-11, show that the proposed screening criteria were exceeded at most sites. The LEL criteria were exceeded at all 18 sampling sites on the Menomonee River main stem, Little Menomonee River, and Lilly Creek. Severe Effect Level guidelines for selected heavy metals were exceeded at Hoyt Park--copper and lead--and

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[7]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, 1987.

[8]Wisconsin Department of Natural Resources, Remedial Action Plan, Milwaukee Harbor Estuary, 1991.

[9]Wisconsin Department of Natural Resources, (Draft) Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System, June 1994.

[10]Lauran Palmer, Evaluation of Polychlorinated Biphenyls and Polycyclic Aromatic Hydrocarbons in the Menomonee River, Canals, and Milwaukee Harbor, UW-SP Report, August 1993.

[11]Fan Ni, Michael F. Gin, and Erik R. Christensen, Toxic Organic Contaminants in the Sediments of the Milwaukee Harbor Estuary, Final Report, Milwaukee Metropolitan Sewerage District, 1992.

Table VII-11

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES
IN THE MENOMONEE RIVER WATERSHED: 1989-1992

| | Sampling Stations | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Menomonee River Main Stem | | | | | | | Little Menomonee River | | | | | | | | Lilly Creek | | | |
| Substances Sampled | CTH F | Germantown | Mount Mary College | Lilly Road | C&NW Railway | Hoyt Park | Wauwa-tosa | Friestadt Road | Brown Road | C&NW Railway | Calumet Road | Good Hope Road | Good Hope Road | Mill Road | STH 100 | Mill Road | Silver Spring Road | Nicolet Avenue | Mouth |
| Heavy Metals (mg/kg) | | | | | | | | | | | | 1989 | 1992 | | | | | | |
| Arsenic | 5.0 | 1.0 | 6.0 | 3.0 | 4.0 | 6.0 | 7.0 | 38.0 | 2.9 | 5.8 | 4.5 | 7.0 | 4.0 | 5.5 | 3.5 | 10.0 | 2.0 | 12.0 | 5.0 |
| Cadmium | 2.0 | 2.0 | 3.0 | 1.0 | 2.0 | 4.0 | 5.0 | 1.0 | 1.0 | 7.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.0 | 1.0 | 1.0 | 2.0 |
| Chromium | 30.0 | 40.0 | 30.0 | 30.0 | 30.0 | 70.0 | 70.0 | 20.0 | -- | -- | -- | -- | 20.0 | -- | -- | 30.0 | 20.0 | 20.0 | 20.0 |
| Copper | 33.0 | 48.0 | 49.0 | 41.0 | 50.0 | 140.0 | 130.0 | 29.0 | -- | -- | -- | -- | 2.0 | -- | -- | 41.0 | 40.0 | 23.0 | 26.0 |
| Lead | 30.0 | 40.0 | 80.0 | 90.0 | 60.0 | 260.0 | 40.0 | 20.0 | 95.0 | 56.0 | 29.0 | 37.0 | 10.0 | 22.0 | 69.0 | 50.0 | 30.0 | 20.0 | 50.0 |
| Mercury | 0.06 | 0.2 | 0.4 | 0.2 | 0.08 | 0.2 | 0.2 | 0.06 | -- | -- | -- | -- | 0.2 | -- | -- | 0.04 | 0.04 | 0.04 | 0.06 |
| Nickel | 20.0 | 30.0 | 20.0 | 20.0 | 30.0 | 40.0 | 40.0 | 20.0 | -- | -- | -- | -- | 10.0 | -- | -- | 20.0 | 30.0 | 20.0 | 20.0 |
| Zinc | 140.0 | 140.0 | 280.0 | 260.0 | 250.0 | 540.0 | 850.0 | 93.0 | 190.0 | 2,100.0 | 220.0 | 160.0 | 93.0 | 100.0 | 180.0 | 190.0 | 130.0 | 77.0 | 120.0 |
| Total Polycyclic Aromatic Hydrocarbons (mg/kg) | 0.0 | 0.0 | 21.7 | 50.6 | 48.1 | 114.5 | 42.5 | 0.3 | 46.7 | 61.8 | 119.4 | 10.5 | 2,262.9 | 118.5 | 35.2 | 25.1 | 5.4 | 0.0 | 36.6 |
| Total Polychlorinated Biphenyls (μg/kg) | 10.0 | 10.0 | -- | 20.0 | 10.0 | -- | -- | 10.0 | -- | -- | -- | -- | -- | -- | -- | -- | 10.0 | 10.0 | 10.0 |
| Aldrin | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | -- | -- | -- | 1.0 | -- | -- | -- | 1.0 | 1.0 | 1.0 | 1.0 |
| Chlordane | 10.0 | 10.0 | 20.0 | -- | 10.0 | 20.0 | 20.0 | 10.0 | -- | -- | -- | -- | -- | -- | -- | 10.0 | 10.0 | 20.0 | 10.0 |
| Total DDT | 3.0 | 1.0 | 18.0 | 7.0 | 10.0 | 17.0 | -- | 1.0 | -- | -- | -- | -- | -- | -- | -- | 1.0 | 1.0 | 4.0 | 6.0 |
| op+pp DDT | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| pp DDD | 7.0 | 1.0 | 34.0 | 12.0 | 30.0 | 30.0 | 13.0 | 6.0 | -- | -- | -- | 21.0 | -- | -- | -- | 4.0 | 1.0 | 2.0 | 8.0 |
| pp DDE | 8.0 | 1.0 | 22.0 | 7.0 | 5.0 | 11.0 | 13.0 | 13.0 | -- | -- | -- | 16.0 | -- | -- | -- | 3.0 | 1.0 | 5.0 | 19.0 |
| Mirex | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | -- | -- | -- | 1.0 | -- | -- | -- | 1.0 | 1.0 | 1.0 | 1.0 |
| TCDD | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| $NH_3$-N (mg/l) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| O&G (mg/l) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CN (mg/l) | 0.5 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 2.5 | 0.5 | 2.9 | 5.8 | 4.5 | 0.5 | 7.0 | 5.6 | 3.5 | 0.5 | 0.5 | 0.5 | 0.5 |

Note: Values recorded as 0.0 are below the limit of detection.

Source: Wisconsin Department of Natural Resources, U.S. Geological Survey, and SEWRPC.

Wauwatosa--copper and zinc--on the Menomonee River main stem, and at Friestadt Road--arsenic--and the Chicago & North Western railroad crossing--zinc--on the Little Menomonee River. PAH SEL guidelines were exceeded at Good Hope Road on the Little Menomonee River during 1992. This latter exceedance may be related to a chemical spill within the Little Menomonee River watershed on Good Hope Road immediately prior to the date the sample was obtained and is unlikely to reflect the normal condition of the river sediments at this location.

Since the completion of the initial regional water quality management plan, 62 spills of toxic substances into streams within the Menomonee River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 27 have occurred in the main stem of the Menomonee River, 20 in the City of Milwaukee, three in the Village of Menomonee Falls, two in the City of Wauwatosa, and one each in the Villages of Germantown and Butler. The remaining spills have occurred in tributaries of the Menomonee River, including Honey Creek, Underwood Creek, the Little Menomonee River, Butler Ditch, Lilly Creek, and South Menomonee and Burnham Canals. The majority of the substances that were spilled into surface waters were oil or related petroleum products.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Menomonee River and its major tributaries were assessed, with the results set forth in Table VII-12. Fish populations and diversity ranged from poor to good in stream reaches where data were available.

Fish kills were documented in five streams in the Menomonee River watershed--Honey Creek, Underwood Creek, the Nor-X-Way Channel, Burnham Canal, and the Menomonee River main stem in the Cities of Wauwatosa and Milwaukee. Where known, the specific cause of each documented fish kill is shown in Table VII-12.

Standards were not fully met for fecal coliform levels in the majority of the Menomonee River watershed. Dissolved oxygen concentrations exceeded the standards in the Menomonee River main stem from CTH Q to Lilly Road and downstream of 25th Street, as well as in South Menomonee and Burnham Canals. In addition, un-ionized ammonia nitrogen levels exceeded the standards in the Menomonee River from STH 145 to Lilly Road, from Silver Spring Drive to Capitol Drive, and downstream of 70th Street. Metals concentrations exceeded chronic toxicity standards set forth in Chapter II at all sampling stations.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were fair to very poor, except for the Menomonee River West Branch which had a good rating and Little Menomonee Creek which had a good to fair rating. Moderate levels of streambed sedimentation were noted throughout much of the watershed.

Table VII-12 sets forth the water quality index classifications[12] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As

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[12]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table VII-12

CHARACTERISTICS OF STREAMS IN THE MENOMONEE RIVER WATERSHED

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| North Branch of Menomonee River upstream STH 145 | 10.0 | -- | No | No | No | -- | Yes | -- | -- | Moderate | -- |
| Menomonee River West Branch | 4.2 | Good | No | No | No | -- | Yes | Yes | Good | Low (gravel, rubble) | Low |
| Menomonee River Downstream STH 145 to CTH Q | 3.8 | -- | No | No | Yes | -- | Yes | Yes | Fair | Moderate | -- |
| Menomonee River Downstream CTH Q to Lilly Road | 3.8 | -- | No | Yes | Yes | -- | Yes | Yes | Fair | Moderate | -- |
| Menomonee River Downstream Lilly Road to Good Hope Road | 7.1 | -- | No | No | No | -- | Yes | Yes | Fair | Moderate (sand, gravel, rubble) | -- |
| Menomonee River Downstream Good Hope Road to Silver Spring | 2.7 | -- | No | No | No | -- | Yes | Yes | Fair | Moderate | -- |
| Menomonee River Downstream Silver Spring to Hampton Avenue | 2.1 | -- | No | No | Yes | -- | Yes | Yes | Poor | Moderate | -- |
| Menomonee River Downstream Hampton Avenue to Capitol Drive | 1.3 | -- | Yes[f] | No | Yes | -- | Yes | Yes | Poor | -- | -- |
| Menomonee River Downstream Capitol Drive to North Avenue | 2.7 | -- | No | No | No | -- | Yes | Yes | Poor | Moderate | -- |
| Menomonee River Downstream North Avenue to 70th Street | 2.4 | Poor | No | No | No | -- | Yes | Yes | Poor | Moderate (rubble, sand, silt) | -- |
| Menomonee River Downstream 70th Street to 25th Street | 4.4 | Poor | Yes[g] | No | Yes | -- | Yes | Yes | Very poor | Moderate (rubble, sand, silt) | Major |
| Menomonee River Downstream 25th Street to 2nd Street | 1.7 | Good | Yes[h] | Yes | Yes | -- | Yes | Yes | -- | -- | -- |
| South Menomonee and Burnham Canals | 1.5 | Good | Yes | Yes | -- | -- | Yes | Yes | -- | Moderate | Major |
| Honey Creek | 8.4 | Poor | Yes[f] | No | No | -- | Yes | Yes | Fair-very poor | Moderate (concrete, rubble, gravel) | Major |

Table VII-12 (continued)

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | NH3 | Total P | Fecal Coliform | Toxics | | | |
| Underwood Creek | 8.9 | Poor | Yes[i] | No | No | -- | Yes | Yes | Fair-poor | Moderate (concrete) | Major |
| Little Menomonee Creek | 2.3 | Fair | No | No | No | -- | Yes | -- | Good-fair | Moderate (silt, clay, sand, gravel, rubble) | Low |
| Little Menomonee River | 9.7 | Fair | No | No | No | -- | Yes | Yes | Fair-Poor | Moderate | -- |
| Butler Ditch | 2.4 | Poor | No | No | No | -- | Yes | -- | Poor | Moderate (sand, gravel, rubble) | -- |
| Dousman Ditch | 2.5 | Poor | No | No | No | -- | Yes | Yes | -- | -- | Major |
| Lilly Creek | 3.4 | Good | No | No | No | -- | Yes | Yes | Poor | Moderate | Major |
| Nor-X-Way Channel | 4.5 | Good | Yes[f] | No | No | -- | Yes | -- | Fair-poor | Low (clay, silt, sand, gravel, rubble) | Moderate |
| Willow Creek | 3.2 | Fair | No | No | No | -- | Yes | -- | Fair | Moderate (sand) | Moderate |

[a] Based upon stream appraisal documentation set forth in the 1992 Water Resource Appraisals for the Menomonee River watershed and professional judgement of area fish managers.

[b] Unless otherwise noted, fish kills are assumed to be the result of natural fluctuations in water conditions.

[c] The most recent water quality data available as described in Figures VII-1 through VII-5 were used to evaluate water quality in the Menomonee River system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for Menomonee River watershed stream reaches based upon simulated year 2000 land use conditions and current levels of pollutant control.

[d] Biotic index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in DNR Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality in Streams," Hilsenhoff 1982.

[e] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures, or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

[f] Undetermined cause.

[g] Due to a spill of spent pickle liquor.

[h] Due to suspected industrial discharge.

[i] Due to a spill of #2 heating oil from a petroleum pipeline.

Source: SEWRPC.

indicated in Table VII-13, recent comparative data were available for five stations along the main stem of the Menomonee River. These stations and an additional station where water quality data was collected by the Department of Natural Resources are shown on Map VII-5. The data obtained for MMSD sampling station Mn-7a, the Menomonee River at Hampton Avenue, were used for comparative purposes in conjunction with earlier data from the Menomonee River at Capitol Drive. The data indicate that at stations Mn-6, Mn-7a, and Mn-10, water quality conditions have remained "fair" in 1964, 1974-75, and in 1990-91. In the upper reaches of the Menomonee River at station Mn-3, water quality conditions declined from "good" in 1964 to "fair" in 1974-75, and have remained "fair" based on 1990-91 data.

A summary of potential pollution sources in the Menomonee River watershed by stream reach is shown in tabular summary in Table VII-14. Review of the data indicate that the majority of the conversion of lands from rural to urban uses has occurred within Milwaukee County, with much of the conversion having occurred prior to 1976. More recent conversion of lands to urban uses has occurred in the Villages of Menomonee Falls and Germantown. It should be noted that the majority of the documented spills of toxic substances and the majority of the permitted industrial discharges occur in the Menomonee River main stem, from 70th Street downstream to 25th Street, and in the South Menomonee and Burnham Canals, Honey Creek, Underwood Creek, and the Little Menomonee River. It should also be noted that three abandoned landfills are indicated to be potentially impacting the Little Menomonee River, two of these were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program.

Compliance with Water Use Objectives

As indicated in Chapter II, the major stream reaches in the Menomonee River watershed as of 1993, are generally recommended for warmwater sport fish and limited recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. The West Branch of the Menomonee River, the Menomonee River main stem from USH 41 to the Falk Corporation Dam, Honey Creek downstream of Wisconsin Avenue, Underwood Creek upstream of Watertown Plank Road, Little Menomonee Creek, Lilly Creek, Willow Creek, and the Nor-X-Way Channel from Donges Bay Road to Warren Street have limitations for sport fish habitat and are therefore recommended for warmwater forage fish and limited recreational uses. Butler Ditch, Dousman Ditch, and the remaining portions of the Nor-X-Way Channel are recommended for limited forage fish and limited recreational uses. Stream reaches recommended for limited aquatic life and limited recreational uses include portions of Honey Creek and portions of Underwood Creek. The Menomonee River portion of the Milwaukee Harbor estuary is recommended for warmwater sport fish and limited recreational use.

Based upon the available data for sampling stations in the watershed, the main stem of the Menomonee River and its major tributaries did not fully meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. As part of the Menomonee River priority watershed planning program the Wisconsin Department of Natural Resources staff conducted field inspections and limited sampling in order to assess the water quality and biological conditions on all of the streams in the Menomonee River watershed. Those investigations indicated that the majority of the streams in the watershed did not fully meet the recommended water use objectives. Based upon a review of the data summarized in Figures VII-1 through

Table VII-13

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE MENOMONEE RIVER WATERSHED 1964, 1974-1975, AND 1990-91

| Main Stem Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Mn-1 | Fair | Fair | -- |
| Mn-2 | Poor | Fair | -- |
| Mn-3 | Good | Fair | Fair |
| Mn-4 | Poor | Fair | -- |
| Mn-5 | Poor | Poor | -- |
| Mn-6 | Fair | Fair | Fair |
| Mn-7a | Fair | Fair | Fair[b] |
| Mn-7b | Fair | Fair | -- |
| Mn-10 | Fair | Fair | Fair |
| Mn-13 | -- | -- | Fair |
| Tributary Stations | | | |
| Mn-7 | Fair | Fair | -- |
| Mn-8 | Fair | Fair | -- |
| Mn-9 | Fair | Fair | -- |
| Watershed Average | Fair | Fair | Fair |

[a] See Map VII-5 for sampling station locations.

[b] Recent data collected from the Menomonee River at Hampton Avenue were used for comparison purposes with previous data from the Menomonee River at Capitol Drive, located approximately 1.1 miles downstream from the Hampton Avenue station.

Source: SEWRPC.

Table VII-14

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE MENOMONEE RIVER WATERSHED: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| North Branch Menomonee River Upstream STH 145 | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1,3 |
| Menomonee River West Branch | Insignificant | Insignificant | -- | -- | X | -- | -- | 1 | -- | -- | 1,3 |
| Menomonee River Downstream STH 145 to CTH Q | Major[d] | Major[e] | -- | X | X | -- | -- | 4 | Leaking underground storage tank site permitted to discharge remediation wastewater to Menomonee River | Village of Germantown public sewage treatment plant abandoned in 1986 | 1,2,3 |
| Menomonee River Downstream CTH Q to Lilly Road | Moderate | Moderate | 1982-gasoline<br>1991-fuel oil | X | -- | -- | -- | 6 | -- | Village of Menomonee Falls-Pilgrim Road public STP abandoned in 1981 | 1,2 |
| Menomonee River Downstream Lilly Road to Good Hope Road | Significant[d] | Major[e] | 1989-white liquid<br>1987-oil | X | -- | -- | -- | 3 | Lauer I sanitary landfill[g] (abandoned) | Village of Menomonee Falls-Lilly Road public STP abandoned in 1981 | 1,2 |
| Menomonee River Downstream Good Hope Road to Silver Spring | Insignificant | Major[e] | -- | X | -- | -- | -- | 3 | -- | -- | 1,2 |
| Menomonee River Downstream Silver Spring to Hampton Avenue | Moderate | Insignificant[f] | 1983-fuel oil<br>1983-oil<br>1987-petroleum | X | -- | -- | -- | 3 | -- | -- | 1,2 |
| Menomonee River Downstream Hampton Avenue to Capitol Drive | Significant[f] | Insignificant[f] | 1987-gasoline | X | -- | -- | -- | 6 | -- | -- | 1,2 |
| Menomonee River Downstream Capitol Drive to North Avenue | Insignificant[f] | Insignificant[f] | 1984-unknown<br>1986-unknown<br>1992-diesel fuel | X | -- | -- | -- | 7 | -- | -- | 1,2 |

Table VII-14 (continued)

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Menomonee River Downstream North Avenue to 70th Street | Insignificant[f] | Insignificant[f] | 1990-vegetable oil | X | -- | -- | -- | 1 | -- | -- | 2 |
| Menomonee River Downstream 70th Street to 25th Street | Insignificant[f] | Insignificant[f] | 1979-waste oil<br>1980-oil<br>1980-oil<br>1981-oil<br>1982-sewage<br>1984-oil<br>1985-oil<br>1986-fuel oil<br>1988-light sheen only<br>1991-cutting oil<br>1992-gasoline | X | -- | -- | -- | 20 | Two leaking underground storage tank sites permitted to discharge remediation wastewater to Menomonee River | -- | 1,2 |
| Menomonee River Downstream 25th Street to Milwaukee River | Insignificant[f] | Insignificant[f] | 1985-oil<br>1986-refrigeration lube oil<br>1991-ethylene glycol<br>1992-dye | X | -- | -- | -- | -- | -- | -- | 1,2 |
| South Menomonee and Burnham Canals | Insignificant[f] | Insignificant[f] | 1980-sewage water<br>1982-diesel fuel<br>1985-oil<br>1985-oil<br>1986-lube oil<br>1986-waste soil<br>1987-blue powder<br>1989-petroleum product (sheen) | X | -- | -- | -- | 11 | -- | -- | 1,2 |
| Honey Creek | Insignificant[f] | Insignificant[f] | 1984-gasoline<br>1984-unknown<br>1986-unknown<br>1986-gasoline<br>1986-oil or gas<br>1987-sludge<br>1988-oily scum<br>1989-petroleum product (sheen)<br>1990-unknown red substance | X | -- | -- | -- | 9 | Leaking underground storage tank site permitted to discharge remediation wastewater to Honey Creek | -- | 1,2 |

Table VII-14 (continued)

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Underwood Creek | Significant[f] | Significant[f] | 1986-unknown<br>1987-oil sheen<br>1987-concrete wash water<br>1988-oil<br>1992-gasoline<br>1992-oil | X | -- | -- | -- | 16 | Leaking underground storage tank site permitted to discharge remediation wastewater to Underwood Creek<br><br>City of Brookfield landfill (abandoned) | -- | 1,2 |
| Little Menomonee Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1,3 |
| Little Menomonee River | significant | Significant | 1986-oil<br>1987-gasoline<br>1987-oily substance<br>1988-petroleum product<br>1989-unknown<br>1989-oil or gas<br>1991-oil sheen | X | X | -- | -- | 17 | Omega Hills North landfill[g] (abandoned)<br>Geipel landfill (abandoned)<br>Moss American landfill[g] (abandoned) | -- | 1,2,3 |
| Butler Ditch | Moderate[f] | Insignificant[f] | 1978-oil<br>1978-fuel oil<br>1979-oil | X | -- | -- | -- | 2 | -- | -- | 1,2 |
| Dousman Ditch | Significant[f] | Insignificant[f] | -- | X | -- | -- | -- | 3 | -- | -- | 1,2 |
| Lilly Creek | Significant | Major[e] | 1988-oil | X | -- | -- | -- | 2 | -- | -- | 1,2 |
| Nor-X-Way Channel | Moderate | Moderate | -- | X | X | -- | -- | 6 | Leaking underground storage tank site permitted to discharge remediation wastewater to Nor-X-Way channel | -- | 1,2,3 |
| Willow Creek | Significant | Insignificant | -- | X | X | -- | -- | 1 | -- | -- | 1,2,3 |

Footnotes follow.

Table VII-14 (continued)

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] Letter codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place
2. Urban Nonpoint Source Controls Implemented
3. Rural Nonpoint Source Controls Implemented

[d] The amount of post-1976 urban development has increased significantly in comparison to pre-1976 urban development.

[e] The amount of post-1990 urban development is anticipated to increase significantly in comparison to pre-1990 urban development

[f] Considerable urban development existing pre-1976.

[g] Superfund site

Source: Wisconsin Department of Natural Resources and SEWRPC.

VII-5, and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is expected that violations of the fecal coliform standards occur in the main stem of the Menomonee River and in most of its tributaries. Dissolved oxygen and ammonia nitrogen levels do not meet the standards in the reaches of the Menomonee River main stem downstream of 25th Street. Thus, the recommended water use objectives are only partially being achieved in the majority of the major streams in the watershed.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon local nonpoint source pollution abatement planning and land use decisions, the only significant water quality management issue which remains to be addressed is the final level of control which is needed and which is achievable for urban nonpoint source pollution abatement. It is recommended that this issue be examined further following a period of implementation of the ongoing nonpoint source pollution priority watershed program, taking into account subsequent monitoring data and levels of funding available and anticipated.

A potential future amendment to the regional plan for the Menomonee River watershed may potentially be developed under the facility plan update initiated by the Milwaukee Metropolitan Sewerage District in 1995. That plan update is anticipated to constitute an amendment to the regional plan once it is adopted by all of the agencies involved.

## Chapter VIII

## MILWAUKEE RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

### INTRODUCTION

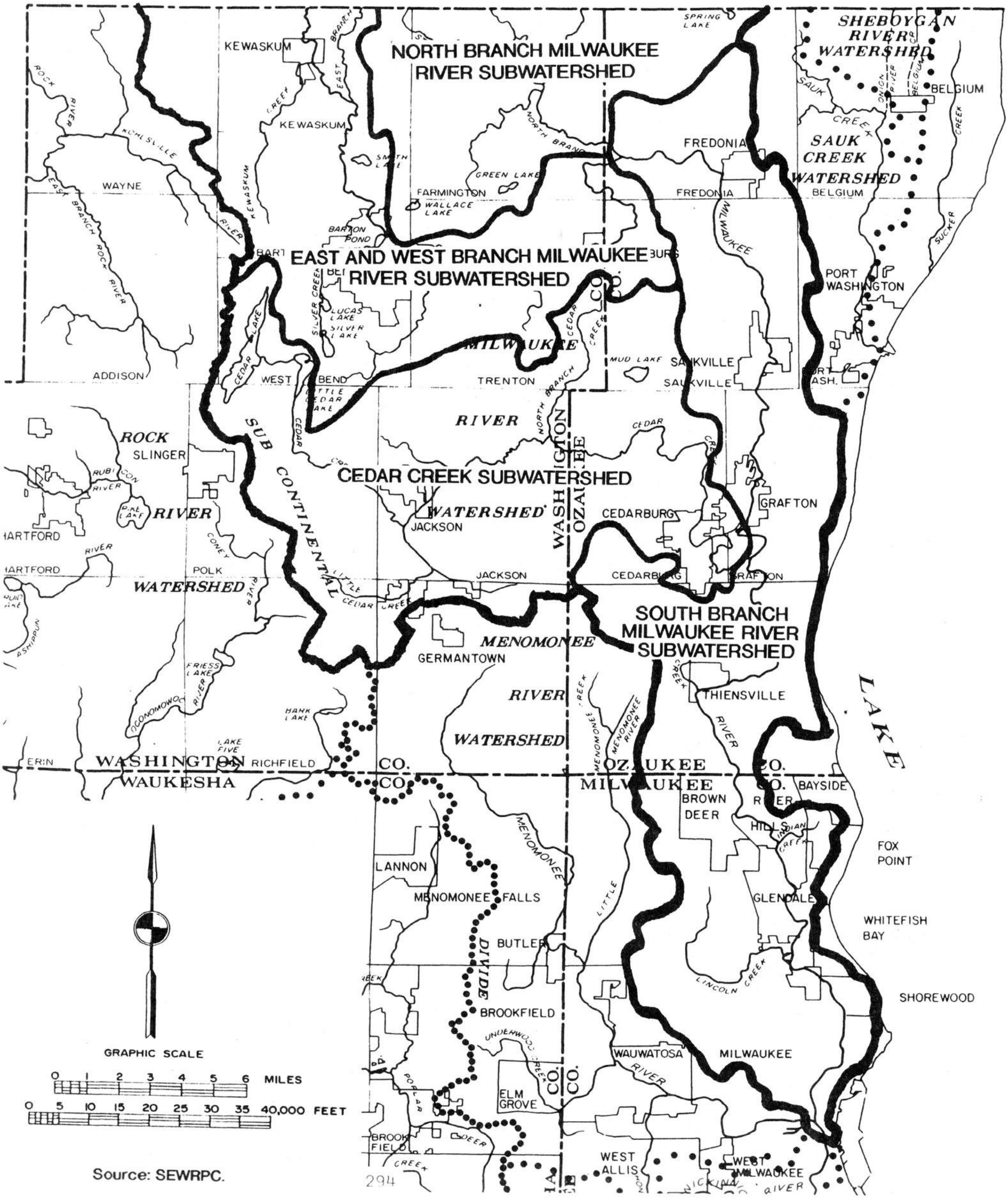
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Milwaukee River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Milwaukee River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Milwaukee River watershed is located in the northeastern and north-central portions of the Region. The portion of the watershed contained within the Region--about 433 square miles--is only a part of a larger--approximately 698-square-mile--watershed. The headwater portion of the watershed lies adjacent to the Region in Dodge, Fond du Lac, and Sheboygan Counties. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin and its principal subwatersheds, together with the locations of the main channels of the Milwaukee River and its principal tributaries, are shown on Map VIII-1.

Within the Southeastern Wisconsin Region, the Milwaukee River watershed contains twelve major lakes having a surface area of 50 acres or more. These lakes are distributed within four subwatersheds: the Cedar Creek, the East/West Branch, and the South Branch subwatersheds. The major lakes in the Cedar Creek subwatershed are Big Cedar Lake, Little Cedar Lake, and Mud Lake. The major lakes in the East/West Branch subwatershed are Barton Pond, Lucas Lake, Silver Lake and Smith Lake. The major lakes in the North Branch subwatershed are Green Lake, Spring Lake, Lake Twelve, and Wallace Lake. The major lake in the South Branch subwatershed is Lac du Cours. Physical characteristics of the major lakes in the Milwaukee River watershed are set forth in Table VIII-1. The data indicate that the major lakes in the Southeastern Wisconsin portion of the watershed have a combined surface water area of about 2,070 acres, or less than 1 percent of the total area of the watershed within Southeastern Wisconsin.

## Map VIII-1

## SUBWATERSHEDS IN THE MILWAUKEE RIVER WATERSHED




Source: SEWRPC.

Table VIII-1

PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED

| **SUBWATERSHED** Lake Name | Surface Area (acres) | Direct Tributary Drainage Area (acres) | Shoreline (miles) | Maximum Depth (feet) | Mean Depth (feet) | Volume (acre-feet) |
|---|---|---|---|---|---|---|
| **CEDAR CREEK** | | | | | | |
| Big Cedar Lake | 932 | 5,495 | 3.8 | 105 | 34 | 31,983 |
| Little Cedar Lake | 246 | 1,718 | 4.4 | 56 | 13 | 3,153 |
| Mud Lake (Ozaukee County) | 245 | 4,233 | 3.9 | 4 | 2.5 | 645 |
| **MILWAUKEE RIVER-EAST/WEST** | | | | | | |
| Barton Pond | 67 | 687 | 3.0 | 5 | 3 | 189 |
| Lucas Lake | 78 | 484 | 2.4 | 15 | 6 | 461 |
| Silver Lake (Washington County) | 118 | 602 | 2.7 | 47 | 20 | 2,306 |
| Smith Lake | 86 | 545 | 1.8 | 5 | 3 | 252 |
| **MILWAUKEE RIVER-NORTH** | | | | | | |
| Green Lake (Washington County) | 71 | 505 | 3.8 | 37 | 17 | 1,195 |
| Spring Lake (Ozaukee County) | 66[a] | 162 | 1.6 | 22 | 7 | 462 |
| Lake Twelve | 53 | 348 | 1.3 | 20 | 7 | 341 |
| Wallace Lake | 52 | 282 | 1.5 | 35 | 11 | 558 |
| **MILWAUKEE RIVER-SOUTH** | | | | | | |
| Lac du Cours | 56 | -- | 1.2 | -- | -- | -- |
| **TOTAL** | 2,070 | 15,061 | 31.4 | -- | -- | 41,545 |

[a]Includes 9 acres in Sheboygan County.

Source: SEWRPC

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically describes the changes in land use which have occurred within the Milwaukee River watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table VIII-2 summarizes the existing land uses in the Southeastern Wisconsin portion of the Milwaukee River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains a number of urbanized areas, 75 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 48 percent of the total area of the watershed in agricultural and related rural uses, about 7 percent in woodlands, about 14 percent in surface water and wetlands, and about 6 percent in other open lands. The remaining 25 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map VIII-2.

Within the Milwaukee River watershed, urban-related land uses are located primarily in Milwaukee County which is nearly fully developed, with limited concentrations of urban development located in Ozaukee and Washington Counties. In the portion of Washington County that lies within the Milwaukee River watershed, the Villages of Jackson and Kewaskum, the areas around both Big and Little Cedar Lakes and Silver Lake, and the City of West Bend all contain concentrations of urban-related land uses. In addition, a major commercial office center and a major industrial center are located in the City of West Bend. Within Ozaukee County, urban development has been rapidly taking place in the southern portion of the county, in and around the City of Cedarburg, the Village of Grafton, and north of Milwaukee County in the City of Mequon and the Village of Thiensville.

The portion of the watershed that lies within Milwaukee County contains, almost exclusively, urban-related land uses. While urban development is still taking place in limited amounts to the west of and in the Village of Brown Deer, high concentrations of already developed urban land are located in the Villages of Fox Point, Whitefish Bay, and Shorewood, and the Cities of Glendale, Wauwatosa, and Milwaukee. In addition, three major industrial centers, Milwaukee North, Milwaukee Glendale, and Milwaukee Near North; and four major commercial retail centers, Northridge, Capitol Court, Bay Shore, and the Milwaukee Central Business District, are located within or partially within the watershed.

Table VIII-2

**LAND USE IN THE MILWAUKEE RIVER WATERSHED: 1975 and 1990[a]**

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 29,322 | 10.6 | 34,557 | 12.5 | 5,235 | 17.9 |
| Commercial | 1,653 | 0.6 | 2,028 | 0.7 | 375 | 22.7 |
| Industrial | 2,014 | 0.7 | 2,435 | 0.9 | 439 | 21.8 |
| Transportation, Communication, and Utilities[b] | 21,016 | 7.6 | 23,341 | 8.4 | 2,325 | 11.1 |
| Governmental and Institutional | 3,062 | 1.1 | 3,281 | 1.2 | 219 | 7.2 |
| Recreational | 4,136 | 1.5 | 4,684 | 1.7 | 548 | 13.3 |
| Subtotal | 61,203 | 22.1 | 70,326 | 25.4 | 9,123 | 14.92 |
| Rural | | | | | | |
| Agricultural and Related | 147,177 | 53.2 | 132,990 | 48.0 | -14,187 | - 9.6 |
| Lakes, Rivers, Streams and Wetlands | | | | | | |
| Woodlands | 39,085 | 14.1 | 39,648 | 14.3 | 563 | 1.4 |
| Open Lands,[c] Landfills, | 17,571 | 6.3 | 18,019 | 6.5 | 448 | 2.5 |
| Dumps, and Extractive | 11,940 | 4.3 | 15,993 | 5.8 | 4,053 | 33.9 |
| Subtotal | 215,773 | 77.9 | 206,650 | 74.6 | - 9,123 | - 4.2 |
| Total | 276,976 | 100.0 | 276,976 | 100.0 | 0 | -- |

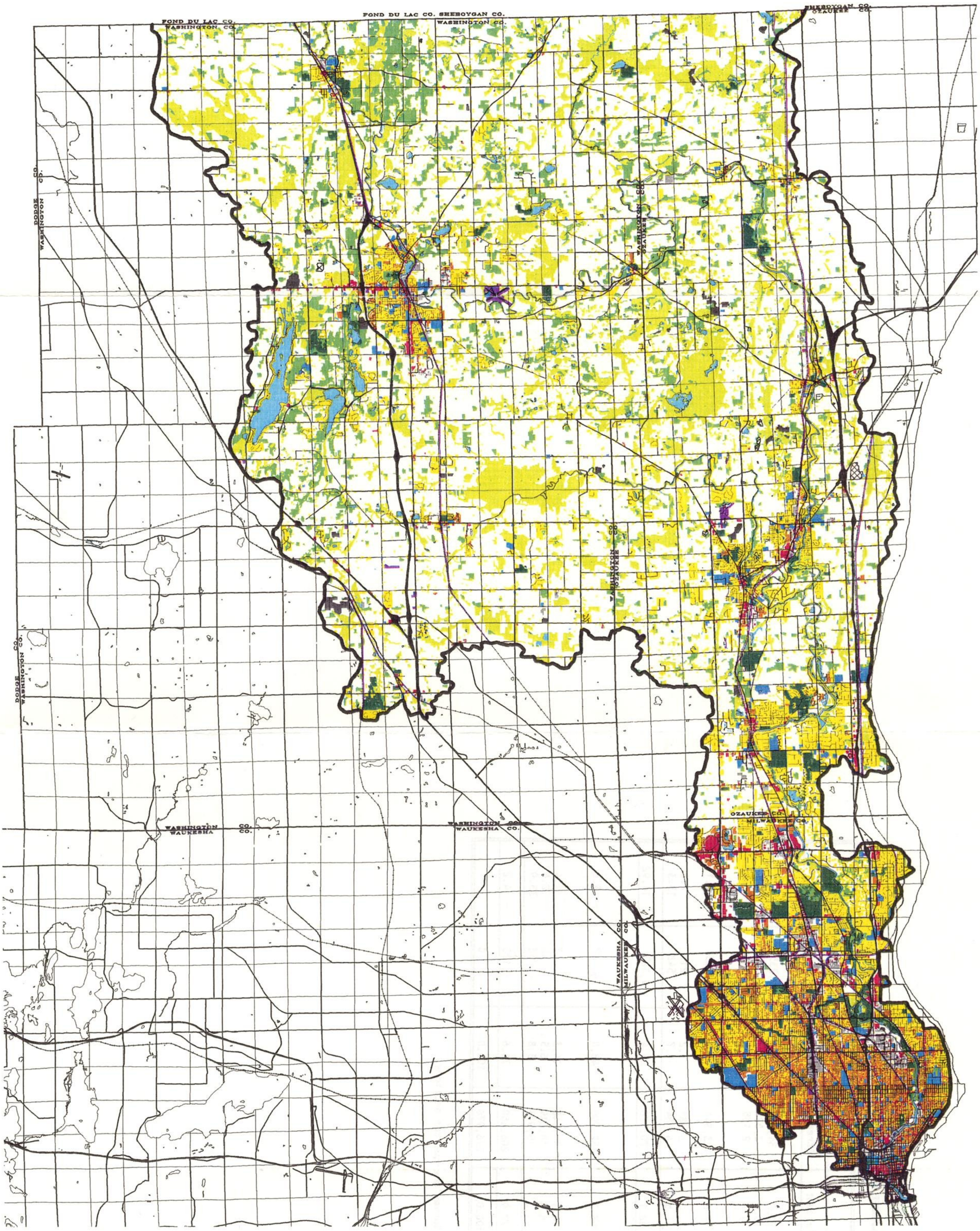
[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

# MAP VIII-2
# LAND USES IN THE MILWAUKEE RIVER WATERSHED: 1990




-LEGEND-

- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREETS AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION, COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

0 3 6

GRAPHIC SCALE IN MILES

The Milwaukee River watershed is about 433 square miles in areal extent, or 16 percent of the total Region. In 1990 about 110 square miles, or about 25 percent of the watershed, was in urban land uses.

Source: SEWRPC

As shown in Table VIII-2, from 1975 to 1990, urban land uses in the watershed increased from about 61,200 acres, or 96 square miles, to about 70,300 acres, or about 110 square miles, or by about 15 percent. As shown in Table VIII-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 29,300 acres, or about 46 square miles in 1975, to about 34,600 acres, or about 54 square miles in 1990, an 18 percent increase. Commercial and industrial land uses increased from about 3,700 acres, or six square miles, to 4,500 acres, or seven square miles, an increase of 22 percent.

The 110 square miles of urban land uses in the watershed as of 1990 approximated the staged 1990 planned level of about 111 square miles envisioned in the adopted year 2000 land use plan. The current status of development in the Milwaukee River watershed and in adjacent portions of Milwaukee, Washington, and Ozaukee Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region.

Table VIII-3 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Milwaukee River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban land uses are expected to increase in Washington County in the Village of Jackson, in the Village of Kewaskum along USH 45, and in and around the City of West Bend. In Ozaukee County, increases in urban-related land uses are anticipated in and around the Cities of Cedarburg and Mequon, and in the Villages of Saukville, Grafton, and Thiensville. A major commercial office center has additionally been proposed for the City of Mequon in the year 2010 land use plan.

In the portion of the watershed contained within Milwaukee County, urban-related land uses are expected to increase in the northwestern corner of the county, with urban re-development occurring throughout the remainder of the county. Under year 2010 planned land use conditions, the entire portion of the watershed contained within Milwaukee County is expected to be developed as urban.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Milwaukee River watershed, as indicated in Table VIII-3, is projected to increase from the 1990 total of about 110 square miles, or about 25 percent of the total area of the watershed, to about 118 square miles, or about 27 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 136 square miles, or about 31 percent of the total watershed by year 2010. It is important to note that the 69 to 73 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a large portion of the remaining agricultural and other open lands of the watershed from rural to urban uses.

Table VIII-3

EXISTING AND PLANNED LAND USE IN THE MILWAUKEE RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 34,557 | 12.5 | 37,502 | 13.5 | 2,945 | 8.5 | 44,887 | 16.2 | 10,330 | 29.9 |
| Commercial | 2,028 | 0.7 | 2,005 | 0.7 | - 23 | - 1.1 | 2,133 | 0.8 | 105 | 5.2 |
| Industrial | 2,435 | 0.9 | 3,214 | 1.2 | 779 | 32.0 | 4,045 | 1.4 | 1,610 | 66.1 |
| Transportation, Communication, and Utilities[b] | 23,341 | 8.4 | 24,463 | 8.8 | 1,122 | 4.8 | 27,144 | 9.8 | 3,803 | 16.3 |
| Governmental and Institutional | 3,281 | 1.2 | 3,357 | 1.2 | 76 | 2.3 | 3,573 | 1.3 | 292 | 8.9 |
| Recreational | 4,684 | 1.7 | 4,899 | 1.8 | 215 | 4.6 | 5,150 | 1.9 | 466 | 10.0 |
| Subtotal | 70,326 | 25.4 | 75,440 | 27.2 | 5,114 | 7.3 | 86,932 | 31.4 | 16,606 | 23.6 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 132,990 | 48.0 | 135,238 | 48.8 | 2,248 | 1.7 | 125,304 | 45.2 | -7,686 | - 5.8 |
| Lakes, Rivers, Streams, and Wetlands | 39,648 | 14.3 | 38,893 | 14.1 | - 755 | - 1.9 | 38,893 | 14.1 | - 755 | - 1.9 |
| Woodlands | 18,019 | 6.5 | 17,374 | 6.3 | - 645 | - 3.6 | 17,236 | 6.2 | - 783 | - 4.4 |
| Open Lands,[c] Landfills, Dumps, and Extractive | 15,993 | 5.8 | 10,031 | 3.6 | -5,962 | -37.3 | 8,611 | 3.1 | -7,382 | - 46.2 |
| Subtotal | 206,650 | 74.6 | 201,536 | 72.8 | -5,114 | - 2.5 | 90,044 | 68.6 | -16,606 | - 8.0 |
| Total | 276,976 | 100.0 | 276,976 | 100.0 | 0 | -- | 276,976 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

Rural land uses may be expected to decline collectively from about 323 square miles in 1990 to about 315 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 297 square miles under the high growth-decentralized land use plan, decreases of about 2 to 8 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Milwaukee River watershed--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary sewer service areas located in the watershed.

With regard to the point source plan element related to the Milwaukee River, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District's water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants; provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of solids management program; and provision of trunk sewers to serve the various communities comprising the District area. As of 1993, the District pollution abatement program was nearing completion, with the deep tunnel system expected to be on line during 1994.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on an update of its Section 201 sewerage facility plan[1] for the entire Milwaukee metropolitan service area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that that facility plan re-examine certain system level decisions that were made in the past, including trunk sewer needs and the retention of the one remaining small sewage treatment plant in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewerage facilities plan update is intended then, upon its adoption by all of the agencies concerned, to constitute an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Milwaukee River watershed.

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[1]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1990.

Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were nine public sewage treatment facilities located in the portion of the Milwaukee River watershed within the Region, as shown on Map VIII-3. The Village of Fredonia, Village of Grafton, Village of Kewaskum, Village of Newburg, Village of Saukville, and the City of West Bend sewage treatment plants discharged to the main stem of the Milwaukee River. The City of Cedarburg and Village of Jackson sewage treatment plants discharged to Cedar Creek, and the Village of Thiensville sewage treatment plant discharged to the Milwaukee River. Of these plants, the plant operated by the Village of Thiensville was abandoned, and a new plant was constructed for the Village of Jackson after 1975, as recommended in the initial plan. The status of implementation in regard to the abandonment, upgrading and expansion, and construction of the public and private sewage treatment plants in the Milwaukee River watershed, as recommended in the initial regional water quality management plan, is summarized in Table VIII-4.

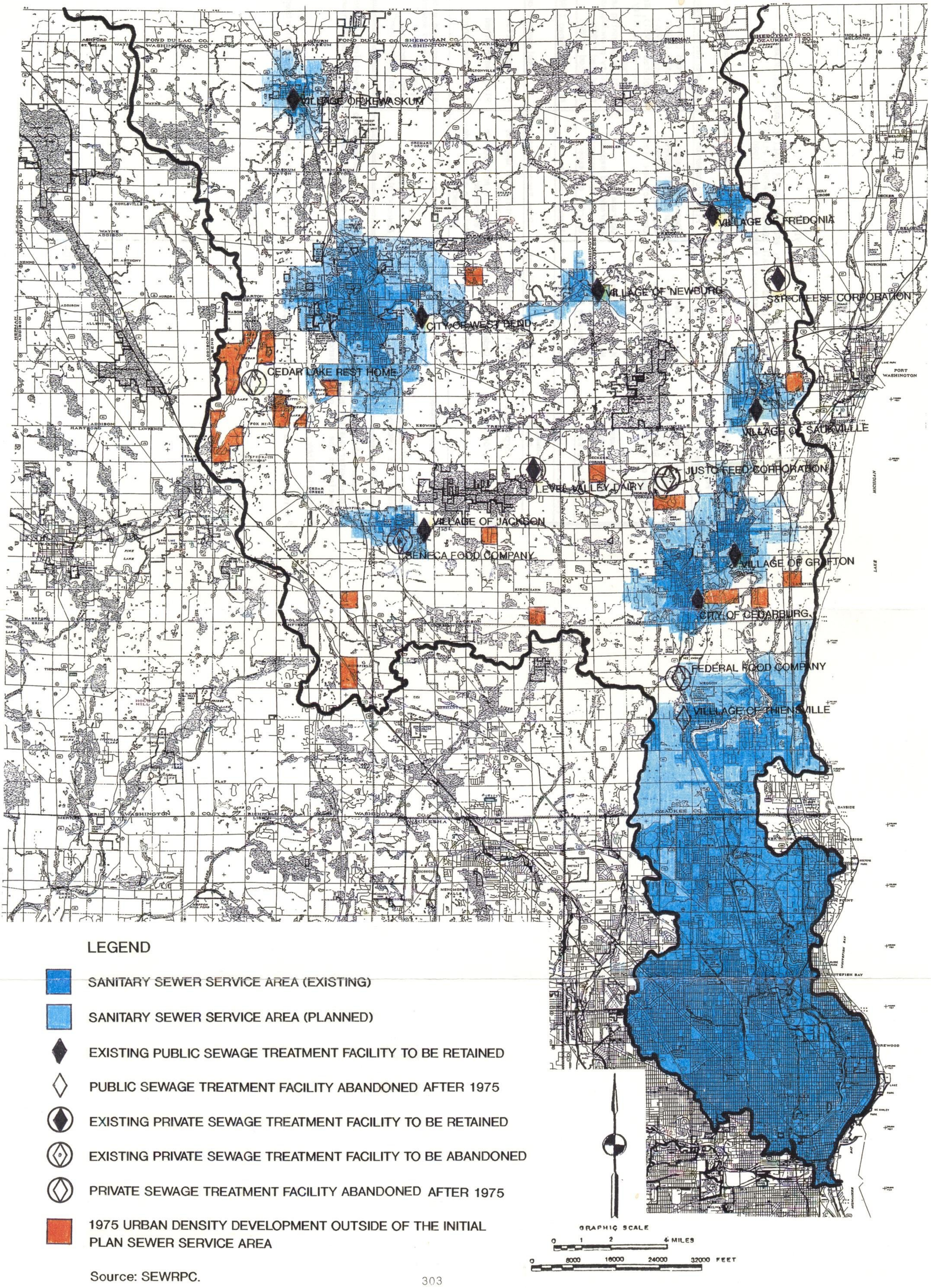
As can be seen by review of Table VIII-4, full implementation of the initial plan would provide for the upgrading and expansion, as needed, of six plants: the City of West Bend and City of Cedarburg plants, and the Village of Fredonia, Village of Grafton, Village of Newburg, and Village of Saukville sewage treatment plants. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the construction of a new plant for the Village of Jackson, and the upgrading of the Village of Kewaskum plant. The Village of Jackson plant has been constructed but currently requires further upgrading. Facility planning is currently being carried out for the upgrading of the Village of Jackson plant, and for the upgrading of the Village of Kewaskum and Village of Newburg plants.

The plants in the watershed have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluent to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site specific phosphorus limitations on all public sewage treatment plants, and in 1993, by the adoption of rules to allow for placement of such limitations. Thus, as specific sewage treatment plant permits are issued, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. To date, all of the public plants in the watershed except for the Village of Newburg and Village of Fredonia plants have installed facilities to provide a conventional level of phosphorus removal. Selected characteristics of the public sewage treatment plants currently existing in the watershed are given in Table VIII-5.

In addition to the publicly-owned sewage treatment facilities, six private sewage treatment plants were in existence in 1975 in the portion of the Milwaukee River watershed contained within the Region. These plants served the following land uses: the Cedar Lake Home Campus, Federal Foods Company, Justo Feed Corporation, Level Valley Dairy, Libby, McNeill and Libby-Jackson facility (currently Seneca Food Company) and S & R Cheese Corporation..

As indicated in Table VIII-4, three of these private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. As of 1990, Map VIII -3

SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE MILWAUKEE RIVER WATERSHED: 1990




Source: SEWRPC.

Table VIII-4

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS
IN THE MILWAUKEE RIVER WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| City of Cedarburg | Cedar Creek | Upgrade and expand | Completed (1990) |
| Village of Fredonia | Milwaukee River | Upgrade and expand | Completed (1982) |
| Village of Grafton | Milwaukee River | Upgrade and expand | Completed (1984) |
| Village of Jackson | Cedar Creek | Construct new plant | Completed (1981), New upgrade required, facility planning underway |
| Village of Kewaskum | Milwaukee River | Upgrade | Facility planning underway |
| Village of Newburg | Milwaukee River | Upgrade and expand | Facility planning underway |
| Village of Saukville | Milwaukee River | Upgrade and expand | Completed (1981) |
| City of West Bend | Milwaukee River | Upgrade and expand | Completed (1980) |
| Village of Thiensville | Milwaukee River | Abandon plant | Plant abandoned (1987) |
| **Private Sewage Treatment Plants** | **Disposal of Effluent** | **Plan Recommendation** | **Implementation Status** |
| Justo Feed Corporation | Soil absorption | Maintain and upgrade as needed | Not in operation |
| Level Valley Dairy | Cedar Creek | Maintain and upgrade as needed | Plant maintained |
| S&R Cheese Corporation | Soil absorption | Maintain and upgrade as needed | Plant maintained |
| Cedar Lake Home Campus | Soil absorption | Abandon plant[a] | Plant abandoned with connection to West Bend sewerage system (1988) |
| Federal Food Company | Soil absorption | Abandon plant | Plant abandoned |
| Seneca Food Company[b] | Soil absorption and Cedar Creek | Abandon plant | Plant maintained[c] |

[a] The Cedar Lake Home Campus private sewage treatment plant was recommended to be maintained in the initial regional water quality management plan. A 1988 amendment to the plan recommended the plant be abandoned, with connection to the City of West Bend sewerage system.

[b] Formerly Libby, McNeill, & Libby, Inc.-Jackson facility.

[c] Private plant is currently used as a supplementary facility to the Village of Jackson sewage treatment plant.

Source: SEWRPC

Table VIII-5

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS
IN THE MILWAUKEE RIVER WATERSHED: 1990

| Name of Public Sewage Treatment Plant | 1990 Estimated Total Area Served (square mile) | 1990 Estimated Total Population Served | Date of Construction and Major Modification | Major Sewage Treatment Unit Processes[a] | Name of Receiving Water to Which Effluent is Disposed | WPDES Permit Expiration Date |
|---|---|---|---|---|---|---|
| City of Cedarburg | 2.8 | 10,100 | 1925, 1935, 1960, 1973, 1979, 1990 | Oxidation ditch, flocculation-clarification, phosphorus removal, chlorination/ dechlorination, post aeration | Cedar Creek | 6/30/98 |
| Village of Fredonia | 0.8 | 1,800 | 1939, 1962, 1982 | Flow equalization, activated biological filter, activated sludge clarification, chlorination | Milwaukee River | 12/31/99 |
| Village of Grafton | 2.3 | 9,300 | 1934, 1960, 1970, 1984 | Clarification, two-stage activated sludge system, clarification phosphorus removal, chlorination/ dechlorination, post aeration | Milwaukee River | 6/30/97 |
| Village of Jackson | 0.5 | 2,500 | 1939, 1981 | Clarification, rotating biological contactors, clarification, sand filtration, phosphorus removal, chlorination | Cedar Creek | 9/30/89 |
| Village of Kewaskum | 0.7 | 2,500 | 1955, 1972, 1980 | Activated sludge, clarification, phosphorus removal, chlorination/declorination | Milwaukee River | 6/30/93 |
| Village of Newburg | 0.6 | 1,000 | 1966 | Activated sludge, clarification, chlorination | Milwaukee River | 6/30/87 |
| Village of Saukville | 0.7 | 3,700 | 1959, 1981 | Activated sludge, phosphorus removal, chlorination/ dechlorination | Milwaukee River | 12/31/98 |
| City of West Bend | 6.1 | 23,900 | 1967, 1973, 1980 | Biotowers, clarification, activated sludge, clarification, chlorination, post aeration, nitrification, phosphorus removal, sand filters | Milwaukee River | 3/31/95 |

Table VIII-5 (continued)

| Name of Public Sewage Treatment Plant | Hydraulic Loading[b] (mgd) | | | | BOD5 Loading[b] (pounds/day) | | | | Suspended Solids Loading[b] (pounds/day) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | | | | Existing | | | | Existing | | | |
| | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity |
| City of Cedarburg | 1.58 | 2.435 | 2.75 | 0 | 2,068 | 2,566 | 4,590 | 0 | 1,826 | 2,185 | 3,670 | 0 |
| Village of Fredonia | 0.185 | 0.235 | 0.60 | 0 | 256 | 301 | 651 | 0 | 282 | 334 | -- | 0 |
| Village of Grafton | 1.33 | 1.58 | 2.20 | 0 | 1,475 | 1,769 | 2,875 | 0 | 1,930 | 2,464 | 3,765 | 0 |
| Village of Jackson | 0.47 | 0.63 | 0.87 | 0 | 1,215 | 1,660 | 1,724 | 0 | 1,429 | 2,733 | 1,700 | 2 |
| Village of Kewaskum | 0.36 | 0.58 | 0.50 | 1 | 1,294 | 1,802 | 2,200 | 0 | 848 | 1,277 | -- | 0 |
| Village of Newburg | 0.07 | 0.09 | 0.08 | 2 | 125 | 172 | 136 | 1 | 104 | 125 | -- | 0 |
| Village of Saukville | 0.56 | 0.79 | 1.00 | 0 | 786 | 1,028 | 1,668 | 0 | 701 | 854 | 2,085 | 0 |
| City of West Bend | 3.45 | 4.09 | 9.00 | 0 | 4,818 | 6,306 | 13,000 | 0 | 6,272 | 7,828 | 15,250 | 0 |

[a] In addition, plants typically include headworks and miscellaneous processes such as pumping, flow metering and sampling, screening and grit removal, as well as sludge handling and disposal facilities.

[b] Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

the Cedar Lake Home Campus and the Federal Foods Company plant had been abandoned and the Seneca Food Company plant is in limited use as a supplementary facility to the Village of Jackson sewage treatment plant. The Justo Feed Corporation plant has ceased operation. The two remaining private plants were recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES) permit program.

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Milwaukee River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Wisconsin Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were 12 sewer service areas identified in, or partially in, the Milwaukee River watershed: Cedarburg, Fredonia, Grafton, Jackson, Kewaskum, Mequon, Milwaukee Metropolitan Sewerage District, Newburg, Saukville, Thiensville, Waubeka, and West Bend. Currently, all of these areas, with the exception of the Milwaukee Metropolitan Sewerage District, had undergone refinements as recommended. The boundaries of the sewer service areas through 1993 are shown on Map VIII-3. Table VIII-6 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer service area in the Milwaukee River watershed, as refined through 1993, totals about 72 square miles, or about 17 percent of the total watershed area within the Region, as shown in Table VIII-6.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation, with expansion and upgrading as necessary, of the City of Cedarburg, Village of Fredonia, Village of Grafton, Village of Newburg, Village of Saukville, and City of West Bend sewage treatment plants, as well as the upgrading of the Village of Kewaskum and Village of Jackson plants. Estimated approximate dates for beginning facility planning for

Table VIII-6

PLANNED SANITARY SEWER SERVICE AREAS IN
THE MILWAUKEE RIVER WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sanitary Sewer Service Area (square mile) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Refined Sanitary Sewer Service Areas | | | | |
| Cedarburg Grafton | 14.3 | Cedarburg Grafton | June 15, 1987 | SEWRPC CAPR No. 91, Sanitary Sewer Service Area for the City of Cedarburg and the Village of Grafton, Ozaukee County, Wisconsin |
| Fredonia Waubeka | 2.2 | Fredonia Waubeka | September 13, 1984 | SEWRPC CAPR No. 96, Sanitary Sewer Service Area for the Village of Fredonia, Ozaukee County, Wisconsin |
| Jackson | 2.7 | Jackson | June 17, 1984 | SEWRPC CAPR No. 124, Sanitary Sewer Service Area for the Village of Jackson, Washington County, Wisconsin |
| Kewaskum | 3.8 | Kewaskum | March 7, 1988 | SEWRPC CAPR No. 161, Sanitary Sewer Service Area for the Village of Kewaskum, Washington County, Wisconsin |
| Mequon Thiensville | 20.9 | Mequon Thiensville | January 15, 1992 | SEWRPC CAPR No. 188, Sanitary Sewer Service Area for the City of Mequon and the Village of Thiensville, Ozaukee County, Wisconsin |
| Newburg | 2.2 | Newburg | March 3, 1993 | SEWRPC CAPR No. 205, Sanitary Sewer Service Area for the Village of Newburg, Ozaukee and Washington Counties, Wisconsin |
| Saukville | 4.3 | Saukville | December 1, 1983 | SEWRPC CAPR No. 90, Sanitary Sewer Service Area for the Village of Saukville, Ozaukee County, Wisconsin |
| West Bend | 21.2 | West Bend | December 2, 1982 | SEWRPC CAPR No. 35, Sanitary Sewer Service Area for the City of West Bend, Washington County, Wisconsin |
| Subtotal | 71.6 | | | |
| Unrefined Sanitary Sewer Service Areas | | | | |
| Milwaukee Metropolitan Sewerage District | 57.9 | - - | - - | - - |
| Subtotal | 57.9 | | | |
| Total | 129.5 | | | |

NOTE: CAPR - Community Assistance Planning Report

Source: SEWRPC.

the expansion and upgrading of existing sewage treatment plans are indicated in Table VIII-7. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for the eight public sewage treatment plants recommended to be retained.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map VIII-4. Table VIII-7 presents selected design data for the eight public sewage treatment plants which are recommended to be maintained in the Milwaukee River watershed. It is important to note that the Village of Newburg plant recorded monthly average flows during 1990 which equaled or exceeded the average design capacity of the plant, as shown in Table VIII-5.

Table VIII-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the eight public sewage treatment plants in the Milwaukee River watershed. Under the intermediate growth-centralized land use plan, one plant is anticipated to have average annual hydraulic loading rates equal to or higher than the average annual design capacity. Under the high growth-decentralized land use plan, seven of the existing plants are anticipated to have loading rates equal to or higher than the average annual design capacity. Thus, there is expected to be significant additional treatment plant expansion and associated costs under the higher growth decentralized future scenario than would be expected under the intermediate growth-centralized land use plan.

Based upon review and analysis of the data in Tables VIII-5 and VIII-7, including estimates of future condition loadings on an annual average and maximum monthly basis, and based upon the age of the current facilities, estimates of timing of needed facility planning were made. It appears that facility planning should be initiated during the next three years by the Villages of Kewaskum, Newburg, and Jackson to consider the need for expansion and upgrading of their sewage treatment plants. It should be noted that the need for facility planning for the Kewaskum plant is dependent upon decisions to be made regarding the continued use of the treatment plant by a major dairy plant. No additional facility planning is expected to be needed until after the year 2000 for the plants operated by the Cities of Cedarburg and West Bend, and Villages of Fredonia, Grafton, Jackson, and Saukville, assuming that development occurs in accordance with the recommended year 2010 land use plan as described for the intermediate growth-centralized land use future condition. Should development occur as envisioned under the high growth-decentralized land use future scenario, facility planning for nearly all of the public sewage treatment plants in the Milwaukee River watershed should be initiated by the year 2000, except for the City of West Bend and City of Cedarburg which currently have adequate capacity until late in the planning period to provide service for development under the high growth-decentralized land use future scenario. Continued review of plant operations and State-required compliance maintenance reports for all plants will provide the basis for determining the timing for initiating facility planning programs to explore plant expansion alternatives.

The current planned sanitary sewer service areas in the Milwaukee River watershed are shown on Map VIII-4. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. All or portions of the following sewer service areas are located in the

Table VIII-7

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE MILWAUKEE RIVER WATERSHED: 1990 AND 2010

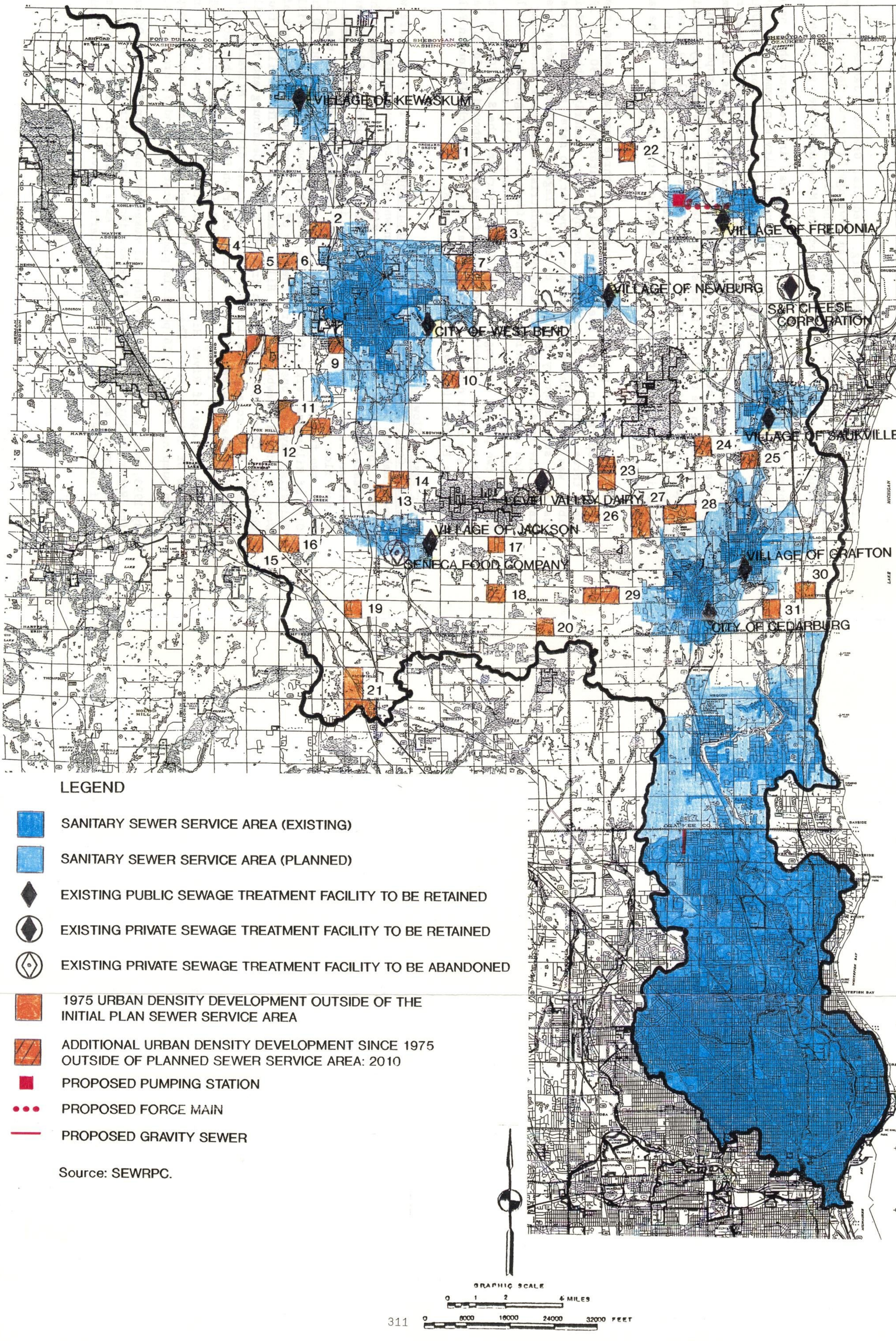
| Name of Public Sewage Treatment Plant | Sewer Service Area | Design Capacity Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intermediate Growth Centralized Land Use Plan | | | High Growth Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Area Served (square mile) | Resident Population Served | Planned Sewer Service Area (square mile) | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| City of Cedarburg | Cedarburg | 2.75 | 1.58 | 2.8 | 10,100 | 7.4 | 12,400 | 1.87 | >2010 | 27,800 | 3.80 | 2005 |
| Village of Fredonia | Fredonia, Waubeka | 0.60 | 0.18 | 0.8 | 1,600 | 2.3 | 2,300 | 0.24 | 2005 | 6,500 | 0.76 | 2000 |
| Village of Grafton | Grafton | 2.20 | 1.33 | 2.3 | 9,300 | 6.9 | 11,500 | 1.60 | >2010 | 24,100 | 3.18 | 2000 |
| Village of Jackson | Jackson | 0.87 | 0.47 | 0.5 | 2,500 | 2.7 | 3,500 | 0.59 | 1995 | 7,800 | 1.13 | 1995 |
| Village of Kewaskum | Kewaskum | 0.50 | 0.36 | 0.7 | 2,500 | 3.8 | 2,900 | 0.42 | 1996 | 7,100 | 0.94 | 1996 |
| Village of Newburg | Newburg | 0.08 | 0.07 | 0.6 | 1,000 | 2.2 | 1,100 | 0.08 | 1995 | 2,000 | 0.09 | 1995 |
| Village of Saukville | Saukville | 1.00 | 0.56 | 0.7 | 3,700 | 4.3 | 4,300 | 0.63 | 2005 | 8,600 | 1.17 | 2000 |
| City of West Bend | West Bend | 9.00 | 3.45 | 6.1 | 23,900 | 21.2 | 32,500 | 4.53 | 2005 | 53,800 | 7.18 | 2004 |

[a]Approximate year in which facility planning for a plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average design flows compared to average annual and maximum monthly flows and age of facilities based upon date of last major construction.

Source: SEWRPC

Map VIII-4

UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE MILWAUKEE RIVER WATERSHED: 2010



Milwaukee River watershed: Cedarburg, Fredonia, Grafton, Jackson, Kewaskum, Mequon, Newburg, Milwaukee Metropolitan Sewerage District, Saukville, Thiensville, Waubeka, and West Bend. Together, the planned service areas total about 130 square miles, or about 30 percent of the Milwaukee River watershed.

As noted above, most of the sewer service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Additional refinements are envisioned to be needed for the Newburg and the Milwaukee Metropolitan Sewerage District sewer service areas. These refinements are recommended to be conducted in 1995 and 1996. It is also recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plants, there were three private sewage treatment plants in operation within the Milwaukee River watershed in 1990. In 1990, of these three plants, the Seneca Food Company plant, formerly Libby, McNeill and Libby, was recommended for abandonment; however, to date, the plant remains in use as a supplementary facility to the Village of Jackson sewage treatment plant. The remaining two plants serve industrial facilities generating wastewater which requires special treatment considerations and generally are located beyond the current limits of the planned sanitary public sewer service areas. For the two plants serving the Level Valley Dairy and the S & R Cheese Corporation, the need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 61 known combined sewer outfalls and 127 known separate sewer system flow relief devices located in the portion of the Milwaukee River watershed within the Southeastern Wisconsin Region. Of the combined sewer outfalls, 60 discharged to the Milwaukee River and one discharged to Lincoln Creek. Of the separate sewer system flow relief devices, 49 discharged to the main stem of the Milwaukee River, two from the City of Glendale, seven from the City of Mequon, 20 from the City of Milwaukee, eight from the Village of Shorewood; five from the Village of Whitefish Bay, and one each from the City of West Bend and the Villages of Brown Deer, Fredonia, Newburg, River Hills, Saukville, and Thiensville; four discharged to Cedar Creek, two each from the City of Cedarburg and the Village of Jackson; 54 discharged to Lincoln Creek from the City of Milwaukee; six discharged to Beaver Creek from the Village of Brown Deer; 13 discharged to Indian Creek, 11 from the Village of Fox Point and one each from the City of Glendale and the Village of River Hills; and one discharged to Pigeon Creek from the Village of Thiensville. The devices included 27 sanitary sewerage bypasses, seven pumping stations, 16 portable pumping stations, and 77 crossovers.

By 1993, work was completed by the Milwaukee Metropolitan Sewerage District on its Water Pollution Abatement Program, including construction of the Inline Storage System and major relief sewers. As a result of this project, many of the flow relief devices within the watershed have recently been eliminated.

Those which remain include combined sewer overflows, selected bypasses and crossovers, and portable pumping station sites which physically remain in the sewerage system but are expected to function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table VIII-8, 186 points of sanitary sewer system flow relief--including 67 combined sewer overflows--were reported to exist as of 1993 in the Milwaukee River watershed. These flow relief points were located in 15 sewerage systems. The fact that the total number of relief devices is nearly the same as reported in 1975, even though a significant number of devices have been eliminated, is the result of additional field inventories conducted during the period after 1975, which revealed a larger number of such devices in existence. With the completion of the Inline Storage System, bypassing of sewage from the combined sewer overflows is expected to occur an average of about two times per year. The Milwaukee Harbor estuary study documented that this level of reduction in combined sewer overflow discharges would be adequate to meet water quality standards in the estuary portion of the Milwaukee River, assuming other water quality improvement measures recommended were carried out. Bypassing from other sanitary sewer flow relief devices is expected to be further reduced over time as additional sewerage system upgrading is accomplished by the Milwaukee Metropolitan Sewerage District and other local units of government operating sewer systems.[2]

Current Plan Recommendations: It is recommended that the Cities of Cedarburg, Mequon, Milwaukee, and West Bend; the Villages of Brown Deer, Fredonia, Grafton, Jackson, Kewaskum, Newburg, River Hills, Saukville, Shorewood, and Whitefish Bay; and the Milwaukee Metropolitan Sewerage District continue to monitor the sanitary sewer system operations to ensure that the use of the existing sanitary sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading be conducted with the assumption that there will be no planned bypasses of untreated sewage from the sanitary sewerage system and that the use of all flow relief devices within the sanitary sewerage system will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan, as updated, recommended the construction of eight intercommunity trunk sewers in the Milwaukee River watershed, as shown in Table VIII-9. Four of these trunk sewers would provide additional conveyance capacity in the Milwaukee Metropolitan sewer system; one trunk sewer would connect Thiensville to the Mequon sewerage system to permit the abandonment of the

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[2]During 1994, the City of Milwaukee developed specific preliminary plans to eliminate 52 of the 106 crossovers in the City's sanitary sewer system. In most cases, the crossovers were conveyed to other locations in the Milwaukee intercepting sewer system where adequate capacity was available. These plans were being refined and reviewed with the Milwaukee Metropolitan Sewerage District staff at years end.

Table VIII-8

KNOWN SEWAGE FLOW RELIEF DEVICES IN
THE MILWAUKEE RIVER WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Combined Sewer Overflow | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| Village of Kewaskum | 0 | 0 | 0 | 0 | 1 | 0 | 1 | Used only in case of equipment failure |
| City of West Bend | 0 | 0 | 0 | 1 | 0 | 0 | 1 | Used only in case of equipment failure |
| Village of Jackson | 0 | 0 | 0 | 0 | 1 | 0 | 1 | Used only in case of extreme wet weather |
| Village of Newburg | 0 | 0 | 0 | 1 | 0 | 0 | 1 | Used only in case of extreme wet weather |
| Village of Fredonia | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Used only in case of extreme wet weather |
| Village of Saukville | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Used only in case of extreme wet weather |
| Village of Grafton | 0 | 0 | 0 | 2 | 0 | 1 | 3 | Used only in case of equipment failure or extreme wet weather |
| City of Cedarburg | 0 | 0 | 0 | 1 | 0 | 0 | 1 | Used only in case of extreme wet weather |
| City of Mequon | 0 | 0 | 0 | 3 | 0 | 0 | 3 | Used only in case of extreme wet weather |
| Village of Brown Deer | 0 | 0 | 2 | 0 | 0 | 0 | 2 | Crossovers are fitted with manually-operated gate valves |
| Village of River Hills | 0 | 0 | 0 | 0 | 0 | 2 | 2 | Used only in case of extreme wet weather |
| Village of Whitefish Bay | 0 | 0 | 2 | 0 | 0 | 3 | 5 | Used only in case of extreme wet weather |
| Village of Shorewood | 0 | 0 | 5 | 0 | 0 | 0 | 5 | Crossovers are fitted with manually-operated gate values |
| City of Milwaukee | 0 | 1[a] | 76[b] | 0 | 0 | 0 | 77 | Used only in case of extreme wet weather |

Table VIII-8 (continued)

| Sewerage System | Sewage Treatment Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Combined Sewer Overflow | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| Milwaukee Metropolitan Sewerage District | 0 | 66 | 16 | 0 | 0 | 0 | 82 | Crossovers used only in case of extreme wet weather; CSO bypassing expected about twice per year |
| Total | 0 | 67 | 101 | 8 | 2 | 8 | 186 | |

[a] Proposed to be abandoned in 1995.

[b] Fifty-three of these crossovers are equipped with electric pumps to facilitate bypassing.

Source: SEWRPC.

Table VIII-9

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE MILWAUKEE RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Northridge | Not Completed |
| Northeast Side Relief | |
| North Branch | Completed (1983) |
| East Branch | Completed (1983) |
| Milwaukee River Relief | No Action[a] |
| Thiensville-Mequon | Completed (1987) |
| Waubeka-Fredonia | Not Completed |
| Jackson | Completed (1981) |
| Silver Lake-West Bend Trunk Sewer[b] | Completed (1993)[b] |

[a] Construction of this trunk sewer was completed in 1994.

[b] The Silver Lake-West Bend trunk sewer was added to the plan based upon a March 1992 plan amendment. Construction of this trunk sewer was completed in 1993.

Source: SEWRPC.

Village of Thiensville sewage treatment plant; one would connect the Waubeka sanitary sewer service area to the Village of Fredonia sewage treatment plant; one would permit the relocation of the Village of Jackson sewage treatment plant; and one would permit connection of the Silver Lake Sanitary District sewer system to the City of West Bend sewerage system. These trunk sewers have been fully constructed, with the exception of the Northridge and Waubeka-Fredonia trunk sewers.

Current Plan Recommendations: The current regional water quality management plan includes recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Milwaukee River watershed within the Region, as shown on Map VIII-4. Two intercommunity trunk sewers in the Milwaukee River watershed are currently recommended to be constructed. These trunk sewers include the Northridge sewer, which would provide capacity for the northwestern portion of the service area tributary to the Sewerage District sewerage system; and the Waubeka-Fredonia sewer, which would connect urban development in the Waubeka area to the Village of Fredonia sewerage system.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of 68 known point sources of pollution identified in the Milwaukee River watershed other than public and private sewage treatment plants. These sources discharge industrial cooling, process, rinse, wash, and filter backwash waters through 118 outfalls directly or indirectly to the surface water system. Of these 118 point source outfalls, 45 discharged directly to the main stem of the Milwaukee River, 42 discharged indirectly to the main stem of the Milwaukee River, 31 discharged to other tributaries, and one outfall discharged to a soil absorption basin. Eighty-two--or about 70 percent--of the outfalls discharged cooling water only. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 120 known such point sources of wastewater discharging to the Milwaukee River and its major tributaries or the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table VIII-10 summarizes selected characteristics of these other point sources and Map VIII-5 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 152 known, permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface waters or groundwater in the Milwaukee River watershed. These point sources of wastewater discharge, primarily industrial cooling, process, rinse, and wash water, discharge directly, or following treatment, to the groundwater or the surface waters of the Milwaukee River watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Table VIII-10

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
WATER POLLUTION IN THE MILWAUKEE RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| American Landmark Management | Milwaukee | 1 | General | 0044938-3 | 9/30/95 | -- | -- | Milwaukee River | -- |
| Amity Leather Products Company | Washington | 2 | General | 0044938-3 | 9/30/95 | 3172 | Personal leather goods | Milwaukee River via storm sewer | -- |
| Amoco Oil Co. (Estabrook Apts.) | Milwaukee | --[d] | General | 0046566-3 | 9/30/95 | -- | -- | Milwaukee River | -- |
| Aqua-Chem, Inc. | Milwaukee | 4 | General | 0044938-3 | 9/30/95 | 3443 | Fabricated plate work(boiler shops) | Lincoln Creek via storm sewer | -- |
| Architectural Concrete Products, Inc. | Milwaukee | 5 | General | 0046507-2 | 9/30/95 | 3272 | Concrete products | Lincoln Creek via storm sewer | -- |
| Autotrol Corporation | Milwaukee | 6 | General | 0044938-3 | 9/30/95 | 3493 | Steel springs except wire | Milwaukee River via storm sewer | -- |
| Badger Middle School | Washington | 7 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Milwaukee River via storm sewer | -- |
| Bardes Plastics, Inc. | Milwaukee | 8 | General | 0044938-3 | 9/30/95 | 3082 | Unsupported plastics profile shapes | Lincoln Creek | -- |
| Bend Industries, Inc. | Washington | 9 | General | 0046507-2 | 9/30/95 | 3271 | Concrete block and brick | Leach field | -- |
| Brown Deer High School Pool | Milwaukee | 10 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Milwaukee River via unnamed trib. | -- |
| Cedarburg Swimming Pool | Ozaukee | 11 | General | 0046523-2 | 9/30/95 | -- | Municipal pool | Cedar Creek via storm sewer | -- |
| Cera-mite Corporation | Ozaukee | 12 | General | 0044938-3 | 9/30/95 | 3675 | Electronic capacitors | Milwaukee River via storm sewer | -- |
| Charter Processing Inc. | Ozaukee | 13 | General | 0044938-3 | 9/30/95 | 3452/3496 | Bolts, nuts, rivets, misc. prod. | Milwaukee River via storm sewer | -- |
| Continental Can Company | Milwaukee | 14 | General | 0044938-3 | 9/30/95 | 3411 | Metal cans | Milwaukee River via storm sewer | -- |
| Crown Cork & Seal Company, Inc. | Milwaukee | 15 | General | 0044938-3 | 9/30/95 | 3466 | Crowns and closures | Lincoln Creek via storm sewer | -- |
| Culligan Water Conditioning | Milwaukee | 16 | General | 0046540-1 | 9/30/95 | 1711 | Plumbing & soft water conditioners | Lincoln Creek via storm sewer | -- |
| Culligan Water Conditioning-West Bend | Washington | 17 | General | 0046540-1 | 9/30/95 | 1711 | Plumbing & soft water conditioning | Milwaukee River via storm sewer | -- |
| Dickmann Manufacturingg Co., Inc. | Ozaukee | 18 | General | NEW | -- | 3499/3496 | Fabricated metals & wire products | Milwaukee River via storm sewer | -- |
| E.R. Wagner Manufacturing Company | Milwaukee | 19 | General | 0044938-3 | 9/30/95 | 3429/3469 | Hardware; Metal stampings | Lincoln Creek | -- |
| Eaton Corp.-Cutler Hammer Prod. Div. | Milwaukee | 20 | General | SPEC PERM | -- | 3812/3625 | Search & navigation equipment, etc. | Lincoln Creek | -- |
| Eaton Corp.-Oper. & Tech. Center | Milwaukee | 21 | General | 0044938-3 | 9/30/95 | 3812/3625 | Search & navigation equipment, etc. | Lincoln Creek via storm sewer | -- |
| Federal Distributing, Inc. | Milwaukee | --[d] | General | 0046566-2 | 9/30/95 | -- | -- | Milwaukee River via Brown Deer Creek Tributary | -- |
| Franchise Mailing Systems | Milwaukee | 23 | General | SPEC PERM | -- | 7331 | Direct mail advertising services | Milwaukee River via storm sewer | -- |
| Fred Usinger, Inc. | Milwaukee | 24 | General | 0044938-3 | 9/39/95 | 2013 | Sausages & other meat products | Milwaukee River | -- |
| Gehl Company | Washington | 25 | General | 0044938-3 | 9/30/95 | 3523 | Farm machinery and equipment | Milwaukee River | -- |
| Glen Hills Middle School (Pool) | Milwaukee | 26 | General | 0046523-2 | 9/30/95 | 8211 | Secondary schools | Milwaukee River via storm sewer | -- |
| Grafton High School (Pool) | Ozaukee | 27 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Milwaukee River via storm sewer | -- |
| Great Lakes Biochemical Co., Inc. | Milwaukee | 28 | General | 0044938-3 | 9/30/95 | 2835 | Diagnostic substances | Milwaukee River | -- |
| Henri's Food Products Co., Inc. | Milwaukee | 29 | General | 0044938-3 | 9/30/95 | 2035 | Pickles, sauces & salad dressings | Milwaukee River via storm sewer | -- |
| Hercules, Incorporated | Milwaukee | 30 | General | 0044938-3 | 9/30/95 | 2821 | Plastics materials and resins | Milwaukee River | -- |
| Homestead High School (Pool) | Ozaukee | 31 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Lincoln Creek via storm sewer | -- |
| Interstate Drop Forge, Inc. | Milwaukee | --[d] | General | 0044938-3 & 0046566-2 | 9/30/95 | 3462 | Iron and steel forgings | Lincoln Creek via storm sewer | -- |
| Johnson Controls, Inc.-Civic Drive | Milwaukee | 33 | General | NPR-LET | -- | 3822/3561 | Environmental cont.; Pumping equip. | Lincoln Creek via storm sewer | -- |
| Johnson Controls, Inc.-Glen Park | Milwaukee | 34 | General | 0044938-3 | 9/30/95 | 3822 | Environmental controls | Milwaukee River | -- |
| Kettle Moraine YMCA | Washington | 35 | General | 0046523-2 | 9/30/95 | 7997 | Membership sports & rec. club | Milwaukee River via Silver Creek | -- |
| Kewaskum Frozen Foods, Inc. | Washington | 36 | General | 0044938-3 | 9/30/95 | 2011 | Meat packing plants | Milwaukee River | -- |
| Le Club | Milwaukee | 37 | General | 0046523-2 | 9/30/95 | 7997 | Membership sports & recreation club | Milwaukee River | -- |
| Leeson Electric Corp. | Ozaukee | 38 | General | 0044938-3 | 9/30/95 | 3621/3546 | Motors, generators, light fixtures | Lincoln Creek via storm sewer | -- |
| Longview Fibre Company | Milwaukee | 39 | General | 0044938-3 | 9/30/95 | 2653 | Corrugated and solid fiber boxes | Milwaukee River via storm sewer | -- |
| Marigold Foods, Inc. | Washington | 40 | General | 0044938-3 | 9/30/95 | 2026 | Fluid milk | Milwaukee River | -- |

Table VIII-10 (cont'd)

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Marshall Fields - Grand Avenue | Milwaukee | 41 | General | 0044938-3 | 9/30/95 | 5311 | Department store | Milwaukee River | -- |
| Meadow Brook Park Pool (Grafton) | Ozaukee | 42 | General | 0046523-2 | 9/30/95 | NA | Municipal pool | Milwaukee River via storm sewer | -- |
| Mequon Swimming Pool | Ozaukee | 43 | General | 0046523-2 | 9/30/95 | NA | Municipal pool | Milwaukee River | -- |
| Milw. Bd. Sch. Dir.: Custer H.S. | Milwaukee | 44 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Lincoln Creek via storm sewer | -- |
| Milw. Bd. Sch. Dir.: Madison H.S. | Milwaukee | 45 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Lincoln Creek via storm sewer | -- |
| Milw. Bd. Sch. Dir.: Marshall H.S. | Milwaukee | 46 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Lincoln Creek via storm sewer | -- |
| The Milwaukee Center | Milwaukee | 47 | General | SPEC PERM | 9/30/95 | 6512 | Non residential building operat. | Milwaukee River | -- |
| Milwaukee Country Club | Milwaukee | 48 | General | 0046523-2 | 9/30/95 | 7997 | Membership sports & rec. club | Milwaukee River | -- |
| Milwaukee County Dineen Park Pool | Milwaukee | 49 | General | 0046523-2 | 9/30/95 | NA | Municipal pool | Lincoln Creek via storm sewer | -- |
| Milwaukee County Lincoln Park Pool | Milwaukee | 50 | General | 0046523-2 | 9/30/95 | N/A | Municipal pool | Milwaukee River via storm sewer | -- |
| Milwaukee County McGovern Park Pool | Milwaukee | 51 | General | 0046523-2 | 9/30/95 | N/A | Municipal pool | Lincoln Creek via storm sewer | -- |
| Milwaukee Gear Co., Inc. | Milwaukee | 52 | General | 0044938-3 | 9/30/95 | 3398 | Metal heat treating | Milwaukee River via storm sewer | -- |
| Northridge Lakes | Milwaukee | 53 | General | 0046523-2 | 9/30/95 | 6513 | Apartment bldg. operators | Beaver Creek | -- |
| North Shore Water Commission | Milwaukee | 54 | General | SPEC PERM | -- | 4941 | Water supply | Groundwater discharge | -- |
| North Suburban YMCA: Schreoder Pool | Milwaukee | 55 | General | 0046523-1 | 9/30/95 | 7991 | Physical fitness club | Milwaukee River | -- |
| Oster - Sunbeam Joint Ventures | Milwaukee | 56 | General | SPEC PERM | 9/30/95 | 3634 | Electrical housewares and fans | Milwaukee River via storm sewer | -- |
| Ozaukee Country Club | Ozaukee | 57 | General | 0046523-2 | 9/30/95 | 7997 | Membership sports & rec. club | Milwaukee River | -- |
| Pereles Brothers, Inc. | Milwaukee | 58 | General | 0044938-3 | 9/30/95 | 3089 | Plastics products | Lincoln Creek via storm sewer | -- |
| Perry Printing Co. - Milwaukee Div. | Milwaukee | 59 | General | 0044938-3 | 9/30/95 | 2752 | Commerical printing - lithographic | Beaver Creek via drainage ditch | -- |
| Phoenix Products Company, Inc. | Milwaukee | 60 | General | 0044938-3 | 9/30/95 | 2671 | Paper & laminated packaging | Lincoln Creek via storm sewer | -- |
| Pressure Cast, Div. Leggett & Platt | Ozaukee | 61 | General | 0044938-3 | 9/30/95 | 3363 | Aluminum die casting | Milwaukee River | -- |
| Production Stamping Corp. | Milwaukee | 62 | General | 0044938-3 | 9/30/95 | 3469 | Metal stampings | Brown Deer Creek | -- |
| Rexford Paper Company | Milwaukee | 63 | General | 0044938-3 | 9/30/95 | 2672 | Paper coated and laminated pkg. | Lincoln Creek via storm sewer | -- |
| Rexnord Corp.-Plastics Division | Ozaukee | 64 | General | 0044938-3 | 9/30/95 | 3714 | Motor vehicle parts, relays, etc. | Milwaukee River | -- |
| Rexnord Corp.-Stearns Division | Milwaukee | 65 | General | 0044938-3 | 9/30/95 | 3625 | Relays and industrial controls | Milwaukee River Canal | -- |
| Riveredge Nature Center | Washington | 66 | General | 0044938-3 | 9/30/95 | 9512 | Nature conservancy | Milwaukee River | -- |
| Rose Industries, Inc. | Milwaukee | 67 | General | 0044938-3 | 9/30/95 | 3531 | Construction machinery | Brown Deer Creek | -- |
| Rostad Aluminum Corp. | Ozaukee | 68 | General | 0044938-3 | 9/30/95 | 3363 | Aluminum die casting | Milwaukee River via storm sewer | -- |
| Rowe Sand & Gravel, Inc. | Ozaukee | 69 | General | 0045615-2 | 9/30/95 | 3281 | Cut stone & stone products | Cedar Creek | -- |
| Schmitz Ready Mix-Mequon | Ozaukee | 70 | General | 0046507-2 | 9/30/95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Sealcraft Packaging Corp. | Milwaukee | 71 | General | 0044938-3 | 9/30/95 | 3089 | Plastics | Milwaukee River via storm sewer | -- |
| Sherwood Medical (Beatreme Foods) | Washington | 72 | General | SPEC PERM | -- | 3842 | Surgical appl. & supplies | Cedar Creek | -- |
| Shorewood High School (Pool) | Milwaukee | 73 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Milwaukee River via storm sewer | -- |
| Square D Co.-Richards Street Plant | Milwaukee | 74 | General | 0044938-3 | 9/30/95 | 3625 | Relays and industrial controls | Milwaukee River via storm sewer | -- |
| Stainless Foundry & Engineering, Inc. | Milwaukee | 75 | General | 0044938-3 | 9/30/95 | 3324/3325 | Steel & steel investment found | Lincoln Creek via storm sewer | -- |
| Super Steel Products Corp.-Calumet | Milwaukee | 76 | General | 0044938-3 | 9/30/95 | 3499 | Fabricated metal products | Lincoln Creek | -- |
| Treat All Metals, Inc. | Milwaukee | 77 | General | 0044938-3 | 9/30/95 | 3398 | Metal heat treating | Milwaukee River via storm sewer | -- |
| USEM/Doerr Electric Corp. | Ozaukee | 78 | General | 0044938-3 | 9/30/95 | 3621 | Motors and generators | Cedar Creek via unnamed trib. | -- |
| United Division-Mid City Foundry Co. | Ozaukee | 79 | General | 0044938-3 | 9/30/95 | 3321 | Gray and ductile iron foundries | Milwaukee River via storm sewer | -- |
| Universal Foods Corp.-Bioventures | Milwaukee | 80 | General | 0044938-3 | 9/30/95 | 2022/2099 | Cheese and Food preparation | Lincoln Creek via storm sewer | -- |

Table VIII-10 (cont'd)

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Universal Strap, Inc. | Washington | 81 | General | 0044938-3 | 9/30/95 | 2396 | Automotive & apparel trim | Hasmer Creek | -- |
| Vaporized Coatings, Inc. | Milwaukee | 82 | General | 0044938-3 | 9/30/95 | 3471 | Plating and polishing | Lincoln Creek via storm sewer | -- |
| W. H. Brady Co.-Coated Products Div. | Milwaukee | 83 | General | 0044938-3 | 9/30/95 | 2672 | Papercoated and laminated prod. | Lincoln Creek via storm sewer | -- |
| W. H. Brady Co.-Parkland Court | Milwaukee | 84 | General | 0044938-3 | 9/30/95 | 3679 | Electronic components | Lincoln Creek via storm sewer | -- |
| West Bend High School (Pool) | Washington | 85 | General | 0046523-2 | 9/30/95 | 8211 | Secondary school | Milwaukee River via storm sewer | -- |
| West Bend Water Utility | Washington | 86 | General | 0046566-1 | 9/30/95 | 4941 | Water supply | Milwaukee River | -- |
| Wilke Dairy Company | Milwaukee | 87 | General | 0044938-3 | 9/30/95 | 5143 | Dairy products - wholesale | Milwaukee River via storm sewer | -- |
| Wisconsin Color Press, Inc. | Milwaukee | 88 | General | 0044938-3 | 9/30/95 | 2759/2752 | Commercial printing: nec & litho. | Lincoln Creek via storm sewer | -- |
| Wisconsin Paperboard Corp.-Newark | Milwaukee | 89 | General | 0044938-3 | 9/30/95 | 2631 | Paperboard mills | Milwaukee River | -- |
| Wisconsin Thermoset Molding, Inc. | Milwaukee | 90 | General | 0044938-3 | 9/30/95 | 3089 | Plastic products | Milwaukee River via storm sewer | -- |
| Wright Metal Processors, Inc. | Milwaukee | 91 | General | 0044938-3 | 9/30/95 | 3479 | Metal coating and allied services | Lincoln Creek via storm sewer | -- |
| YMCA of Metro Milwaukee | Milwaukee | 92 | General | 0046523-2 | 9/30/95 | 7991 | Physical fitness facility | Milwaukee River via storm sewer | -- |
| Yahrs Ready-Mix, Inc. | Washington | 93 | General | 0046507-2 | 9/30/95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| A. O. Smith Automotive Products Co. | Milwaukee | 1A | Specific | 0027278 | 12-31-94 | 3714 | Motor vehicle parts & accessories | Lincoln Creek via storm sewer | None |
| Amcast Industrial Corp. Meta Mold Div | Ozaukee | 2A | Specific | 0000604 | 03-31-92 | 3363 | Aluminum die casting | Cedar Creek | None |
| Aqua-Chem, Inc.-Cleaver Brooks | Milwaukee | 3A | Specific | 0043559 | 12-31-89 | 3443 | Fabricated plate work | Milwaukee River via storm sewer | None |
| Aqua-Chem, Inc.-North Plant #2 | Milwaukee | 4A | Specific | 0004502 | 12-31-89 | 3443 | Fabricated plate work | Milwaukee River via storm sewer | None |
| Badger Meter, Inc. | Milwaukee | 5A | Specific | 0033529 | 12-31-89 | 3824 | Fluid meters and counting devices | Milwaukee River via storm sewer | 7 |
| Beatreme Foods (Sherwood Medical) | Washington | 6A | Specific | 0046965 | 12-31-91 | 2022 | Cheese-natural & processed | Hasmer Creek | None |
| Bieri's Cheese, Inc. | Washington | 7A | Specific | 0057355 | 09-30-92 | 2022 | Cheese-natural & processed | Groundwater discharge | None |
| Brewery Works, Inc. | Milwaukee | 8A | Specific | 0046736 | 01-31-96 | 7699 | Repair services | Milwaukee River via storm sewer | None |
| Briggs & Stratton Corp.-Glendale | Milwaukee | 9A | Specific | 0000621 | 12-31-89 | 3499 | Fabricated metal products | Brown Deer Creek | 7 |
| Brookside Poultry Farms, Inc. | Washington | 10A | Specific | 0056677 | 12-31-93 | 0259 | Poultry & eggs | Groundwater discharge | None |
| Cook Composites & Polymers | Ozaukee | 11A | Specific | 0027731 | 06-30-95 | 2821 | Plastics materials and resins | Milwaukee River | 7 |
| Florence Eiseman, Inc. | Milwaukee | 12A | Specific | 0033901 | 03-31-90 | 2361 | Girl & children's clothing | Milwaukee River | None |
| J. F. Shea Co., Inc. (NSW Dropshaft) | Milwaukee | 13A | Specific | 0047121 | 06-30-93 | 1622 | Bridge, tunnel & elev. hwy. const. | Milwaukee River | 6, 8 |
| Johnson Brass & Mach. Foundry Inc. | Ozaukee | 14A | Specific | 0037923 | 06-30-89 | 3365/3366/3369 | Aluminum, copper, nonferrous fndy. | Milwaukee River | 6 |
| Johnson Control Globe Battery | Milwaukee | 15A | Specific | 0000108 | 12-31-91 | 3625 | Relays and industrial controls | Lincoln Creek via unnamed trib. | None |
| The Kelch Corp. | Ozaukee | 16A | Specific | 0044083 | 07-31-95 | 3545 | Machine tool accessories | Milwaukee River | None |
| Morrison Knudsen Co., Inc. | Milwaukee | 17A | Specific | 0047139 | 04-30-90 | 1622 | Bridge, tunnel and elev. hwy. const. | Lincoln Creek via storm sewer | None |
| OMC Milwaukee Plant 5 | Milwaukee | 18A | Specific | 0000558 | 06-30-89 | 3519 | Internal combustion engines | Lincoln Creek via storm sewer | None |
| Oster Division-Sunbeam | Milwaukee | 19A | Specific | 0001023 | 09-30-90 | 3634 | Electric housewares and fans | Milwaukee River via storm sewer | None |
| Praefke Brake and Supply Corp. | Washington | 20A | Specific | 0025291 | 09-30-90 | 3714 | Motor vehicles parts & accessories | Milwaukee River | None |
| Regal Ware, Inc. | Washington | 21A | Specific | 0000060 | 12-31-89 | 3631 | Household cooking equipment | Milwaukee River | None |
| Schaefer Livestock Operation | Washington | 22A | Specific | 0056723 | 09/30/95 | 0219 | General livestock | Milwaukee River | None |
| Terminal Storage Company | Milwaukee | 23A | Specific | 0042684 | 03-31-90 | 4225 | General warehousing and storage | Milwaukee River Canal | None |
| West Bend Company | Washington | 24A | Specific | 0027294 | 09-30-92 | 3634 | Electric housewares and fans | Milwaukee River | None |
| WI Electric Power Co.-Commerce Plant | Milwaukee | 25A | Specific | 0000892 | 09-30-90 | 4911 | Electric services | Milwaukee River | 5 |
| WI Paperboard Corp. | Milwaukee | 26A | Specific | 0054984 | 09-30-90 | 2611 | Pulp mills | Milwaukee River | None |
| WI University-Milwaukee Power Plant | Milwaukee | 27A | Specific | 0040282 | 08-31-95 | 4961 | Steam and air-conditioning supply | Lake Michigan via storm sewer | None |

Footnotes follow.

Table VIII-10 (cont'd)

[a] Table VIII-10 includes 120 known, permitted sources of wastewater discharging to the Milwaukee River and its tributaries, or to the groundwater systems in the Milwaukee River watershed. As of 1993, there were 152 known, permitted point sources of water pollution.

[b] See Map VII-5, "Point Sources of Pollution other than Sewage Treatment Facilities in the Milwaukee River Watershed: 1990."

[c] The number code refers to the following treatment systems:

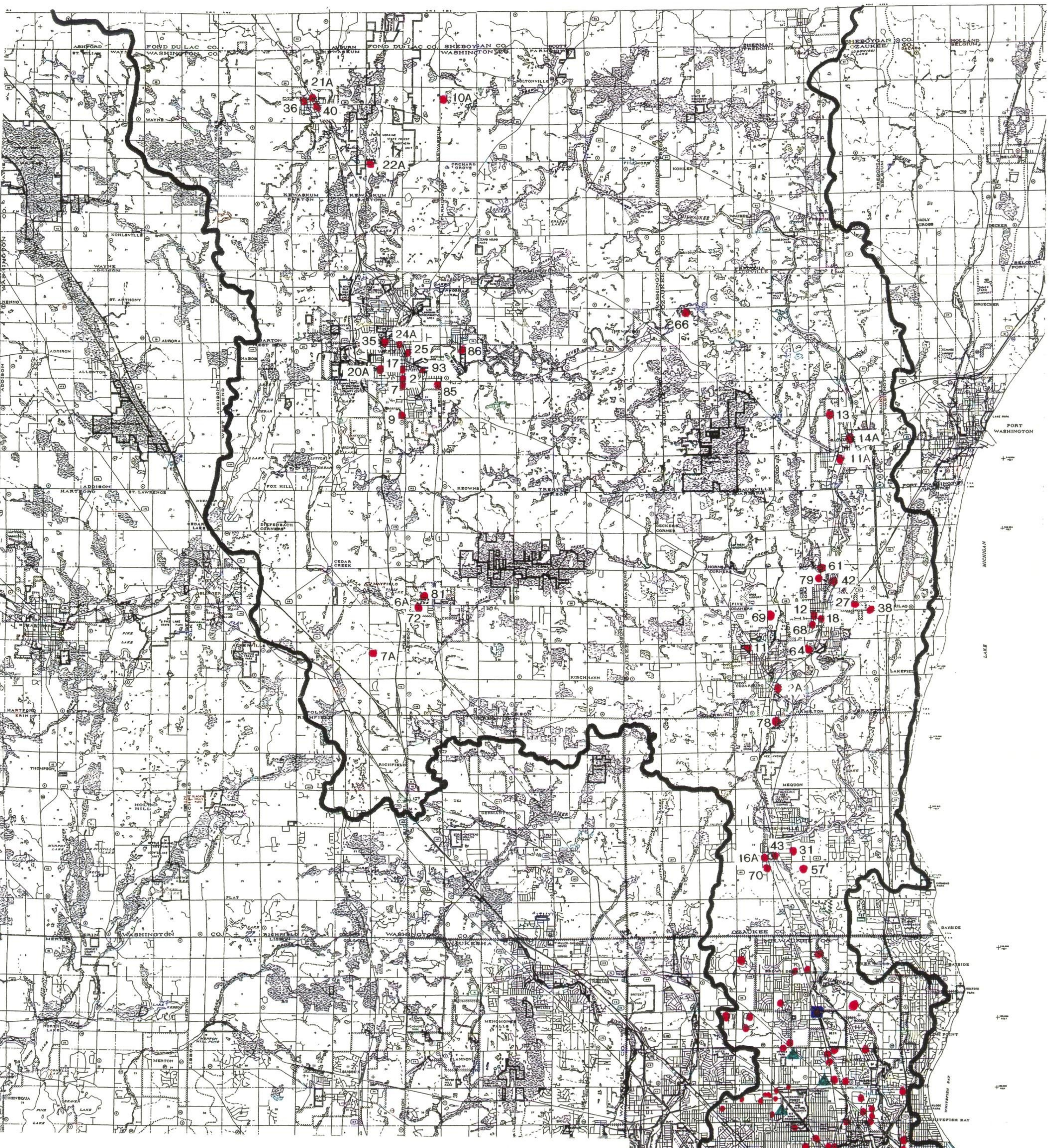
1. ACT sludge extended air
2. Absorption pond
3. Aerated lagoon
4. Anaerobic digestion
5. Filters- general
6. Gravity sedimentation
7. Holding pond
8. Oil and grease removal
9. Secondary clarification
10. Septic tanks
11. Spray irrigation
12. Stabilization lagoon

[d] Permitted as Leaking Underground Storage Tank (LUST) remediation site discharging to surface or groundwater as of 1990. As of 1993, there were seven additional LUST remediation sites discharging to surface or ground waters in the Milwaukee River watershed. See Table VIII-12, "Miscellaneous Potential Pollution Sources in the Milwaukee River Watershed: 1990", for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map VIII-5

POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE MILWAUKEE RIVER WATERSHED: 1990




LEGEND

1 ● POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

2 ■ LEAKING UNDERGROUND STORAGE TANKS DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER

3 ▲ LANDFILLS THAT POTENTIALLY IMPACT SURFACE WATER QUALITY

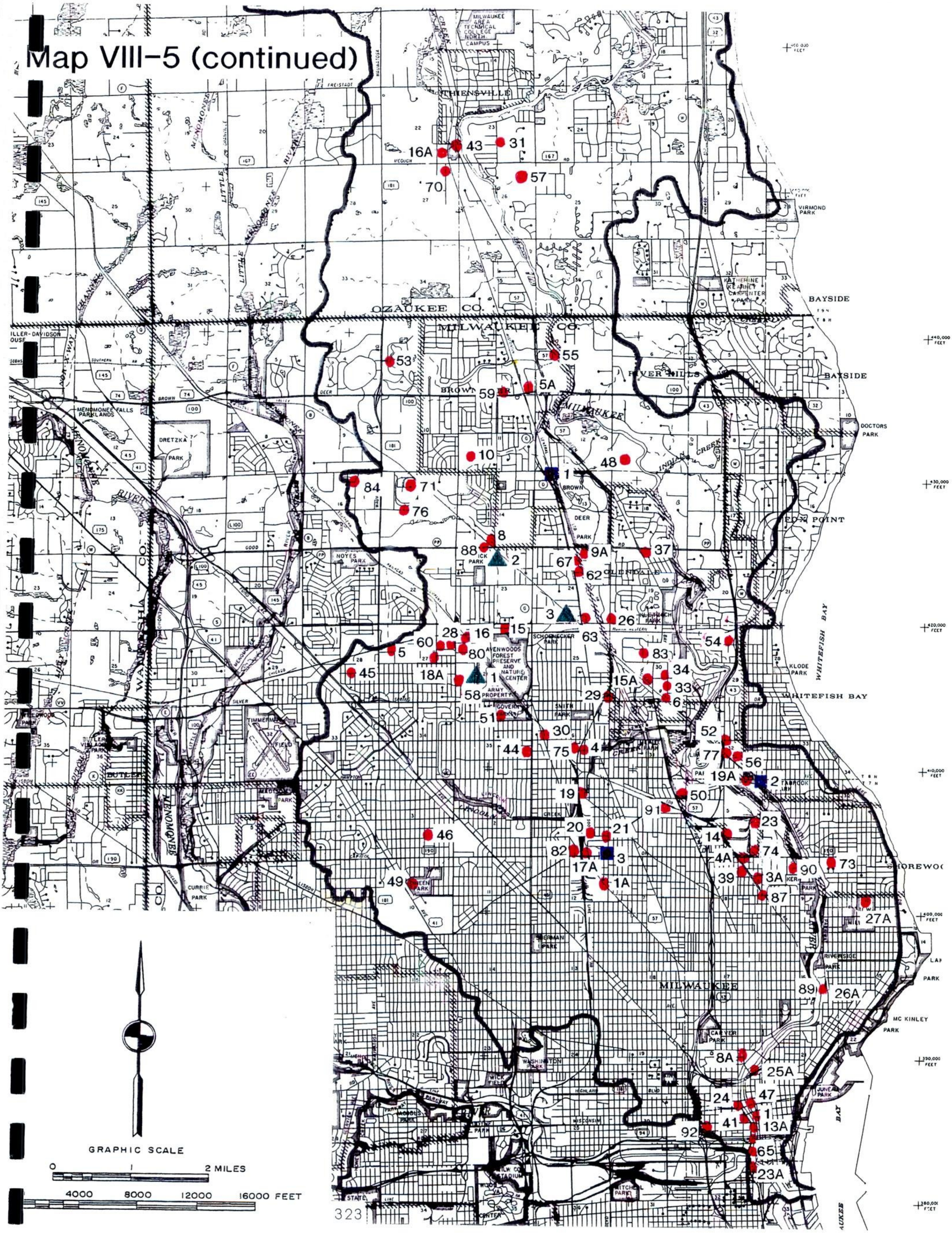
GRAPHIC SCALE

0 1 2 4 MILES

0 8000 16000 24000 32000 FEET

Source: SEWRPC.

# Map VIII-5 (continued)



Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were 14 enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, three of those areas had been added to the planned 2010 sewer service area. Due to increased urban growth within the watershed since 1975, twenty new enclaves of urban development have been created beyond the planned sewer service areas and three of the urban development enclaves identified in the original plan have been expanded, as shown on Map VIII-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table VIII-11. As shown in Table VIII-11, approximately one-half of these areas--17 of the 31 sites--are covered by soils, and have lot sizes, which indicate a high probability of meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. The remaining areas have soils and lot sizes having a high probability of not meeting these criteria and alternative wastewater disposal methods should be considered. Two of these latter areas are located adjacent to Big and Little Cedar Lakes where alternative forms of wastewater management have been investigated during 1989[3] and 1991.[4] Based upon the studies completed, the installation of a public sanitary sewer system for these two lake areas was not recommended. However, it is recommended that this conclusion be reconsidered later in the planning period based upon the then current conditions of the onsite sewerage systems in the area. Thus, for these two areas and for the remaining enclaves located in areas where soils are not considered to meet current criteria for conventional onsite systems, it is recommended that an inspection and maintenance program for the onsite sewerage disposal system be initiated and that further site-specific planning be conducted to determine the best wastewater management practice at such time as significant problems become evident.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Milwaukee River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can be subsequently transported to surface waters.

There are currently three active landfills and 95 known abandoned landfills located in the Milwaukee River watershed. Three of the abandoned landfills in the Milwaukee River watershed have been reported to be potentially impacting Lincoln Creek. The location of these landfills are shown on Map VIII-5 and listed in Table VIII-12.

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[3]See Tri Lakes Sanitary Study, Ruekert & Mielke, Inc., November 1989.

[4]See Silver and Little Cedar Lake Sewerage Facility Plan, Ruekert & Mielke, Inc., August 1991.

Table VIII-11

EXISTING URBAN DEVELOPMENT OUTSIDE OF THE PLANNED PUBLIC SANITARY SEWER SERVICE AREA IN THE MILWAUKEE RIVER WATERSHED: 2010

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| | Washington County | | |
| 1[c] | Town of Farmington-Section 20 | 129 | 2.5 |
| 2 | Town of Barton-Section 4 | 118 | 0.3 |
| 3[c] | Town of Barton-Section 33 | 133 | 1.3 |
| 4[c] | Town of Barton-Section 6 | 113 | 2.1 |
| 5[c] | Town of Barton-Section 20 | 108 | 1.0 |
| 6[c] | Town of Barton-Section 33 | 113 | -- |
| 7[c] | Town of Trenton-Sections 5, 8, and 9 | 457 | -- |
| 8[c] | Big Cedar Lake | 1,290 | 0.9 |
| 9 | Town of West Bend-Section 22 | 194 | -- |
| 10 | Little Cedar Lake | 220 | 0.5 |
| 11 | Town of West Bend-Section 33 and 34 | 402 | 0.9 |
| 12 | Town of Polk-Section 4 | 158 | 2.4 |
| 13 | Town of Jackson-Section 7 | 129 | 0.5 |
| 14 | Town of Jackson-Section 7 | 159 | 0.9 |
| 15[c] | Town of Polk-Section 21 | 109 | 2.5 |
| 16 | Town of Polk-Section 22 | 115 | 1.5 |
| 17 | Town of Jackson-Section 22 | 179 | 1.7 |
| 18[c] | Town of Jackson-Section 27 | 216 | 1.9 |
| 19 | Town of Polk-Section 36 | 172 | 1.7 |
| 20 | Town of Jackson-Section 36 | 214 | 3.0 |
| 21[c] | Town of Richfield-Sections 12 and 13 | 590 | 3.8 |
| | Ozaukee County | | |
| 22 | Town of Fredonia-Section 19 | 128 | 1.3 |
| 23 | Town of Cedarburg-Section 5 and 8 | 299 | 2.1 |

Table VIII-11 (Cont'd)

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| 24[c] | Town of Cedarburg-Section 2 | 142 | 0.8 |
| 25 | Town of Cedarburg-Section 1 | 143 | -- |
| 26 | Town of Cedarburg-Section 18 | 239 | 2.1 |
| 27[c] | Town of Cedarburg-Section 16 | 242 | 0.4 |
| 28 | Town of Cedarburg-Section 15 | 486 | -- |
| 29 | Town of Cedarburg-Sections 29 and 30 | 235 | 0.5 |
| 30[c] | Town of Grafton-Section 29 | 175 | 0.5 |
| 31[c] | Town of Grafton-Section 31 | 210 | 2.0 |
| | Total | 7,994 | 39 |

[a] See Map VIII-4

[b] Urban development is defined in this context as concentrations of urban land uses within any given U.S. Public Land Survey quarter section that has at least 32 housing units, or an average of one housing unit per five gross acres, and is not served by public sanitary sewers.

[c] Based upon consideration of soils, lot sizes, and density, further site specific planning should be conducted during the planning period to determine the best means of providing for wastewater management.

Source: SEWRPC.

Table VIII-12

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE MILWAUKEE RIVER WATERSHED: 1990

| Map ID Number[a] | Landfills Indicated to be Potential Pollution Sources | Civil Division Location | Surface Water Potentially Impacted |
|---|---|---|---|
| 1 | U.S. Army Reserve Landfill-Havenwoods Park[b] | City of Milwaukee | Lincoln Creek |
| 2 | Village of Whitefish Bay[b] | City of Milwaukee | Lincoln Creek |
| 3 | City of Milwaukee Landfill[b] | City of Milwaukee | Lincoln Creek |
| | Leaking Underground Storage Tank Sites[c,d] | | Receiving Water |
| 1 | Federal Distributing, Inc. | Village of Brown Deer | Milwaukee River |
| 2 | Amoco Oil Company | City of Milwaukee | Milwaukee River |
| 3 | Interstate Drop Forge, Inc. | City of Milwaukee | Lincoln Creek |
| | Additional Groundwater Contamination Sites[c,e] | | |
| | None | | |

[a]Refers to Map VIII-5, "Point Sources of Pollution Other Than Sewage Treatment Facilities in the Milwaukee River Watershed: 1990."

[b]As indicated in Wisconsin Department of Natural Resources Milwaukee River South Branch Watershed Water Resource Appraisal and Stream Classification, 1989.

[c]Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters.

[d]As of 1993, there were seven additional leaking underground storage tank sites in the Milwaukee River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Eddie's Service in the Village of Saukville, which is permitted to discharge to the Milwaukee River via a storm sewer; Herbst Service Station in the Village of Jackson, which is permitted to discharge to a tributary of Cedar Creek; Jacobus Company-West Bend Bulk Terminal in the City of West Bend, which is permitted to discharge to the Milwaukee River via a storm sewer; O'Connor Oil Company, Cooper Environmental, in the City of West Bend which is permitted to discharge into the Milwaukee River via a storm sewer; Ozaukee County Highway Department in the Town of Saukville, which is permitted to discharge to groundwater; TriPar Oil in the City of West Bend, which is permitted to discharge to the Milwaukee River via a storm sewer--all in Ozaukee County; and Milwaukee Gear Company in the City of Milwaukee, Milwaukee County, which is permitted to discharge to the Milwaukee River via a storm sewer.

[e]As of 1993, there was one groundwater contamination site whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Moore Oil Company in the City of Milwaukee, which is permitted to discharge to Lincoln Creek.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Milwaukee River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were three known permitted leaking underground storage tank sites that were discharging remediation waters to surface waters in the Milwaukee River watershed, as indicated in Table VIII-12 and shown on Map VIII-5. As of 1993, there were seven additional leaking underground storage tanks in the Milwaukee River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table VIII-12.

As of 1993, there were 622 additional leaking underground storage tanks in the Milwaukee River watershed identified by the Wisconsin Department of Natural Resources that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks have the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters. As of 1993, there was one permitted site discharging to surface water in the Milwaukee River watershed, as indicated in Table VIII-12.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, malfunctioning septic systems, and pollutant contributions from the atmosphere.

### Existing Conditions and Status of Plan Implementation

For the Milwaukee River watershed, the adopted plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, onsite sewage disposal system management, and streambank erosion control. The plan also recommended that additional nonpoint source controls be provided in the Lake Twelve drainage area, which would reduce nonpoint sources of pollution by about 75 percent in the rural areas. No nonpoint source controls were recommended in the southern portion of the watershed where the deep tunnel-combined sewer overflow abatement plan has been implemented.

In 1971, the Commission prepared a comprehensive plan[5] for the Milwaukee River watershed. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas and for rural nonpoint source management planning in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Milwaukee River watershed through a variety of local and State regulations and programs. These programs include the regulation of onsite sewage disposal systems under programs currently administered by Washington, Ozaukee, and Milwaukee Counties in the unincorporated areas and by the local units of government in incorporated areas served by onsite systems. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified.

Significant progress has been made in the area of construction site erosion control. As of January 1993, the Cities of Cedarburg, Glendale, Mequon, and Milwaukee; the Villages of Fredonia, Germantown, Grafton, Jackson, Kewaskum, Newburg, and Saukville; and the Town of Cedarburg had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. In addition, Washington County, the City of West Bend, and the Villages of River Hills and Thiensville had ordinances which were developed independently from the model, while an ordinance based on the model is currently being drafted for the Town of Grafton. The Cities of Mequon and West Bend also have developed stormwater ordinances.

With regard to rural nonpoint source pollution control, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program has been used in selected cases in the Milwaukee River watershed. Other programs, such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are being utilized in the Milwaukee River watershed primarily for cropland soil erosion control and wildlife habitat purposes, and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum

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[5]SEWRPC Planning Report No. 13, A Comprehensive Plan for the Milwaukee River Watershed, Volume One, Inventory Findings and Forecasts, 1969; Volume Two, Alternative Plans and Recommended Plan, 1970.

annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Washington and Ozaukee Counties. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

The local programs described above and the Wisconsin Department of Natural Resources priority watershed program described below have probably resulted in some reduction in the pollutant loadings from nonpoint sources. However, this element of the plan has only been partially implemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for individual projects or land management practices to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. Four such programs are currently underway in the Milwaukee River watershed: the North Branch Milwaukee River Priority Watershed Project, the East and West Branch Milwaukee River Priority Watershed Project, the Milwaukee River South Priority Watershed Project, and the Cedar Creek Priority Watershed Project.[6]

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[6]Wisconsin Department of Natural Resources Publications No. WR-253-90, A Nonpoint Source Control Plan for the North Branch Milwaukee River Priority Watershed Project, June 1989; WR-255-90, A Nonpoint Source Control Plan for the East and West Branches of the Milwaukee River Priority Watershed Project, February 1989; WR-245-91, A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project, December 1991; and, A Nonpoint Source Control Plan for the Cedar Creek Priority Watershed Project, 1992.

North Branch Milwaukee River Priority Watershed Project: The North Branch Milwaukee River watershed was designated a "priority watershed" in 1984. Planning for the North Branch Milwaukee River priority watershed was completed in 1989 and implementation of practices will continue for about an eight-year period, to July 1997. Rural elements of the North Branch Milwaukee River priority watershed project are administered by the Fond du Lac, Ozaukee, Sheboygan, and Washington County Land Conservation Committees. Urban elements of project are being administered by the Villages of Adell, Cascade, and Random Lake.

The North Branch Milwaukee River priority watershed project established nonpoint source pollutant reduction goals to obtain loading reductions for sediment and phosphorus ranging from 10 to 40 percent for the subareas considered. Additional control recommendations were established for barnyards and livestock operations. These loading reductions were based primarily upon field inventories of the streams in the North Milwaukee River watershed. Observations were made of the sediment imbeddedness and biological conditions of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. The nonpoint source pollutant reductions set forth in the North Branch Milwaukee River priority watershed plan are generally consistent with the recommendations of the initial plan.

In order to achieve these objectives, the North Branch Milwaukee River priority watershed program includes recommendations and funding eligibility for the nonpoint source control measures presented below.

Rural Land Management--

- Provision of fencing and other streambank erosion control practices for about 65,000 feet of eroding streambank.
- Formation of detailed conservation plans to develop the best management practices for about 12,000 acres of cropland.
- Installation of management practice for 64-86 barnyards and the installation of improved practices for manure spreading on 1,600 acres.

Urban Land Management--

- Provision of construction site erosion control for new urban development which is expected in the watershed during the planning period.
- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

East and West Branches of the Milwaukee River Priority Watershed Program: The East and West branches of the Milwaukee River watershed was designated as a "priority watershed" in 1984. Planning for the watershed project was completed in 1989 and implementation of practices will continue for an eight-year period to July 1997. Rural elements of the East and West Branches of the Milwaukee River priority watershed project are administered by the Dodge, Fond du Lac, Ozaukee, Sheboygan, and Washington County Lake Conservation Committees. Urban elements of the project are being administered by the City of West Bend and the Villages of Kewaskum, Campbellsport, and Newburg.

The East and West Branches of the Milwaukee River priority watershed project established nonpoint source pollutant reduction goals to obtain loading reductions of from 10 to 50 percent for sediment and from 25 to 50 percent for phosphorus. These loading reductions were based primarily upon field inventories of the streams in the East and West Branches of the Milwaukee River watershed. Observations were made of the sediment imbeddedness and biological condition of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. The recommendations of the priority watershed plan for the rural areas are generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. However, priority watershed plan recommendations for the urban areas are costly and full implementation will be difficult. The plan recommends that further detailed stormwater management planning and assessments of the levels of control required to meet the water use objectives be carried out as part of the subsequent plan implementation actions.

In order to achieve these objectives, the East and West Branch Milwaukee River priority watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

Rural Land Management--

- The provision of fencing and other streambank erosion controls at 76 sites with a total of about 23,000 feet of eroding streambank.

- Preparation of detailed conservation plans to develop the best management practices for about 14,000 acres of cropland.

- Installation of facilities and management practices for 63 barnyards and improved practices for manure spreading on 1,200 acres.

Urban Land Management--

- Provision of construction erosion control for urban development which is expected in the watershed during the planning period.

- The preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

- Institution of public information and education programs on nonpoint source pollution abatement; and the institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers.

Milwaukee River South Priority Watershed Project: The Milwaukee River South watershed was designated as a "priority watershed" in 1984. Planning for the watershed project was completed in 1991 and implementation of practices will continue for an eight-year period ending in October 1999. Rural elements of the Milwaukee River South priority watershed project are administered by the Ozaukee County Land Conservation Committee. Urban elements of the project are being administered by the incorporated municipalities in the project area.

The Milwaukee River South priority watershed project established nonpoint source pollutant loading reduction goals of 50 percent for sediment, from 50 to 70 percent for phosphorus, and 50 percent for heavy metals. These loading reductions were based primarily upon field inventories of the streams in the Milwaukee River South watershed. Observations were made of the sediment imbeddedness and biological condition of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. In addition, the pollutant reduction goals were based upon a qualitative consideration of the toxicity of metals in urban runoff. The nonpoint source pollutant reductions set forth in the Milwaukee River South priority watershed plan for the rural areas are generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. However, priority watershed plan recommendations for the urban areas are costly and full implementation will be difficult. The plan recommends that further detailed stormwater management planning and assessments of the levels of control required to meet the water use objectives be carried out as part of the subsequent plan implementation actions.

In order to achieve these objectives, the Milwaukee River South priority watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

<u>Rural Land Management</u>--

- Provision of fencing and other streambank erosion control practices for about 36,000 feet of eroding streambank.

- Formation of detailed conservation plans to develop the best management practices for about 14,000 acres of cropland.

- Installation of management practices for 43 barnyards.

- The installation of facilities and management practices for 29 livestock operations to change manure spreading practices.

<u>Urban Land Management</u>--The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for implementation of construction erosion controls; the institution of a public information and education program on nonpoint source pollution abatement; and institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizes. The plan further recommends the development of a "segmented program" providing for the stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices is also recommended. Specific core and segmented programs include:

- Provision of construction erosion control for new urban development which is expected in the watershed during the planning period.

- Provision of nonpoint source control practices on about 16,000 to 35,000 acres of existing urban development and about 7,000 acres of new urban land targeted for nonpoint source control. Possible urban nonpoint source pollution control practices include wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

- Provision of streambank erosion control measures at 16 sites, located primarily along Indian and Lincoln Creeks.

Cedar Creek Priority Watershed Project: The Cedar Creek watershed was designated as a priority watershed in 1984. Planning for the watershed project was completed in 1992 and implementation of practices will continue for an eight-year period ending in March 2000. Rural elements of the Cedar Creek priority watershed project are administered by the Ozaukee and Washington County Land Conservation Committees. Urban elements of the project are being administered by the City of Cedarburg, the Villages of Jackson and Grafton, and the Big Cedar Lake and Little Cedar Lake Protection and Rehabilitation Districts.

The Cedar Creek priority watershed project established nonpoint source pollutant loading reduction goals of from 50 to 75 percent for sediment. Additional reduction goals of 50 percent were established for urban stormwater pollutants, and of 60 percent for nutrient loadings to surface waters from animal waste sources and eroding uplands.

These loading reductions were based primarily upon field inventories of the streams in the Cedar Creek watershed. Observations were made of the sediment imbeddedness and biological condition of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. In addition, the pollutant reduction goals were based upon a qualitative consideration of the toxicity of metals in urban runoff. The recommendations of the priority watershed plan for the rural areas are generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. However, priority watershed plan recommendations for the urban areas are costly and full implementation will be difficult. The plan recommends that further detailed stormwater management planning and assessments of the levels of control required to meet the water use objectives be carried out as part of the subsequent plan implementation actions.

In order to achieve these objectives, the Cedar Creek watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

Rural Land Management:

- Provision of fencing and other streambank erosion control practices for 23 sites where cattle access is suspected to be causing degradation of habitat and/or water quality.

- Formation of detailed conservation plans to develop the best management practices for about 22,000 acres of cropland.

- Installation of management practices for 24 barnyards.

- Installation of facilities and management practices for 22 livestock operations to change manure spreading practices.

- Purchase of four conservation easements in selected areas of the watershed where it is demonstrated to be the least-cost practicable control alternative.

Urban Land Management--The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for implementation of construction erosion controls; the institution of a public information and education program on nonpoint source pollution abatement; and institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizes. The plan further recommends the development of a "segmented program" providing for the stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices is also recommended. Specific core and segmented programs include:

- Provision of construction erosion control for new urban development which is expected in the watershed during the planning period.

- Provision of nonpoint source control practices on existing urban and new urban land targeted for nonpoint source control. Possible urban nonpoint source pollution control practices include wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

Current Plan Recommendations

It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, in addition to land management practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings are recommended to be carried out throughout the Milwaukee River watershed. Within the rural areas in the drainage area of Lake Twelve, it is recommended that additional practices providing for levels of control for about a 75 percent reduction in nonpoint source loadings be provided. It is further recommended that the levels of control set forth above as developed for the four priority watershed projects be utilized as the initial basis for subsequent stormwater management planning purposes and for project eligibility under the State priority watershed program. These levels of reduction are recommended to be refined based upon subsequent detailed stormwater management planning and based upon additional monitoring and quantitative analyses which are recommended to be conducted during the plan implementation period. These data and consideration of estimated costs and available funds for the urban practices are recommended to be evaluated to define the recommended final level of control. Such refinement would include further consideration of toxics reduction requirements.

The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous section, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

As of 1993, long-term monitoring has been carried out in the Milwaukee River watershed on a sustained basis by the U.S. Geological Survey at one station located on the Milwaukee River main stem and by the Milwaukee Metropolitan Sewerage District at nine stations located on the Milwaukee River main stem. Data from five of the Milwaukee Metropolitan Sewerage District sampling stations, as shown on Map VIII-6, were used to document current long-term water quality conditions in the watershed. Short-term monitoring has also been conducted at 13 sites by either the Department of Natural Resources or the U.S. Geological Survey during the period 1988 through 1993.

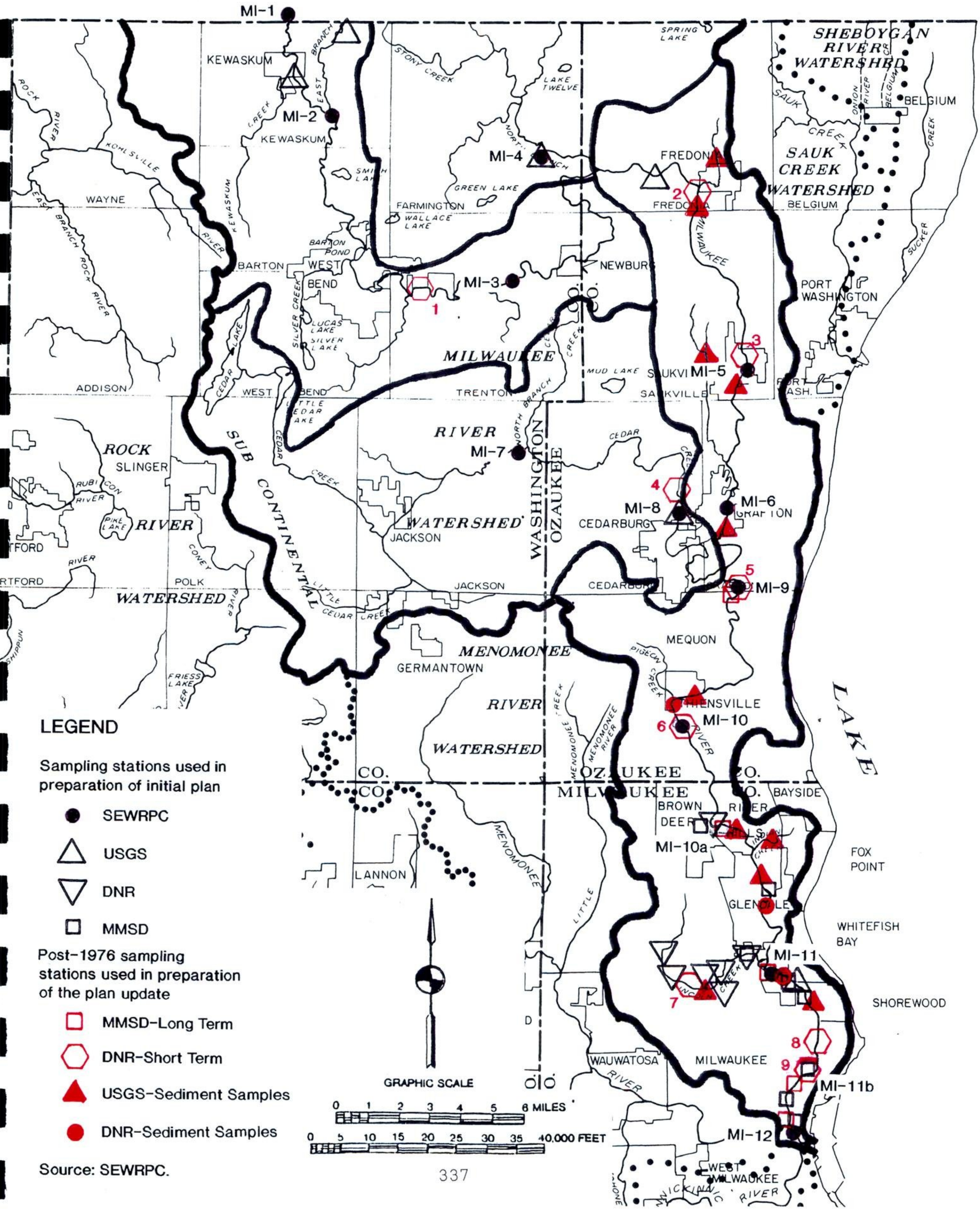
Currently, water quality monitoring is being carried out in several lakes as part of the DNR Self-help Monitoring Program, including Big Cedar Lake, Green Lake, Little Cedar Lake, Silver Lake (Washington County), and Wallace Lake. In addition, limited water quality monitoring has been carried out on the major lakes in the watershed by the U.S. Geological Survey, the Wisconsin Department of Natural Resources, and by local lake management agencies.

### Current Plan Recommendation

Continued water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the U.S. Geological Survey and the Milwaukee Metropolitan Sewerage District on the Milwaukee River on a continuing long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at Ml-4, Ml-5, Ml-6, and Ml-8, and at ten selected additional stations, with one station each on Silver, Kewaskum, Quaas, Stony, Wallace, Little Cedar, Indian, Pigeon, and Lincoln Creeks, and one on the Milwaukee River East Branch. During the same one-year period, it is recommended that biological monitoring be conducted on the stations which water quality data are collected by the Milwaukee Metropolitan Sewerage District. It is recommended that this program be conducted within the next five to seven years and repeated at five- to seven-year intervals. These recommendations can be coordinated with and are consistent with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five- to seven-year rotating cycle.

The lake monitoring program for each lake should consist, at a minimum, of one intensive monitoring effort to establish baseline conditions and of long-term participation in the DNR Self-help Monitoring Program that can be conducted by citizen-volunteer residents on the lakes. As noted earlier, several lakes already participate in this program. For each lake, it is recommended that the monitoring program should be expanded to establish current conditions during a

# Map VIII-6
## LOCATIONS OF WATER QUALITY AND SEDIMENT SAMPLING SITES IN THE MILWAUKEE RIVER WATERSHED




Source: SEWRPC.

two-year or more period of intensive monitoring followed by a continual long-term monitoring program designed to detect changes in water quality conditions. In this regard, the monitoring program should be tailored to provide data needed for preparation or updating of comprehensive lake management plans for the major lakes in the watershed. Such programs are being undertaken by the Department of Natural Resources on Big Cedar Lake in Washington County as part of the Long-Term Trends Program. The water quality sampling program should be carried out at spring turnover (April) and during June, July, and August during two subsequent years with samples collected weekly.

LAKES MANAGEMENT PLAN ELEMENT

Existing Condition and Status of Plan Implementation

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of the major lakes in the Milwaukee River watershed and for consideration of other lake management measures. Institutional recommendations were also made for the formation of new special purpose units of government where none exist to carry out the plan implementation measures. For each major lake in the Milwaukee River watershed, the initial plan recommended that a comprehensive lake management plan be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. As noted in the previous sections, the preparation of such a comprehensive plan requires supporting water quality monitoring programs to be established.

The status of lake management, protection, and rehabilitation efforts on and around the major lakes in the Milwaukee River watershed is discussed for each major lake in the following paragraphs:

Barton Pond: Barton Pond is located within the East and West Branches of the Milwaukee River Priority watershed planning area. The urban development around the pond is within the City of West Bend sewer service area and is provided with a public sanitary sewer system. Water quality assessments of this pond have not been made. Enrollment of this waterbody in the DNR Self-help Monitoring Program is recommended.

Big Cedar Lake: Big Cedar Lake is located within the Cedar Creek priority watershed planning area. The lake is a DNR Long-term Trend Monitoring lake, and the Big Cedar Lake Protection and Rehabilitation District and Big Cedar Lake Sanitary District participate in the DNR Self-help Monitoring Program. An approved aquatic plant management plan has been prepared for this lake.[7]

Green Lake: Green Lake is located within the East and West Branch of the Milwaukee River priority watershed. The Green Lake Association participates in the DNR Self-help Monitoring Program.

Lac Du Cours: Lac Du Cours is located within the Milwaukee River South priority watershed planning area. No specific water quality data are available and no specific plan implementation activities have been documented on this lake as

[7]Aron & Associates, Big Cedar Lake Plant Management Plan, April 1993.

of 1993. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended.

Little Cedar Lake: Little Cedar Lake is located within the Cedar Creek priority watershed planning area. The Little Cedar Lake Protection District participates in the DNR Self-help Monitoring Program. Sewerage services are provided by the Little Cedar Lake Protection District.

Lucas Lake: Lucas Lake is located within the East and West Branch of the Milwaukee River priority watershed planning area. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended.

Mud Lake (Ozaukee County): Mud Lake is located within the Cedar Creek priority watershed. This lake has been assigned to the limited forage fish community and limited recreational use category due to its highly eutrophic character and shallow water depth in the initial plan but has been reassigned to the maintenance of warmwater sportfish and full recreational use as a result of detailed investigations carried out by the Wisconsin Department of Natural Resources during the Cedar Creek priority watershed project water resources appraisal process.[8]

Silver Lake (Washington County): Silver Lake is located within the current East and West Branch of the Milwaukee River Priority Watershed Program planning area. The Silver Lake District, Silver Lake Association, and the Silver Lake Sanitary District are participants in the DNR Self-help Monitoring Program. Jointly, these organizations have developed an aquatic plant management plan for the lake. The urban development around the lake is provided with a public sanitary sewer system.

Smith Lake: Smith Lake is located within the East and West Branch of the Milwaukee River priority watershed planning area. It is recommended that Smith Lake enroll in the DNR Self-help Monitoring Program.

Spring Lake: Spring Lake is located within the North Branch Milwaukee River priority watershed planning area. It is recommended that Spring Lake enroll in the DNR Self-help Monitoring Program.

Lake Twelve: Lake Twelve is located within the North Branch Milwaukee River priority watershed planning area. It is recommended that Lake Twelve enroll in the DNR Self-help Monitoring Program.

Wallace Lake: Wallace Lake is located within the North Branch Milwaukee River priority watershed planning area and within the West Bend sanitary sewer service area. The Wallace Lake Sanitary District provides sewerage services to the lakeshore area and conducts regular monitoring of the lake as a participant in the DNR Self-help Monitoring Program.

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[8]Wisconsin Department of Natural Resources Publication No. WR-336-93, Nonpoint Source Control Plan for the Cedar Creek Priority Watershed Project, August 1993.

## Current Plan Recommendations

Management measures recommended and in-lake measures which are considered potentially applicable and should be considered in more detail are shown in Table VIII-13 for the twelve major lakes in the Milwaukee River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality, biological conditions, and water budget monitoring programs are reaffirmed in the updated plan recommendations for the Milwaukee River watershed. The management recommendations for the lakes are based upon review of the lake planning set forth in the initial plan and the current status of implementation of the recommendations, as well as any subsequent local planning.

It is recognized that the preparation of comprehensive lake management plans may need to be conducted in a staged manner in order to best utilize available resources. In this regard, the water quality monitoring, aquatic plant management, and watershed protection measure planning and implementation are considered to be logical components of the comprehensive plans which can be conducted under separate planning programs, if designed to be integrated into a comprehensive lake management plan.

In addition to the recommendations noted for the major lakes in the Milwaukee River watershed, it is recommended that water quality planning and supporting monitoring be conducted for those lakes and similar water bodies in the watershed which are less than 50 acres in size, where such activities are deemed to be important for water quality protection. In such cases, management techniques similar to those recommended to be applicable for consideration on the major lakes in the watershed can be considered for lake management purposes.

# WATER QUALITY AND BIOLOGICAL CONDITIONS

## Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; the 1976 Commission monitoring program conducted under the regional water quality management planning effort; in addition to the U.S. Geological Survey (USGS), the Wisconsin Department of Natural Resources and the Milwaukee Metropolitan Sewerage District sampling programs. Available data collected in those programs for the Milwaukee River watershed included samplings at twelve Commission stations: nine on the Milwaukee River main stem and three on its tributaries; at seven DNR stations; at six USGS stations; and at eight Milwaukee Metropolitan Sewerage District stations. The sampling station locations are shown on Map VIII-6.

Long-term post-1976 water quality data have been collected by the Milwaukee Metropolitan Sewerage District for nine stations on the Milwaukee River. Water resource appraisal information, including biological condition and water quality data collected by the Wisconsin Department of Natural Resources for the Milwaukee River Nonpoint Source Priority Watershed Projects and the Milwaukee River

Table VIII-13

MANAGEMENT MEASURES TO BE CONSIDERED IN LOCAL MANAGEMENT PLANS FOR THE MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED: 1993[a]

| SUBWATERSHED Lake Name | Area (acres) | Water Quality Monitoring | Prepare Comprehensive Management Plan | Watershed-based Measures | | | | | | In-lake Management Measures | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Public Sanitary Sewer Service | Onsite Sewage System Mgmt | Rural NPS Mgmt | Urban NPS Mgmt | Construction Site NPS Mgmt | Livestock Mgmt | Macrophyte Harvest | Aeration | Nutrient Inactivation | Dredge | Sediment Cover | Water Level Mgmt | Fish Mgmt |
| CEDAR CREEK | | | | | | | | | | | | | | | | |
| Big Cedar Lake | 932 | o | + | - | + | o | o | o | + | o | - | + | - | - | - | + |
| Little Cedar Lake | 246 | o | + | - | + | o | o | o | + | - | - | + | + | + | - | + |
| Mud Lake (Ozaukee Co.) | 245 | + | + | - | - | o | - | - | + | - | - | - | - | - | - | - |
| MILWAUKEE RIVER-EAST/WEST | | | | | | | | | | | | | | | | |
| Barton Pond | 67 | + | + | o | - | o | o | o | - | - | - | - | + | + | - | + |
| Lucas Lake | 78 | + | + | - | + | o | o | o | - | + | - | + | + | + | - | + |
| Silver Lake (Washington) | 118 | o | + | o | - | o | o | o | - | o | - | + | - | + | - | + |
| Smith Lake | 86 | + | + | - | + | o | o | - | + | + | - | + | + | + | - | + |
| MILWAUKEE RIVER-NORTH | | | | | | | | | | | | | | | | |
| Green Lake (Washington) | 71 | o | + | - | + | o | o | - | - | - | - | + | - | + | - | + |
| Spring Lake (Ozaukee) | 66 | + | + | - | + | o | o | o | - | - | - | + | + | + | - | + |
| Lake Twelve | 53 | + | + | - | + | o | o | o | - | - | - | + | + | + | - | + |
| Wallace Lake | 52 | o | + | o | - | o | o | - | - | + | - | + | + | + | - | + |
| MILWAUKEE RIVER-SOUTH | | | | | | | | | | | | | | | | |
| Lac du Cours | 56 | + | + | o | - | o | o | - | - | - | - | - | - | - | - | + |

NOTE: o = on-going management measures; + = management measures proposed or recommended for further consideration; - = management measures not specifically recommended for further consideration

[a] Management measures recommended for further consideration in local management plan are summarizd from those adopted in SEWRPC Planning Report No. 30, modified as necessary as the results of subsequent implementation actions, monitoring programs, and planning studies.

Source: SEWRPC.

Basin Integrated Resource Management Plans,[9] were also available for use in the assessment of current water quality conditions. Water quality data have also been collected on a short-term basis at 13 locations in the Milwaukee River watershed. Data collected at nine sites from 1988 through 1993, along with long-term data from five Milwaukee Metropolitan Sewerage District stations, as shown on Map VIII-6, were used to assess current water quality conditions as discussed in the next section and, where appropriate, to make a generalized comparison to historic conditions.

In addition to the data obtained since preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Milwaukee River watershed.

Long-term water quality data collected by the Milwaukee Metropolitan Sewerage District at five sampling stations on the main stem of the Milwaukee River--Ml-9, at Pioneer Road; Ml-10a, at Brown Deer Road; Ml-11, at Port Washington Road; Ml-11b, at Walnut Street; and Ml-12, at the Chicago and North Western railway near the confluence of the Milwaukee and Menomonee Rivers--are summarized in Figures VIII-1 through VIII-5. The short-term data collected by the U.S. Geological Survey and the Wisconsin Department of Natural Resources during the period 1988 through 1993 are summarized in Figures VIII-6 through VIII-9 and in Table VIII-14. The water quality standards indicated in Figures VIII-1 through VIII-9 and in Table VIII-14 are those set forth for specific biological and recreational use objectives as described in Chapter II.

Review of those data for stations Ml-9, 10a, 11, and 11b, indicates that following 1980, there appears to be improvements in water quality conditions as evidenced by reduced variabilities and, in some cases, reduced concentrations in BOD, volatile suspended solids, un-ionized ammonia nitrogen, fecal coliform, and nitrate. Improvements were also noted at stations Ml-11a and Ml-11b, with reduced levels of chlorophyll-a. These improvements may be attributed, in part, to the completion, after 1980, of plant upgradings for the Cities of Cedarburg and West Bend and Villages of Grafton, Fredonia, and Saukville; to the abandonments of the Village of Thiensville sewage treatment plant in 1984; to the reduction in the frequency of sanitary sewer flow bypassing due to the increased conveyance facilities installed under the Milwaukee Metropolitan Sewerage District water pollution abatement program; and to other sewer system rehabilitation actions. Water quality improvements may additionally be attributed, in part, to the reduction in pollutant loadings from industrial point sources and to the limited implementation of nonpoint source pollution abatement programs within the watershed as part of the Milwaukee River priority watershed program. Temperature, dissolved oxygen, and pH levels remained variable with no apparent

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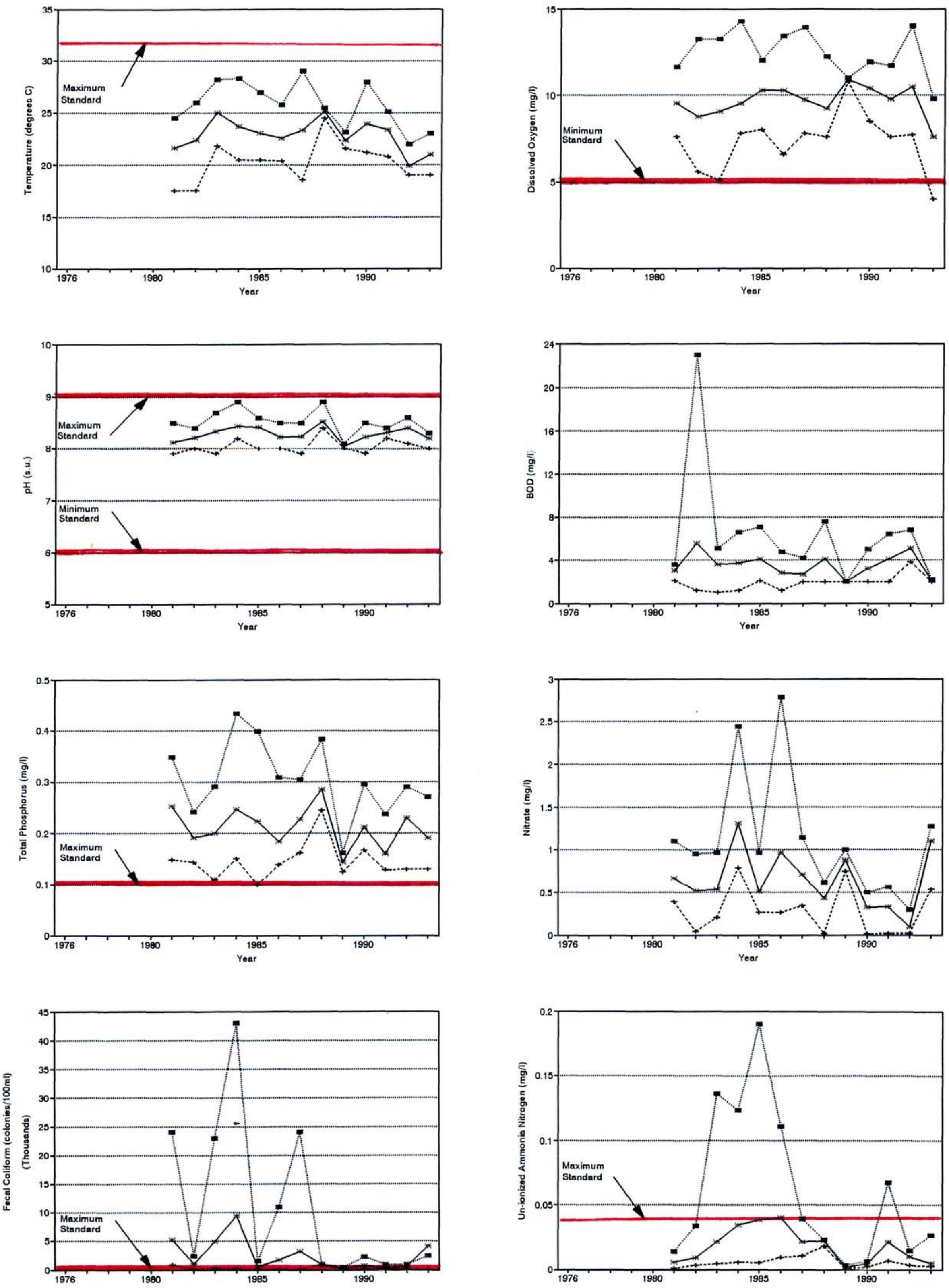
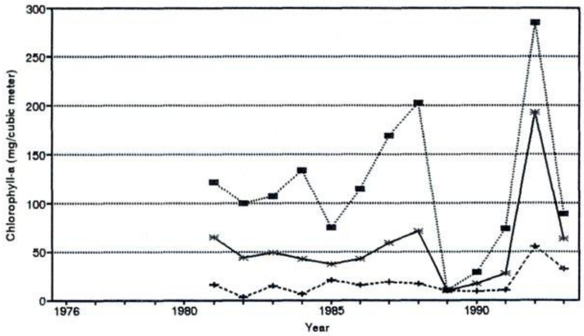
[9]Wisconsin Department of Natural Resources. "Milwaukee River Basin Integrated Management Plans-North Branch, 1990; South Branch, 1992."

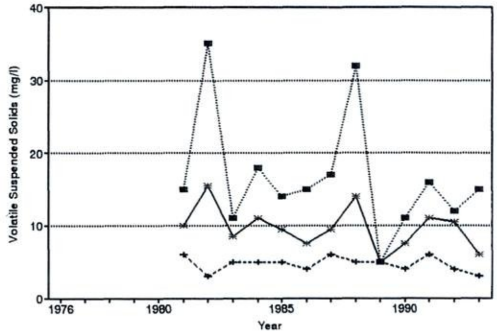
# Figure VIII-1
## WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-9: 1976-1993

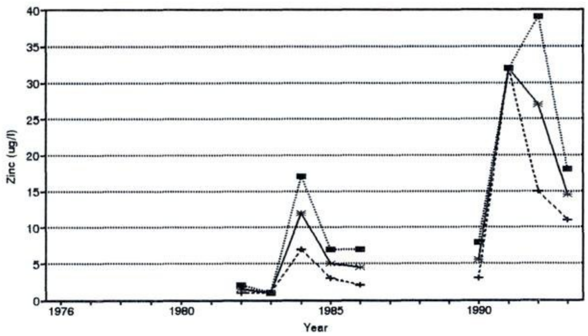



Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

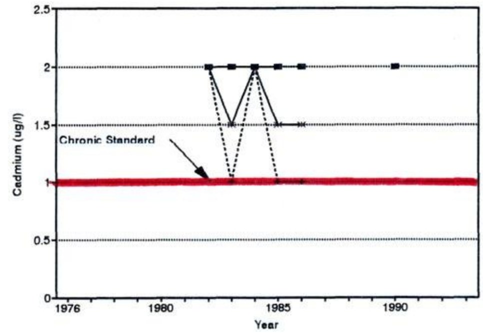
# Figure VIII-1 (cont'd)



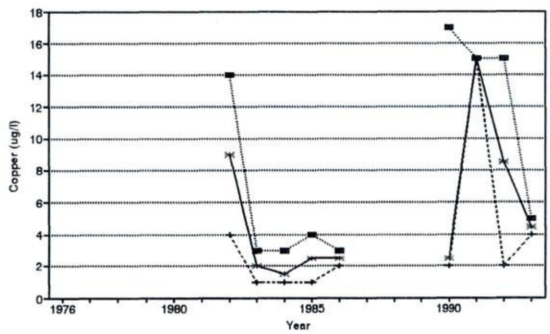



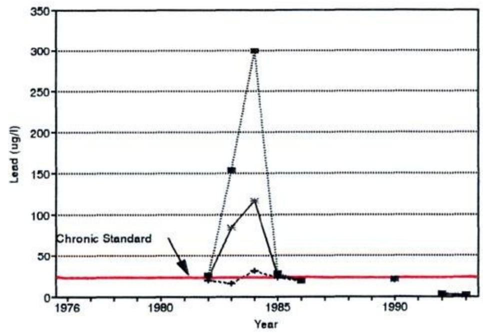

Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of of 89.2 ug/l was not violated in any year.



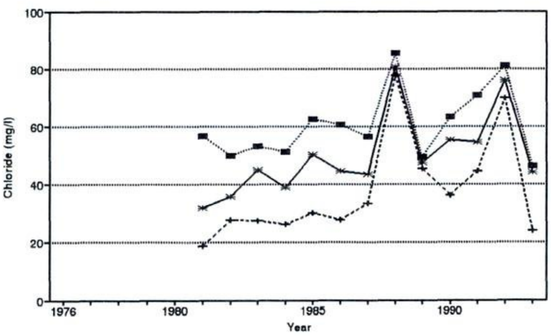

Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.



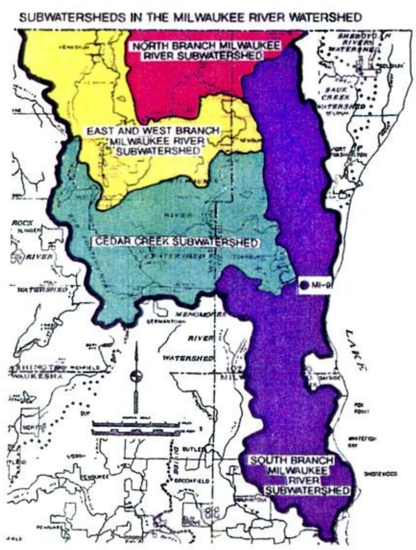

Note: The maximum standard of 1000 mg/l was not violated in any year.

## LEGEND

**MAXIMUM VALUE**

**MINIMUM VALUE**

**AVERAGE VALUE**




Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

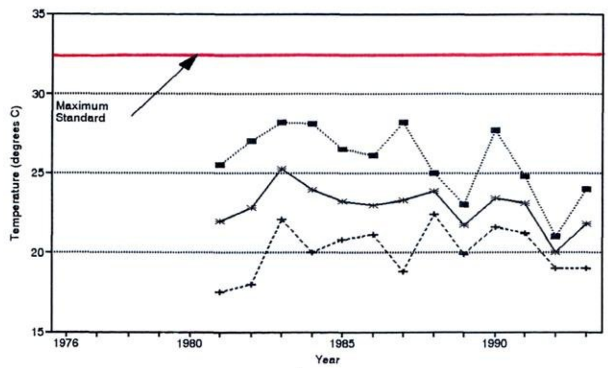


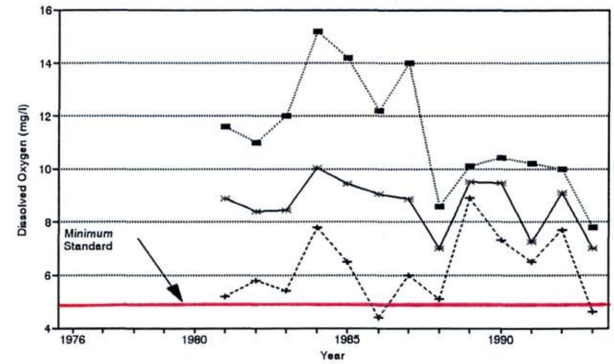
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

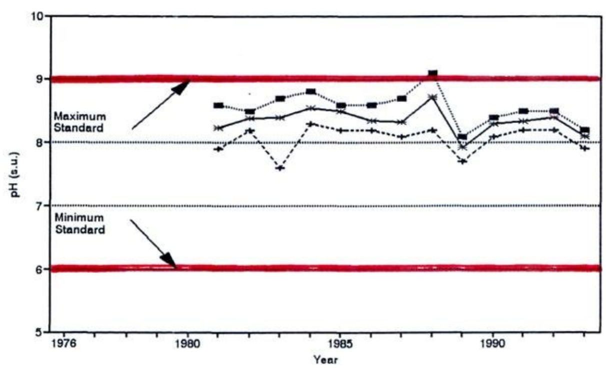
Figure VIII-2

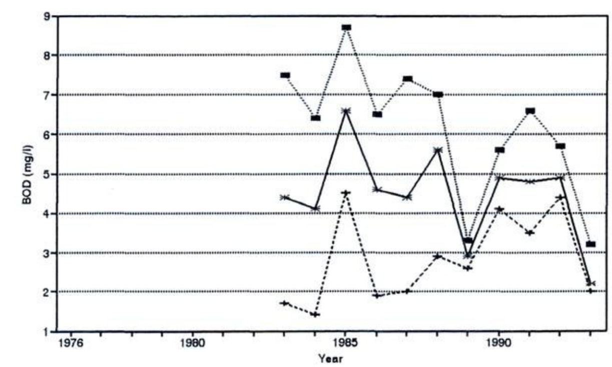
WATER QUALITY DATA FOR THE MILWAUKEE RIVER

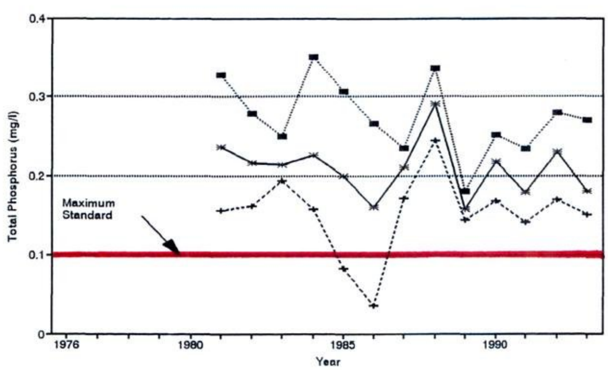
AT STATION MI-10a: 1976-1993

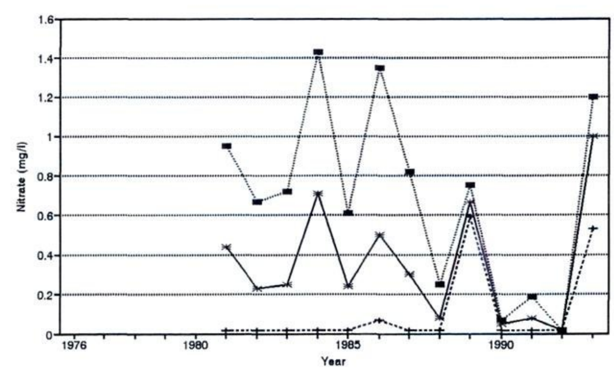


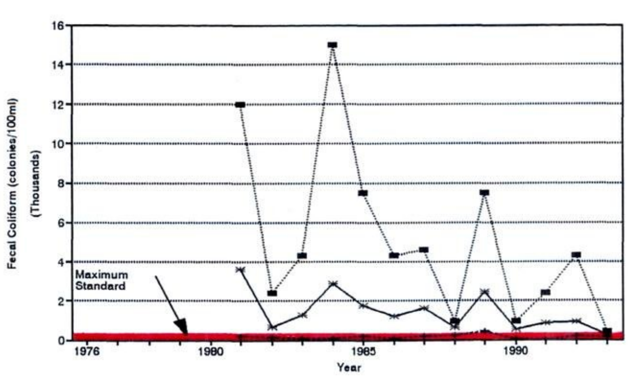



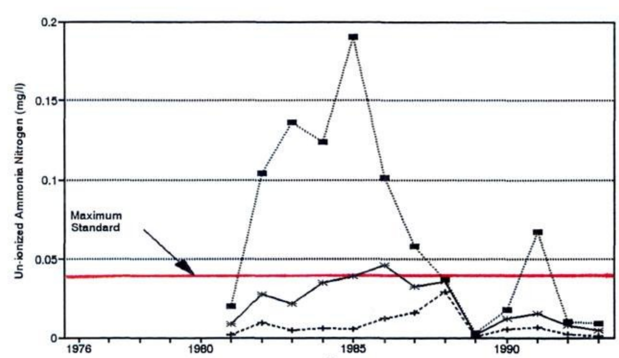



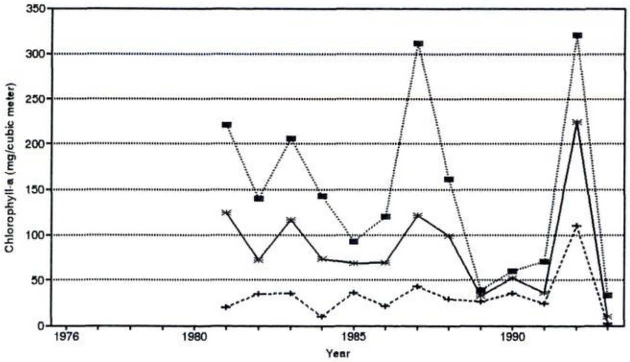

Note: The maximum standard of 0.1 mg/l was violated in all years.

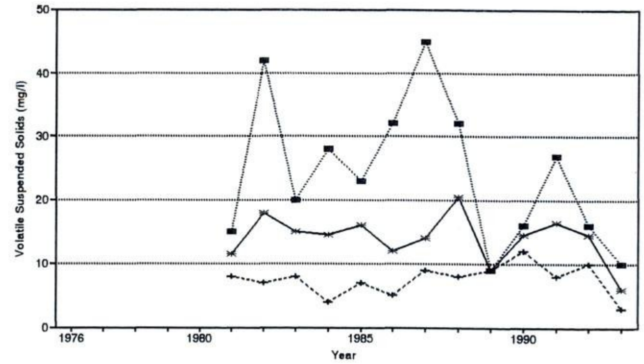


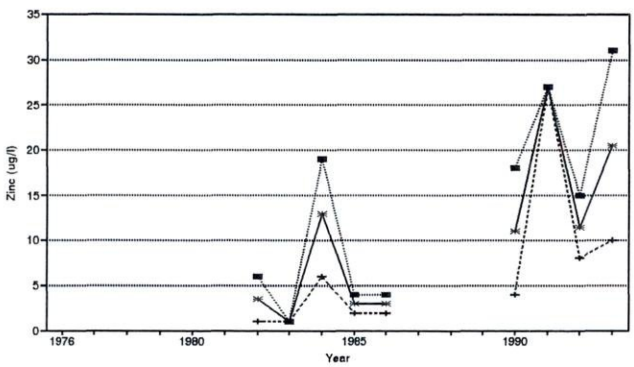




Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

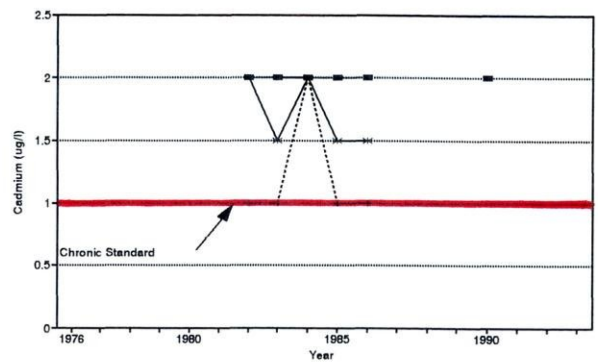
## Figure VIII-2 (cont'd)



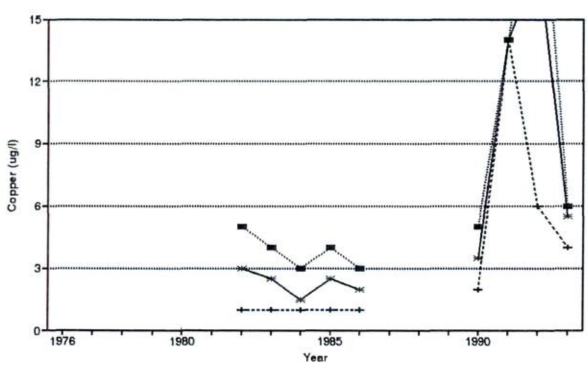



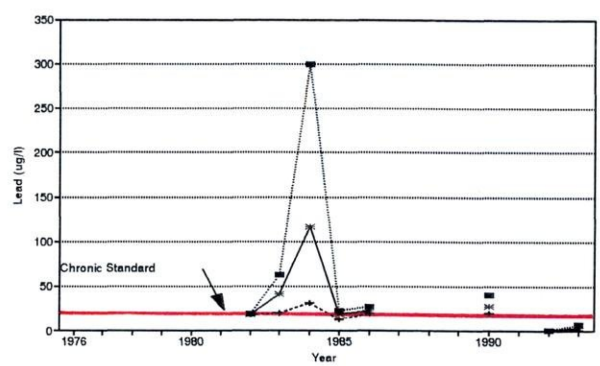

Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of of 89.2 ug/l was not violated in any year.



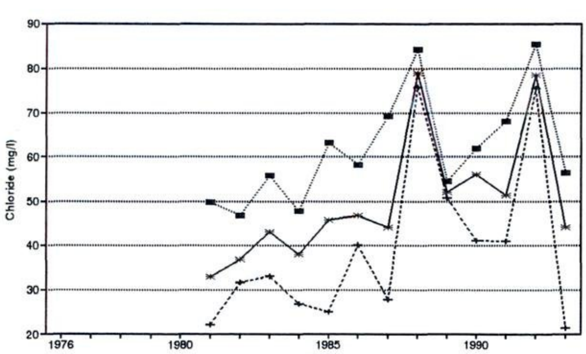

Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.



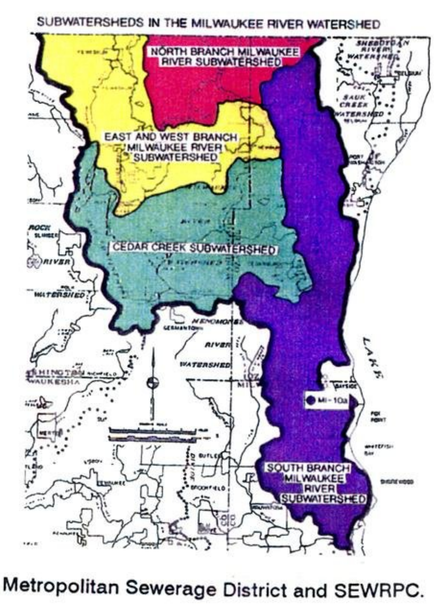

Note: The maximum standard of 1000 mg/l was not violated in any year.

**LEGEND**

**MAXIMUM VALUE**

**MINIMUM VALUE**

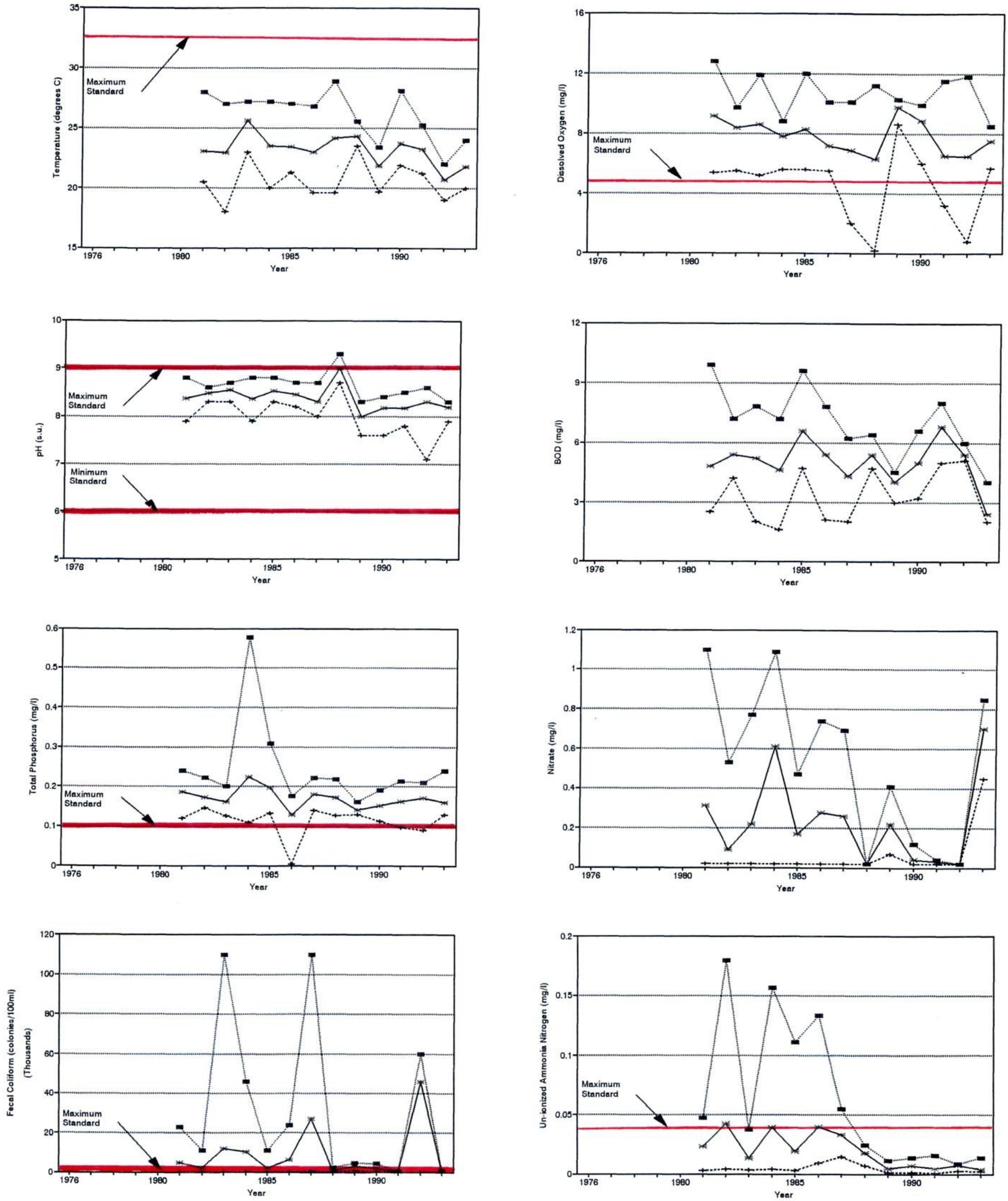
**AVERAGE VALUE**




Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

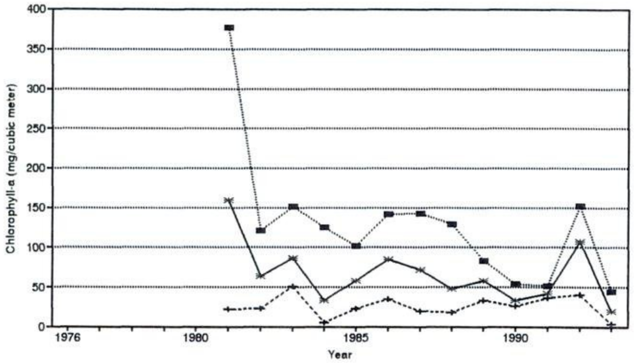
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

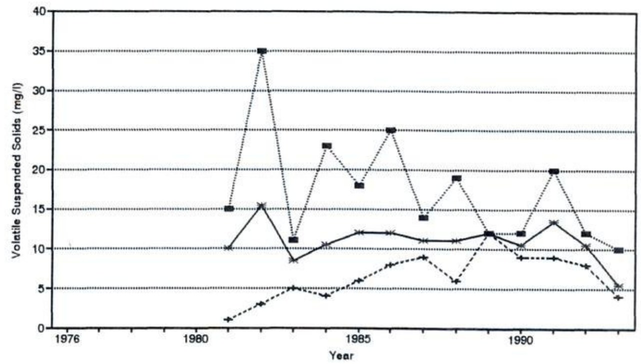
## Figure VIII-3
## WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-11: 1976-1993

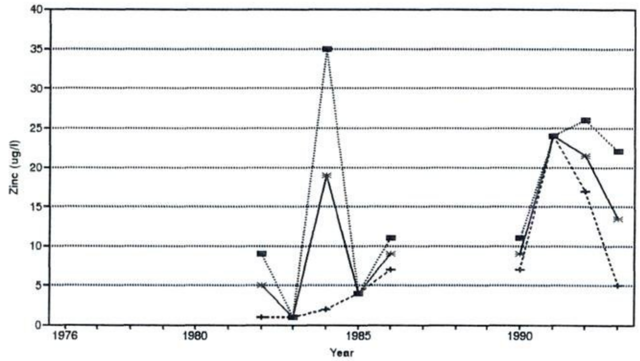



Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

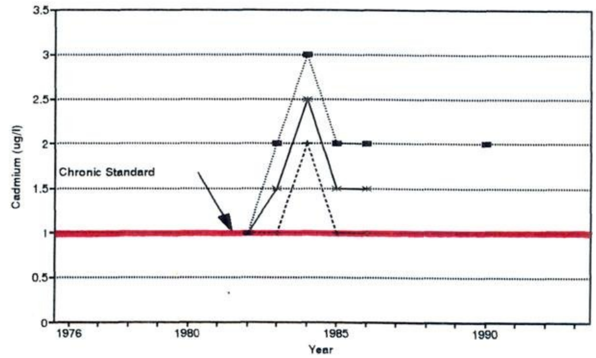
# Figure VIII-3 (cont'd)



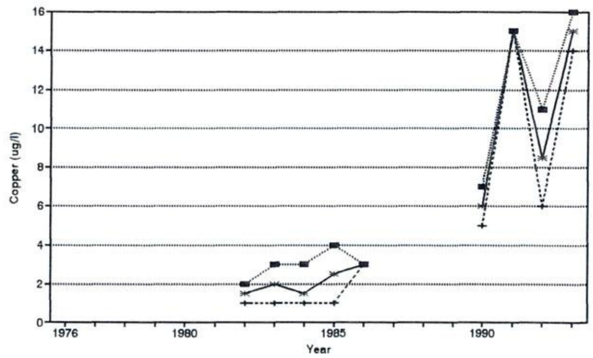



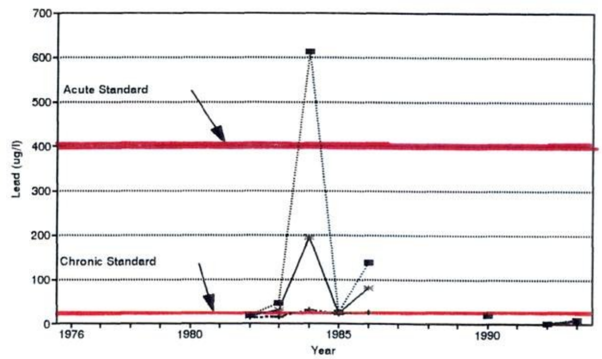

Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of of 89.2 ug/l was not violated in any year.

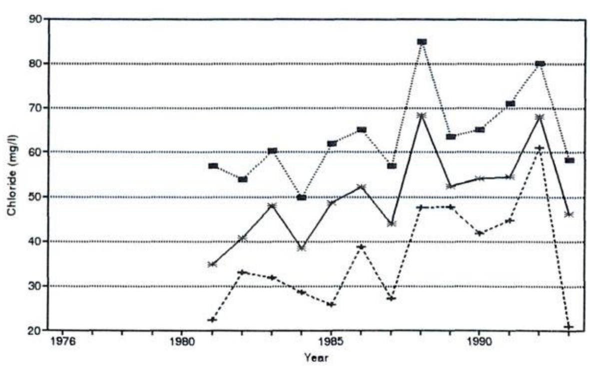



Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

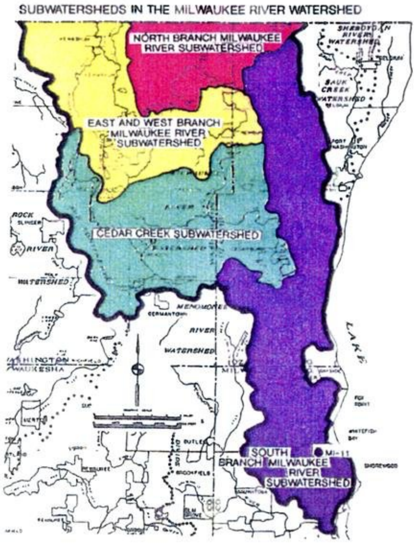
## LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

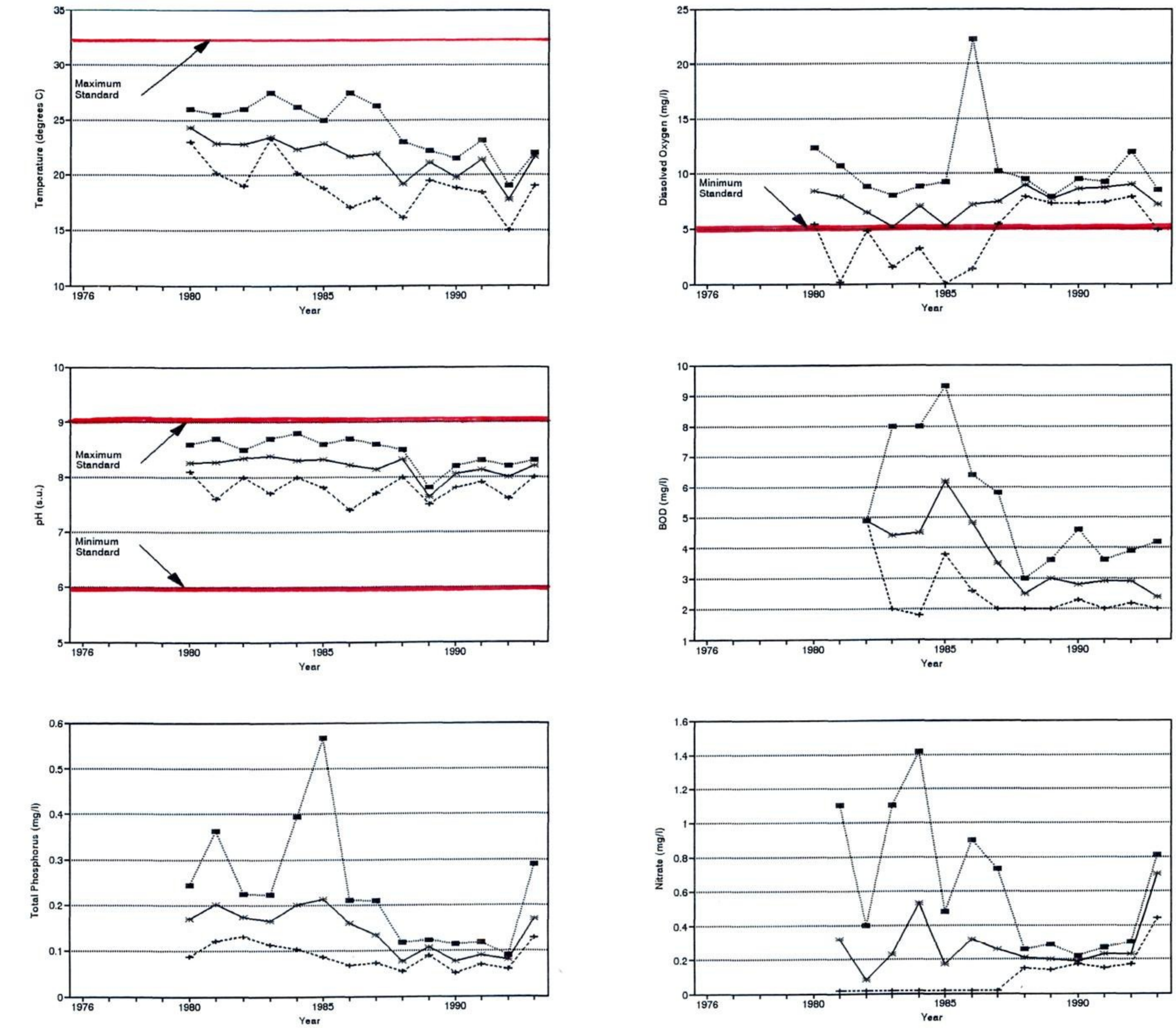
SUBWATERSHEDS IN THE MILWAUKEE RIVER WATERSHED



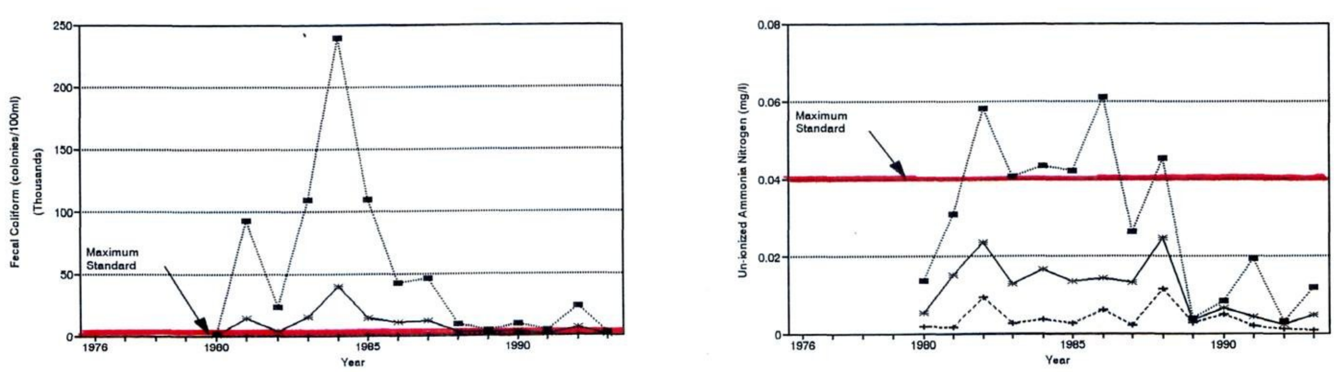

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

# Figure VIII-4
## WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-11b: 1976-1993

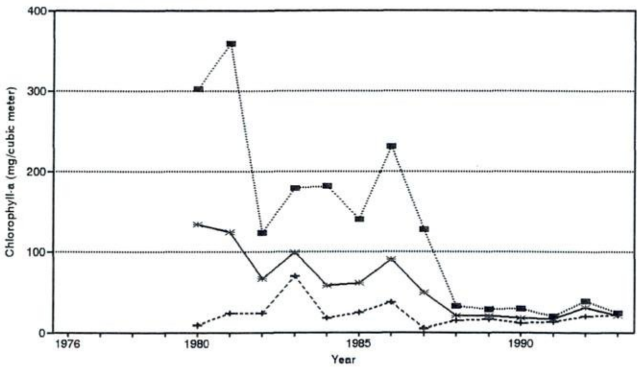


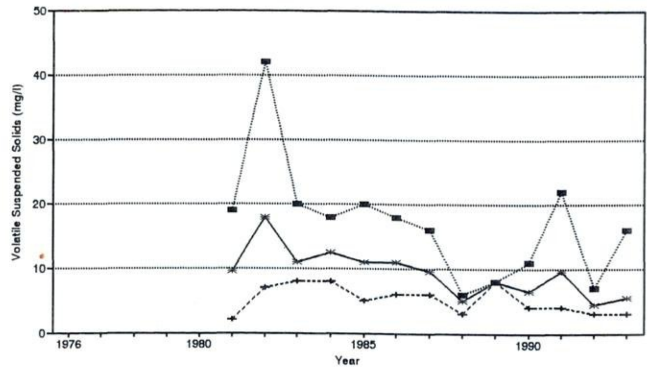

Note: No standard has been established for surface waters classified as limited recreational use.

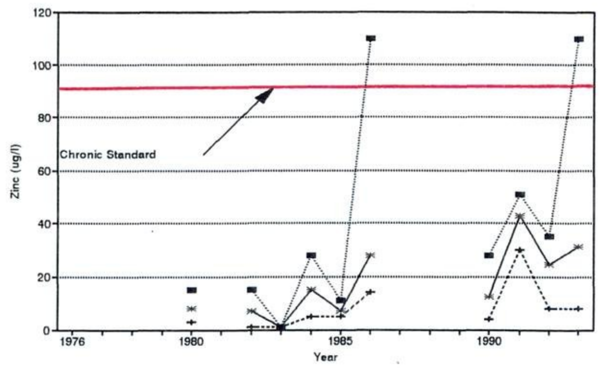



Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

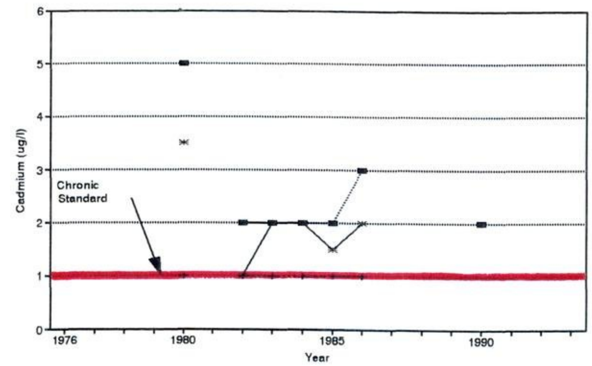
# Figure VIII-4 (cont'd)



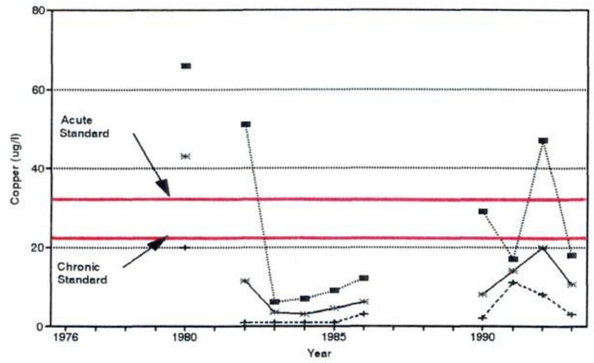



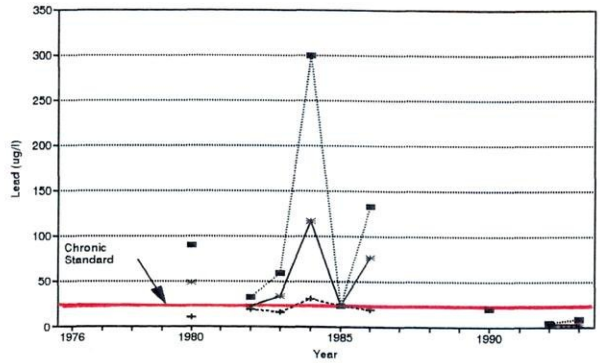




Note: The acute standard of 202.9 ug/l was not violated in any year.

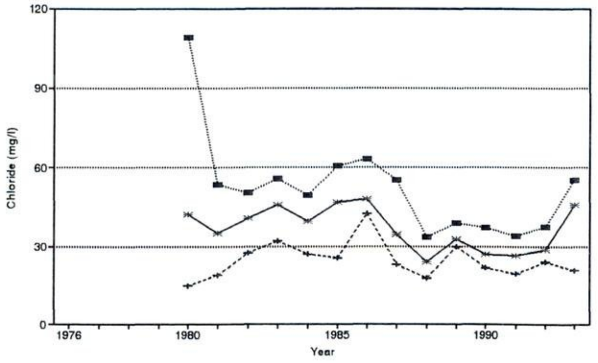



Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.



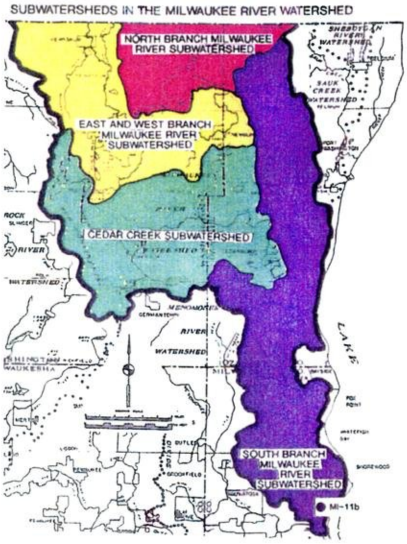

Note: The maximum standard of 1000 mg/l was not violated in any year.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE



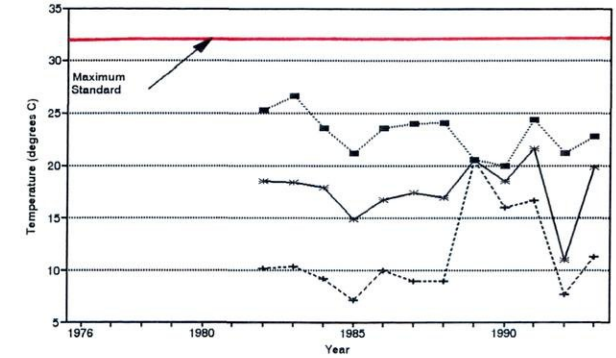

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

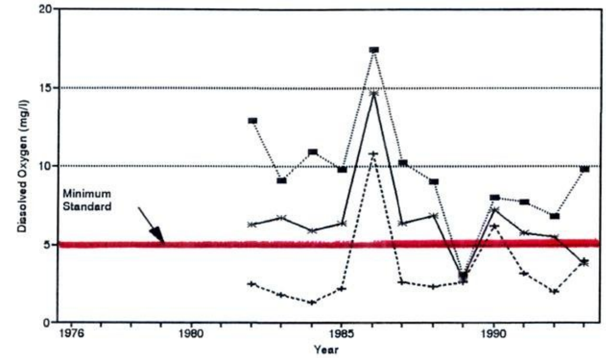
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

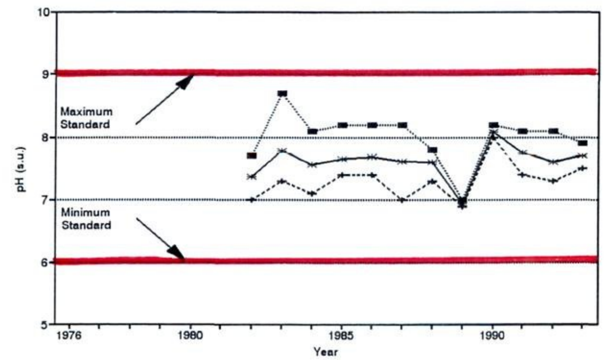
Figure VIII-5

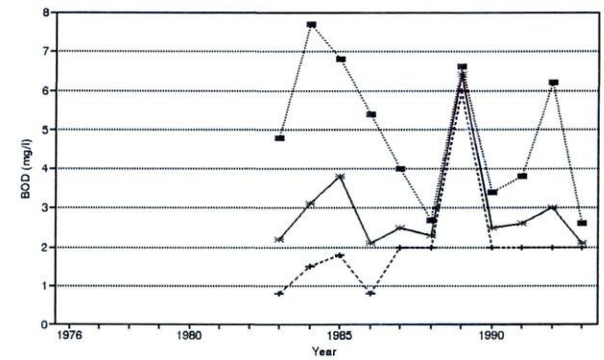
WATER QUALITY DATA FOR THE MILWAUKEE RIVER

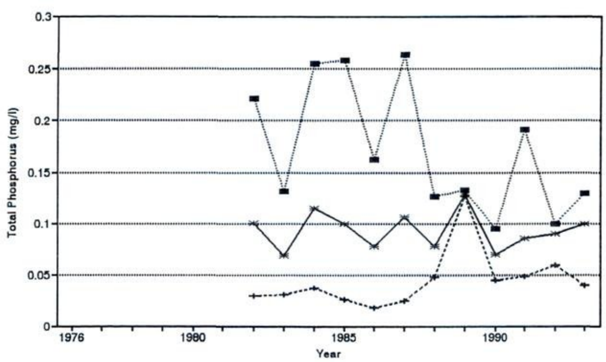
AT STATION MI-12: 1976-1993

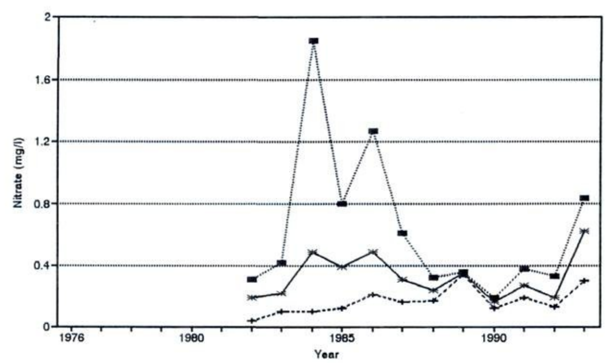


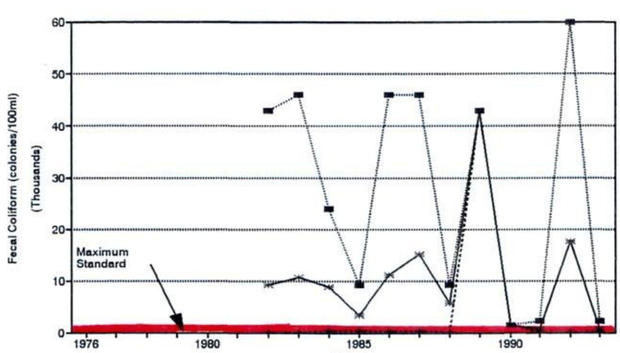



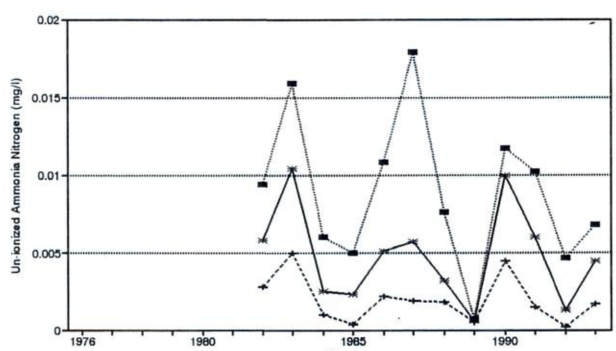




Note: No standard has been established for surface waters classified as limited recreational use.

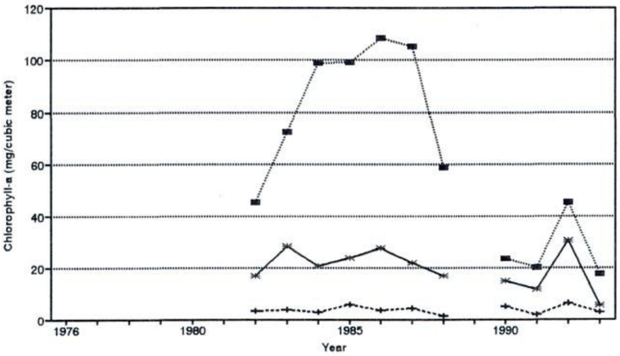


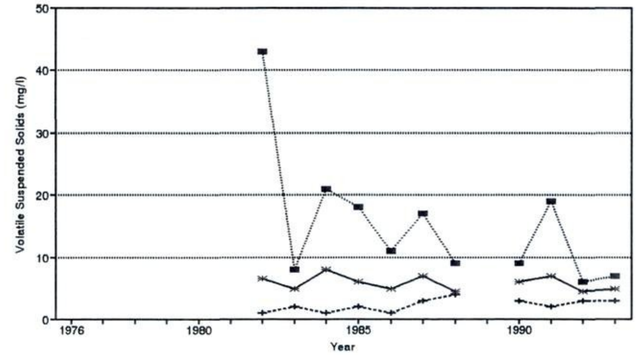

Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

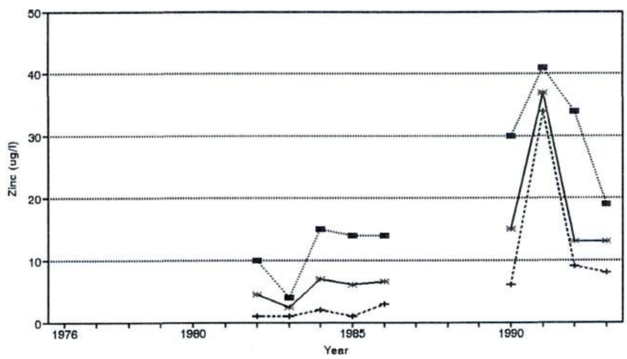



Note: The maximum standard of 0.04 mg/l was not violated in any year.

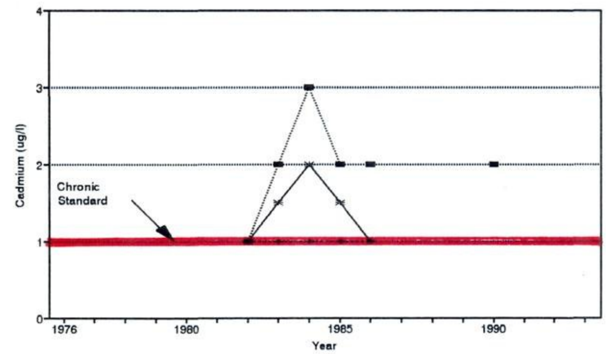
# Figure VIII-5 (cont'd)



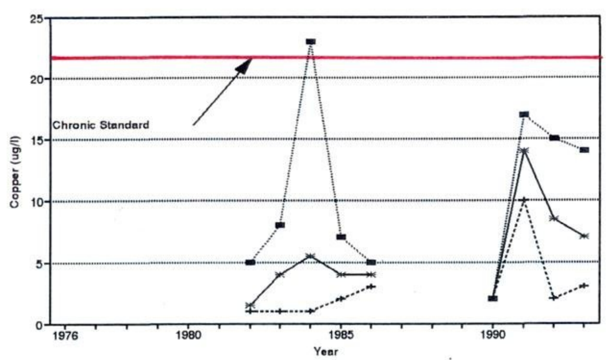



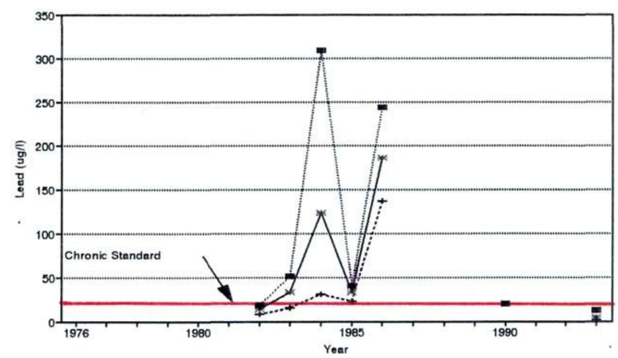

Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



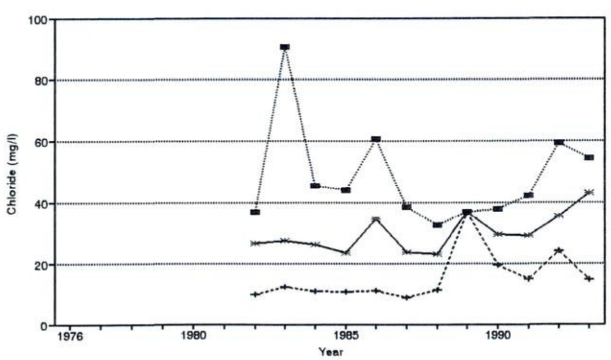

Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

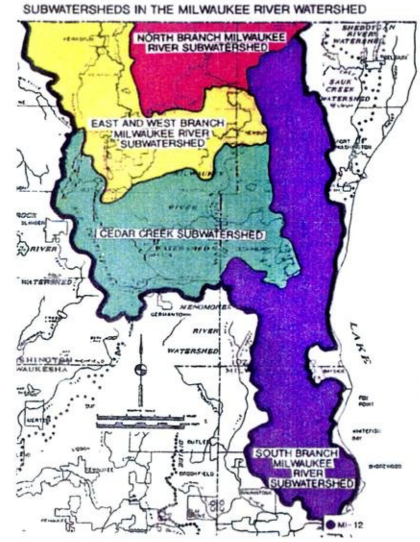
**LEGEND**

**MAXIMUM VALUE**

**MINIMUM VALUE**

**AVERAGE VALUE**

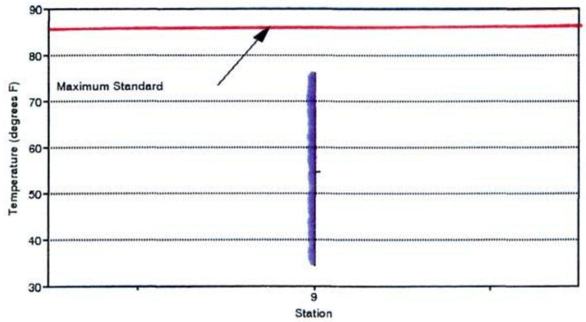
SUBWATERSHEDS IN THE MILWAUKEE RIVER WATERSHED



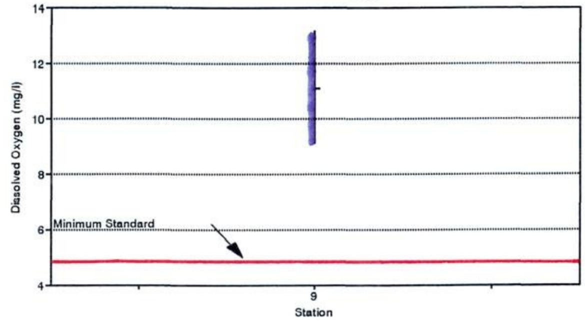

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

# Figure VIII-6
## Milwaukee River Watershed Short-Term Water Quality Sampling Data: 1990

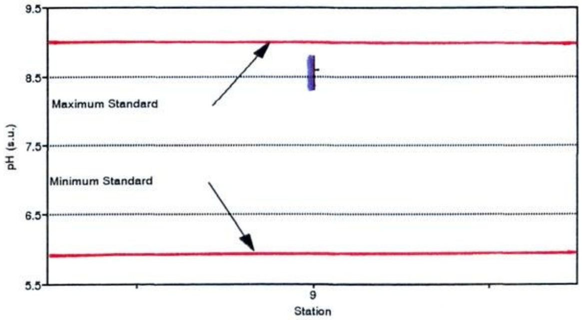
Temperature



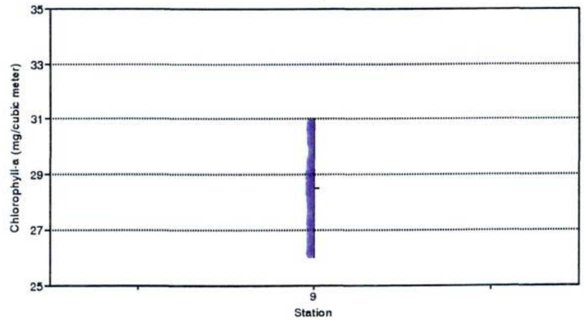

Dissolved Oxygen



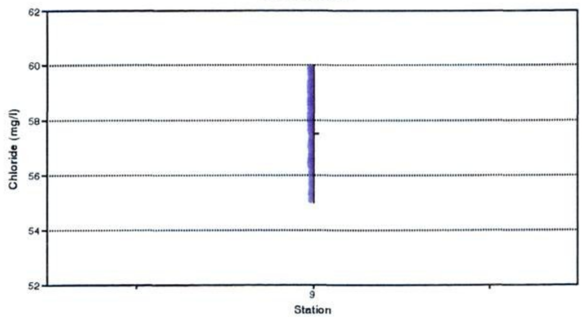

pH



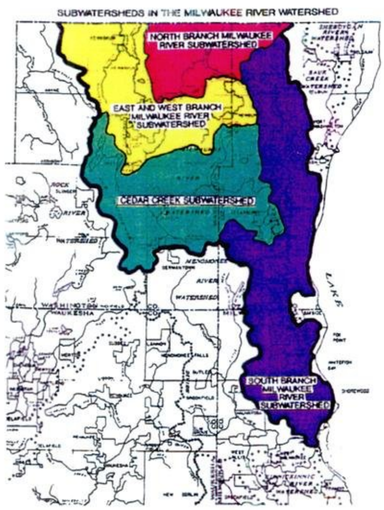

Chlorophyll-a




Chloride




Note: The maximum standard of 1000 mg/l was not violated in any sample.




LEGEND

Maximum

Average

Minimum

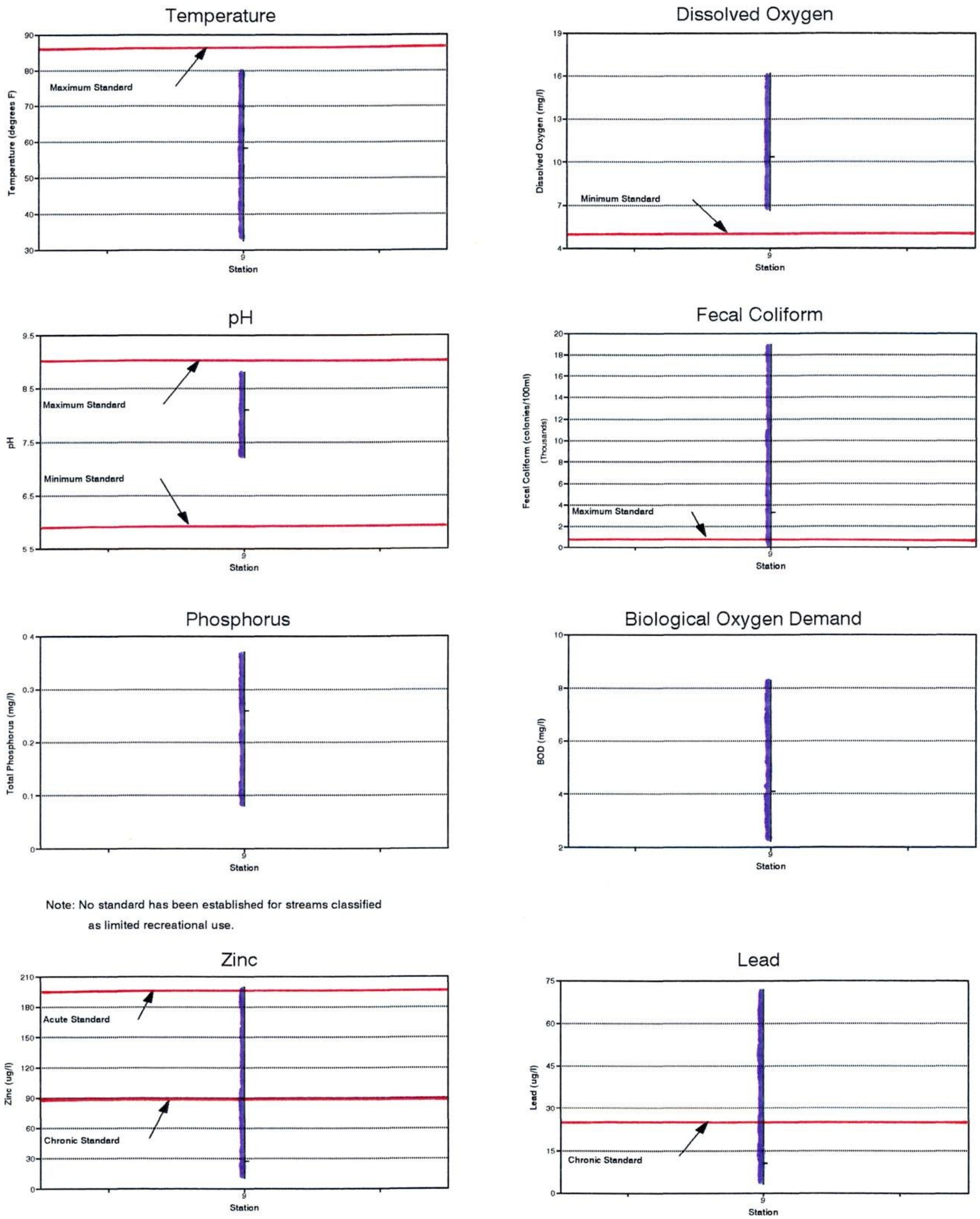
Milwaukee River Subwatershed Designation

- East and West Branches
- North Branch
- Cedar Creek
- South Branch

Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classification and water quality criteria. Refer to Table VIII-14 for summarized water quality data.

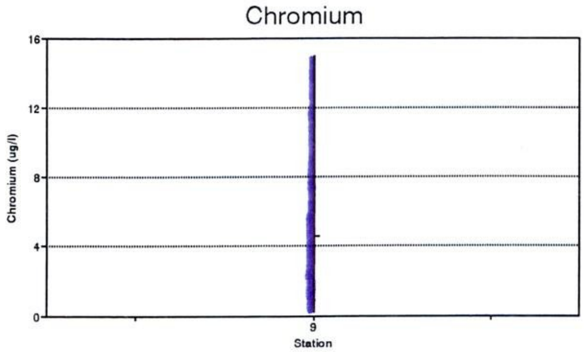
Source: Wisconsin Department of Natural Resources and SEWRPC.

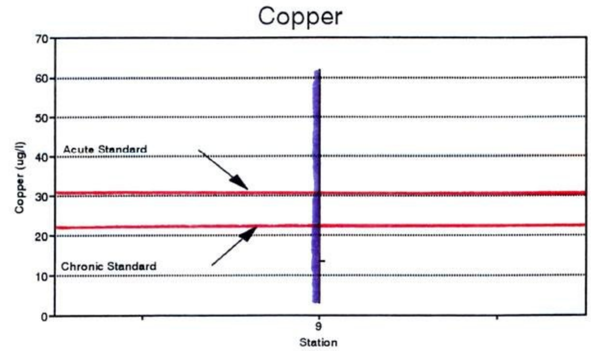
# Figure VIII-7
## Milwaukee River Watershed Short-Term Water Quality Sampling Data: 1991

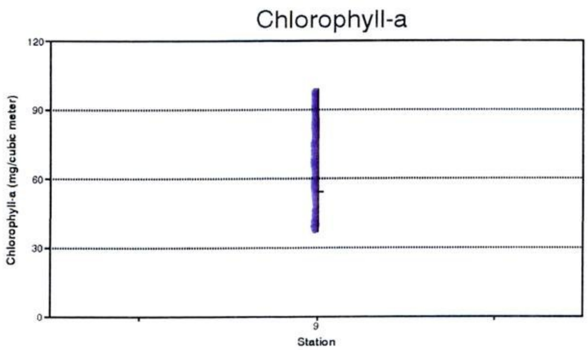


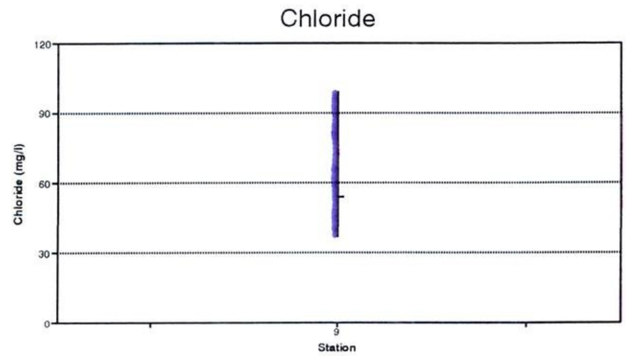

Note: The acute standard of 408.6 ug/l was not violated in any sample.

## Figure VIII-7 (cont'd)

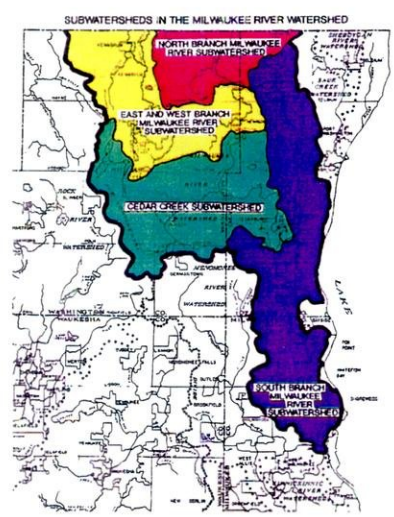


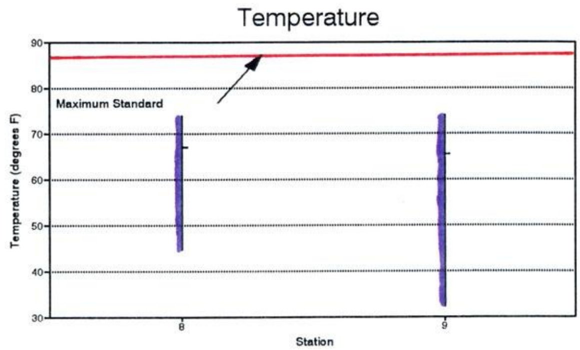


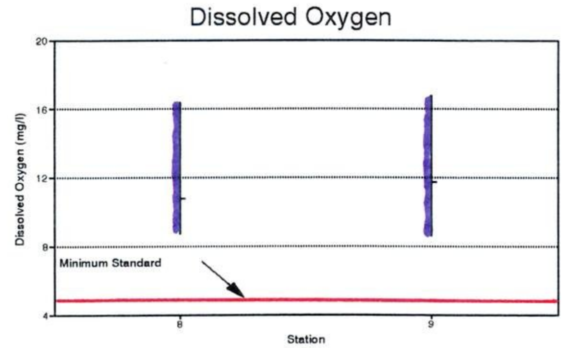


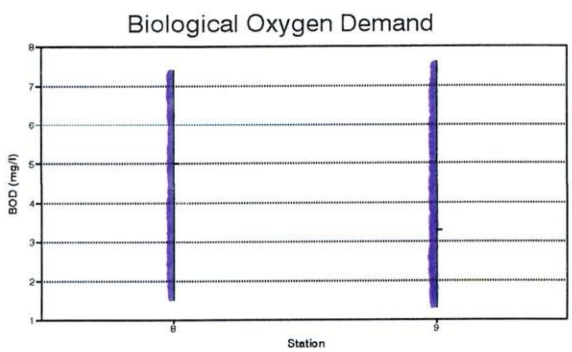

Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table VIII-14 for summarized water quality data.

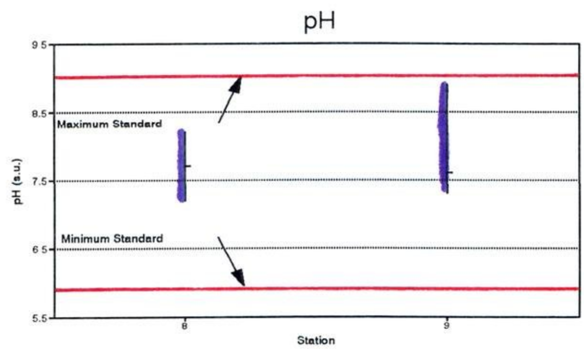
Source: Wisconsin Department of Natural Resources and SEWRPC.

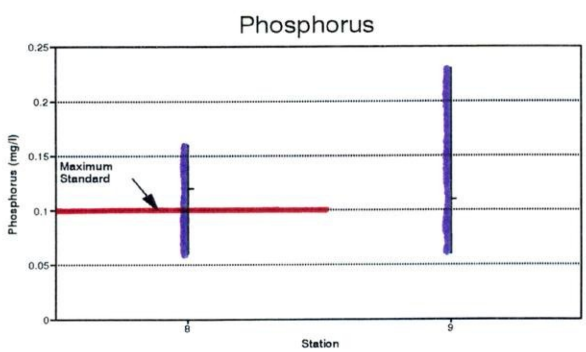
## Figure VIII-8
## Milwaukee River Watershed Short-Term Water Quality Sampling Data: 1992



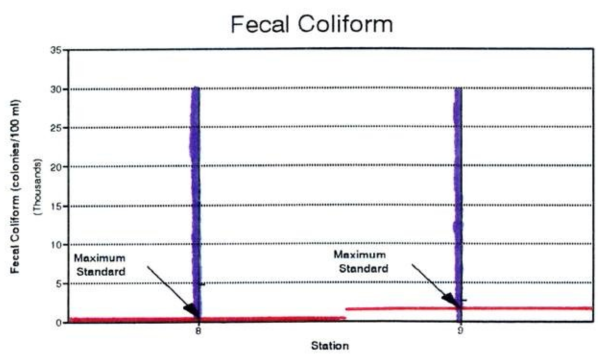



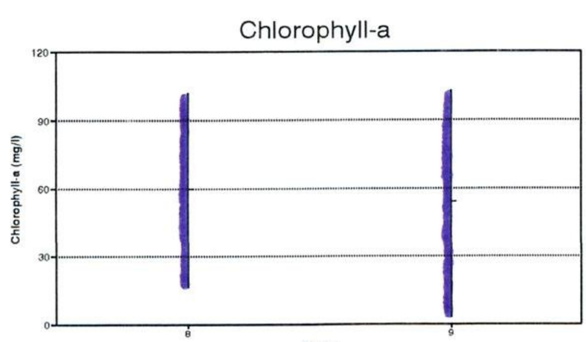



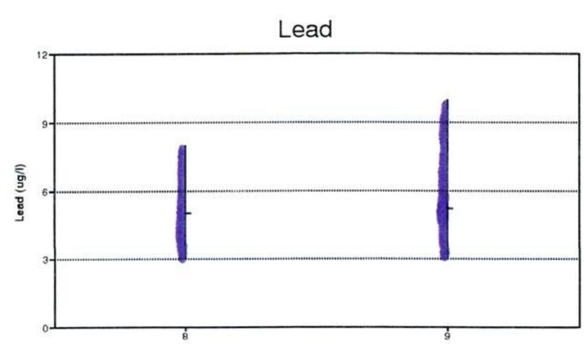




Note: No standard has been established for surface waters classified as limited recreational use.




Note: The maximum standard for station 8 of 200/400 colonies per 100 ml was violated in all samples.

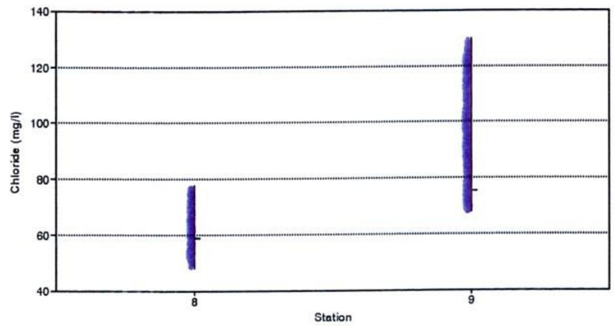



Note: The acute standard of 408.6 ug/l and the chronic standard of 24.4 ug/l was not violated in any sample.

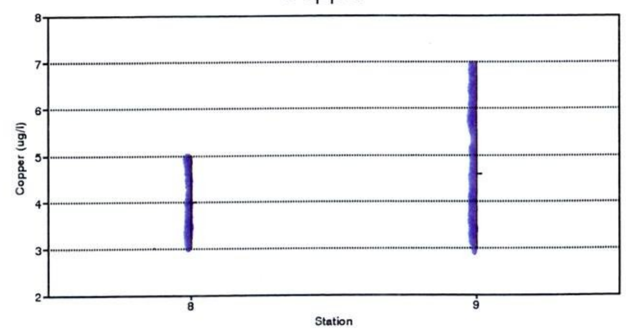
# Figure VIII-8 (cont'd)

## Chloride



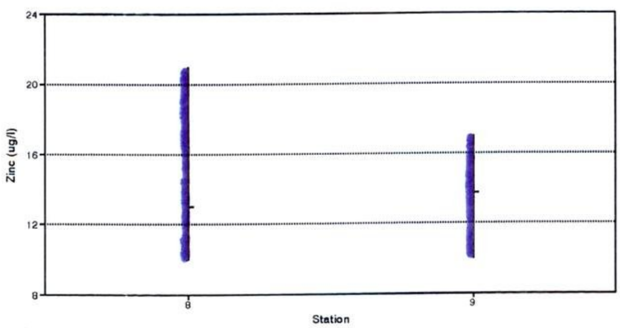

Note: The maximum standard of 1000 mg/l was not violated in any sample.

## Copper



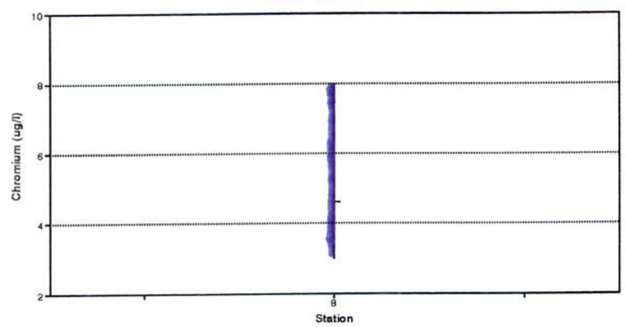

Note: The acute standard of 31.9 ug/l and the chronic standard of 22.1 ug/l were not violated in any sample.

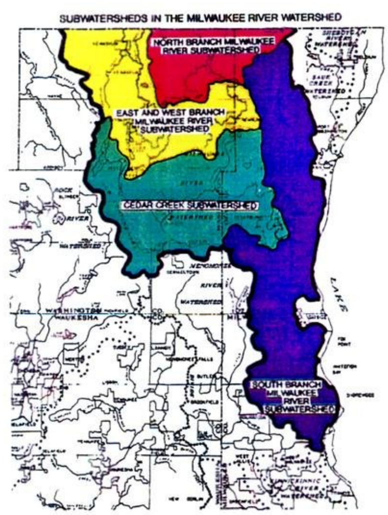
## Zinc




Note: The acute standard of 202.9 ug/l and the chronic standard of 89.2 ug/l were not violated in any sample.

## Chromium




LEGEND

Maximum

Average

Minimum

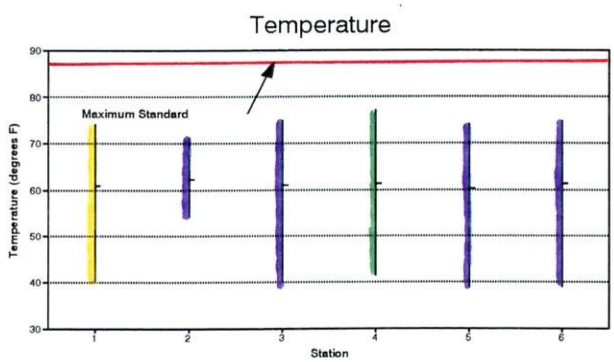
Milwaukee River Subwatershed Designation

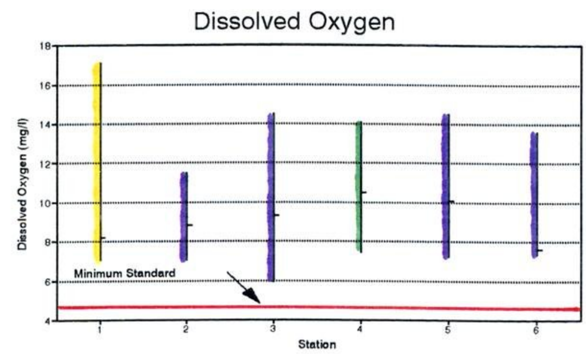
- East and West Branches
- North Branch
- Cedar Creek
- South Branch

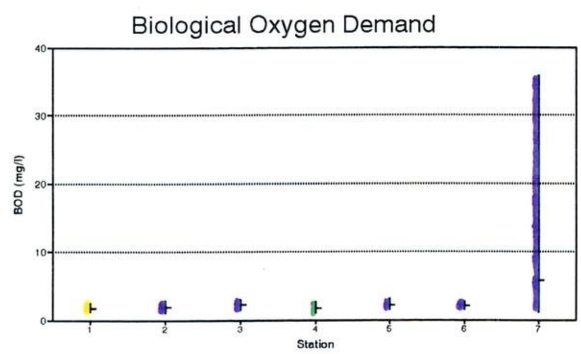
Standards indicated are those established for warmwater sport fish and full recreational use objectives, with the exception of station 9. Standards indicated for station 9 are those established for warmwater sportfish and limited recreational use. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classification and water quality criteria. Refer to Table VIII-14 for summarized water quality data.

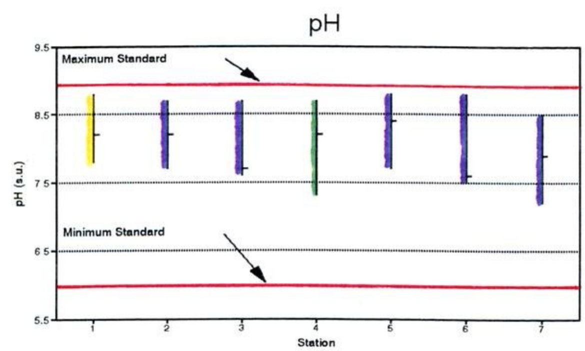
Source: Wisconsin Department of Natural Resources and SEWRPC.

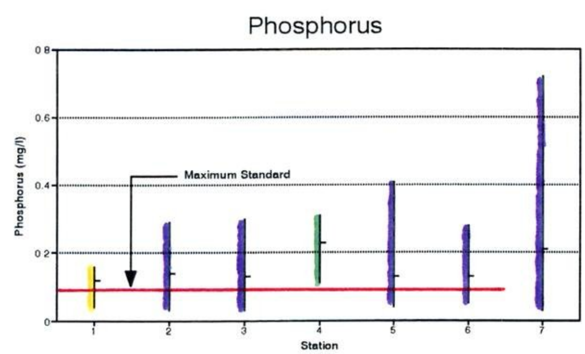
## Figure VIII-9
## Milwaukee River Watershed Short-Term Water Quality Data: 1993



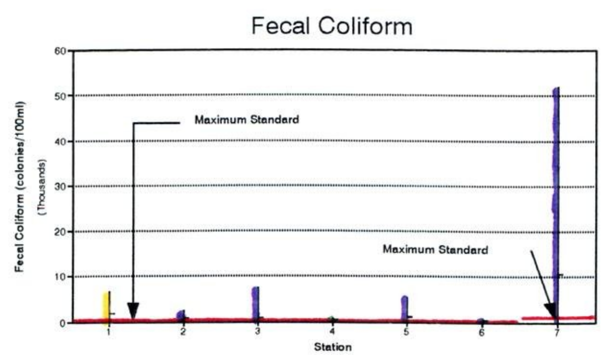



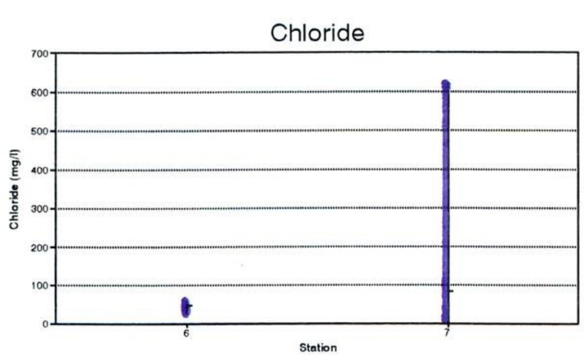



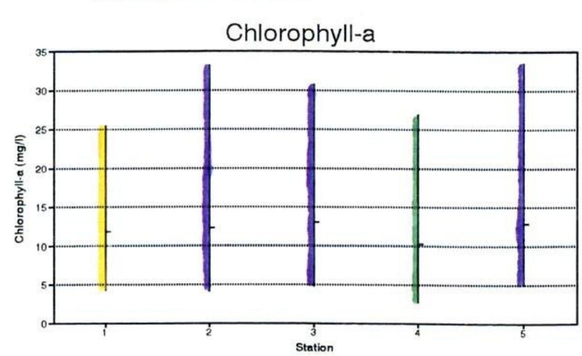

Note: No standard has been established for surface waters classified as limited recreational use.




Note: The maximum standard of 200/400 colonies per 100ml was violated at stations 1-6 and the maximum standard of 1000/2000 colonies per 100 ml was violated at station 7.

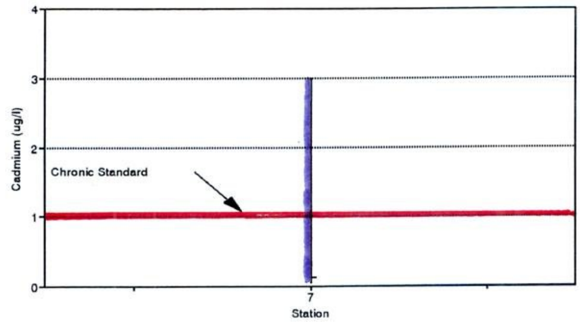



Note: The maximum standard of 1000 mg/l was not violated in any sample.



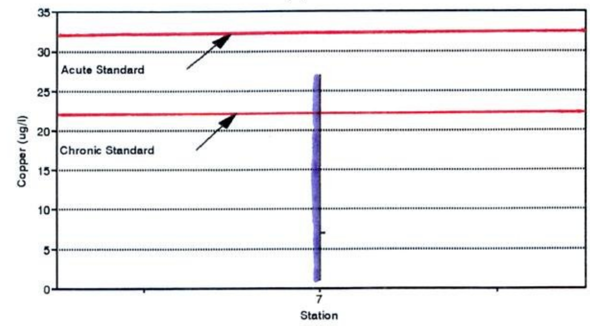
## Figure VIII-9 (cont'd)

### Cadmium

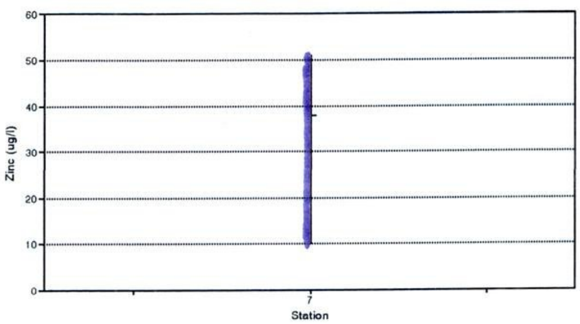



Note: The acute standard of 63.3 ug/l was not violated in any sample.

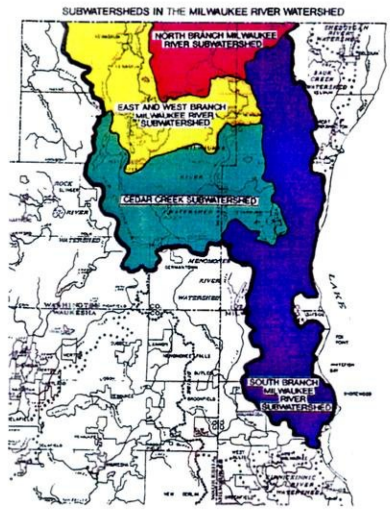
### Copper




### Zinc




Note: The acute standard of 202.9 ug/l and the chronic standard of 89.2 ug/l were not violated in any sample.





Standards indicated are those established for warmwater sport fish and full recreational use objectives, with the exception of station 7. Standards indicated for station 7 are those established for limited forage fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table VIII-14 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VIII-14

MILWAUKEE RIVER WATERSHED SHORT-TERM STREAM WATER QUALITY
SAMPLING DATA: 1988-1993

| Sampling Station Number and Subwatershed[a] | Parameter (units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 1EW | Temperature (°F) | Maximum of 89.0 | 40.3-74.1 | No | May-November 1993 | 11 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.0-17.1 | No | May-November 1993 | 11 |
| | Biological Oxygen Demand (mg/l) | -- | 1.2-2.6 | -- | May-November 1993 | 11 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.8-8.8 | No | May-November 1993 | 11 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.04-0.16 | Yes | May-November 1993 | 11 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 20-6,800 | Yes | May-November 1993 | 10 |
| | Chlorophyll-a (mg/l) | -- | 4.2-25.5 | -- | May-November 1993 | 11 |
| 2S | Temperature (°F) | Maximum of 89.0 | 54.1-71.2 | No | March-December 1993 | 11 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.0-11.5 | No | March-December 1993 | 11 |
| | Biological Oxygen Demand (mg/l) | -- | 1.0-2.9 | -- | March-December 1993 | 10 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.7-8.7 | No | March-December 1993 | 11 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.03-0.29 | Yes | March-December 1993 | 11 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 40-2,500 | Yes | March-December 1993 | 11 |
| | Chlorophyll-a (mg/l) | -- | 4.0-33.2 | -- | March-December 1993 | 11 |
| 3S | Temperature (°F) | Maximum of 89.0 | 40.3-75.0 | No | May-December 1993 | 11 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 5.9-14.5 | No | May-December 1993 | 11 |
| | Biological Oxygen Demand (mg/l) | -- | 1.5-3.0 | -- | May-December 1993 | 7 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.7-8.7 | No | May-December 1993 | 12 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.03-0.30 | Yes | May-December 1993 | 12 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 10-7,500 | Yes | May-December 1993 | 11 |
| | Chlorophyll-a (mg/l) | -- | 4.7-30.8 | -- | May-December 1993 | 12 |
| 4CC | Temperature (°F) | Maximum of 89.0 | 41.4-77.2 | No | May-November 1993 | 11 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.4-14.1 | No | May-November 1993 | 11 |
| | Biological Oxygen Demand (mg/l) | -- | 1.0-2.7 | -- | May-November 1993 | 10 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.3-8.7 | No | May-November 1993 | 11 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.11-0.31 | Yes | May-November 1993 | 11 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 10-900 | Yes | May-November 1993 | 11 |
| | Chlorophyll-a (mg/l) | -- | 2.6-26.9 | -- | May-November 1993 | 11 |
| 5S | Temperature (°F) | Maximum of 89.0 | 38.8-74.1 | No | May-November 1993 | 12 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.2-14.5 | No | May-November 1993 | 12 |
| | Biological Oxygen Demand (mg/l) | -- | 1.4-3.2 | -- | May-November 1993 | 7 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.7-8.8 | No | May-November 1993 | 12 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.04-0.41 | Yes | May-November 1993 | 12 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 10-5,500 | Yes | May-November 1993 | 8 |
| | Chlorophyll-a (mg/l) | -- | 4.9-33.5 | -- | May-November 1993 | 8 |

Table VIII-14 (continued)

| Sampling Station Number and Subwatershed[a] | Parameter (units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 6S | Temperature (°F) | Maximum of 89.0 | 39.0-74.7 | No | May-December 1993 | 11 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.3-13.6 | No | May-December 1993 | 11 |
| | Biological Oxygen Demand (mg/l) | -- | 1.4-2.8 | -- | May-December 1993 | 6 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.5-8.8 | No | May-December 1993 | 11 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.05-0.28 | Yes | May-December 1993 | 11 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 20-670 | Yes | May-December 1993 | 5 |
| | Chloride (mg/l) | Maximum of 1,000 | 22-58 | No | May-December 1993 | 4 |
| 7S | Biological Oxygen Demand (mg/l) | -- | 1.1-36.0 | -- | March-December 1993 | 46 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.2-8.5 | -- | March-December 1993 | 51 |
| | Phosphorus (mg/l) | -- | 0.03-0.72 | -- | March-December 1993 | 50 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 1,000/2,000 | 10-52,000 | Yes | March-December 1993 | 44 |
| | Chloride (mg/l) | Maximum of 1,000 | 2-620 | No | March-December 1993 | 43 |
| | Cadmium (μg/l) | Acute of 63.3, Chronic of 1.0 | 0.04-3.0 | Yes-chronic | March-December 1993 | 64 |
| | Copper (μg/l) | Acute of 31.9, Chronic of 22.1 | 1.0-27.0 | Yes-chronic | March-December 1993 | 65 |
| | Zinc (μg/l) | Acute of 202.9, Chronic of 89.2 | 10-51 | No | March-December 1993 | 47 |
| 8S | Temperature (°F) | Maximum of 89.0 | 44.8-73.9 | No | July-October 1992 | 9 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 8.7-16.4 | No | July-October 1992 | 9 |
| | Biological Oxygen Demand (mg/l) | -- | 1.5-7.4 | -- | July-October 1992 | 7 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 7.2-8.2 | No | July-October 1992 | 8 |
| | Phosphorus (mg/l) | Maximum of 0.1 | 0.06-0.16 | Yes | July-October 1992 | 7 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 60-30,000 | Yes | July-October 1992 | 9 |
| | Chlorophyll-a (mg/l) | -- | 16-102 | -- | July-October 1992 | 9 |
| | Chloride (mg/l) | Maximum of 1,000 | 48-78 | No | July-October 1992 | 6 |
| | Copper (μg/l) | Acute of 31.9, Chronic of 22.1 | 3-5 | No | July-October 1992 | 3 |
| | Zinc (μg/l) | Acute of 202.9, Chronic of 89.2 | 10-21 | No | July-October 1992 | 3 |
| | Lead (μg/l) | Acute of 408.6, Chronic of 24.4 | 3-8 | No | July-October 1992 | 3 |

Table VIII-14 (continued)

| Sampling Station Number and Subwatershed[a] | Parameter (units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 9S | Temperature (°F) | Maximum of 89.0 | 34.3-76.1 | No | August-December 1990 | 3 |
| | | | 32.4-80.1 | No | January-December 1991 | 17 |
| | | | 32.2-474.1 | No | January-October 1992 | 17 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 9.1-13.2 | No | August-December 1990 | 3 |
| | | | 6.6-16.8 | No | January-December 1991 | 17 |
| | | | 8.6-16.8 | No | January-October 1992 | 17 |
| | pH (S.U.) | Maximum of 9.0, Minimum of 6.0 | 8.3-8.8 | No | August-December 1990 | 2 |
| | | | 7.2-8.8 | No | January-December 1991 | 16 |
| | | | 7.3-8.9 | No | January-October 1992 | 17 |
| | Phosphorus (mg/l) | -- | .08-.37 | -- | January-December 1991 | 16 |
| | | | .06-.23 | -- | January-October 1992 | 17 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 1,000/2,000 | 100-19,000 | Yes | January-December 1991 | 12 |
| | | | 10-30,000 | Yes | January-October 1992 | 14 |
| | Biological Oxygen Demand (mg/l) | -- | 2.2-8.3 | -- | January-December 1991 | 13 |
| | | -- | 1.3-7.6 | -- | January-October 1992 | 17 |
| | Chlorophyl-a (mg/l) | -- | 26-31 | -- | August-December 1990 | 2 |
| | | | 3-110 | -- | January-December 1991 | 16 |
| | | | 3-103 | -- | January-October 1992 | 13 |
| | Chloride (mg/l) | Maximum of 1,000 | 55-60 | No | August-December 1990 | 2 |
| | | | 37-92 | No | January-December 1991 | 16 |
| | | | 68-130 | No | January-October 1992 | 14 |
| | Copper (μg/l) | Acute of 31.9, Chronic of 22.9 | 3-62 | Yes-chronic & Acute | January-December 1991 | 15 |
| | | | 3-7 | No | January-October 1992 | 7 |
| | Zinc (μg/l) | Acute of 202.9, | 10-200 | Yes-Chronic | January-December 1991 | 16 |
| | | Chronic of 89.2 | 10-17 | No | January-October 1992 | 15 |
| | Lead (μg/l) | Acute of 408.6, | 3-72 | Yes-Chronic | January-December 1991 | 16 |
| | | Chronic of 24.4 | 3-10 | No | January-October 1992 | 11 |
| | Chromium (μg/l) | -- | 0.2-15 | -- | January-December 1991 | 16 |
| | | -- | 3-8 | -- | January-October 1992 | 5 |

[a]Subwatershed codes are as follows: EW - East-West Branch of the Milwaukee River; N = North Branch of the Milwaukee River; CC = Cedar Creek; S = South Branch of the Milwaukee River. See Map VIII-6 for detailed locations.

[b]Standards indicated are those established for warmwater sport fish and full recreational use objectives with the exception of Station 7S and 9S. Standards indicated for Station 7S are those established for limited forage fish and limited recreational use objectives. Standards indicated for Station 9S are those established for warmwater sport fish and limited recreational use objectives.

Source: Wisconsin Department of Natural Resources and SEWRPC.

trends, but generally met the standards, with limited exceedances of the dissolved oxygen standard. Phosphorus and fecal coliform levels generally exceeded the standards, while un-ionized ammonia nitrogen levels generally met but occasionally exceeded the standard.

Chloride levels appear to be increasing between 1981 and 1992 at stations, Ml-9, 10a, and 11. However, the levels still meet the standards. The increase in chloride levels may be the result of new urban development which has occurred in the watershed in Ozaukee and northern Milwaukee Counties and the associated winter road maintenance.

Review of the data at station Ml-12 indicates no apparent significant changes in water quality conditions. Temperature and pH levels remained variable with no apparent trends, but were generally within acceptable limits. Violations of the dissolved oxygen standard occurred some of the time and the fecal coliform levels exceeded the standards most of the time.

The remaining water quality data collected on a short-term basis throughout the watershed do not illustrate trends. However, these data do illustrate that fecal coliform and phosphorus standards are exceeded some of the time in the downstream portions of Cedar Creek, East and West Branch of the Milwaukee River, and in the upper reaches of the Milwaukee River main stem, while the dissolved oxygen standard is generally achieved.

As discussed in the subsequent section, chronic toxicity standards for some metals were exceeded in the lower reach of the Milwaukee River.

Toxic and Hazardous Substances: Available data on toxic pollutants gathered by the Wisconsin Department of Natural Resources during a three year period between 1973 and 1976, indicated that levels of mercury, polychlorinated biphenyls (PCBs) and various biocides--aldrin, heptachlor, heptachlor epoxide and phthalate--exceeded U.S. Environmental Protection Agency standards on at least one occasion from 1973 to 1976. Additional data indicated other heavy metals and toxicants--cadmium, chromium, copper, lead, mercury, nickel, zinc and PCBs--did not violate recommended U.S. Environmental Protection Agency standards. However, such were found to be in the stream sediments.

Recent data on water column toxic and hazardous substances in the Milwaukee River were collected by the U.S. Geological Survey (USGS) and the Milwaukee Metropolitan Sewerage District (MMSD). These data indicate that levels of cadmium and lead have violated chronic toxicity level standards for heavy metals, and that levels of copper occasionally violate chronic toxicity level standards in the lower stream reaches of the Milwaukee River. These metal standards were generally not exceeded at the two most upstream stations. Furthermore, only infrequent and small lead standard violations were reported after 1985.

Post-1976 data on toxic and hazardous substances present in stream sediments in the Milwaukee River were collected by the Wisconsin Department of Natural Resources (DNR), the Milwaukee Metropolitan Sewerage District, and the U.S. Geological Survey. Data collected between 1989 and 1993 by the DNR and USGS at seven stations on the Milwaukee River main stem, and four stations on tributary streams to the Milwaukee River indicated the presence of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) at seven sites. Samples obtained from five of these sites exceeded the Lowest Effect Level (LEL) sediment quality screening criteria proposed by the DNR.[10] At Estabrook Park in the City of Milwaukee, the PAH concentration exceeded the Severe Effect Level (SEL) guidelines. Data on heavy metal concentrations in these sediments also generally exceeded the LEL guidelines, as set forth in Table VIII-15 and on Map VIII-6. Concentrations of other toxic substances, including some DDT-derivatives, also exceeded the SEL at five stations.

Data collected in 1990 by the MMSD at seven locations in the Milwaukee River main stem from Lincoln Creek downstream to the Milwaukee harbor indicated the presence of PCBs and PAHs at all sampling stations.[11] Higher levels of PCBs were recorded in those sediments sampled nearer to the harbor, while higher levels of PAHs were observed in those sediments sampled nearer to the confluence with Lincoln Creek. Concentrations of PCBs and PAHs exceeded the proposed LEL guidelines at all stations.

In 1991 and 1992, sediment sampling data were also collected in the Milwaukee River as part of the North Avenue Dam Feasibility Study[12] which was undertaken to analyze potential impacts of a change in the management of the North Avenue Dam. Data collected from mudflat and channel sediments upstream of the dam indicated that the majority of the chemicals sampled exceeded the LEL sediment quality guideline concentrations proposed by the DNR for the study area. Results indicated that higher concentrations of PCBs and PAHs had accumulated in the mudflat sediments than in the channel sediments of the river.

Additional sediment data were collected in Cedar Creek in 1991 by the DNR.[13] Sediments sampled above four dams within the City of Cedarburg were found to be highly contaminated with PCBs which exceeded the LEL guidelines at all stations sampled and the SEL guidelines in the Columbia, Wire & Nail, and Hamilton dams. These sediments were determined to have a high potential to contaminate large volumes of river sediment downstream, particularly during periods of high stream flow.

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[10]Wisconsin Department of Natural Resources, (draft) Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System, June 1994.

[11]Fan Ni, Michael F. Gin, and Erik R. Christensen, Toxic Organic Contaminants in the Sediments of the Milwaukee Harbor Estuary, Final Report, Milwaukee Metropolitan Sewerage District, 1992.

[12]Woodward-Clyde Consultants, North Avenue Dam Feasibility Study, Final Report, April 1994.

[13] Steve Westenbroek, Cedar Creek PCB Mass Balance, (draft) Wisconsin Department of Natural Resources, 1993.

Table VIII-15

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES
IN THE MILWAUKEE RIVER WATERSHED: 1989-1993

| Substances Sampled | Sampling Stations | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Milwaukee River Main Stem | | | | | | | Milwaukee River Tributaries | | | |
| | STH 60 | Fireman Park | Tennis Club | Kletzsch Park | Esta-brook Park | C&NW RR | Thiens-ville | Lincoln Creek | Fredonia Creek | Mole Creek | Indian Creek |
| Heavy Metals (mg/kg) | | | | | | | | | | | |
| Arsenic | 1.0 | 6.0 | 4.0 | 7.0 | -- | 3.0 | -- | 4.0 | 7.0 | 5.0 | 4.0 |
| Cadmium | 5.0 | 6.0 | 3.0 | 5.0 | -- | 3.0 | -- | 2.0 | 1.0 | 1.0 | 1.0 |
| Chromium | 30.0 | 60.0 | 30.0 | 50.0 | -- | 50.0 | -- | 20.0 | 1.0 | 20.0 | 20.0 |
| Copper | 49.0 | 45.0 | 41.0 | 79.0 | -- | 70.0 | -- | 39.0 | 44.0 | 25.0 | 42.0 |
| Lead | 120.0 | 80.0 | 80.0 | 170.0 | -- | 150.0 | -- | 80.0 | 40.0 | 20.0 | 30.0 |
| Mercury | 0.1 | 0.3 | 0.2 | 0.2 | -- | 0.2 | -- | 0.07 | 0.06 | 0.07 | 0.06 |
| Nickel | 20.0 | 30.0 | 20.0 | 40.0 | -- | 30.0 | -- | 30.0 | 20.0 | 10.0 | 30.0 |
| Zinc | 200.0 | 220.0 | 180.0 | 380.0 | -- | 280.0 | -- | 160.0 | 140.0 | 76.0 | 97.0 |
| Total Polycyclic Aromatic Hydrocarbons (mg/kg) | 20.4 | 5.3 | 0.0 | 23.9 | -- | 19.8 | -- | 45.7 | 0.0 | 0.0 | 0.2 |
| Total Polychlorinated Biphenyls (ug/kg) | -- | -- | -- | 10.0 (1989, USGS) 0.05 (1993, DNR) | 36,000 | -- | 0.05 | -- | 10.0 | 10.0 | 10.0 |
| Aldrin ($\mu$g/kg) | 1.0 | 1.0 | 1.0 | 1.0 | -- | 1.0 | -- | 1.0 | 1.0 | 1.0 | 1.0 |
| Chlordane | 10.0 | 15.0 | 10.0 | 10.0 | -- | 10.0 | -- | 20.0 | 10.0 | 10.0 | 10.0 |
| Total DDT | 1.0 | 6.0 | 2.0 | 3.0 | -- | 7.0 | -- | 3.0 | 1.0 | 1.0 | 3.0 |
| op+pp DDT | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| pp DDD | 6.0 | 25.0 | 2.0 | 3.0 | -- | 10.0 | -- | 11.0 | 5.0 | 3.0 | 11.0 |
| pp DDE | 2.0 | 43.0 | 5.0 | 5.0 | -- | 5.0 | -- | 4.0 | 2.0 | 2.0 | 20.0 |
| Mirex | 1.0 | 1.0 | 1.0 | 1.0 | -- | 1.0 | -- | 1.0 | 1.0 | 1.0 | 1.0 |
| TCDD | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| $NH_3$-N (mg/kg) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| O&G (mg/kg) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CN (mg/kg) | 0.5 | 0.5 | 0.9 | 4.4 | -- | 0.7 | -- | 0.5 | 0.5 | 0.8 | 0.5 |

NOTE: Values recorded as 0.0 are below the limit of detection.

Source: Wisconsin Department of Natural Resources, U.S. Geological Survey, and SEWRPC.

Data collected in 1992 for a DNR study of the impacts of stormwater runoff on urban streams in Milwaukee County[14] recorded high levels of pollutants within the water column and in bottom sediments of Lincoln Creek. Concentrations of oil and grease, PAHs, and heavy metals in Lincoln Creek all exceeded those concentrations recorded at a reference site located in a non-urbanized portion of the Milwaukee River. These pollutants were linked to stormwater discharges, accentuated during periods of high stream flow.

Since the completion of the initial regional water quality management plan, 63 spills of toxic substances into streams of known locations in the Milwaukee River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 39 have occurred in the main stem of the Milwaukee River and 20 have occurred in Lincoln Creek. The remaining spills have occurred in smaller tributaries of the Milwaukee River, including Beaver Creek and Pigeon Creek. The majority of the substances that were spilled into surface waters were gasoline or related petroleum products.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Milwaukee River and its major tributaries were assessed, with the results set forth in Table VIII-16. Where data were available, fish populations and diversity ranged from fair to good.

Fish kills were documented at eight locations in the Milwaukee River watershed--Lincoln Creek, Cedar Creek, Pigeon Creek, Brown Deer Creek, and in the Milwaukee River main stem in the Villages of Grafton and Kewaskum and in the Cities of West Bend and Milwaukee. Fish kills are generally related to seasonal fluctuations in water temperature and levels of dissolved oxygen as well as spawning activity, but can also be related to human activity such as the discharge of pollutants into surface water. Where known, the specific cause of each documented fish kill is shown in Table VIII-16.

Standards are not expected to be met for ammonia nitrogen and phosphorus concentrations, and for fecal coliform levels in the majority of the Milwaukee River main stem from about CTH C in Ozaukee County downstream to the Milwaukee Harbor estuary. Levels of fecal coliform are also not expected to fully meet the standards in Lincoln, Indian, Kewaskum, and Silver Creeks, in the North Branch of the Milwaukee River, and the lower portions of Cedar Creek. In addition, dissolved oxygen concentrations are estimated not to meet the standard in the lower reaches of Cedar Creek, Lincoln Creek, Pigeon Creek, and in the Milwaukee River main stem downstream of Wells Street.

As noted in Table VIII-16, available data on toxics indicate problems with water column toxic pollutants in the lower portions of the Milwaukee River and in Lincoln Creek, and in the lower portions of Cedar Creek. Data collected by the Milwaukee Metropolitan Sewerage District at five stations on the Milwaukee River main stem indicate that the standards for chronic toxicity for cadmium and lead have been exceeded and that violations of chronic toxicity standards for zinc and copper were reported at Station Ml-llb. The standards for acute toxicity,

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[14]John P. Masterson and Roger T. Bannerman, Impacts of Stormwater Runoff on Urban Streams in Milwaukee County, Wisconsin, Wisconsin Department of Natural Resources, 1994.

Table VIII-16

CHARACTERISTICS OF STREAMS IN SUBWATERSHEDS WITHIN THE MILWAUKEE RIVER WATERSHED

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| CEDAR CREEK | | | | | | | | | | | |
| a. Cedar Creek u/s Little Cedar Creek inflow | 8.0 | Good | -- | No | No | No | No | -- | Good-fair | Moderate (sand,silt, gravel, rubble) | Moderate |
| b. Little Cedar Creek | 7.2 | Good | -- | -- | -- | -- | -- | -- | -- | Moderate (sand and gravel) | Major |
| c. Cedar Creek d/s Little Cedar Creek inflow- CTH M | 9.8 | Good | -- | Yes | No | No | Yes | -- | Fair-poor | Moderate (silt,sand, gravel) | Major |
| d. Cedar Creek d/s CTH M to STH 60 | 9.5 | Good | -- | Yes | No | No | No | -- | Fair | Moderate (silt,sand, gravel, rubble) | Low |
| e. Cedar Creek d/s STH 60 | 6.7 | Good | Yes | No | No | Yes | Yes | Yes | -- | Moderate | Low |
| f. North Branch | 7.3 | -- | -- | -- | -- | -- | -- | -- | Very good-fair | Moderate (sand,silt, gravel, rubble) | -- |
| g. Friedens Creek | 3.2 | -- | -- | -- | -- | -- | -- | -- | Very good -good | Moderate (sand, silt) | Moderate |
| h. Lehner Creek | 1.8 | Good | -- | -- | -- | -- | -- | -- | Very good-good | -- | -- |
| TOTAL | 53.5 | | | | | | | | | | |
| MILWAUKEE RIVER- EAST AND WEST BRANCHES | | | | | | | | | | | |
| a. Milwaukee River d/s North Washington Co line-CTH H | 5.4 | Good | Yes[f] | No | No | No | No | -- | Excellent[g] | Moderate (sand, gravel, silt) | Low |
| b. Milwaukee River d/s CTH H to Woodford Drive | 4.9 | Poor | -- | No | No | No | No | -- | -- | High (sand, gravel, silt, rubble) | -- |
| c. Milwaukee River d/s Woodford Drive to STH 33 | 13.6 | Fair | Yes[f] | No | No | Yes | No | -- | Good-poor[g] | High (sand, gravel, rubble) | -- |
| d. Milwaukee River d/s STH 33 | 9.9 | -- | -- | No | No | Yes | No | -- | Good[i] | High (sand, gravel, rubble) | -- |
| e. Kewaskum Creek | 6.4 | Good | -- | No | No | No | Yes | -- | -- | Moderate | -- |
| f. Silver Creek | 4.0 | Fair | -- | No | No | No | Yes | -- | Good | High (silt, sand, gravel) | Major |
| g. Quaas Creek | 4.9 | Good | -- | -- | -- | -- | -- | -- | Very good-fair | Moderate (sand, silt, gravel, rubble) | Low |
| h. East Branch Milwaukee River d/s north Washington County Line | 5.0 | Fair | -- | -- | -- | -- | -- | -- | -- | Low (gravel & sand) | Low |
| TOTAL | 54.1 | | | | | | | | | | |

Table VIII-16 (cont'd)

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] DO | $NH_3$ | Total P | Fecal Coliform | Toxics | Biotic Index Rating[d] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MILWAUKEE RIVER-NORTH | | | | | | | | | | | |
| a. North Branch of Milwaukee River | 8.5 | Good | -- | No | No | No | Yes | -- | Excellent[g] -good | Moderate-high | -- |
| b. Stony Creek | 10.0 | -- | -- | -- | -- | -- | -- | -- | -- | Moderate (silt, gravel) | Moderate |
| c. Wallace Creek | 8.6 | Good | -- | -- | -- | -- | -- | -- | -- | Low | -- |
| TOTAL | 27.1 | | | | | | | | | | |
| MILWAUKEE RIVER-SOUTH | | | | | | | | | | | |
| a. Milwaukee River Upstream STH 33 | 11.1 | -- | -- | No | No | No | Yes | -- | Good | Moderate (boulder, cobble, gravel) | -- |
| b. Milwaukee River downstream STH 33 to STH 57 | 13.7 | Good | -- | No | No | Yes | Yes | Yes | Good | Moderate (boulder, cobble, gravel) | -- |
| c. Milwaukee River downstream STH 57 to CTH C | 4.5 | Fair-good | Yes[h] | No | Yes | Yes | Yes | Yes | Good | Low to Moderate (cobble, gravel) | -- |
| d. Milwaukee River downstream CTH C to Mequon Road | 13.4 | Good | -- | No | Yes | Yes | Yes | Yes | Good | High (cobble, gravel) | -- |
| e. Milwaukee River downstream Mequon Road to Brown Deer Rd | 6.1 | -- | Yes | No | Yes | Yes | Yes | Yes | Good | High (cobble, gravel) | -- |
| f. Milwaukee River d/s Brown Deer Rd.-Port Washington Rd. | 10.4 | -- | -- | No | Yes | Yes | Yes | Yes | -- | High (cobble, gravel) | -- |
| g. Milwaukee River d/s Port Wash. Road to North Avenue | 3.8 | -- | Yes[i] | No | Yes | Yes | Yes | Yes | -- | -- | -- |
| h. Milwaukee River downstream North Avenue to Walnut St. | 0.9 | -- | -- | No | Yes | -- | Yes | Yes | -- | -- | Moderate |
| i. Milwaukee River downstream Walnut Street to Wells St. | 0.8 | -- | -- | No | Yes | -- | Yes | Yes | -- | -- | Moderate |
| j. Milwaukee River downstream Wells Street to Water St. | 0.6 | -- | -- | Yes | Yes | -- | Yes | Yes | -- | -- | Moderate |
| k. Milwaukee River downstream Water Street | 0.8 | -- | -- | Yes | Yes | -- | Yes | Yes | -- | -- | Moderate |
| l. Lincoln Creek | 9.4 | Fair | Yes | Yes | No | -- | Yes | Yes | Very poor | -- | Major |
| m. Indian Creek | 1.9 | -- | -- | Yes | No | -- | Yes | -- | Very Poor | -- | Major |
| n. Brown Deer Creek | 1.9 | -- | Yes[j] | -- | -- | -- | -- | -- | Very Poor | Moderate (sand, gravel, bubble) | Moderate |
| o. Pigeon Creek | 2.4 | Good | Yes[k] | Yes | No | No | No | -- | Fair-Good | Low-moderate (gravel, cobble) | Low |
| TOTAL | 80.7 | | | | | | | | | | |

Footnotes follow.

Table VIII-16 (cont'd)

[a]Based upon stream appraisal documentation set forth in the DNR Water Resource Appraisals for the Cedar Creek, East/West Branch, North Branch, and South Branch Milwaukee River watershed.

[b]Unless otherwise noted, fish kills are assumed to be the result of natural fluctuations in water conditions.

[c]The most recent water quality data available as described in Figures VIII-1 through VIII-5 in addition to data available from DNR Water Resource Appraisals used to evaluate water quality in the Milwaukee River system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for Milwaukee River watershed stream reaches based upon year 2000 land use conditions, and current levels of pollution control, if appropriate.

[d]Except where otherwise indicated, biotic index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in Wisconsin Department of Natural Resources Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality in Streams," Hilsenhoff, 1982.

[e]Physical modifications to the channel were defined as: Major if 50 percent or more of the stream reach was modified by structural measures or was deepened or straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

[f]Reported to be due to a discharge of ammonia.

[g]Based upon the Index of Biotic Integrity (IBI) discussed in U.S. Department of Agriculture, Forest Service, General Technical Report NC-149, "Using the Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams of Wisconsin," Lyons, April 1992.

[h]Two fish kills were reported in this stream reach. A light fish kill recorded in 1980 was reported to be a result of cooling water discharge through a storm sewer. The cause of a moderate kill recorded in 1990 was undetermined.

[i]Undetermined source.

[j]Reported to be due to a discharge of lubricating and cutting oils.

[k]Reported to be due to a discharge of chlorine.

[l]Subsequent sampling in 1987 resulted in an Index of Biotic Integrity (IBI) rating of excellent.

Source: Wisconsin Department of Natural Resources and SEWRPC.

as defined in Chapter II, were exceeded only on very limited occurrences. Since 1985, no significant violations of the lead standard have been reported.

The biotic index ratings, which are biological indicators of water quality within a stream system, ranged from very poor to excellent in the watershed. Where data were available in the Milwaukee River South branch subwatershed, Milwaukee River tributaries generally received poorer biotic index ratings than main stem stream reaches. Moderate to high and high levels of streambed sedimentation were observed in the North Branch of the Milwaukee River and in the Milwaukee River from CTH C downstream to Port Washington Road, respectively. High levels were also noted in the Milwaukee River downstream of the north Washington County line to STH 33 and in Silver Creek. Elsewhere, the levels were generally low to moderate.

Table VIII-17 sets forth the water quality index classifications[15] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table VIII-17, recent comparative water quality data were available for four stations on the Milwaukee River main stem; one in the Town of Grafton, Ml-9; one at Brown Deer Road, Ml-10a; one at Port Washington Road, Ml-11; and one just upstream of the Milwaukee Harbor estuary, Ml-12. These stations are shown on Map VIII-6. The limited comparative data available indicate that water quality conditions from 1974-75 and to 1990-92 have remained "fair" at Stations Ml-9, Ml-10, and Ml-12. Water quality conditions at Station Ml-11 have remained "good" from 1974-75 to 1990-92.

A summary of potential pollution sources in the Milwaukee River watershed by stream reach is shown in tabular summary in Table VIII-18. Review of the data indicate that the majority of the conversion of lands from rural to urban uses has occurred in the Milwaukee River South subwatershed and that much of this conversion occurred before the completion of the initial plan. As a result, a relatively small amount of new urban development has occurred in these areas, and much of the development occurs in the form of urban re-development. It should be noted that a majority of the documented spills of toxic substances and the majority of the permitted industrial discharges have also occurred in streams in the Milwaukee River South subwatershed. Data on nonpoint source pollution, public and private sewage treatment plants discharging to surface waters, and additional potential impacts to surface water quality are included in Table VIII-18.

<u>Lakes</u>

Lake water quality data available for use in preparing the initial regional water quality management plan were obtained from the Wisconsin Department of Natural Resources quarterly lake monitoring program for selected lakes and Wisconsin Department of Natural Resources and Southeastern Wisconsin Regional Planning Commission lake use reports. Post-1976 data on phosphorus and chlorophyll concentrations and water clarity for major lakes in the Milwaukee River watershed, where available, are presented in Table VIII-19.

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[15]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, <u>Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975</u>, June 1978.

Table VIII-17

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE MILWAUKEE RIVER WATERSHED 1964, 1974-1975, AND 1990-1992

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July and August 1990 and 1991 |
|---|---|---|---|
| Main Stem Stations | | | |
| Ml-1 | Fair | Fair | N/A |
| Ml-2 | Fair | Fair | N/A |
| Ml-3 | Good | Fair | N/A |
| Ml-5 | Good | Good | N/A |
| Ml-6 | Good | Fair | N/A |
| Ml-9 | Good | Fair | Fair |
| Ml-10 | Fair | Fair | Fair[b] |
| Ml-11 | Fair | Good | Good |
| Ml-11b | N/A | N/A | Good |
| Ml-12 | Fair | Fair | Fair |
| Tributary Stations | | | |
| Ml-4 | Fair | Fair | N/A |
| Ml-7 | Fair | Fair | N/A |
| Ml-8 | Fair | Fair | N/A |
| Watershed Average | Fair | Fair | Fair |

[a] See Map VIII-6 for sampling station locations.

[b] Recent data collected from the Milwaukee River at Brown Deer Road (Ml-10a) were used for comparison purposes with previous data collected from the Milwaukee River at CTH H (Ml-10), located approximately 3.6 miles upstream from the Brown Deer Road station.

Source: SEWRPC.

Table VIII-18

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE MILWAUKEE RIVER WATERSHED: 1990

| SUBWATERSHED Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| **CEDAR CREEK** | | | | | | | | | | | |
| Cedar Creek Upstream Little Cedar Creek Inflow | Significant | Insignificant | -- | X | X | -- | -- | 3 | -- | | 1,2,3 |
| Little Cedar Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| Cedar Creek Down-stream Little Cedar Creek Inflow to CTH M | Insignificant | Insignificant | -- | X | X | 1 | 1 | 1 | -- | Seneca Food Company private sewage treatment plant recommended for abandonment | 1,2,3,4 |
| Cedar Creek Downtream CTH M to STH 60 | Insignificant | Insignificant | -- | -- | X | -- | 1 | -- | -- | | 2,3 |
| Cedar Creek Downstream STH 60 | Significant[d] | Insignificant[d] | -- | X | X | 1 | -- | 5 | -- | | 1,2,3 |
| North Branch Cedar Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | 1 | -- | | 1,2,3 |
| Friedens Creek | Significant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| Lehner Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| **MILWAUKEE RIVER-EAST/WEST** | | | | | | | | | | | |
| Milwaukee River Downstream North Washington County Line to CTH H | Significant[e] | Moderate | -- | X | X | 1 | -- | 3 | -- | | 1,2,3,4 |
| Milwaukee River Downstream CTH H to Woodford Drive | Significant[e] | Insignificant | -- | -- | X | -- | -- | 1 | -- | | 1,2,3 |
| Milwaukee River Downstream Woodford Drive to STH 33 | Significant[d] | Insignificant[d] | 1985 - oil | X | X | 1 | -- | 7 | -- | | 1,2,3 |
| Milwaukee River Downstream STH 33 | Insignificant | Insignificant | -- | X | X | 1 | -- | 1 | -- | | 1,2,3 |
| Kewaskum Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| Silver Creek | Moderate[e] | Insignificant | -- | X | X | -- | -- | 1 | -- | | 1,2,3 |
| Quaas Creek | Significant[e] | Significant | -- | -- | X | -- | -- | 1 | -- | | 1,2,3 |

Table VIII-18 (cont'd)

| SUBWATERSHED Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| East Branch Milwaukee River Downstream North Washington County Line | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| **MILWAUKEE RIVER- NORTH** | | | | | | | | | | | |
| North Branch Milwaukee River | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| Stony Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| Wallace Creek | Significant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| **MILWAUKEE RIVER-SOUTH** | | | | | | | | | | | |
| Milwaukee River Upstream STH 33 | Insignificant | Insignificant | -- | X | X | 1 | -- | 1 | -- | | 1,2,3 |
| Milwaukee River Downstream STH 33 to STH 57 | Significant | Insignficant | 1989-petroleum | X | X | 1 | -- | 6 | -- | | 1,2,3 |
| Milwaukee River Downstream STH 57 to CTH C | Significant[d] | Insignificant[d] | 1989-dye lubricant mixture | X | X | 1 | -- | 2 | -- | | 1,2,3 |
| Milwaukee River Downstream CTH C to Mequon Road | Moderate[d] | Significant[d] | | X | X | -- | -- | 5 | -- | Village of Thiensville public sewage treatment plant abandoned in 1987 | 1,2,3 |
| Milwaukee River Downstream Mequon Road to Brown Deer Road | Moderate[d] | Significant[d] | 1986-unknown<br>1989-drain oil | X | x | -- | -- | 5 | -- | | 1,2,3 |
| Milwaukee River Downstream Brown Deer Road to Port Washington Road | Insignificant[d] | Insignificant[d] | 1978-gasoline<br>1980-oil<br>1985-oil<br>1987-petroleum<br>1989-oil<br>1990-copolymer #5S<br>1990-petroleum products | X | X | -- | -- | 12 | Leaking Underground Storage Tank permitted to discharge remediation wastewater to Milwaukee River | | 1,2,3 |

Table VIII-18 (cont'd)

| SUBWATERSHED Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Milwaukee River Downstream Port Washington Road to North Avenue | Insignificant[d] | Insignificant[d] | 1978-fuel oil<br>1983-fuel oil<br>1985-oil<br>1986-unknown<br>1986-chemicals<br>1987-red foamy stain | X | -- | -- | -- | 13 | Leaking underground storage tank permitted to discharge remediation wastewater to Milwaukee River | | 1,2,3 |
| Milwaukee River Downstream North Avenue to Walnut Street | Insignificant[d] | Insignificant[d] | 1984-fuel oil<br>1986-oil/foam<br>1988-sewage<br>1988-unknown<br>1990-heavy material | X | -- | -- | -- | 2 | -- | | 1,2,3 |
| Milwaukee River Downstream Walnut Street to Wells Street | Insignificant[d] | Insignificant[d] | 1982-gasoline<br>1983-gasoline<br>1986-oil<br>1987-waste oil<br>1987-red substance<br>1988-old oil or fuel<br>1988-unknown<br>1989-sodium hydroxide | X | -- | -- | -- | 3 | -- | | 1,2,3 |
| Milwaukee River Downstream Wells Street to Water Street | Insignificant[d] | Insignificant[d] | 1980-oil<br>1983-unknown<br>1985-oil, waste<br>1986-unknown<br>1988-discharge from drain pipe | X | -- | -- | -- | 6 | -- | | 1,2,3 |
| Milwaukee River Downstream Water Street | Insignificant[d] | Insignificant[d] | 1982-fuel<br>1983-detergent<br>1987-sewage | X | -- | -- | -- | -- | -- | | 1,2,3 |

Table VIII-18 (cont'd)

| SUBWATERSHED Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] Historical 1976-1990 | Expected 1990-2010 | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources: Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lincoln Creek | Insignificant[d] | Insignificant[d] | 1979-oil (2)<br>1980-oil<br>1981-oil<br>1983-petroleum<br>1985-oil<br>1987-sheen<br>1987-oil (2)<br>1988-sheen<br>1988-unknown<br>1988-gas/oil<br>1988-oil<br>1989-petroleum products<br>1990-petroleum<br>1990-petroleum sheen (2)<br>1990-weathered oil<br>1990-black gritty silt<br>1990-oil | X | -- | -- | -- | 31 | Leaking underground storage tank permitted to discharge remediation wastewater to Lincoln Creek<br><br>Leachate seepage from U.S. Army Reserve Center/ Havenwoods Park landfill (abandoned)<br><br>Village of Whitefish Bay landfill (abandoned)<br><br>City of Milwaukee landfill (abandoned) | | 1,2,3 |
| Indian Creek | Insignificant[d] | Insignificant[d] | | X | X | -- | -- | -- | -- | | 1,2,3 |
| Brown Deer Creek | Insignificant[d] | Insignificant[d] | 1988-petroleum<br>1989-oil | X | X | -- | -- | 3 | | | 1,2,3 |
| Pigeon Creek | Inisgnificant | Insignificant | 1986-paint thinner<br>1989-clay | X | X | -- | -- | -- | | | 1,2,3 |

Footnotes follow.

Table VIII-18 (cont'd)

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] Letter codes refer to the following ongoing pollution abatement efforts:

1. Construction Erosion Control Ordinances in place
2. Urban Nonpoint Source Controls Implemented
3. Rural Nonpoint Source Controls Implemented
4. Sewage Treatment Plant Upgrading Underway

[d] Considerable urban development existing pre-1976.

[e] The amount of post-1976 urban development has increased in comparison to pre-1976 urban development.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VIII-19

WATER QUALITY OF THE MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED

| SUBWATERSHED Lake Name | Area (acres) | Total Phosphorus (mg/l) | | | | | Chlorophyll-a (µg/l) | | | | | Secchi Disk (feet) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average | Date of Data | Source[b] | Maximum | Minimum | Average | Date of Data | Source[b] |
| CEDAR CREEK | | | | | | | | | | | | | | | | |
| Big Cedar Lake | 932 | 0.15 | 0.01 | 0.01(187) | 1985-89 | LTT | 46 | 2 | 24.0(64) | 1985-89 | LTT | 17.1 | 4.3 | 9.8(148) | 1985-89 | LTT |
| Little Cedar Lake | 246 | 0.34 | 0.01 | 0.11(33) | 1973-86 | STORET | 17.0 | 5.0 | 9.4(5) | 1985-86 | STORET | 23.0 | 11.75 | 15.8(7) | 1991-92 | SELF-HELP |
| Mud Lake (Ozaukee County) | 245 | 0.08 | 0.01 | 0.04(20) | 1973-75 | LSF | -- | -- | -- | -- | -- | 5.5 | 2.0 | 3.2(7) | 1973-75 | LSF |
| MILWAUKEE RIVER-EAST/WEST | | | | | | | | | | | | | | | | |
| Barton Pond | 67 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Lucas Lake | 78 | 0.02 | 0.01 | 0.01(10) | 1985-86 | STORET | 10.0 | 4.0 | 5.7(7) | 1980-86 | STORET | 9.5 | 5.9 | 8.1(7) | 1980-86 | STORET |
| Silver Lake (Washington) | 118 | 0.04 | <0.01 | 0.01(14) | 1985-86 | STORET | 5.0 | 2.0 | 3.0(3) | 1985 | STORET | 6.25 | 21.5 | 11.5(30) | 1988-91 | SELF-HELP |
| Smith Lake | 86 | 0.02 | 0.02 | 0.02(2) | 1985-86 | STORET | -- | -- | 5.0(1) | 1985 | STORET | -- | -- | 4.3(1) | 1985 | STORET |
| MILWAUKEE RIVER-NORTH | | | | | | | | | | | | | | | | |
| Green Lake (Washington) | 71 | 0.05 | 0.01 | 0.03(15) | 1985-86 | STORET | 16.0 | 5.0 | 7.9(7) | 1980-86 | STORET | 16.5 | 3.5 | 8.95(113) | 1989-92 | SELF-HELP |
| Spring Lake (Ozaukee) | 66 | 0.02 | 0.01 | 0.01(13) | 1985-89 | STORET | 5.0 | 3.0 | 4.5(6) | 1980-86 | STORET | 9.0 | 6.25 | 7.6(5) | 1987 | SELF-HELP |
| Lake Twelve | 53 | 0.02 | 0.01 | 0.01(7) | 1985-86 | STORET | 8.0 | 5.0 | 7.0(3) | 1985-86 | STORET | 6.9 | 4.6 | 5.9(3) | 1985-86 | STORET |
| Wallace Lake | 52 | 0.05 | 0.01 | 0.03(12) | 1985-86 | STORET | 23.0 | 5.0 | 10.2(6) | 1980-86 | STORET | 9.5 | 6.5 | 7.78(9) | 1991-92 | SELF-HELP |
| MILWAUKEE RIVER-SOUTH | | | | | | | | | | | | | | | | |
| Lac du Cours | 57 | -- | -- | 0.05(1) | 1979 | LSF | -- | -- | 25.0(1) | 1979 | LSF | -- | -- | 1.5(1) | 1979 | LSF |

[a] Number in parenthesis refers to the number of samples taken.

[b] The following sources were cited:
LSF..........Wisconsin Department of Natural Resources, Lake Survey Forms
LTT..........Long Term Trends Lake Monitoring Program Data: 1985-1987
SELF-HELP.....Wisconsin Self-Help Lake Monitoring Program Data: 1986-1988
STORET........U.S. Environmental Protection Agency Water Information Storage and Retrieval System

Source: SEWRPC.

Toxic and Hazardous Substances: Since the preparation of the initial plan, there has only been one reported toxic spill on the major lakes in the Milwaukee River watershed. In 1986 a spill of an unknown substance was reported on Lac du Cours.

Water Quality Assessments: Data from Table VIII-19 were used in the calculation of trophic state indices for each of the major lakes where data were available. Trophic states, indicating degrees of nutrient enrichment in the lakes, were assigned using the Wisconsin Trophic State Index[16] for each major lake in the Milwaukee River watershed where data were available, as indicated in Table VIII-20. The available trophic state index values using the Carlson Trophic State Index are also provided for current and historic conditions, as shown in Table VIII-21. These data are presented using the Carlson Trophic State Index in order to present the newer data on a comparable basis to the historic data which used that Index.

The data available, as shown in Table VIII-20, indicate that all of the lakes may be classified in the mesotrophic to eutrophic range. Mesotrophic indicates lakes with moderate levels of nutrient enrichment whereas eutrophic lakes are nutrient-rich lakes. Big Cedar, Little Cedar, Green, Lucas, and Smith Lakes are all drainage lakes classified in the mesotrophic range. Lake Twelve and Wallace Lake are spring lakes classified as mesotrophic. Spring lake in Ozaukee County is a mesotrophic lake and Silver Lake in Washington County is a slightly mesotrophic lake, both of which are drained lakes. Mud Lake and Lac du Cours[17] are both eutrophic seepage lakes. No current data are available to make assessments of trophic status for Barton Pond, a drainage lake in Washington County. No conclusions regarding changes in water quality conditions can be drawn based upon the limited data available, although in the case of Little Cedar Lake the Carlson index values demonstrate some indication that their water quality has improved marginally during this period.

Fish kills, primarily related to seasonal fluctuations in water temperature and levels, dissolved oxygen or human activity, periodically occur in lakes in the Milwaukee River watershed. Since the initial plan, recorded fish kills in a major lake in the Milwaukee River watershed occurred in Silver Lake (Washington County) in 1984. However, these occurrences do not appear to be chronic. Thus, despite the obvious concern that those episodes create among lake users, they do not appear to warrant special planning considerations at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Milwaukee River watershed, as of 1993, are generally recommended for warm water sport fish and full recreational uses. Lehner Creek and portions of Quaas and Stony Creeks

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[16]The Wisconsin State Index is set forth in "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," R.A. Lillie et al, Research Management Findings, No. 35, May 1993.

[17]Since the publication of the previous edition of this water quality management plan--SEWRPC Planning Report No. 30, the surface area of this lake has been revised to 56 acres; hence, it is included as a major lake in this edition.

Table VIII-20

**TROPHIC STATE INDEX VALUES FOR MAJOR LAKES WITHIN THE MILWAUKEE RIVER WATERSHED[a]**

| Lake Name | Wisconsin Trophic State Index Values[b] | | | |
|---|---|---|---|---|
| | Total-P | Chlorophyll-a | Secchi | Mean |
| Barton Pond | -- | -- | -- | -- |
| Big Cedar Lake | 47.5 | 48.4 | 43.9 | 46.6 |
| Little Cedar Lake | 64.7 | 51.6 | 35.0 | 50.4 |
| Green Lake | 54.6 | 50.3 | 43.2 | 49.4 |
| Lac du Cours | 58.6 | 58.9 | 71.4 | 63.0 |
| Lucas Lake | 46.1 | 47.8 | 47.1 | 47.0 |
| Mud Lake | 56.8 | -- | 59.0 | 57.9 |
| Silver Lake (Washington County) | 46.1 | 43.0 | 42.0 | 43.7 |
| Smith Lake | 51.5 | 46.8 | 56.2 | 51.5 |
| Spring Lake (Ozaukee County) | 46.1 | 46.0 | 47.9 | 46.7 |
| Lake Twelve | 46.1 | 49.4 | 51.6 | 49.0 |
| Wallace Lake | 54.6 | 52.2 | 47.7 | 51.5 |

[a] Wisconsin Trophic State Index Values were calculated using water chemistry data shown in Table VIII-19.

[b] Wisconsin Trophic State Index ranges:
below 44 = oligotrophic
44 - 53 = mesotrophic
54 - 75 = eutrophic
above 75 = hypertrophic

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VIII-21

COMPARISON OF TROPHIC STATE INDEX VALUES FOR MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED[a]

| Lake Name | Carlson Trophic State Index Values[b] | | |
|---|---|---|---|
| | Satellite Information 1979-1981 | Water Chemistry pre-1981 | Water Chemistry 1981-1991 |
| Barton Pond | -- | -- | -- |
| Big Cedar Lake | 46 | -- | 59 |
| Little Cedar Lake | 48 | 71 | 59 |
| Green Lake | 47 | -- | 50 |
| Lac du Cours | 56 | 64 | -- |
| Lucas Lake | 47 | -- | 43 |
| Mud Lake | -- | 56 | -- |
| Silver Lake (Washington County) | 44 | -- | 50 |
| Smith Lake | -- | -- | 49 |
| Spring Lake (Ozaukee County) | 47 | -- | 43 |
| Lake Twelve | 49 | -- | 45 |
| Wallace Lake | 47 | -- | 59 |

[a] Carlson Trophic State Index values were calulated from available data from spring measurements for phosphorus and from summer measurements for chlorophyll-a and water clarity. Water chemistry values were determined from Wisconsin Lakes-A Trophic Assessment Using Landsat Digital Data, 1993.

[b] Carlson Trophic State Index Ranges:
below 40 = oligotrophic
40-50 = mesotrophic
50-60 = eutrophic
above 60 = hypertrophic

Source: Wisconsin Department of Natural Resources, U.S. Environmental Protection Agency, and SEWRPC.

are recommended for coldwater fish because of their potential to support trout populations, and are recommended for full recreational uses. Stream reaches recommended for warmwater sportfish and limited recreational uses include the Milwaukee River downstream of North Avenue, and portions of Lincoln and Indian Creeks. Kewaskum Creek, Silver Creek, Pigeon Creek, and portions of Quaas and Wallace Creeks have limitations for sport fish habitat and are recommended for warmwater forage fish and full recreational use. Brown Deer Creek and Lincoln Creek upstream of Silver Spring Drive and from Hampton Avenue to 32nd Street are recommended for limited forage fish and limited recreational uses, while Indian Creek upstream of IH-43 and Lincoln Creek from Silver Spring to Hampton and from 32nd Street to Teutonia Avenue are both recommended for limited aquatic life and limited recreational uses. The remaining streams are recommended for warmwater sport fish and full recreational uses. In addition, as noted in Chapter II, the East Branch of the Milwaukee River from the Fond du Lac-Washington County line downstream to STH 28 has been designated as an "Exceptional Resource Water."

Based upon the available data for sampling stations in the watershed, the main stem of the Milwaukee River and many of its tributaries did not fully meet water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. As part of the Milwaukee River priority watershed planning program, the DNR staff conducted field inspections and limited sampling in order to assess the water quality and biological conditions on all of the streams in the Milwaukee River watershed. Those investigations indicated that the majority of the streams in the watershed did not fully meet the recommended water use objectives. Based upon a review of the data summarized in Figures VIII-1 through 9 and in Table VIII-14 and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of fecal coliform and phosphorus standards occur in the majority of the stream reaches in the watershed. However, the recommended water use objectives may potentially be met in Lehner Creek and in portions of Quaas and Stony Creeks, based upon the observed uses in those streams. In addition, it is expected that portions of the upper reaches of the East and West Branches of the Milwaukee River and some of their tributaries likely do meets the standards associated with the recommended water use objectives.

The waters of lakes in the Milwaukee River watershed are recommended for the maintenance of a warm water sport fishery and full recreational use. Mud Lake is recommended for limited aquatic life and limited recreational use. All of the lakes for which complete water quality data were available between 1965 and 1975 violated the standards for all parameters--total phosphorus of 0.02 mg/l, dissolved oxygen and fecal coliform--recommended by the Commission. Modeling data developed in the initial plan indicates that none of the lakes fully met the phosphorus standard.

As shown in Table VIII-19, recent monitoring data are available for Big Cedar Lake, Little Cedar Lake, Lucas Lake, Silver Lake (Washington County), Smith Lake, Green Lake (Washington County), Spring Lake (Ozaukee County), Lake Twelve, Wallace Lake, and Lac du Cours to assess the current compliance with water quality standards for the major lakes in the Milwaukee River watershed. Based upon those data as summarized in the Carlson Trophic State Index values set forth in Table VIII-6, it may be expected that Big Cedar Lake, Little Cedar Lake, Green Lake, Mud Lake, Silver Lake, and Wallace Lake would have total phosphorus levels exceeding the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon local nonpoint source pollution abatement planning and land use decisions, the only significant water quality management issue which remains to be addressed is the level of control which is needed and which is achievable for urban nonpoint source pollution abatement. It is recommended that this issue be examined further following a period of implementation of the ongoing nonpoint source pollution priority watershed program, taking into account subsequent monitoring data and levels of funding available and anticipated.

A future amendment to the regional plan for the Milwaukee River watershed may potentially be developed under the facility plan update initiated by the Milwaukee Metropolitan Sewerage District in 1995. That plan update is anticipated to constitute an amendment to the regional plan once it is adopted by all of the agencies involved.

## Chapter IX

## WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

### INTRODUCTION

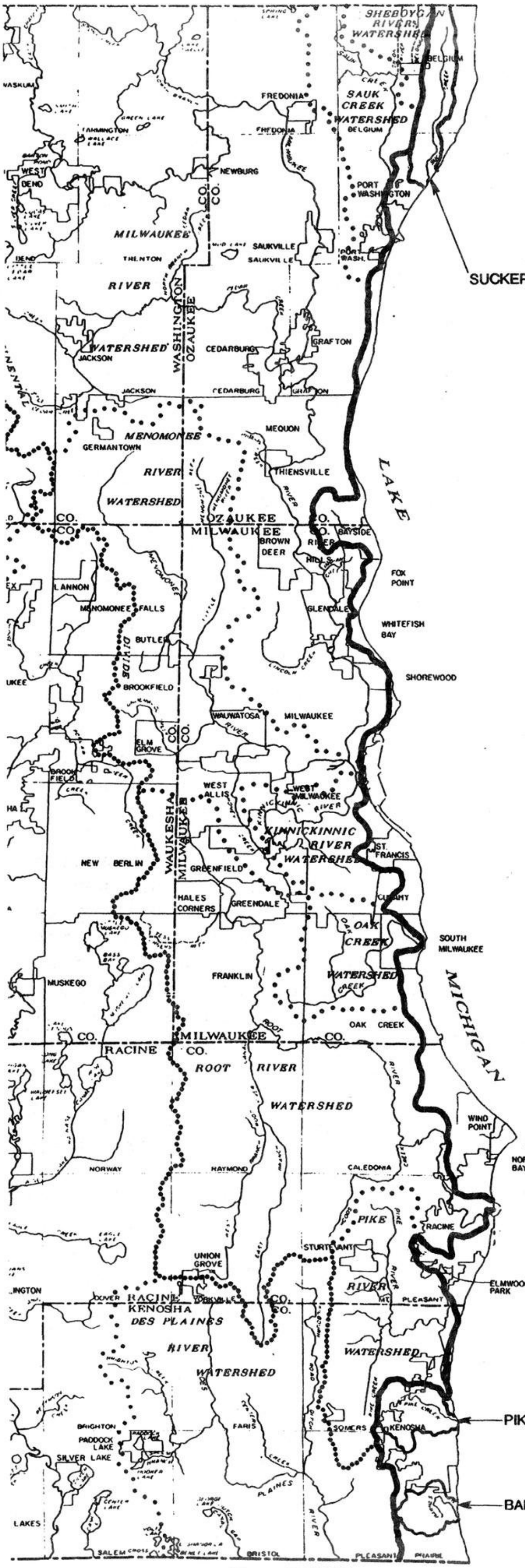
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the minor streams and direct drainage area tributary to Lake Michigan through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the watershed of minor streams and direct drainage area tributary to Lake Michigan as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The watersheds of numerous small creeks and streams in the extreme eastern portion of the Region, as well as the watersheds of the Milwaukee, Menomonee, Kinnickinnic, Root, and Pike Rivers, and Oak and Sauk Creeks, drain directly to Lake Michigan. For convenience, the group of small watersheds which are directly tributary or tributary through small streams to Lake Michigan is considered as a single unit in this plan update--the watershed of minor streams and direct drainage area tributary to Lake Michigan. The Milwaukee, Menomonee, Kinnickinnic, Root, and Pike River watersheds, and Oak and Sauk Creek watersheds are covered in separate chapters of this plan.

The watershed of minor streams and direct drainage area tributary to Lake Michigan encompasses the watersheds of Sucker Creek in the northern portion of the Region and Pike Creek and Barnes Creek in the south, as well as the direct drainage riparian lands to Lake Michigan in Kenosha, Milwaukee, Ozaukee and Racine Counties. The portion of this composite watershed contained within the Region--about 93-square miles--is only a small part of a much larger Lake Michigan watershed. Rivers and streams within this watershed are part of the St. Lawrence River drainage system which lies east of the subcontinental divide. The boundaries of the watershed of minor streams and direct drainage area tributary to Lake Michigan, together with the locations of the main surface water courses draining to Lake Michigan, are shown on Map IX-1.

Map IX-1

SUBWATERSHEDS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN




SUCKER CREEK SUBWATERSHED

PIKE CREEK SUBWATERSHED

BARNES CREEK SUBWATERSHED

Source: SEWRPC.

Within the Southeastern Wisconsin Region, the watershed of minor streams and direct drainage area tributary to Lake Michigan contains no lakes with a surface area of 50 acres or more.

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the watershed of minor streams and direct drainage area tributary to Lake Michigan since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban uses has the potential to impact on water quality as a result of increased point source and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table IX-1 summarizes the existing land uses in the watershed of minor streams and direct drainage area tributary to Lake Michigan in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains numerous urbanized areas, 48 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 29 percent of the total area of the watershed in agricultural and related rural uses, about 4 percent in woodlands, about 4 percent in water and wetlands, and about 11 percent in other open lands. The remaining 52 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map IX-2.

Within the watershed of minor streams and direct drainage area tributary to Lake Michigan, major concentrations of urban development exist in all four Lake Michigan shoreline counties. Since 1975, only limited development has been occurring in the direct drainage area, primarily within the City of Mequon in Ozaukee County, the Towns of Caledonia and Mount Pleasant in Racine County, and the Village of Pleasant Prairie in Kenosha County.

Within the Barnes Creek subwatershed, urban-related land uses are located in the northern portion of the subwatershed, in and adjacent to the City of Kenosha. Small concentrations of residential land uses are also located in the southeastern portion of the subwatershed, along STH 174 and CTH Q.

The Pike Creek subwatershed, which lies almost entirely within the City of Kenosha, is highly urbanized, with only some remaining open space and scattered urban development located in the northwest portion of the subwatershed, north of STH 142, in the Town of Somers. One major industrial center, located just west of the downtown area between CTH K and STH 158, lies within the subwatershed.

Table IX-1

LAND USE IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA
TRIBUTARY TO LAKE MICHIGAN: 1975 and 1990[a]

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 14,948 | 25.0 | 16,107 | 26.9 | 1,159 | 7.8 |
| Commercial | 700 | 1.2 | 827 | 1.4 | 127 | 18.1 |
| Industrial | 1,275 | 2.1 | 1,225 | 2.0 | - 50 | 3.9 |
| Transportation, Communication, and Utilities[b] | 8,756 | 14.6 | 9,509 | 15.9 | 753 | 8.6 |
| Governmental and Institutional | 1,629 | 2.7 | 1,666 | 2.8 | 37 | 2,3 |
| Recreational | 1,553 | 2.6 | 1,869 | 3.1 | 316 | 20.3 |
| Subtotal | 28,861 | 48.2 | 31,203 | 52.1 | 2,342 | 8.1 |
| Rural | | | | | | |
| Agricultural and Related | 19,879 | 33.3 | 17,110 | 28.6 | -2,769 | -13.9 |
| Lakes, Rivers, Streams and Wetlands | 2,402 | 4.0 | 2,352 | 3.9 | - 50 | - 2.1 |
| Woodlands | 2,301 | 3.9 | 2,350 | 3.9 | 49 | 2.1 |
| Open Lands[c], Landfills, Dumps, and Extractive | 6,349 | 10.6 | 6,876 | 11.5 | 527 | 8.3 |
| Subtotal | 30,931 | 51.8 | 28,688 | 47.98 | -2,243 | - 7.3 |
| Total | 59,792 | 100.0 | 59,891 | 100.0 | 99[d] | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

[d] The change in total area of the watershed is the net effect of Lake Michigan shoreline erosion and accretion and of landfill activities.

Source: SEWRPC.

# MAP IX-2

# LAND USES FOR THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990


The watershed of minor streams and direct area tributary to Lake Michigan is about 93 square miles in areal extent, or about 4 percent of the total Region. In 1990, about 49 square miles, or about 52 percent of the watershed, was in urban land uses.

Within the Sucker Creek subwatershed, only limited urban development has occurred in the Village of Belgium and in and around the unincorporated place of Lake Church, as the subwatershed is primarily an agricultural area. Scattered urban-related land uses are additionally located along the CTH LL corridor in the Towns of Belgium and Port Washington.

As shown in Table IX-1, from 1975 to 1990, urban land uses in the watershed increased from about 28,900 acres, or 45 square miles to about 31,200 acres, or 49 square miles, or by about 8 percent. Residential use has increased within the watershed from about 15,000 acres, or 23 square miles in 1975, to about 16,100 acres, or 25 square miles in 1990, an increase of 8 percent. Commercial and industrial land uses increased only slightly, from about 1,980 acres, or three square miles, to about 2,050 acres, an increase of about 4 percent.

The 49 square miles of urban land uses in the watershed as of 1990 can be compared to the staged 1990 planned level of about 52.7 square miles envisioned in the year 2000 land use plan. The current status of development in the watershed of minor streams and direct drainage area tributary to Lake Michigan and in adjacent portions of Milwaukee, Ozaukee, Racine, and Kenosha Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table IX-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the minor stream and direct drainage area watershed tributary to Lake Michigan and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban redevelopment is anticipated to occur in the already urbanized portions of the watershed of Milwaukee County and the Cities of Mequon, Kenosha, and Racine. Within the Barnes Creek subwatershed, urban land uses are expected to increase within the entire subwatershed, with more concentrated development to the north and west of Barnes Creek, adjacent to the City of Kenosha. Within the Pike Creek subwatershed, urban land uses are expected to increase in the northwestern portion of the subwatershed and urban redevelopment is anticipated in the already urbanized portions. Within the less urbanized Sucker Creek subwatershed, urban land uses are anticipated to increase in the Village of Belgium.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the watershed of minor streams and direct drainage area tributary to Lake Michigan, as indicated in Table IX-2, is projected to increase from the 1990 total of about 49 square miles, or about 52 percent of the total area of the watershed, to about 54 square miles, or about 58 percent of the total area of the watershed, by the year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 56 square miles, or about 60 percent of the total area of the subwatershed, by the year 2010. It is important to note that the 40 to 42 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features and, as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands, and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban

Table IX-2

EXISTING AND PLANNED LAND USE IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 16,107 | 26.9 | 18,137 | 30.3 | 2,031 | 12.6 | 19,108 | 31.9 | 3,001 | 18.6 |
| Commercial | 827 | 1.4 | 815 | 1.4 | - 12 | - 1.5 | 841 | 1.4 | 14 | 1.7 |
| Industrial | 1,225 | 2.0 | 1,410 | 2.4 | 185 | 15.1 | 1,527 | 2.6 | 302 | 24.7 |
| Transportation, Communication, and Utilities[b] | 9,509 | 15.9 | 10,123 | 16.9 | 614 | 6.5 | 10,495 | 17.5 | 986 | 10.4 |
| Governmental and Institutional | 1,666 | 2.8 | 1,755 | 2.9 | 89 | 5.3 | 1,786 | 3.0 | 120 | 7.2 |
| Recreational | 1,869 | 3.1 | 2,338 | 3.9 | 469 | 25.1 | 2,403 | 4.0 | 534 | 28.6 |
| Subtotal | 31,203 | 52.1 | 34,578 | 57.8 | 3,375 | 10.8 | 36,160 | 60.4 | 4,957 | 15.9 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 17,110 | 28.6 | 16,196 | 27.0 | - 914 | - 5.3 | 14,985 | 25.0 | -2,125 | -12.4 |
| Lakes, Rivers, Streams, and Wetlands | 2,352 | 3.9 | 2,249 | 3.8 | - 103 | - 4.4 | 2,249 | 3.8 | - 103 | - 4.4 |
| Woodlands | 2,350 | 3.9 | 2,292 | 3.8 | - 58 | - 2.5 | 2,282 | 3.8 | - 68 | - 2.9 |
| Open Lands[c], Landfills, Dumps, and Extractive | 6,876 | 11.5 | 4,576 | 7.6 | -2,300 | -33.4 | 4,215 | 7.0 | -2,661 | -38.7 |
| Subtotal | 28,688 | 47.9 | 25,313 | 42.2 | -3,375 | -11.8 | 23,731 | 39.6 | -4,957 | -17.3 |
| Total | 59,891 | 100.0 | 59,891 | 100.0 | 0 | -- | 59,891 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 45 square miles in 1990 to about 40 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 37 square miles under the high growth-decentralized land use plan, decreases of about 12 and 17 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the watershed of minor streams and direct drainage area tributary to Lake Michigan--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary sewer service areas located within the watershed of minor streams and direct drainage area tributary to Lake Michigan.

With regard to the point source plan element related to the watershed of minor streams and direct drainage area to Lake Michigan, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District's water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants; provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of a solids management program; and provision of trunk sewers to serve the various communities comprising the District service area. As of 1993, the District's pollution abatement program was nearing completion, with the deep tunnel system expected to be online during 1994.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on an update of its Section 201 sewerage facility plan[1] for the entire Milwaukee metropolitan service area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that the facility plan re-examine certain system level decisions that were made in the past including trunk sewer needs, and the cost-effectiveness of retaining the one remaining small sewage treatment plant in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewerage facilities plan update is intended, then, upon its adoption by all of the agencies concerned to constitute an amendment to the regional water quality management plan herein

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[1] Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1980.

presented. Such an amendment could impact on the facilities within the watershed of minor streams and direct drainage area tributary to the Lake Michigan watershed.

Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were eight public sewage treatment plants located in the watershed of minor streams and direct drainage area tributary to Lake Michigan, as shown on Map IX-3. The Milwaukee Metropolitan Sewerage District (MMSD) Jones Island and South Shore plants, the Cities of Port Washington, South Milwaukee, Racine, and Kenosha sewage treatment plants, and the North Park Sanitary District sewage treatment plants discharged directly or indirectly through harbors to the coastal waters of Lake Michigan. The Pleasant Park Utility Company plant discharged to Lake Michigan via a drainage ditch. Of these eight plants, the plants operated by the North Park Sanitary District and Pleasant Park Utility Company were abandoned after 1975, as recommended in the initial plan. The status of implementation in regard to the abandonment, upgrading and expansion, and construction of the public and private sewage treatment plants in the watershed of minor streams and direct drainage area tributary to Lake Michigan, as recommended in the initial regional water quality management plan, is summarized in Table IX-3.

As can be seen by review of Table IX-3, full implementation of the initial plan would provide for the upgrading, as needed, of three plants--the Milwaukee Metropolitan Sewerage District Jones Island and South Shore Plants, and the City of South Milwaukee plant. The initial plan also included recommendations for the expansion of the City of Kenosha, City of Racine, and City of Port Washington sewage treatment plants, as well as the abandonment of the North Park Sanitary District and Pleasant Park Utility Company plants. Implementation of these recommendations has been largely completed with the exception of the upgrading of the City of South Milwaukee plant. No action has yet been taken with regard to this plant. Selected characteristics of the public sewage treatment plants currently existing in the watershed are given in Table IX-4.

In addition to the publicly-owned sewage treatment facilities, five private sewage treatment plants were in existence in 1975 in the watershed of minor streams and direct drainage area tributary to Lake Michigan. These five plants served the following land uses: the Chalet-on-the-Lake Restaurant, the Port Country Club, the Siennadale Motherhouse, the Sisters of Notre Dame Academy (currently Concordia College), and the Wisconsin Electric Power Company Oak Creek Plant.

As indicated in Table IX-3, all five of the private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. As of 1990, four of the five plants had been abandoned. As of 1994, the Concordia College sewage treatment plant was continuing operations.

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the watershed of minor streams and direct drainage area tributary to Lake Michigan. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the

Table IX-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS IN THE
WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA
TRIBUTARY TO LAKE MICHIGAN: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| City of Kenosha | Lake Michigan | Expand | Partially competed[a] |
| Milwaukee Metropolitan Sewerage District-Jones Island Plant | Lake Michigan via Milwaukee outer harbor | Upgrade | Construction underway |
| Milwaukee Metropolitan Sewerage District-South Shore Plant | Lake Michigan | Upgrade | Construction underway |
| City of Port Washington | Lake Michigan | Expand | Construction underway |
| City of Racine | Lake Michigan | Expand | Partially completed, construction underway for additional plant improvements, including equalization basin[b] |
| City of South Milwaukee | Lake Michigan | Upgrade | No action |
| North Park Sanitary District | Lake Michigan | Abandon plant | Plant abandoned (1988) |
| Pleasant Park Utility Company | Lake Michigan via drainage ditch | Abandon plant | Plant abandoned (1990) |
| Private Sewage Treatment Plants | | | |
| Chalet-on-the-Lake Restaurant | Lake Michigan | Abandon plant | Plant abandoned (1981) |
| Port Country Club[c] | Soil absorption | Abandon plant | Plant abandoned (1980) |
| Siennadale Motherhouse | Bartlett Creek | Abandon plant | Plant abandoned (1990) |
| Concordia University[d] | Lake Michigan | Abandon plant | No action |
| Wisconsin Electric Power Company-Oak Creek Plant | Lake Michigan | Abandon plant | Plant abandoned (1986) |

[a]Plant expansion was completed in 1994.

[b] Plant expansion was completed in 1991.

[c] Most recently known as the Squires Country Club.

[d] Formerly Sisters of Notre Dame Academy.

Source: SEWRPC.

Table IX-4

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE
TREATMENT PLANTS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990

| Name of Public Sewage Treatment Plant | 1990 Estimated Total Area Served (square mile) | 1990 Estimated Total Population Served | Date of Construction and Major Modification | Major Sewage Treatment Unit Processes[a] | Name of Receiving Water to which Effluent is Disposed | WPDES Permit Expiration Date |
|---|---|---|---|---|---|---|
| City of Kenosha | 20.0 | 88,800 | 1941, 1967, 1984 | Clarification, phosphorus removal, activated sludge, clarification, chlorination, dechlorination | Lake Michigan | 6/30/98 |
| Milwaukee Metropolitan Sewrage District- Jones Island Plant | 255.4 | 1,036,000 | 1925, 1935, 1969, 1970, 1990 | Phosphorus removal, activated sludge, clarification, chlorination, dechlorination | Lake Michigan via Milwaukee outer harbor | 3/31/99 |
| Milwaukee Metropolitan Sewerage District- South Shore Plant | | | 1969, 1974, 1990 | Clarification, activated sludge, clarification, phosphorus removal, chlorination, dechlorination | Lake Michigan | 3/31/99 |
| City of Port Washington | 2.5 | 9,300 | 1956, 1972, 1990 | Activated sludge, contact stabilization, clarification, phosphorus removal, ultraviolet disinfection | Lake Michigan | 6/30/97 |
| City of Racine | 32.25 | 124,400 | 1938, 1967, 1977, 1989 | Equalized basin, clarification, phosphorus removal, activated sludge, chlorination | Lake Michigan | 6/30/96 |
| City of South Milwaukee | 4.8 | 21,000 | 1937, 1952, 1962, 1972, 1985 | Activated sludge, clarification, phosphorus removal, chlorination | Lake Michigan | 6/30/97 |

Table IX-4 (continued)

| Name of Public Sewage Treatment Plant | Hydraulic Loading (mgd) | | | | BOD5 Loading (pounds per day) | | | | Suspended Solids Loading (pounds per day) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | | | | Existing | | | | Existing | | | |
| | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Flow Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Flow Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Flow Exceeded the Design Capacity |
| City of Kenosha | 23.02 | 35.09 | 28.6[c] | 1 | 16,907 | 20,474 | 29,700 | 0 | 24,647 | 34,445 | 34,300 | 1 |
| Milwaukee Metropolitan Sewerage District-Jones Island Plant | 123.00 | 139.30 | 200.0 | 0 | 268,757 | 307,551 | 323,600 | 0 | 273,760 | 388,564 | 332,000 | 2 |
| Milwaukee Metropolitan Sewerage District-South Shore Plant | 101.00 | 158.00 | 150.0 | 1 | 118,66 | 141,987 | 265,000 | 0 | 152,089 | 196,434 | 265,000 | 0 |
| City of Port Washington | 1.42 | 1.72 | 3.1 | 0 | 1,803 | 2,231 | 4,315 | 0 | 2,237 | 2,737 | 5,386 | 0 |
| City of Racine | 28.80 | 43.90 | 30.0[d] | 3 | 23,212 | 26,374 | 61,300 | 0 | 32,887 | 41,275 | 50,000 | 0 |
| City of South Milwaukee | 3.45 | 5.10 | 6.0 | 0 | 3,995 | 5,642 | 11,000 | 0 | 5,850 | 9,836 | -- | 0 |

[a] In addition,plants typically include headworks and miscellaneous processes such as pumping, flow-metering and sampling, screening, and grit removal, as well as sludge handling and disposal facilities.

[b] Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data.

[c] In 1994, the City of Kenosha completed a sewerage system upgrading and expansion project, including 30.0-million gallon equalization and wastewater storage facilities for its sewerage system, resulting in a hydraulic design capacity of 28.6 mgd on an average annual basis and 68 mgd on a wet weather average basis.

[d] In 1994, the City of Racine was preparing facility planning for sewerage system upgrading and expansion.

Source: Wisconsin Department of Natural Resources and SEWRPC.

municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were nine sewer service areas identified within, or partially within, the watershed of minor streams and direct drainage area tributary to Lake Michigan: Belgium, Lake Church, Port Washington, Mequon, Milwaukee Metropolitan Sewerage District (MMSD), South Milwaukee, Racine, Kenosha, and Pleasant Park. Currently, all of these areas, with the exception of the Milwaukee Metropolitan Sewerage District[2] and the Lake Church sewer service areas, have undergone refinements as recommended. The boundaries of the sewer service areas as refined through 1993 are shown on Map IX-3. Table IX-5 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer service area in the, as refined through 1993, totals about 49 square miles, or about 53 percent of the total watershed area, as shown in Table IX-5.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the City of Kenosha, City of Port Washington, City of Racine, City of South Milwaukee, and MMSD Jones Island and South Shore sewage treatment plants. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table IX-6. This recommendation regarding plant facility upgrading and expansion as needed, also applies to the treatment plant solids management element for the six public sewage treatment plants recommended to be retained.

With regard to the two treatment plants operated by the Cities of Racine and Kenosha, further consideration should be given to evaluating a potential change in the recommendations set forth in the initial plan. That potential change is proposed based upon the findings of 1992 sanitary sewerage and water supply system plans which were completed for the greater Racine and greater Kenosha areas. The findings and recommendations of the planning work for the former are contained in a report prepared by Alvord, Burdick & Howson, entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area,

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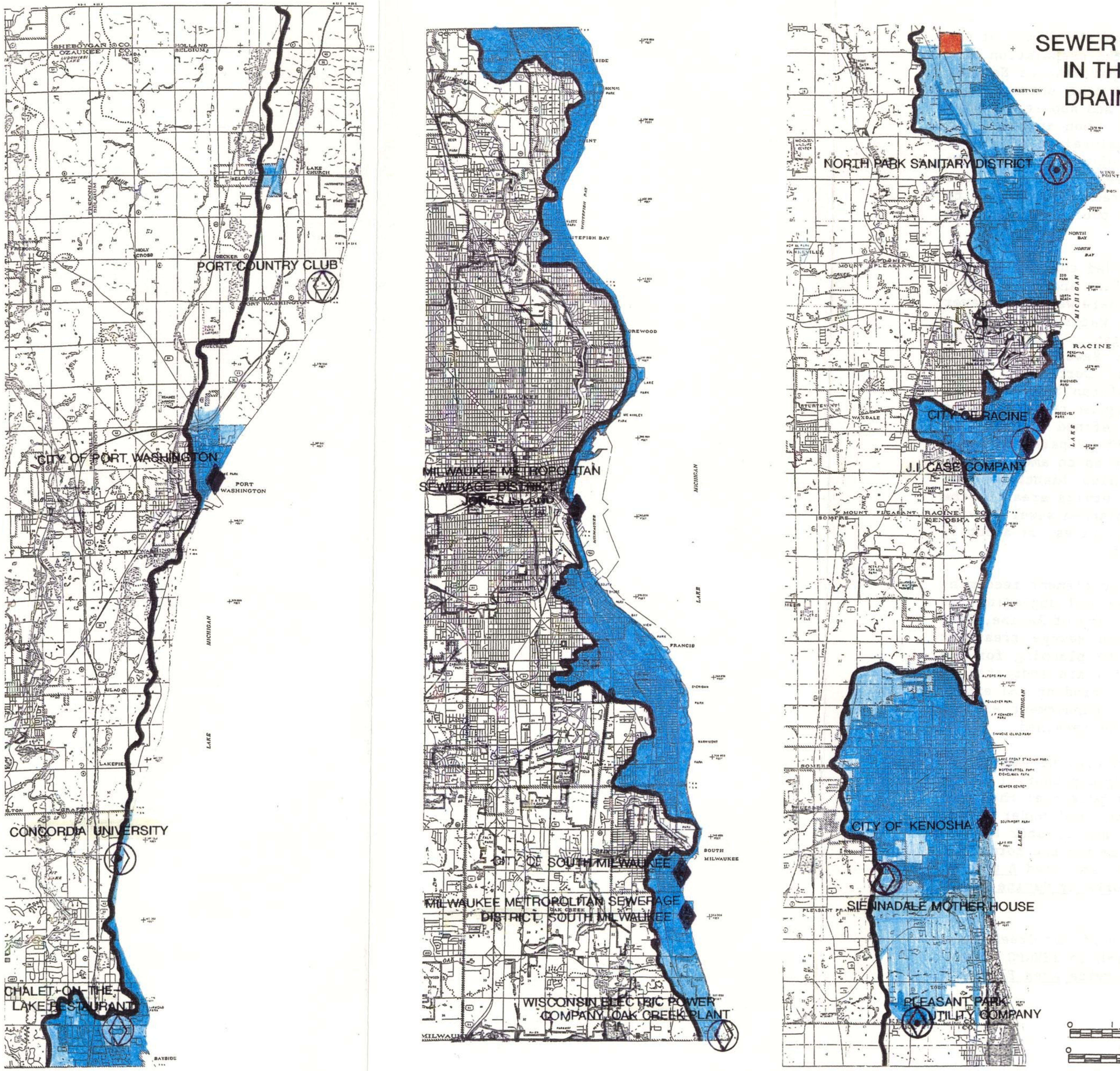
[2]As of September 1994, the sewer service areas for the City of Oak Creek portion of the MMSD sewer service area was refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area Plan for the City of Oak Creek, Milwaukee County, Wisconsin.

Map IX-3

# SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990




## LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- PRIVATE SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA

Source: SEWRPC.

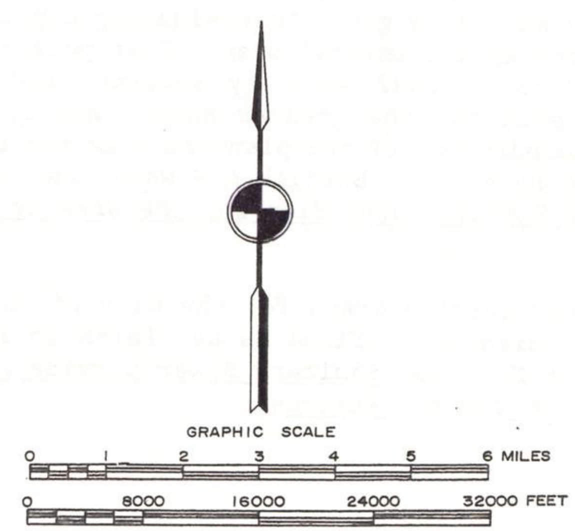


Table IX-5

PLANNED SANITARY SEWER SERVICE AREAS IN
THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Refined Sanitary Sewer Service Areas | | | | |
| Belgium | 1.3 | Belgium | June 15, 1987 | SEWRPC CAPR No.97, 2nd Edition, Sanitary Sewer Service Area for the Village of Belgium, Ozaukee County, Wisconsin |
| Kenosha<br>Pleasant Park<br>Somers | 22.7 | Kenosha | December 2, 1985 | SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin |
| Mequon<br>Thiensville | 4.0 | Mequon<br>Thiensville | January 15, 1992 | SEWRPC CAPR No. 188, Sanitary Sewer Service Area for the City of Mequon and the Village of Thiensville, Ozaukee County, Wisconsin |
| Port Washington | 1.8 | Port Washington | December 1, 1983 | SEWRPC CAPR No. 95, Sanitary Sewer Service Area for the City of Port Washington, Ozaukee County, Wisconsin |
| Racine<br>Caddy Vista | 19.2 | Racine<br>Caddy Vista | December 1, 1986 | SEWRPC CAPR No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin |
| Subtotal | 49.0 | | | |
| Unrefined Sanitary Sewer Service Areas | | | | |
| Milwaukee Metropolitan Sewerage District (portion)[a] | 16.9 | -- | -- | -- |
| Lake Church | 1.1 | -- | -- | -- |
| South Milwaukee | 1.4 | -- | -- | -- |
| Subtotal | 19.4 | -- | -- | -- |
| Total | 68.4 | -- | -- | -- |

Note: CAPR - Community Assistance Planning Report

[a] As of September 1994, the City of Oak Creek sanitary sewer service area portion of the Milwaukee Metropolitan Sewerage District was refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area Plan for the City of Oak Creek, Milwaukee County, Wisconsin. This refined Oak Creek sanitary sewer service area encompasses 3.0 miles within the minor streams and direct drainage area tributary to Lake Michigan.

while the findings and recommendations of the planning work for the latter are contained in a report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area. Those reports, which were prepared for study areas including all of the eastern portion Racine County extending from Lake Michigan to a distance of about two miles west of IH 94 and all of Kenosha County extending from Lake Michigan to a distance of one mile west of IH 94 include portions of the watershed of minor streams and direct drainage area tributary to Lake Michigan. The reports identified the sanitary sewer and water supply needs of those planning areas, and evaluated alternative means of meeting those needs; recommended coordinated design year 2010 sewerage and water supply system plans for the areas; identified intergovernmental, administrative, legal, and fiscal issues inherent in the implementation of the system plans; and recommended institutional structures for implementation of those plans. The recommended sewerage system and planned service areas developed in this subregional system plan are shown on Maps IV-4A and XIII-4A. As of December 1994, the needed intergovernmental agreement and approvals of the system plan or the attendant changes to the regional water quality management plan had not been achieved. Thus, the inclusion of these plan recommendations in the updated plan are pending intergovernmental agreement on the recommendations.

The current point source pollution abatement plan element, including the planned sewer service areas, and including the components noted above to be held in abeyance pending approval of the Cities of Racine and Kenosha, is summarized on Map IX-4. Table IX-6 presents selected design data for the six public sewage treatment plants which are recommended to be maintained in the watershed of minor streams and direct drainage area tributary to Lake Michigan. It is important to note that three plants recorded monthly average hydraulic loadings which equaled or exceeded the average design capacities of the plants, as shown on Table IX-4. It should be noted that the City of Kenosha completed a sewerage system upgrading and expansion in 1994, and that facility planning was underway for sewerage system upgrading and expansion for the City of Racine in 1994, and the Milwaukee Metropolitan Sewerage District facility planning was initiated in 1995.

Table IX-6 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the six public sewage treatment plants in the watershed of minor streams and direct drainage area tributary to Lake Michigan.

The current planned sanitary sewer service areas in the watershed of minor streams and direct drainage area tributary to Lake Michigan are shown on Map IX-4. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. All or portions of the following sewer service areas are located in the watershed of minor streams and direct drainage area tributary to Lake Michigan: Kenosha, Racine, South Milwaukee, Milwaukee Metropolitan Sewerage District, and Port Washington. Together, the planned service areas within the watershed total about 68 square miles, or about 73 percent of the watershed of minor streams and direct drainage area tributary to Lake Michigan.

As noted above, most of the sewer service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Additional refinements are envisioned to be needed for the Lake Church and remaining portion of the Milwaukee Metropolitan Sewerage District sewer

Map IX-4

UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 2010

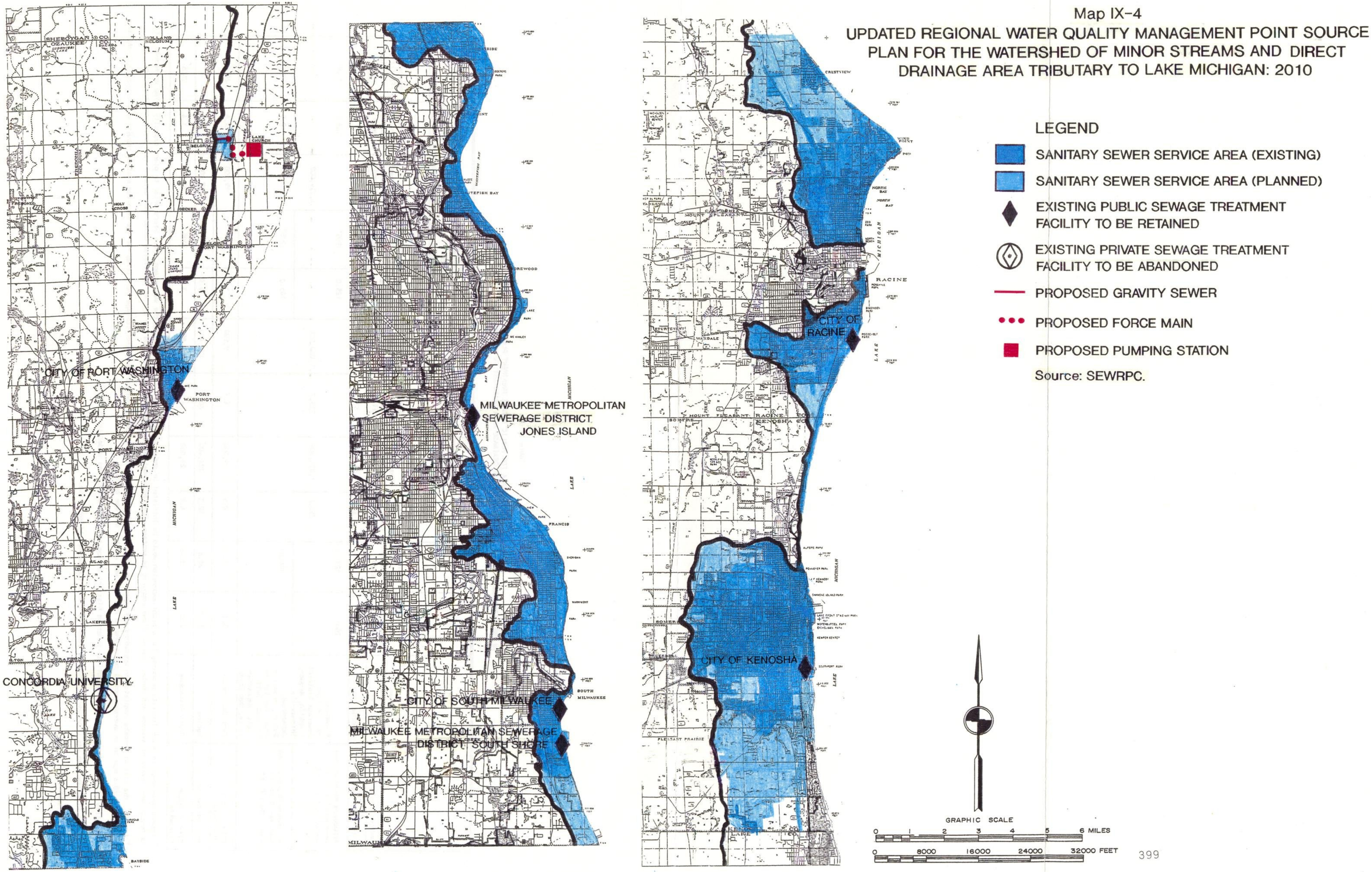


Table IX-6

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990 AND 2010

| Name of Public Sewage Treatment Plant | Sewer Service Area | Design Capacity Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intermediate Growth Centralized Land Use Plan | | | High Growth Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Total Area Served (square mile) | Resident Population Served | Planned Sewer Service Area (square mile) | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| City of Kenosha[b] | Kenosha | 28.6[b] | 23.02 | 20.0 | 83,800 | 53.2 | 100,900 | 25.0 | 2010 | 118,400 | 27.3 | 2010 |
| Milwaukee Metropolitan Sewerage District-Jones Island Plant | Milwaukee Metropolitan Sewerage District, Franklin, Mequon, Thiensville, Germantown, Butler, Brookfield East, New Berlin, Muskego, Caddy Vista, Menomonee Falls, Oak Creek | 200 | 123.20 | 250.6 | 1,036,000 | 335.7 | 1,060,000 | 125.0 | 1995[c] | 1,134,000 | 128.0 | 1995[c] |
| Milwaukee Metropolitan Sewerage District-South Shore Plant | | 120 | 100.01 | | | | | 105.0 | 1995[c] | | 110.0 | 1995[c] |
| City of Port Washington | Port Washington | 3.1 | 1.42 | 2.5 | 9,300 | 5.7 | 9,900 | 1.5 | 2010 | 19,000 | 2.6 | 2000 |
| City of Racine | Racine | 30.0[d] | 28.8 | 32.3 | 124,400 | 60.4 | 133,400 | 30.0 | --[d] | 167,800 | 34.2 | --[d] |
| City of South Milwaukee | South Milwaukee | 6.0 | 3.45 | 4.8 | 21,000 | 4.8 | 19,800 | 3.3 | 2005 | 20,300 | 3.4 | 2005 |

[a] Approximate year in which facility planning for a plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average and monthly design flows compared to average expected annual and maximum monthly flows and the age of facilities based upon data of last major construction.

[b] In 1994, the City of Kenosha completed an upgrading and expansion, including 30.0 million gallon equalization and wastewater storage facilities for its sewerage system, resulting in a hydraulic design capacity of 28.6 mgd on an average annual basis and 68 mgd on a wet weather average basis.

[c] Facility planning for Milwaukee Metropolitan Sewerage District sewage treatment plants was underway in 1995.

[d] Local facility plan was underway in 1994 for sewerage system upgrading and expansion.

Source: SEWRPC

service area. It is recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plants, there was one private sewage treatment plant in operation within the watershed of minor streams and direct drainage area tributary to Lake Michigan in 1990. This facility serves Concordia College. This private plant is recommended to be abandoned during the planning period with connection to the Milwaukee Metropolitan Sewerage District system through the City of Mequon sewerage system. It is recommended that at such time as the Concordia College sewage treatment plant requires a major upgrading and/or expansion, that an evaluation be conducted of the cost effectiveness of the alternative of abandoning the plant with connection to the Mequon public sewerage system.

Sewer Flow Relief Devices

Existing Conditions and Status of Plan Implementation: As shown in Table IX-7, 63 points of sanitary sewer system flow relief--including two combined sewer overflows--were reported to exist during 1993 in the watershed of minor streams and direct drainage area tributary to Lake Michigan. These flow relief points are located in nine sewerage systems and include, in addition to the two combined sewer overflows, selected bypasses which physically remain in the sewerage system but are expected to function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. These flow relief points, except for the combined sewer overflows, have only been in operation infrequently, with the average discharge occurrence frequency over this five-year period being less than once per year per flow relief location. This equates to an average of about six isolated overflow occurrences per year considering all reported bypassing. With the completion of the Inline Storage System, bypassing of sewage from the combined sewer overflows is expected to occur an average of about one to two times per year. The Milwaukee Harbor estuary study[3] documented that this level of reduction in combined sewer overflow discharges would be adequate to meet water quality standards within the Milwaukee outer harbor, assuming the other water quality improvement measures recommended are carried out. Bypassing from the other sanitary sewer flow relief devices is expected to be further eliminated over time as sewerage system upgrading is completed.[4]

Current Plan Recommendations: It is recommended that the Cities of Cudahy, Milwaukee, and Racine; the Villages of Bayside, North Bay, and Whitefish Bay; the Milwaukee Metropolitan Sewerage District, the Crestview Sanitary District,

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[3]See SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, Volume One, Inventory Findings, Volume Two, Alternative and Recommended Plans, December 1987.

[4]In 1994, the City of Racine was planning a sewer rehabilitation program, including upgrading of lift stations and construction of relief sewers. This project should result in the elimination of many of the bypasses in that system.

Table IX-7

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE WATERSHED
OF THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Combined Sewer Overflow | Cross-overs | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| Village of Bayside | -- | -- | 5 | 1 | -- | -- | 6 | Used only in case of extreme wet weather |
| Village of Whitefish Bay | -- | -- | 19 | -- | -- | 1 | 20 | Used only in case of extreme wet weather |
| City of Milwaukee | -- | -- | 1 | -- | -- | -- | 1 | Used only in case of extreme wet weather |
| Milwaukee Metropolitan Sewerage District | -- | 2 | 2 | -- | -- | -- | 4 | Used only in case of extreme wet weather |
| City of Cudahy | -- | -- | 19 | -- | -- | -- | 19 | Used only in case of extreme wet weather |
| North Park Sanitary District | -- | -- | -- | 2 | -- | -- | 2 | Used only in case of equipment failure |
| Crestview Sanitary District | -- | -- | -- | -- | 1 | -- | 1 | Used only in case of extreme wet weather |
| Village of North Bay | -- | -- | -- | -- | 2 | -- | 2 | Used only in case of extreme wet weather |
| City of Racine | -- | -- | 5 | 1 | 2 | -- | 8 | Used only in case of equipment failure or extreme wet weather |
| TOTAL | -- | 2 | 51 | 4 | 5 | 1 | 63 | |

Source: SEWRPC.

and the North Park Sanitary District continue to monitor the sewerage system operations to ensure that the use of the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading within the watershed be conducted with the assumption that there will be no planned bypasses of untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of three intercommunity trunk sewers in the watershed of minor streams and direct drainage area tributary to Lake Michigan, as shown in Table IX-8. One trunk sewer would connect anticipated urban development in the unincorporated Village of Lake Church to the Village of Belgium sewerage system. This trunk sewer has not yet been constructed. The second trunk sewer would connect the North Park Sanitary District service area and other portions of the Town of Caledonia to the City of Racine sewerage system. The construction of this trunk sewer was completed in 1988, and the North Park Sanitary District facility was subsequently abandoned as recommended in the initial plan. A further intercommunity trunk sewer would connect the Pleasant Park Utility Company service area and portions of the Village of Pleasant Prairie to the City of Kenosha sewerage system. The construction of this trunk sewer was completed in 1990 and the Pleasant Park Utility Company sewage treatment plant abandoned as recommended in the initial plan.

Current Plan Recommendations: The current regional water quality management plan includes recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the watershed of minor streams and direct drainage area tributary to Lake Michigan. Two of the three intercommunity trunk sewers recommended to be constructed in the watershed under the initial plan have been completed. The remaining trunk sewer to connect the unincorporated Village of Lake Church to the Village of Belgium sewerage system is recommended to be constructed at such time as the provision of sanitary sewer service to Lake Church is considered further and implemented.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: As of 1990, there were 47 point sources of wastewater discharging cooling water and other types of wastewater to the watershed of minor streams and direct drainage area tributary to Lake Michigan through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table IX-9 summarizes selected characteristics of these other point sources and Map IX-5 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 65 known permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the watershed of minor streams and direct

Table IX-8

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
| --- | --- |
| Lake Church-Belgium | Not completed |
| Caledonia-Crestview and North Park-Racine | Completed (1988) |
| Pleasant Prairie-Kenosha | Completed (1990) |

Source: SEWRPC.

Table IX-9

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION
IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990[a]

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Ametek Lamb Electric Division | Racine | 1 | General | 0044938-3 | 9-30-95 | 3564/3621 | Blowers, fans, mtrs., generators | Lake Michigan via storm sewer | -- |
| Anderson Park Pool | Kenosha | 2 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Barnes Creek via storm sewer | -- |
| Arneson Foundry, Inc. | Kenosha | 3 | General | 0044938-3 | 9-30-95 | 3321/3325 | Gray & ductile iron, steel foundry | Lake Michigan via storm sewer | -- |
| Benjamin Air Rifle Company | Racine | 4 | General | 0044938-3 | 9-30-95 | 3484 | Small arms | Lake Michigan via storm sewer | -- |
| Best Western Harborside Inn | Ozaukee | 5 | General | 0046523-2 | 9-30-95 | 7011 | Hotels and motels | Lake Michigan via harbor | -- |
| Boliden-Allis Inc.: Res. & Test Ctr. | Milwaukee | 6 | General | 0044938-3 | 9-30-95 | 8732 | Commercial nonphysical research | Lake Michigan | -- |
| Bostrom Seating, Inc. | Milwaukee | 7 | General | 0044938-3 | 9-30-95 | 2531 | Public bldg. and related furniture | Lake Michigan via storm sewer | -- |
| Bradford High School Pool | Kenosha | 8 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Pike Creek | -- |
| City of Cudahy Water Utility | Milwaukee | 9 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Lake Michigan | -- |
| City of Racine: Gaslight Point Prjt. | Racine | 10 | General | 0046558-1 | 9-30-95 | -- | N/A | Lake Michigan | -- |
| EZ Paintr. Corp. | Milwaukee | 11 | General | SPEC PERM | 9-30-95 | 3991 | Brooms and brushes | Lake Michigan | -- |
| Fox Point Municipal Pool | Milwaukee | 12 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Lake Michigan via storm sewer | -- |
| Gleason Ready Mix | Racine | 13 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| In-Sink-Erator. -Emerson, Inc. | Racine | 14 | General | 0044938-3 | 9-30-95 | 3639 | Household appliances | Lake Michigan via storm sewer | -- |
| Jacobsen Div. -Textron Industries | Racine | 16 | General | 0044938-3 | 9-30-95 | 3524 | Lawn & garden equipment | Lake Michigan via storm sewer | -- |
| Milw. Water Works-Linwood Purif. Plt. | Milwaukee | 17 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Lake Michigan | -- |
| North Shore Cement & Burial Vault Inc | Kenosha | 18 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| West Point Raquet & Fitness Club | Racine | 19 | General | 0046523-2 | 9-30-95 | 7997 | Membership sports & rec. club | Lake Michigan via unnamed trib. | -- |
| Port Washington Water Utility | Ozaukee | 20 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Lake Michigan | -- |
| Quality Concrete Steps & Porches | Milwaukee | 21 | General | 0046507-2 | 9-30-95 | 3272 | Concrete products | Groundwater discharge | -- |
| Racine School Dist.: Horlick H.S. | Racine | 22 | General | 0046523-1 | 9-30-95 | 8211 | Secondary school | Lake Michigan via storm sewer | -- |
| Racine School Dist.: Wachwitz Elem. | Racine | 23 | General | 0046523-1 | 9-30-95 | 8211 | Elementary school | Lake Michigan via storm sewer | -- |
| Rainfair, Inc.-Memorial Drive | Racine | 24 | General | 0044938-3 | 9-30-95 | 2385 | Waterproof outerwear | Lake Michigan via storm sewer | -- |
| Reuther High School (pool) | Kenosha | 25 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Pike Creek via storm sewer | -- |
| S.C.Johnson & Son- R & D Center | Racine | 26 | General | 0044938-3 | 9-30-95 | 2842/2879 | Polishes, sanitation, ag. chems. | Lake Michigan via storm sewer | -- |
| St. Francis High School (pool) | Milwaukee | 27 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Lake Michigan via storm sewer | -- |
| Snap-on Tools Corp. | Kenosha | 28 | General | 0044938-3 | 9-30-95 | 3425/3429 | Saw blades, saws & hardware | Lake Michigan via storm sewer | -- |
| Surgitek, Inc. | Racine | 29 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Lake Michigan via storm sewer | -- |
| Tremper High School (pool) | Kenosha | 30 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Lake Michigan via storm sewer | -- |
| Twin Disc, Inc. -21st St. Factory | Racine | 31 | General | 0044938-3 | 9-30-95 | 3566/3568 | Speed changers, drivers,etc. | Lake Michigan via storm sewer | -- |
| Vulcan Materials Co.- Racine Plant | Racine | 32 | General | 0046515-2 | 9-30-95 | 3281/3274 | Cut stone; stone products; lime | Lake Michigan via storm sewer | -- |
| Washington Park Pool- Kenosha | Kenosha | 33 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Pike Creek | -- |
| Whitefish Bay High School (pool) | Milwaukee | 34 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Lake Michigan via storm sewer | -- |
| Wire & Metal Specialties Co. | Milwaukee | 35 | General | 0044983-3 | | 3443 | Fabricated plate work | Lake Michigan via storm sewer | -- |
| YWCA of Racine | Racine | 36 | General | 0046523-2 | | 7991 | Physical fitness facility | Lake Michigan via storm sewer | -- |

Table IX-9 (cont'd)

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Chrysler Corp -Engineering Division | Kenosha | 1A | Specific | 0000833 | 06-03-92 | 3714 | Motor vehicles, parts & accessor. | Pike Creek via storm sewer | 5 |
| Everbrite, Inc. | Milwaukee | 2A | Specific | 0045764 | 06-30-88 | 3646 | Commercial lighting fixtures | Lake Michigan via storm sewer | None |
| J.I. Case Company (24th & Mead) | Racine | 3A | Specific | 0000311 | 06-30-93 | 3523 | Farm machinery & equipment | Lake Michigan via storm sewer | 3, 5, 1, 2 |
| Kenosha City Harbor Conf. Disp. Fac. | Kenosha | 4A | Specific | 0045390 | 06-30-93 | 4432 | Freight transportation on L. Mich. | Lake Michigan | None |
| Ladish Company, Inc. -Cudahy | Milwaukee | 5A | Specific | 0000728 | 06-30-90 | 3462 | Iron & steel forgings | Lake Michigan via storm sewer | None |
| Lakeshore Towers of Racine | Racine | 6A | Specific | 0048470 | -- | -- | -- | Lake Michigan | None |
| Outokumpu American Brass, Inc. | Kenosha | 7A | Specific | 0000299 | 09-30-87 | 3351 | Copper rolling and drawing | Lake Mickigan via storm sewer | 5, 3, 1 |
| Solvay Animal Health, Inc. | Ozaukee | 8A | Specific | 0033294 | 08-31-90 | 8731 | Commercial physical research | Lake Michigan | 3 |
| Twin Disc, Inc. | Racine | 9A | Specific | 0038199 | 08-31-94 | 3566 | Speed changers, drivers, etc. | Lake Michigan via storm sewer | None |
| Wisconsin Elec. Power Co. -Oak Creek | Milwaukee | 10A | Specific | 0000914 | 06-30-90 | 4911 | Electric services | Lake Michigan | 6, 8 |
| Wisconsin Nat. Gas Co. -Oak Creek | Milwaukee | 11A | Specific | 0054372 | 03-31-90 | 4923 | Gas transmission & distribution | Lake Michigan via storm sewer | None |
| Young Radiator Company | Racine | 12A | Specific | 0039748 | 12-31-86 | 3714 | Motor vehicle parts | Lake MIchigan via ditch | 6, 2, 7, 4 |

[a] Table IX-9 includes 47 known, permitted point sources of wastewater discharging to the surface or groundwater of the watershed of the minor streams and direct drainage area tributary to Lake Michigan.

[b] See Map IX-5, "Point Sources of Pollution Other than Sewage Treatment Plants in the Watershed of the Minor Streams and Direct Tributary Area to Lake Michigan: 1990."

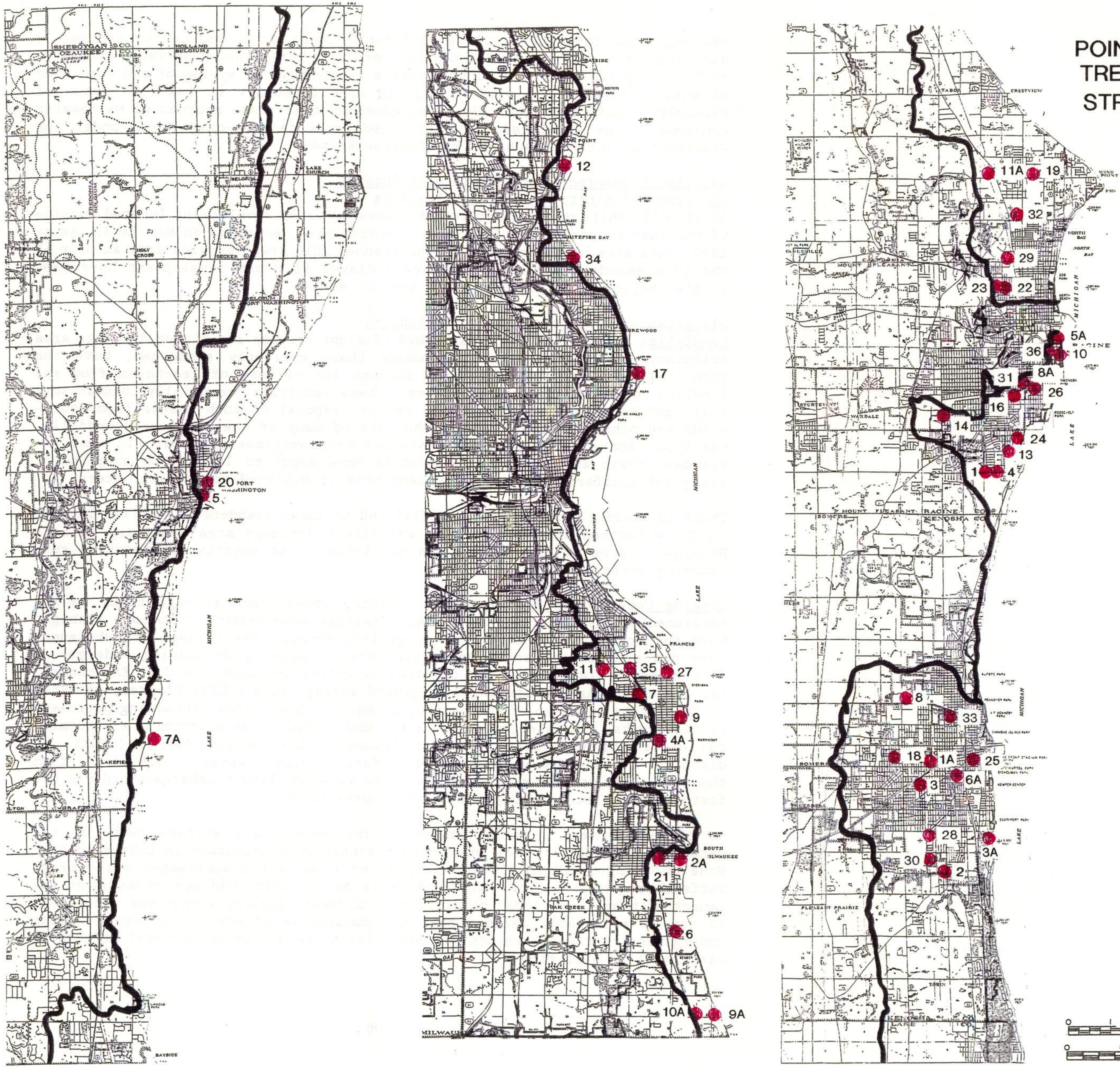
[c] The number code refers to the following treatment systems:

1. Chemical conversion/addition
2. Cooagulation flocculation
3. Gravity sedimentation
4. Gravity thickening
5. Oil and grease removal
6. pH control
7. Secondary clarification
8. Tube/Plate settlers

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map IX-5

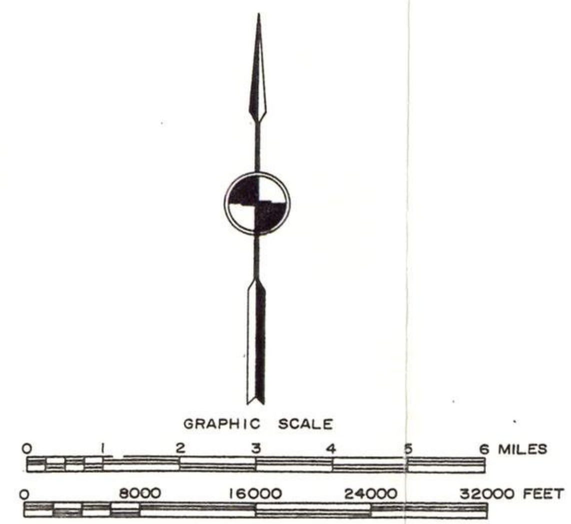
# POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990




LEGEND

● POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.



drainage area tributary to Lake Michigan. These point sources of wastewater discharge primarily industrial cooling, process, rinse, and wash water directly, or following treatment, to surface waters or groundwater system of the watershed of minor streams and direct drainage area tributary to Lake Michigan, or directly to Lake Michigan. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside
the Proposed Sanitary Sewer Service Area

As of 1975, there was one enclave of unsewered urban development located outside of the then proposed year 2000 sewer service area, as shown on Map IX-3. As of 1990, this area has been added to the planned 2010 sewer service area as part of the plan amendment process. No new enclaves of urban development have been created beyond these planned sewer service areas.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the watershed of minor streams and direct drainage area tributary to Lake Michigan, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can be subsequently transported to surface waters.

There is currently one active landfill and 46 known abandoned landfills located in the watershed of minor streams and direct drainage area tributary to Lake Michigan. None of these landfills are known to be negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the watershed of minor streams and direct drainage area tributary to Lake Michigan have the potential to affect water quality through the release of substances into the surrounding soils and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate clean up of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing clean up efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground waters. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were 231 known leaking underground storage tanks in the watershed of minor streams and direct drainage area tributary to Lake Michigan. None of these involved the discharging of remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground waters. As of 1993, there were no such permitted sites discharging to surface or ground waters in the watershed of minor streams and direct drainage area tributary to Lake Michigan.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

### Existing Conditions and Status of Plan Implementation

For the watershed of minor streams and direct drainage area tributary to Lake Michigan, the initial plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to erosion control, streambank erosion control, and onsite sewage disposal system management. The plan recommended that additional nonpoint source controls be provided in certain areas. Within the Barnes Creek subwatershed, the plan recommends a reduction of about 50 percent in the urban areas. No nonpoint source control practices were recommended in the portion of Milwaukee County where the deep tunnel combined sewer overflow abatement plan has been implemented and where a relatively high level of nonpoint source control will be achieved by the conveyance of most of the stormwater to the Milwaukee Metropolitan Sewerage District sewerage system.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the watershed of minor streams and direct drainage area tributary to Lake Michigan through local and State regulation and programs. In the area of construction site erosion control, significant progress has been made. As of January 1993, the Cities of Kenosha, Oak Creek, Cudahy, Milwaukee, and Mequon, and the Village of Pleasant Prairie had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. The ordinance adopted by the City of Cudahy applies only to subdivisions, and the ordinance adopted by the City of Mequon includes stormwater management requirements. In addition, the City of Port Washington had adopted a construction site erosion control ordinance that predates the model ordinance which applies to commercial developments and subdivisions; and the Village of River Hills has an ordinance which was developed independently from the model. As of 1994, an ordinance is being drafted for the Town of Grafton.

While new development is largely being served by sanitary sewer, the existing unsewered development and some additional new unsewered development within the watershed is regulated by onsite sewage disposal system programs administered by Kenosha, Racine, and Ozaukee Counties. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of new systems, and for problem resolution of failing systems where they are identified.

Rural nonpoint source control implementation actions, such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others, are utilized primarily for cropland soil erosion control and wildlife habitat purposes, respectively, and will have positive water quality impacts. Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection, as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Kenosha, Racine, and Ozaukee Counties. Those plans identify priority areas for cropland soil erosion to tolerable levels. Soil Conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While the local programs described above have probably resulted in some reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for the cost of an individual project or land management practice to local governments and private landowners upon completion of the detailed plans. The funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. A portion of the watershed of minor streams and direct drainage area tributary to Lake Michigan is being proposed to be included within the study area for the Milwaukee River South priority watershed project. The area proposed to be added to the Milwaukee River South priority watershed project area includes about 14.4 square miles of the Lake Michigan direct drainage area extending from the northern limits of the Town of Grafton in Ozaukee County to the Milwaukee Harbor estuary. A description of the Milwaukee River South priority watershed project is included in Chapter VIII. Planning for the Milwaukee River South priority watershed project[5] and was completed in 1991, and implementation of practices began in October 1991 and will continue for eight years.

Because of the situation of the watershed within the Lake Michigan coastal zone, and because of community concerns relating to the extensive erosion of shorelands due to storms, ice-cover and high water conditions existing with the Laurentian Great Lakes System, the Commission has prepared coastal erosion control plans for Milwaukee[6] and Racine[7] Counties. The plans identify priority actions required to control and reduce the erosion of shorelands as well as providing for longer term protection of the shorelands, and, additionally, recommend shoreland management practices intended to minimize coastal zone erosion and its consequences for economic activities within the watershed of minor streams and direct drainage area tributary to Lake Michigan.

While the local programs described above have likely resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

Current Plan Recommendations: It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, in addition to land management, would provide at least a 25 percent reduction in loadings to the watershed of minor streams and direct drainage area tributary to Lake Michigan. Within the Barnes Creek subwatershed, it is recommended that additional practices providing for levels of control for about a 50 percent reduction in nonpoint source loadings be provided.

The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, additional portions of the watershed of minor streams and direct drainage area tributary to Lake Michigan should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make State cost-sharing funds and related programs available for nonpoint source pollution control measures. The current priority ranking of

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[5]Wisconsin Department of Natural Resources, Publication No. WR-245-91, A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project, December 1991.

[6] SEWRPC Community Assistance Planning Report No. 110, A Lake Michigan Coastal Erosion and Related Land Use Management Study for the City of St. Francis, Wisconsin, August 1984; SEWRPC Community Assistance Planning Report No. 155, A Lake Michigan Shoreline Erosion Control Plan for Northern Milwaukee County, Wisconsin, December 1988; SEWRPC Community Assistance Planning Report No. 163, A Lake Michigan Shoreline Erosion Control Plan for Milwaukee County, Wisconsin, October 1989.

[7] SEWRPC Community Assistance Planning Report No. 86, A Lake Michigan Coastal Erosion Management Study for Racine County, Wisconsin, October 1982.

watersheds for inclusion in that program is documented in a memorandum[8] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included portions of the watershed of minor streams and direct drainage area tributary to Lake Michigan--the Pike Creek and Sucker Creek subwatersheds--in the high category, indicating that inclusion in the program will be possible within the near future, when the existing planning projects are completed or as additional funds and staff become available within the Department of Natural Resources. In addition, Barnes Creek subwatershed could be considered for a small scale priority watershed project.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous section, the most direct measure of impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

As of 1993, no known monitoring has been carried out on a sustained basis in the watershed of minor streams and direct drainage area tributary to Lake Michigan. Off-shore, long-term monitoring has been carried out in Lake Michigan in the vicinity of Milwaukee Harbor by the Milwaukee Metropolitan Sewerage District at fifteen stations in the Milwaukee Outer Harbor, twelve stations along the south shore in the vicinity of the South Shore Wastewater Treatment Plant, and at fourteen stations in the nearshore zone between Wind Point and Fox Point adjacent to Milwaukee County. Physical, chemical, and biological data are typically collected from these 41 stations at bi-weekly--Outer Harbor and South Shore stations--or monthly--nearshore stations--intervals. These data collected through 1984, as well as additional supplementary water quality data collected during runoff events, was used in the preparation of the Milwaukee Harbor estuary study. A description of water quality conditions based upon that data and upon water quality modeling is documented in that study report.[9]

### Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the Metropolitan Milwaukee Sewerage District at their offshore stations on a continuing long-term basis. That data provide an adequate basis for water quality assessments. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at four stations, with one station each being located on Barnes Creek, Fish Creek, Pike Creek and Sucker Creek. It is recommended that this program be conducted within the next five to seven years and repeated at five to seven year intervals. These recommendations can be coordinated, and are consistent, with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring

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[8]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southwestern Wisconsin: 1993."

[9]SEWRPC Planning Report No. 37, op cit.

activities and perform basic assessments for each watershed in the Region in an approximate five to seven year rotating cycle.

## LAKES MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and or consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological conditions monitoring programs to be established.

As noted above, there are no major lakes in the watershed of minor streams and direct drainage area tributary to Lake Michigan. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

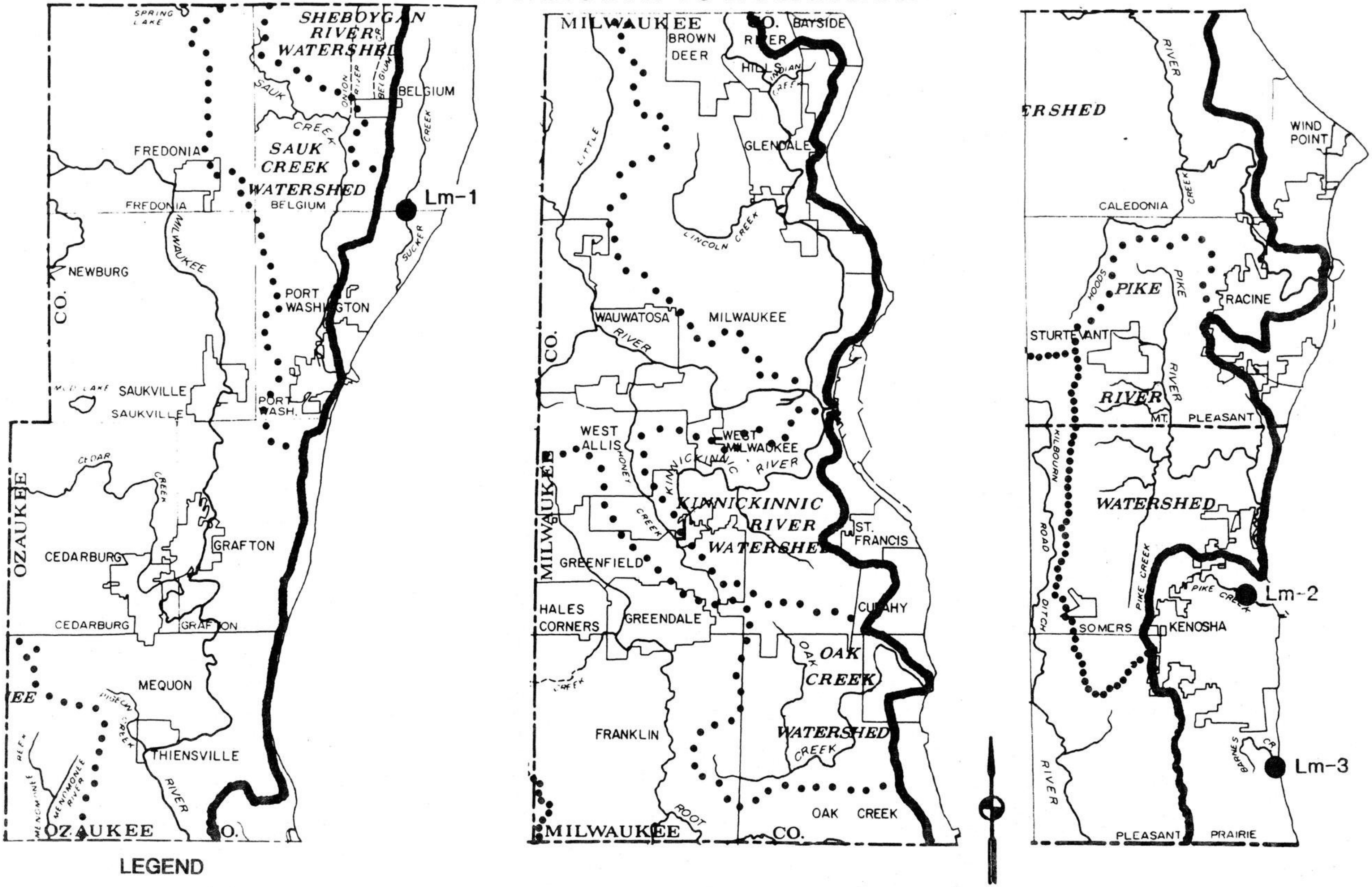
## WATER QUALITY AND BIOLOGICAL CONDITIONS

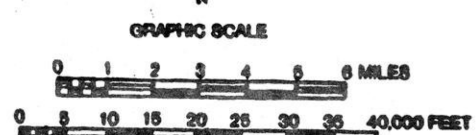
### Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the watershed of minor streams and direct drainage area tributary to Lake Michigan included samplings at three Commission stations shown on Map IX-6: one each on Sucker Creek, Pike Creek, and Barnes Creek.

No known post-1976 comparable water quality data were available for the streams in the Lake Michigan direct drainage watershed. Limited biological condition data collected by the Wisconsin Department of Natural Resources were available for use in the assessment of current water quality conditions. In addition, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. Review of these data can provide insight into the current water quality conditions and the potential for currently achieving the established water use objectives in the watershed of minor streams and direct drainage area tributary to Lake Michigan.

# Map IX-6
## LOCATION OF WATER QUALITY SAMPLING STATIONS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN




LEGEND

Sampling stations used in preparation of initial plan

● SEWRPC

Source: SEWRPC.

Toxic and Hazardous Substances: No known stream water or bottom sediment sampling for toxic and hazardous materials had been available for use in preparing the initial regional water quality management plan.

Since completion of the initial plan, few analyses of the chemical composition of the sediments of the streams directly tributary to Lake Michigan have been conducted. Most studies of sediment chemistry that have been carried out have been related to the Milwaukee Harbor Estuary and are reported in Chapters VI, VII, and VIII on the Kinnickinnic, Menomonee, and Milwaukee River watersheds, respectively, and in the Milwaukee Harbor Estuary Study.[10] Sediment quality data for the offshore portions of Milwaukee Harbor are reported by Palmer[11] and Ni, Gin and Christensen.[12] In the latter study, polychlorinated biphenyl (PCB) concentrations exceeded the Lowest Effect Level (LEL) proposed by the Wisconsin Department of Natural Resources[13] as screening criteria for contaminated sediments at one of the 15 sampling sites in the Outer Harbor. Polycyclic Aromatic Hydrocarbon (PAH) LELs were exceeded at 14 of the 15 stations sampled during this study. Palmer reported similar results from her study; the PCB LEL was exceeded at both stations in the Outer Harbor and the total PAH LEL was exceeded at one of the two stations. Sediment quality data for the Port Washington Harbor are reported in SEWRPC Memorandum Report No. 16, Unpolluted Dredge Materials Disposal Plan for the Port Washington Harbor, City of Port Washington, Ozaukee County, Wisconsin, published in May 1987. Concentrations of arsenic, cadmium, chromium, copper, lead and mercury exceeded the LEL for those metals at two of the four stations sampled. Oil and grease concentrations exceeded the LEL guideline at one site. Additional data for the offshore portion of Kenosha Harbor were collected by the Wisconsin Department of Natural Resources during 1991. Concentrations of the metals--arsenic, cadmium, chromium, copper, lead, and mercury--exceeded the LEL guidelines in this estuary, as did the total PAH concentration.

Since the completion of the initial regional water quality management plan, nine spills of toxic substances into streams within the watershed of minor streams and direct drainage area tributary to Lake Michigan have been documented by the Wisconsin Department of Natural Resources. Of these spills, eight have occurred in Pike Creek and one in Sucker Creek.

Water Quality Assessments: Based upon available data, the water quality and biological characteristics of the watershed of minor streams and direct drainage area tributary to Lake Michigan were assessed, with the results set forth in Table IX-10. Where data were available, fish populations and diversity range

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[10] Ibid.

[11] Lauran Palmer, Evaluation of Polychlorinated Biphenyls and Polycyclic Aromatic Hydrocarbons in the Menomonee River, Canals, and Milwaukee Harbor, Final Report, University of Wisconsin-Stevens Point, August 1993.

[12] Fan Ni, Michael F. Gin & Erik R. Christensen, Toxic Organic Contaminants in the Sediments of the Milwaukee Harbor Estuary, Final Report, Milwaukee Metropolitan Sewerage District, March 1992.

[13] Wisconsin Department of Natural Resources, (Draft) Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System, June 1994.

Table IX-10

CHARACTERISTICS OF STREAMS IN THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating | Streambed Sedimentation (substrate) | Physical Modifications to Channel[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| Barnes Creek | 3.0 | Fair | No | Yes | No | Yes | Yes | -- | -- | Moderate (silt, clay, sand, gravel) | Major |
| Pike Creek | 3.7 | Poor | No | No | No | No | Yes | -- | -- | Moderate to high (silt) | Major |
| Sucker Creek | 8.2 | Fair | No | No | No | No | No | -- | -- | High (clay, silt, gravel, muck) | Major |
| Fish Creek | 3.4 | -- | No | -- | -- | -- | -- | -- | -- | -- | -- |
| Unnamed Stream in T4N, R23E, Sections 21 and 22 | 0.9 | -- | No | -- | -- | -- | -- | -- | -- | -- | -- |
| Unnamed Stream in T4N, R23E, Sections 17 and 20 | 1.7 | -- | No | -- | -- | -- | -- | -- | -- | -- | -- |

[a] Based upon professional judgment of area fish managers.

[b] Simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for stream reaches in the watershed of the minor streams and direct drainage area tributary to Lake Michigan based upon year 2000 land use conditions and current level of pollutant control.

[c] Physical modifcations to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

from poor to fair: Pike Creek has been rated as poor, and Barnes Creek and Sucker Creek have been rated as fair. Standards were not expected to be fully met for dissolved oxygen concentrations and phosphorus levels in Barnes Creek. In addition, fecal coliform levels were expected to be outside of acceptable limits in both Barnes and Pike Creeks. Ammonia nitrogen levels did not appear to pose problems in any of the three major streams in the watershed. No data were available on water column toxic pollutants.

No recent data on biotic index ratings, which are biological indicators of water quality within a stream system, were available for streams within the watershed. Moderate to high levels of streambed sedimentation were noted in all three Creeks, with the highest level of siltation being recorded in Sucker Creek.

Table IX-11 sets forth the water quality index classifications[14] used in the initial plan for three sampling stations in the watershed. The use of that index is discussed in Chapter II. The limited data indicate that water quality conditions remained "fair" from 1964 to 1974 and 1975, but no recent data were available to assess the water quality conditions in 1990 and 1991.

A summary of potential pollution sources in the watershed of minor streams and direct drainage area tributary to Lake Michigan by stream reach is shown in tabular summary in Table IX-12. Review of the data indicate the majority of the conversion of lands from rural to urban uses has occurred historically in the Greater Racine and Kenosha urban areas, and more recently in the Fish Creek subwatershed on the border of Milwaukee and Ozaukee Counties. It should also be noted that a majority of the documented spills of toxic substances and the majority of the permitted industrial discharges occur in Pike Creek in the City of Kenosha. Data on nonpoint source pollution are included in Table IX-12.

### Compliance with Water Use Objectives

As indicated in Chapter II, the major stream reaches in the watershed of minor streams and direct drainage area tributary to Lake Michigan are recommended for warmwater sport fish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II.

Based upon the available data for sampling stations in the watershed, Barnes, Pike, and Sucker Creeks did not meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. Based upon a review of water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the dissolved oxygen, fecal coliform, and phosphorus standards continue to occur in Barnes and Pike Creeks and in the two unnamed streams in Racine County. However, the recommended water use objectives may potentially be met in Sucker Creek and in Fish Creek.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

There are three major water quality issues remaining to be resolved in the watershed of minor streams and direct drainage area tributary to Lake Michigan.

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[14] For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table IX-11

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE WATERSHED OF THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN 1964, 1974-1975, AND 1990-91

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Lm-1 (Sucker Cr) | Fair | Fair | -- |
| Lm-2 (Pike Cr) | Fair | Fair | -- |
| Lm-3 (Barnes Cr) | Fair | Fair | -- |
| Watershed Average | Fair | Fair | -- |

[a] See Map IX-6 for sampling station locations.

Source: SEWRPC.

Table IX-12

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE MINOR STREAMS TRIBUTARY TO LAKE MICHIGAN: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Barnes Creek | Insignificant[d] | Major[e] | -- | X | -- | -- | -- | 1 | -- | | 1 |
| Pike Creek | Insignificant[d] | Moderate | 81-unknown<br>83-unknown<br>86-unknown<br>86-unknown<br>87-paint thinner<br>88-Cutting fluid<br>90-milk-white substance | X | -- | -- | -- | 4 | -- | | 1 |
| Sucker Creek | Insignificant | Insignificant | 84-diesel fuel | -- | X | -- | -- | 0 | -- | | -- |
| Fish Creek | Moderate | Significant | -- | X | -- | -- | -- | 0 | -- | | 1 |
| Unnamed stream in T4N R23E, Sections 21 & 22 | Significant[d] | Moderate | -- | X | -- | -- | -- | 1 | -- | | -- |
| Unnamed stream in T4N R23E, Sections 17 & 20 | Significant | Moderate | -- | X | X | -- | -- | 1 | -- | | -- |

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] Letter codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place

[d] Considerable urban development existing pre-1976.

[e] The amount of post-1990 urban development is anticipated to increase significantly in comparison to pre-1990 urban development.

Source: Wisconsin Department of Natural Resources and SEWRPC.

There are three major water quality issues remaining to be resolved in the watershed of minor streams and direct drainage area tributary to Lake Michigan. These issues relate to the implementation of subregional sewerage system plans; the need for more detailed study of the estuary; and the monitoring and planning related to biological invasives.

Subregional Sewerage System Plan Implementation

The first issue relates to implementation of the sewer service area and treatment plant recommendations set forth in subregional system plans[15] for the greater Racine and greater Kenosha areas. The recommendations of those plans include revisions to the planned sewer service areas in the greater Kenosha area and the greater Racine area and call for the City of Kenosha and City of Racine sewage treatment plants to serve additional areas. These recommendations are described in more detail in Chapters IV and XIII.

Lake Michigan Estuary Water Quality Planning

The estuary reaches of the Milwaukee, Menomonee, and Kinnickinnic Rivers have been specifically considered in the initial plan through the Milwaukee Harbor Estuary Study.[16] The estuary reaches of the Pike and Root Rivers and of Oak Creek, Pike Creek, and Sauk Creek have not been specifically addressed in the initial plan or in this update because of the complexity of the estuaries. It is envisioned that supplemental estuary studies will have to be undertaken to fully assess the water quality related problems of these estuaries and to intelligently assign appropriate water use objectives to all the estuaries. Recommendations in this regard have been developed in an earlier prospectus.[17]

Monitoring of Biological Invasives

The confirmed presence of the zebra mussel, Dreissena polymorpha, in the Laurentian Great Lakes, and specifically within that portion of Lake Michigan coastal zone falling within the Southeastern Wisconsin Region, has specific implications for the management of the coastal zone within this watershed and for the management of other water resources in the Region. These animals have been known to interfere with the beneficial uses of water resources throughout the Great Lakes by blocking inlet pipes and encrusting other structures, causing both nuisance and economic damage to these structures. It is recommended that their distribution within the coastal waters of the Region be monitored on a long-term continuous basis by the Wisconsin Department of Natural Resources (DNR), University of Wisconsin-Sea Grant, and other agencies--especially power generation and water supply utilities--as appropriate. In addition, it is recommended that these agencies also conduct regular reviews of appropriate control measures reported in technical publications and apply such measures when and where necessary. It is further recommended that the DNR and University of Wisconsin-Extension continue public awareness campaigns and that the DNR provide the necessary means for cleaning boats being transported from public boating access points in the

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[15]Alvord Burdick & Howson and Applied Technologies, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area; and Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area.

[16]SEWRPC Planning Report No. 37, op cit.

[17]SEWRPC Prospectus, Lake Michigan Estuary and Direct Drainage Area Subwatershed Planning Program, 1978.

coastal zone to access sites on inland lakes. The confirmed presence of zebra mussels in inland lakes suggests the potential for this animal to rapidly spread throughout the Region. It is expected that there may be a similar need over time to monitor the presence and impacts of other exotic species.

A potential future amendment to the regional plan for the watershed of minor streams and direct drainage areas to Lake Michigan may potentially be developed under the facility plan update initiated by the Milwaukee Metropolitan Sewerage District in 1995. That plan update is anticipated to constitute an amendment to the regional plan once it is adopted by all of the agencies involved.

Chapter X

# OAK CREEK WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

## INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Oak Creek watershed through 1993, where available. Finally, this chapter presents a description of the substantive issues that remain to be addressed in the Oak Creek watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited in the Oak Creek watershed as there are no major lakes located within the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

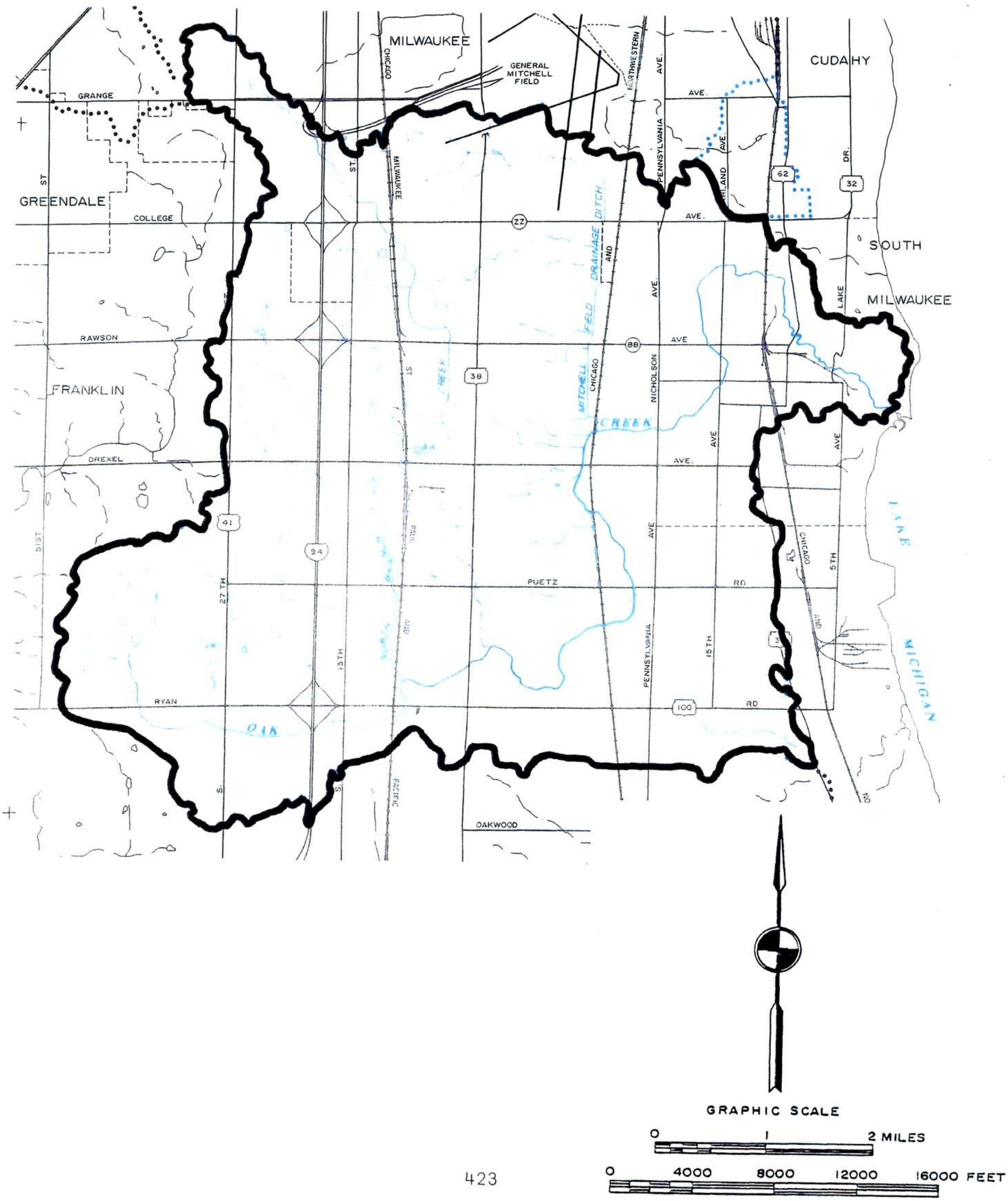
The Oak Creek watershed is located in the east central portion of the Region and covers an area of approximately 28 square miles. The main stem of Oak Creek rises in Milwaukee County and flows easterly and northerly within the County for approximately 13 miles before emptying into Lake Michigan on the eastern border of the watershed. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Oak Creek and its principal tributaries, are shown on Map X-1. The Oak Creek watershed contains no lakes with a surface area of 50 acres or more.

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Oak Creek watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint

# Map X-1

## OAK CREEK WATERSHED



source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table X-1 summarizes the existing land uses in the Oak Creek watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains numerous urbanized areas, 49 percent of the watershed was still in rural land and other open space uses in 1990. These rural uses included about 27 percent of the total area of the watershed in agricultural and related rural uses, about 5 percent of the total area of the watershed in woodlands, about 3 percent in surface water and wetlands, and about 14 percent in open lands. The remaining 51 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map X-2.

Major concentrations of urban development exist largely in the northern far western and far eastern portions of the Oak Creek Watershed. Urban development is located in the northern portion of the Oak Creek watershed, along IH 94 and STH 38, near the General Mitchell International Airport. Other urban-related land uses are located throughout the City of South Milwaukee, along STH 32, and in the City of Franklin portion of the watershed west IH 94. Two of the 22 major industrial centers of the Region are located in the northern portion of the watershed: the Oak Creek industrial center, which is located along Rawson Road, between IH 94 and STH 38; and the Cudahy-South Milwaukee industrial center located just north of the City of South Milwaukee.

As shown in Table X-1, from 1975 to 1990, urban land uses in the watershed increased from about 7,700 acres, or 12 square miles, to about 9,000 acres, or 14 square miles, or by about 17 percent. As shown in Table X-1, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 3,300 acres, or five square miles, in 1975 to about 3,800 acres, or six square miles, in 1990, a 14 percent increase. Commercial and industrial lands increased from about 600 acres, or one square mile, to 900 acres, or 1.4 square miles, an increase of about 42 percent.

The 14 square miles of urban land use in the watershed as of 1990 approximated the staged 1990 planned level of about 14.2 square miles envisioned in the adopted 2000 land use plan. The current status of development in the Oak Creek watershed and in adjacent portions of Milwaukee County was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table X-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Oak Creek watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban uses are expected to increase and along the IH 94 and STH 38 corridors in the Cities of Oak Creek and Milwaukee; in and around the City of Franklin; and in the already urbanized Cities of Cudahy and South Milwaukee.

In order to meet the needs of the expected resident population and employment envisioned under both the intermediate growth-centralized and high growth-decentralized land use plan future conditions, the amount of land devoted to urban use within the Oak Creek watershed, as indicated in Table X-2, is projected to increase from the 1990 total of about 14 square miles, or about 51 percent of

Table X-1

LAND USE IN THE OAK CREEK WATERSHED: 1975 and 1990[a]

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 3,328 | 18.7 | 3,795 | 21.4 | 467 | 14.0 |
| Commercial | 190 | 1.1 | 279 | 1.6 | 89 | 46.8 |
| Industrial | 438 | 2.4 | 616 | 3.5 | 178 | 40.6 |
| Transportation, Communication, and Utilities[b] | 2,842 | 16.0 | 3,374 | 19.0 | 532 | 18.7 |
| Governmental and Institutional | 405 | 2.3 | 453 | 2.5 | 48 | 11.9 |
| Recreational | 509 | 2.9 | 519 | 2.9 | 10 | 2.0 |
| Subtotal | 7,712 | 43.4 | 9,036 | 50.9 | 1,324 | 17.2 |
| Rural | | | | | | |
| Agricultural and Related | 6,400 | 36.1 | 4,754 | 26.8 | - 1,646 | - 25.7 |
| Lakes, Rivers, Streams and Wetlands | 517 | 2.9 | 564 | 3.2 | 47 | 9.1 |
| Woodlands | 852 | 4.8 | 842 | 4.7 | - 10 | - 1.2 |
| Open Lands,[c] Landfills, Dumps, and Extractive | 2,271 | 12.8 | 2,556 | 14.4 | 285 | 12.5 |
| Subtotal | 10,040 | 56.6 | 8,716 | 49.1 | - 1,324 | - 13.2 |
| Total | 17,752 | 100.00 | 17,752 | 100.0 | 0 | -- |

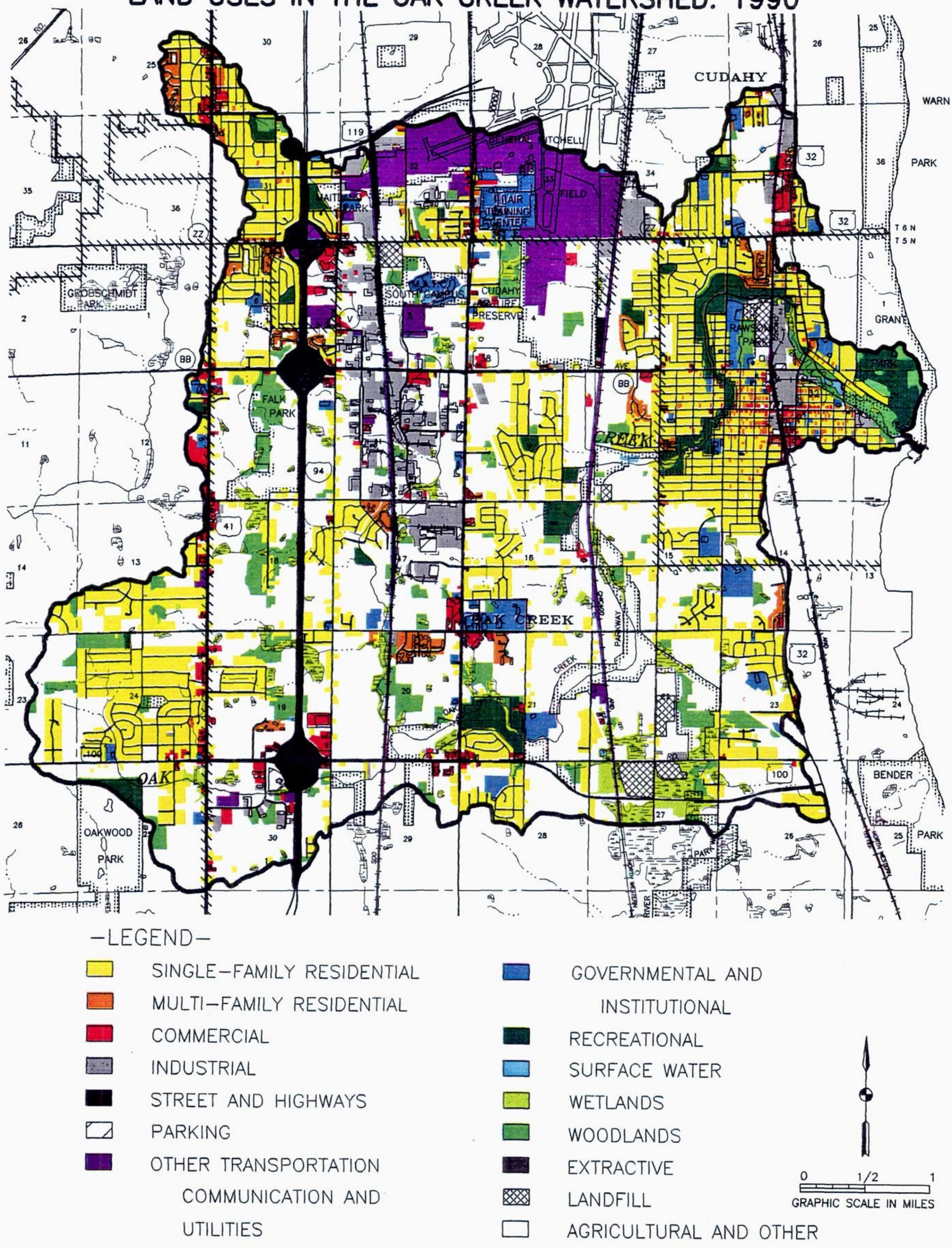
[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

# MAP X-2
# LAND USES IN THE OAK CREEK WATERSHED: 1990




The Oak Creek watershed is about 28 square miles in areal extent, or about 1 percent of the total Region. In 1990, about 14 square miles, or 51 percent of the watershed, was in urban land uses.

Source: SEWRPC

Table X-2

EXISTING AND PLANNED LAND USE IN THE OAK CREEK WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 3,795 | 21.4 | 5,137 | 28.9 | 1,342 | 35.4 | 5,023 | 28.3 | 1,228 | 32.4 |
| Commercial | 279 | 1.6 | 297 | 1.7 | 18 | 6.5 | 338 | 1.9 | 59 | 21.1 |
| Industrial | 616 | 3.5 | 894 | 5.0 | 278 | 45.1 | 976 | 5.5 | 360 | 58.4 |
| Transportation, Communication, and Utilities[b] | 3,374 | 19.0 | 3,890 | 21.9 | 516 | 15.3 | 3,944 | 22.2 | 570 | 16.9 |
| Governmental and Institutional | 453 | 2.5 | 490 | 2.8 | 37 | 8.2 | 485 | 2.7 | 32 | 7.1 |
| Recreational | 519 | 2.9 | 625 | 3.5 | 106 | 20.4 | 626 | 3.5 | 107 | 20.6 |
| Subtotal | 9,036 | 50.90 | 11,333 | 63.8 | 2,297 | 25.4 | 11,392 | 64.1 | 2,356 | 26.1 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 4,754 | 26.8 | 3,817 | 21.5 | - 937 | -19.7 | 3,682 | 20.7 | -1,072 | -22.5 |
| Lakes, Rivers, Streams, and Wetlands | 564 | 3.2 | 525 | 3.0 | - 39 | 6.9 | 525 | 3.0 | - 39 | - 6.9 |
| Woodlands | 842 | 4.7 | 815 | 4.6 | - 27 | - 3.2 | 812 | 4.6 | - 30 | - 3.6 |
| Open Lands,[c] Landfills, dumps, and Extractive | 2,556 | 14.4 | 1,262 | 7.1 | -1,294 | -50.6 | 1,341 | 7.6 | -1,215 | -47.5 |
| Subtotal | 8,716 | 49.1 | 6,419 | 36.2 | -2,297 | -26.3 | 6,360 | 35.9 | -2,356 | -27.0 |
| Total | 17,752 | 100.0 | 17,752 | 100.0 | 0 | -- | 17,752 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

the total area of the watershed, to about 18 square miles, or about 64 percent of the total area of the watershed, by year 2010. It is important to note that the 36 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and, as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulation. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 14 square miles in 1990 to about 10 square miles in the year 2010 under the intermediate growth-centralized and high growth-decentralized conditions, a decrease of about 10 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Oak Creek watershed--including consideration of points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. This section also includes a status report on the public sanitary sewer service areas within the watershed.

With regard to the point source plan element related to the Oak Creek Watershed, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District's water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants; provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of a solids management program; and provision of trunk sewers to serve the various communities comprising the District service area. As of 1993, the District's pollution abatement program was nearing completion, with the deep tunnel system expected to be online during 1994.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on an update of its Section 201 sewerage facility plan[1] for the entire Milwaukee metropolitan service area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that that facility plan re-examine certain system level decisions that were made in the past including trunk sewer needs, and the retention of the one remaining small sewage treatment plant in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewerage facilities plan update is intended, then, upon its adoption by all of the agencies concerned, to constitute

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[1]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan; June 1980.

an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Oak Creek watershed.

Public and Private Wastewater Treatment Systems and Sewer Services Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were no public or private sewage treatment facilities located in the Oak Creek watershed. The sewage treatment plants serving the watershed, including the Milwaukee Metropolitan Sewerage District South Shore plant and the City of South Milwaukee plant, are located in the Lake Michigan direct drainage area and are discussed in Chapter IX. As of 1990, no new sewage treatment plants had been constructed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were two sewer service areas identified within, or partially within, the Oak Creek watershed: South Milwaukee and the Milwaukee Metropolitan Sewerage District. As of 1993, the City of Franklin portion of Milwaukee Metropolitan Sewerage District service area had been refined and the refinement of the City of Oak Creek portion of the service area was underway.[2] The boundaries of the sewer service areas through 1993 are shown on Map X-3. Table X-3 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the service area names and the relationship of the service areas to the service area names following the refinement process. The planned sewer service area in the Oak Creek watershed, as refined through 1993, totals about 2.4 square miles, or about 9 percent of the total watershed area, as shown in Table X-3.

Current Plan Recommendations: No public or private sewage treatment facilities are envisioned for this watershed. The current planned sanitary sewer service areas in the Oak Creek watershed are shown on Map X-3. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. All or portions of the following sewer service areas are located in the Oak Creek watershed: Franklin, Oak Creek, South Milwaukee, and the Milwaukee Metropolitan Sewerage District. Together, the planned service areas within the watershed total about 28 square miles, or the entire area of the Oak Creek watershed.

As noted above, two of the sewer service areas in the watershed have been refined as part of the on-going regional water quality management plan updating process. Additional refinements are envisioned to be needed for South Milwaukee and the remaining portion of the Milwaukee Metropolitan Sewerage District sewer service areas. These refinements are recommended to be conducted in 1995 and 1996. It is also recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

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[2]As of September 1994, the sewer service area for the City of Oak Creek was identified and refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area Plan for the City of Oak Creek, Milwaukee County, Wisconsin.

Table X-3

PLANNED SANITARY SEWER SERVICE AREAS IN THE OAK CREEK WATERSHED: 1993

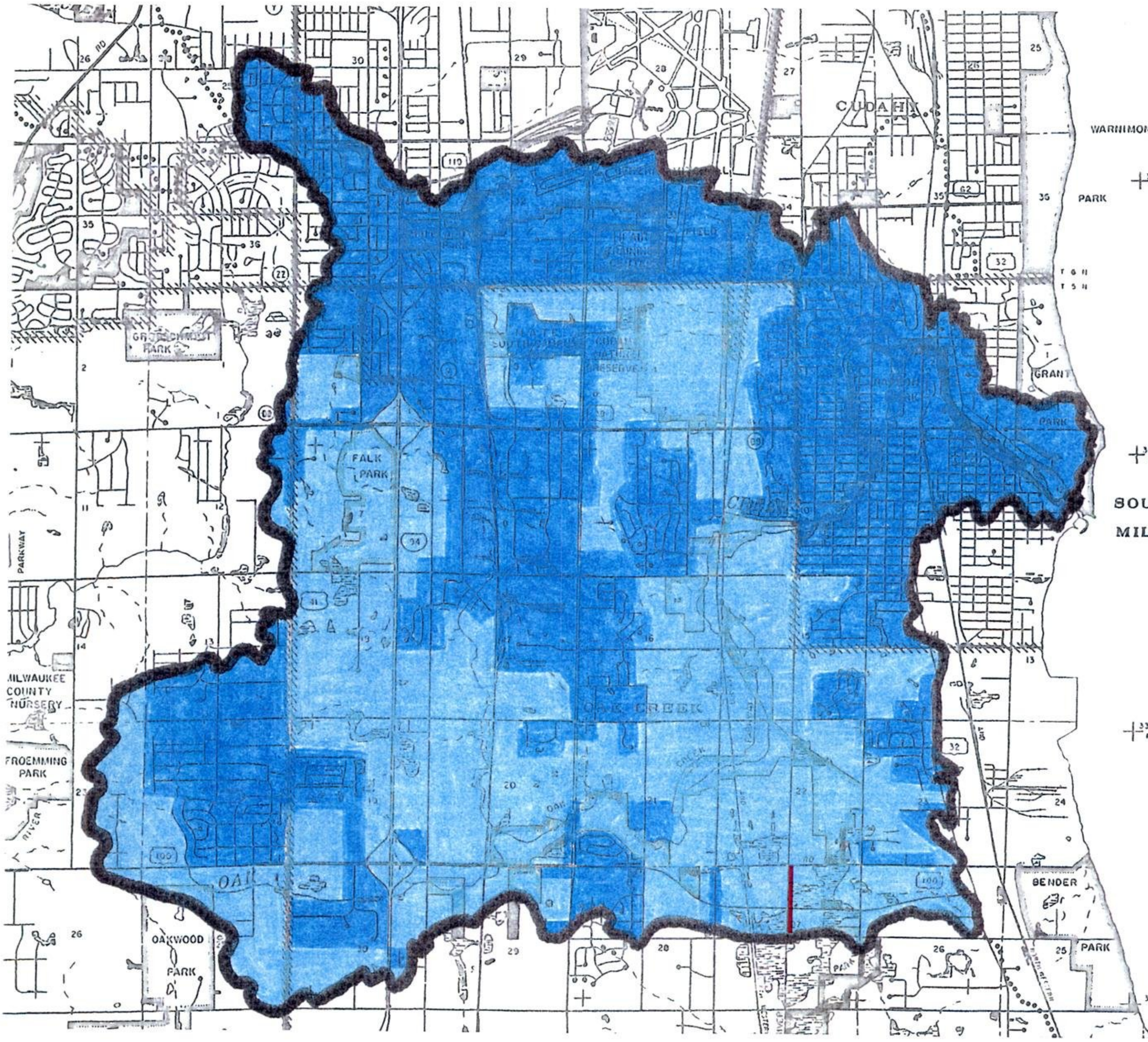
| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Refined Sanitary Sewer Service Areas | | | | |
| Milwaukee Metropolitan Sewerage District (portion) | 2.4 | Franklin | December 5, 1990 | SEWRPC CAPR No. 176, Sanitary Sewer Service Area for the City of Franklin, Milwaukee County, Wisconsin |
| Unrefined Sanitary Sewer Service Areas | | | | |
| Milwaukee Metropolitan Sewerage District[a] (portion) | 21.9 | -- | -- | -- |
| South Milwaukee | 3.4 | -- | -- | -- |
| Subtotal | 25.3 | | | |
| Total | 27.7 | | | |

Note: CAPR - Community Assistance Planning Report

[a] As of September 1994, the City of Oak Creek sanitary sewer service area portion of the Milwaukee Metropolitan Sewerage District service area was refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area for the City of Oak Creek, Milwaukee County, Wisconsin. This refined Oak Creek sewer service area encompasses 17.3 miles within the Oak Creek watershed.

Source: SEWRPC.

# Map X-3
## SANITARY SEWER SERVICE AREAS IN THE OAK CREEK WATERSHED: 1990 AND 2010




LEGEND

SANITARY SEWER SERVICE AREA (EXISTING)

SANITARY SEWER SERVICE AREA (PLANNED)

PROPOSED TRUNK SEWER

Source: SEWRPC.

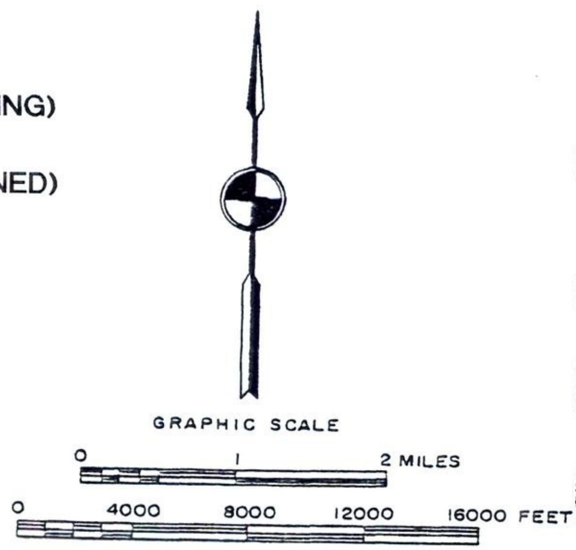


Table X-3a

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE OAK CREEK WATERSHED: 1988-93

| Sewerage Systems | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | Comments |
|---|---|---|---|---|---|---|---|
| | | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| City of South Milwaukee | -- | -- | 2 | -- | -- | 2 | Used only in case of major equipment failure |
| Total | -- | -- | 2 | -- | -- | 2 | |

Source: SEWRPC.

Sewer Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were two known separate sewer system flow relief devices located in the Oak Creek watershed, both of which discharged directly to the main stem of the Oak Creek in the City of South Milwaukee. In 1993 these two devices remained, as shown in Table X-3a. However, as a result of a sanitary sewer system rehabilitation program completed by the City of South Milwaukee in 1984, these two pumping station bypasses are now used only in the event of a major equipment failure, as recommended in the adopted regional water quality management plan.

Current Plan Recommendations: It is recommended that the City of South Milwaukee continue to monitor the sewerage system operations to ensure that the use of the existing sewerage system flow relief devices is limited to periods of power or equipment failure. It is recommended that planning for all sewerage system expansion and upgrading within the watershed be conducted with the assumption that there will be no planned bypasses of untreated sewage, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan, as updated, recommended the construction of two intercommunity trunk sewers in the Oak Creek watershed, as shown in Table X-4. One trunk sewer would provide additional conveyance capacity for areas west and south of the Mitchell Field Airport to the Milwaukee Metropolitan sewerage system and one trunk sewer would connect development in the City of Oak Creek to the Milwaukee Metropolitan sewerage system. These trunk sewers have both been constructed.

Current Plan Recommendations: The current regional water quality management plan included recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Oak Creek watershed. As noted above, both trunk sewers recommended in the initial plan have been constructed. However, one other trunk sewer was considered in the initial plan but was estimated not to be needed until after the planning period, based upon the development expected. This trunk sewer--the Oak Creek Southeast trunk sewer--would generally extend from the existing trunk sewer at Ryan Road and Pennsylvania Avenue south to Elm Road and then west to Nicholson Road. The Caddy Vista Sanitary District connection, as well as major areas in the southern portion of the City Oak Creek, are tributary to existing sewers for which the proposed Oak Creek Southeast trunk sewer will provide relief capacity. Surveillance of the current flows in the existing system, as well as projected needs for development currently approved by the City of Oak Creek, indicates that the existing sewer capacity will be reached. The City of Oak Creek therefore established, in 1994, a moratorium on new land development activities which have not been previously approved. Thus, the Oak Creek Southeast trunk sewer is now included in the updated plan based upon demonstrated needs.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of eight known point sources of pollution identified in the Oak Creek watershed other than public and private sewage treatment plants. These sources discharged industrial cooling, process, rinse, wash, and filter backwash waters through 13 outfalls directly or indirectly to the surface water or groundwater

Table X-4

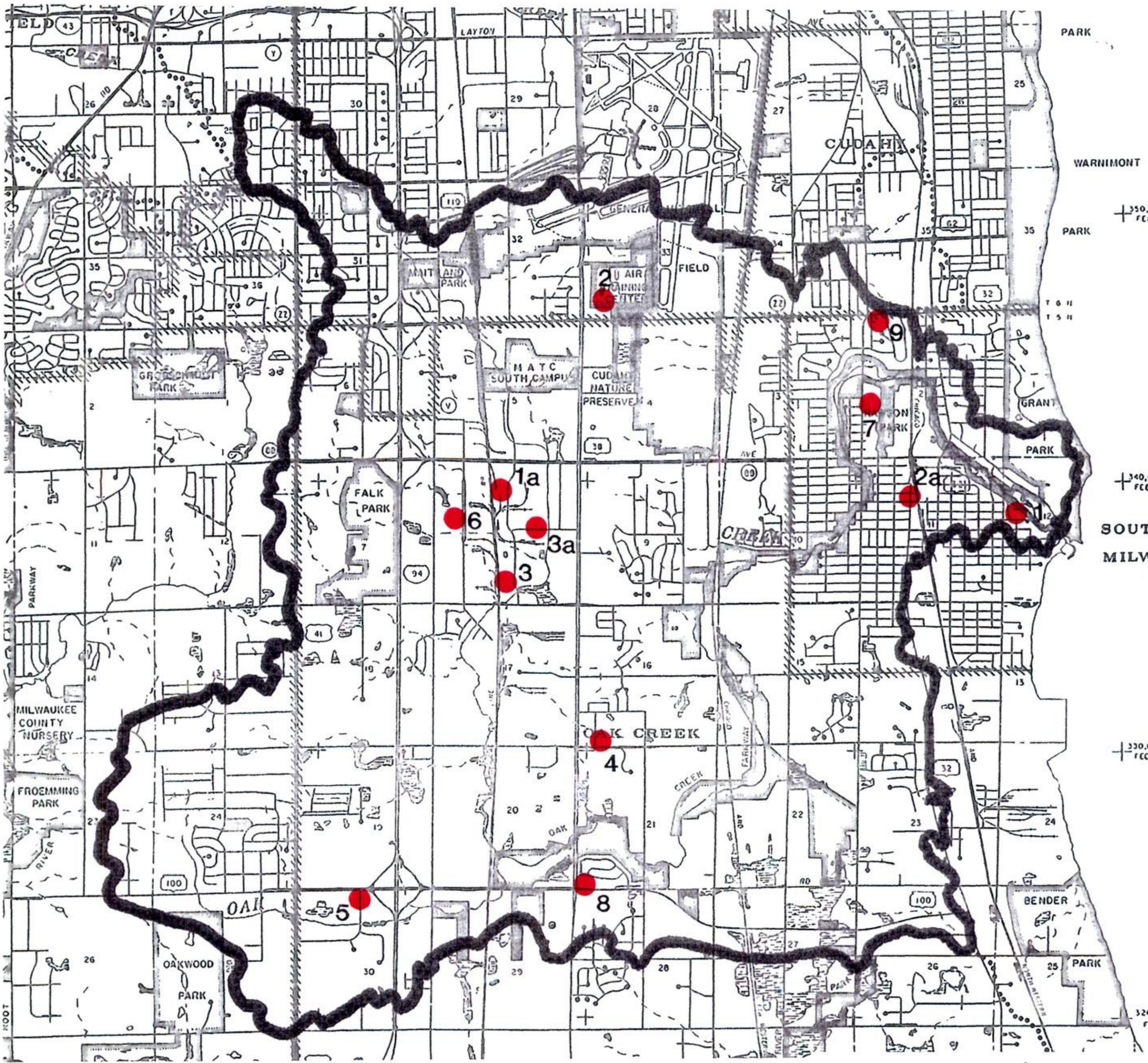
IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE OAK CREEK WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Oak Creek | Completed (1985) |
| Mitchell Field-South | Completed (1986) |

Source: SEWRPC.

# Map X-4

## POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE OAK CREEK WATERSHED: 1990




LEGEND

● POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.

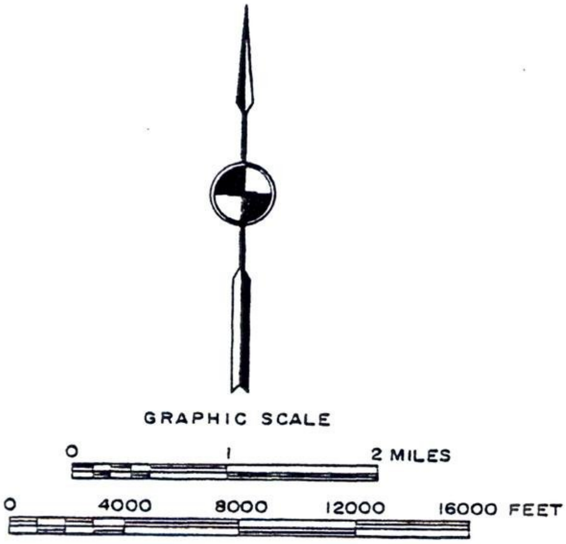


Table X-5

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE OAK CREEK WATERSHED: 1990

| Facility Name | County | Map ID No.[a] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[b] |
|---|---|---|---|---|---|---|---|---|---|
| Oak Creek Watershed | | | | | | | | | |
| Appleton Electric Co. - Foundry Div. | Milwaukee | 1 | General | 0044938-3 | 9-30-95 | 3369 | Non-ferrous foundries | Oak Creek | -- |
| General Mitchell IAP (440th AF Resv.) | Milwaukee | 2 | General | SPEC PERM | 9-30-95 | 4581 | Airports, flying fields, services | Mitchell Field Drainage Ditch | -- |
| Henkel Corporation | Milwaukee | 3 | General | 0044938-3 | 9-30-95 | 2843 | Surface active agents | North Branch Oak Creek | -- |
| Oak Creek Senior H.S. (Pool) | Milwaukee | 4 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Oak Creek via unnamed trib. | -- |
| Oak Creek Services-Milw. Truck Stop | Milwaukee | 5 | General | 0046531-1 | 9-30-90 | 5541 | Gasoline service station | Oak Creek | -- |
| Phillip Orth Company | Milwaukee | 6 | General | 0044938-3 | 9-30-95 | -- | -- | North Branch Oak Creek | -- |
| South Milwaukee-Senior H.S. Pool | Milwaukee | 7 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Oak Creek via storm sewer | -- |
| Vilter Manufacturing, Inc. | Milwaukee | 8 | General | 0044938-3 | 9-30-95 | 3443/3585 | Fabr. plate work; Ref. & hyg. equip. | Oak Creek | -- |
| YMCA of Milwaukee-South Shore Branch | Milwaukee | 9 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Oak Creek via storm sewer | -- |
| Applied Plastics Company, Inc. | Milwaukee | 1A | Specific | 0041700 | 3-31-90 | 3081 | Unsupported plastics, film & sheet | North Branch Oak Creek via storm sewer | None |
| Bucyrus Erie Company | Milwaukee | 2A | Specific | 0001058 | 12-31-89 | 3599 | Industrial machinery | Oak Creek via storm sewer | 1 |
| Thiem Corp. National Starch & Chem. | Milwaukee | 3A | Specific | 0047643 | -- | 2891 | Adhesives and sealants | North Branch Oak Creek via storm sewer | None |

[a] See Map X-4, Point Sources of Pollution in the Oak Creek Watershed: 1990.

[b] The number code refers to the following treatment system:

1. Gravity sedimentation

Source: Wisconsin Department of Natural Resources and SEWRPC.

system. Of these point source outfalls, six were identified as discharging only cooling water. The remaining seven were identified as discharging other types of wastewater. Four of these outfalls discharged directly to the Oak Creek, seven discharged indirectly to the Oak Creek, and two discharged indirectly to the North Branch of Oak Creek. The initial regional water quality management plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 12 such known point sources of wastewater discharging to the Oak Creek and its major tributaries directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table X-5 summarizes selected characteristics of these other point sources and Map X-4 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions were made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were eight known point sources of wastewater other than public and private sewage treatment plants discharging to surface or ground waters in the Oak Creek watershed. These point sources of wastewater discharge, primarily industrial cooling, process, rinse, and wash water, directly or following treatment to the groundwater or the surface waters of the Oak Creek watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

Because the entire Oak Creek watershed is included in the planned public sanitary sewer service area, there were no enclaves of unsewered urban development located outside of the then recommended year 2000, or currently recommended year 2010, sewer service area.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Oak Creek watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can potentially be transported to surface waters.

There are currently three active landfills and 23 known abandoned landfills located in the Oak Creek watershed. None of these landfills are known to be negatively impacting surrounding surface or groundwater.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Oak Creek watershed have the potential to affect water quality through the release of substances into the surrounding soils and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the clean up of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing clean up efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground waters. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were 60 known leaking underground storage tank sites in the Oak Creek watershed. None of these involved the discharging of remediation wastewaters directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters. As of 1993, there were no permitted sites discharging to surface or ground waters in the Oak Creek watershed.

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation
For the Oak Creek watershed, the initial plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, onsite sewage disposal system management, and streambank erosion control. In addition, the plan recommended that additional nonpoint source controls be provided which would reduce nonpoint sources of pollution by about 50 percent in the urban areas.

In 1986, the Commission prepared a comprehensive watershed plan[3] for the Oak Creek watershed in cooperation with various Federal, State, and local authorities. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas in the watershed. Such subsequent planning was and will continue to be directed toward reducing nonpoint source pollutant loadings, as well as providing for local drainage needs in the watershed.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to

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[3]See SEWRPC Planning Report No. 36, A Comprehensive Plan for the Oak Creek Watershed, August 1986.

specific lands. Working with the individual county land conservation committees, the local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin Legislature and currently provides funds for individual projects or land management practices to local governments and private landowners upon completion of the detailed plans. The funds are provided through local assistance grants administered by the Wisconsin Department of Natural Resources.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Oak Creek watershed through local regulation and programs. In the area of construction site erosion control, significant progress has been made. As of January 1993, the Cities of Franklin, Greenfield, Milwaukee, Oak Creek, and Cudahy had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. The ordinance adopted by the City of Cudahy is applicable only to subdivisions.

Rural nonpoint source control implementation actions, such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others, are utilized primarily for cropland soil erosion control and wildlife habitat purposes, respectively, and will have positive water quality impacts. Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances, or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade, and Consumer Protection as priority counties for soil erosion control. Milwaukee County was not identified as one of these priority counties, and soil erosion control plans have not been prepared for any areas of the Oak Creek watershed. Nevertheless, soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While the local programs described above have probably resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

Current Plan Recommendations

It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, plus land management practices, designed to provide about a 50 percent reduction in nonpoint source pollutant loadings in the urban areas and 25 percent reduction in nonpoint source pollutant loadings in the rural areas be carried out throughout the watershed. The type of practices recommended to be considered for this level of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, the watershed should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make State cost-sharing programs available for nonpoint source pollution control measures. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum report[4] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Oak Creek watershed in the high category, indicating that inclusion in the program will be possible within a reasonable time from when the existing planning projects are completed, or additional funds and staff become available within the Department of Natural Resources.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

As of 1993, long-term monitoring has been carried out in the Oak Creek watershed on a sustained basis by the Milwaukee Metropolitan Sewerage District (MMSD) at seven stations located on the Oak Creek main stem. Data from four of these stations were used to document current long-term water quality conditions in the watershed, as shown on Map X-5. Short-term monitoring was also conducted at one site on the North Branch of Oak Creek in this watershed by the Wisconsin Department of Natural Resources during the period 1988 through 1993, as shown on Map X-5 and described later in this chapter.

### Current Plan Recommendation

Increased water quality and biological condition monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the Milwaukee Metropolitan Sewerage District at the current stations on Oak Creek on a continuing basis. This program is considered adequate for the assessment of water quality conditions on the main stem of Oak Creek. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at two selected additional stations located on the major tributaries of Oak Creek, with one station each being located on the North Branch of Oak Creek and the Mitchell Field Drainage Ditch. During this one-year period, it is recommended that biological monitoring also be conducted at the sites for which water quality data

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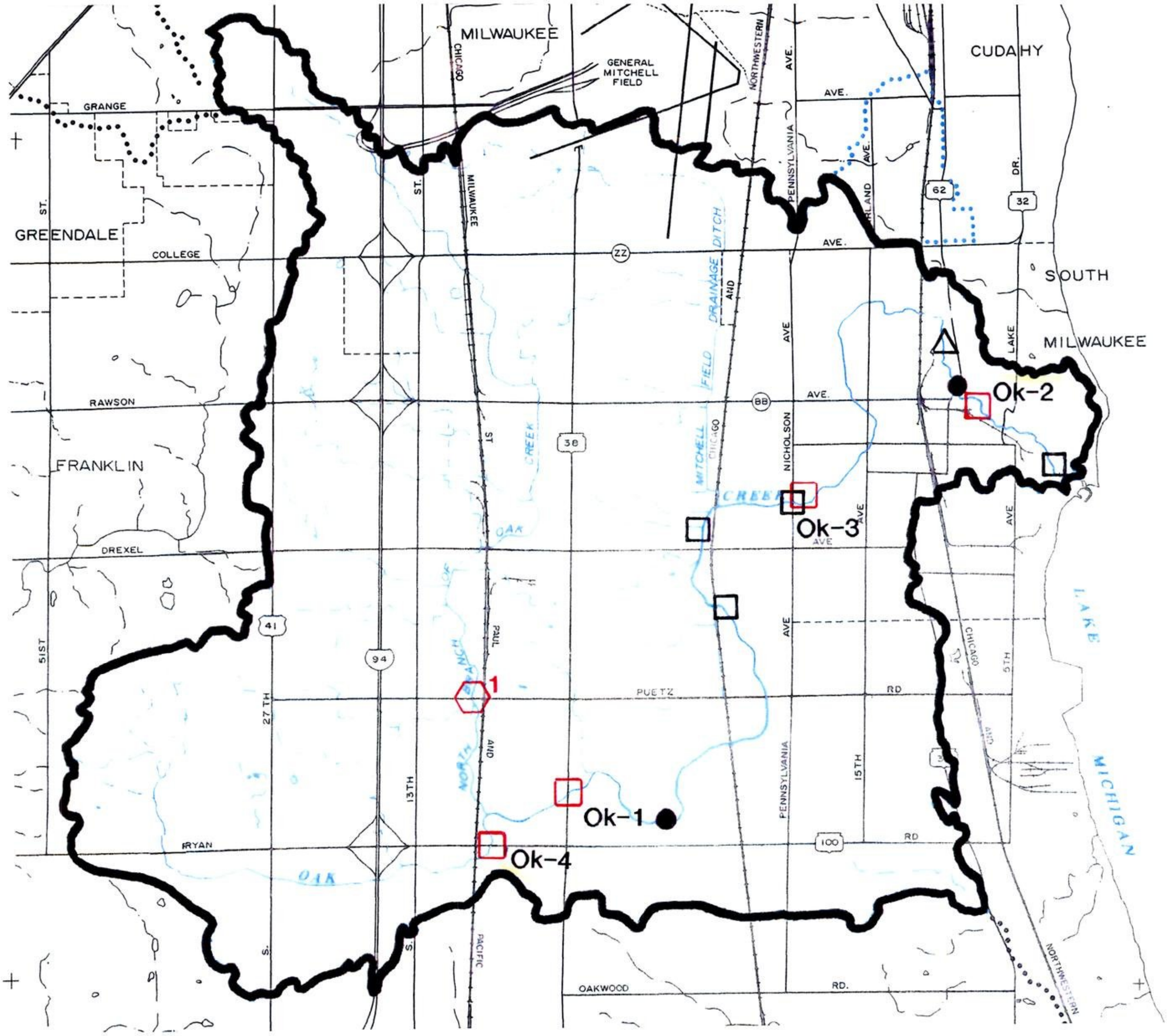
[4]See SEWRPC Memorandum entitled, "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

# Map X-5
## LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE OAK CREEK WATERSHED




LEGEND

Sampling stations used in preparation of initial plan

- ● SEWRPC
- △ USGS
- □ MMSD

Post-1976 sampling stations used in preparation of plan update

- □ MMSD-Long Term
- ⬡ DNR-Short Term

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

is currently being collected. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated, and are consistent, with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five to seven year rotating cycle.

LAKE MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measure such aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological condition monitoring programs to be established.

As noted above, there are no major lakes in the Oak Creek watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

WATER QUALITY AND BIOLOGICAL CONDITIONS

Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; the 1976 Commission monitoring program conducted under the regional water quality management planning effort; and the U.S. Geological Survey (USGS) and Milwaukee Metropolitan Sewerage District (MMSD) sampling programs. Available data collected in those programs for the Oak Creek watershed included samplings at three Commission stations; at four MMSD stations; and at one USGS station, all on the main stem of the Oak Creek. The sampling station locations are shown on Map X-5.

Long-term post-1976 comparable water quality data have been collected by the Milwaukee Metropolitan Sewerage District at seven stations on the Oak Creek. The DNR has also collected water quality data on a short-term basis at one location in the Oak Creek watershed on the North Branch of Oak Creek at Puetz Road. Data from four of the MMSD stations and from the DNR station were used to characterize water quality conditions in the watershed. These sites are shown on Map X-5. The data obtained from the sampling stations were used in this chapter to assess current water quality conditions as discussed in the next section and, where appropriate, to make a generalized comparison to historic conditions.

In addition to the data obtained since preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Oak Creek watershed.

Long-term water quality data collected by the Milwaukee Metropolitan Sewerage District at four sampling stations on the main stem of Oak Creek, at Ok-1 at STH 38, Ok-2 at the Oak Creek Parkway east of STH 32, Ok-3 at Nicholson Avenue, and Ok-4 on Ryan Road, are summarized in Figures X-1 through X-4. The short-term data collected by the DNR is summarized in Figure X-5 and in Table X-6. Both the long-term and short-term sampling data have been used to assess current water quality conditions and to evaluate conditions with respect to water quality standards. The water quality standards indicated in Figures X-1 through X-5 and in Table X-6 are those set forth for specific biological and recreational use objectives as described in Chapter II.

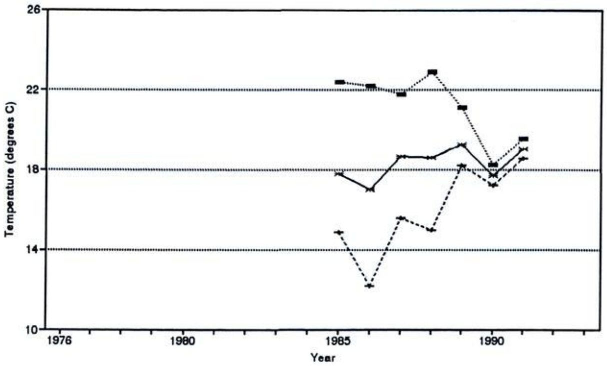
Review of those data for stations Ok-1 through Ok-4 indicate no apparent significant changes in water quality conditions from 1985 through 1993. The only possible trend which can be seen is that the variability of most parameters was reduced with the range of values indicated becoming less in more recent years. Data from all four stations indicate frequent violations of the standards established for total phosphorus, and fecal coliform, as set forth in Chapter II. Violations of the standard dissolved oxygen concentrations occurred at stations Ok-1, Ok-3, and Ok-4. Temperature and levels of pH remained variable, but within standards at all stations. The water quality data collected on a short-term basis on the North Branch of Oak Creek indicate violations of the fecal coliform standard at that location. Chronic toxicity standards for certain metals were also exceeded as discussed in the next section.

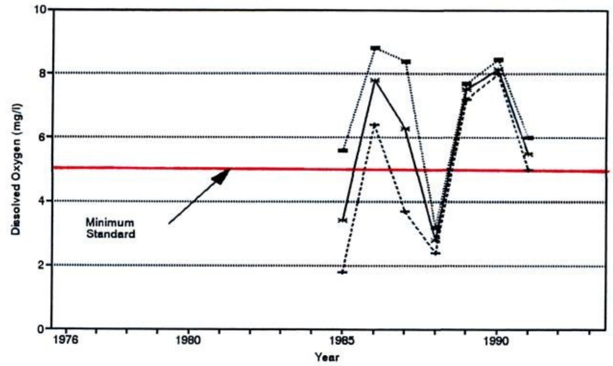
<u>Toxic and Hazardous Substances</u>: Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Oak Creek watershed from 1975 through 1976. The analyses indicated that recommended levels of mercury were exceeded in two of 48 samples, while recommended levels for PCBs were exceeded in one of ten samples. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, DDT, DDE, DDD, aldrin, heptachlor, lindane, dieldrin, heptachlor epoxide, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels.

Sampling and analysis of the bottom sediments conducted on Oak Creek for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Oak Creek watershed from 1975 through 1976. The analyses resulted in detectable concentrations of cadmium, chromium, copper, lead, mercury, nickel, zinc, and PCBs being recorded from the sediments.

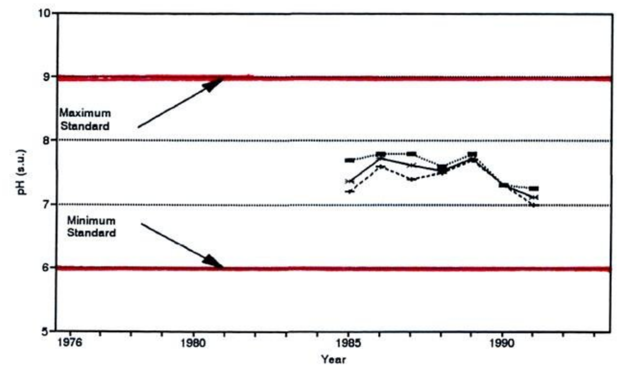
Recent data on toxic and hazardous substances in Oak Creek were collected by the Milwaukee Metropolitan Sewerage District, and are shown in Figures X-1 through X-4. These data indicate that lead and cadmium concentrations at all four stations exceeded the chronic toxicity standards established by the Wisconsin

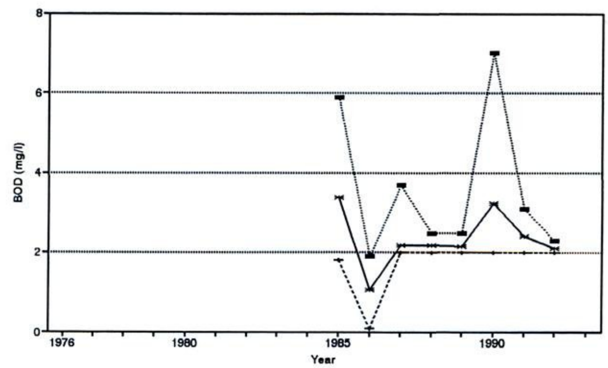
# Figure X-1
# WATER QUALITY DATA FOR THE OAK CREEK AT STATION Ok-4: 1976-1993

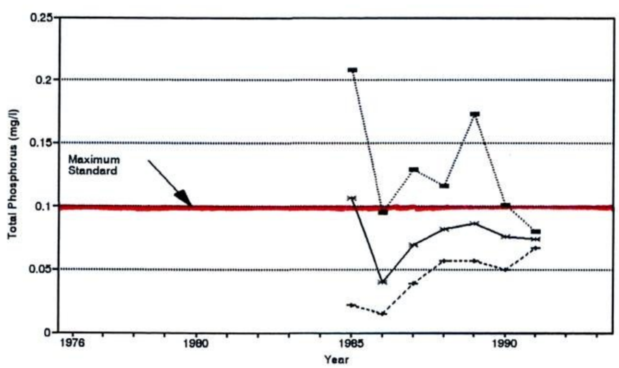


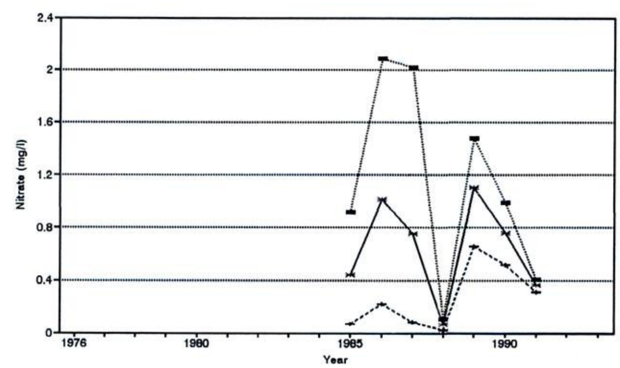



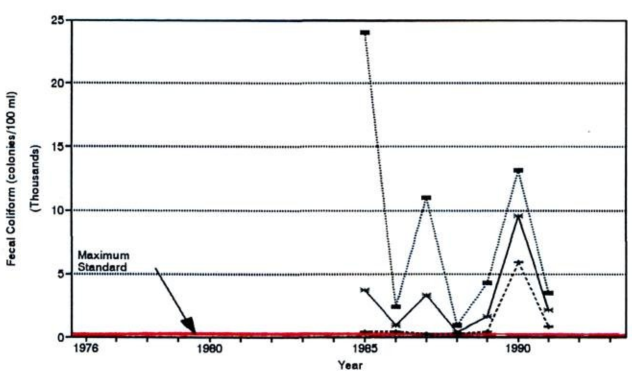

Note: The maximum standard of 31.7 degrees C was not violated in any year.

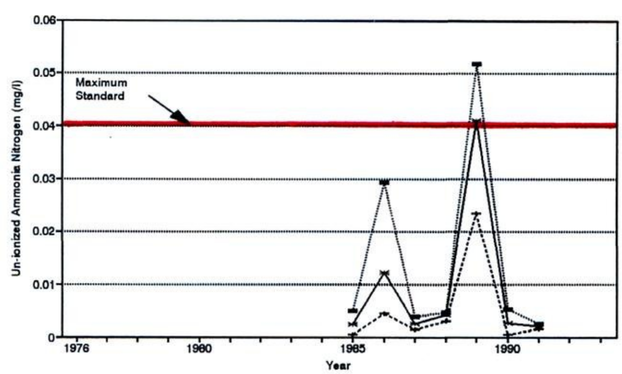


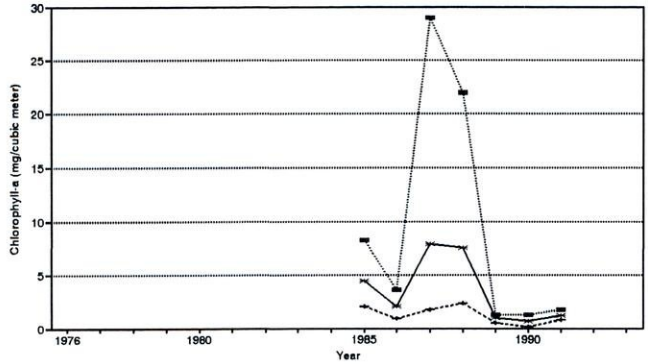



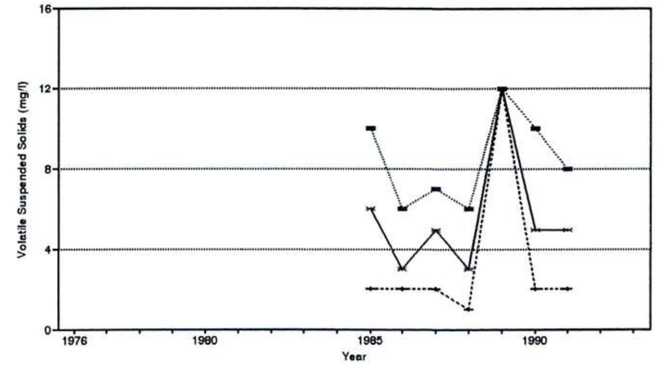



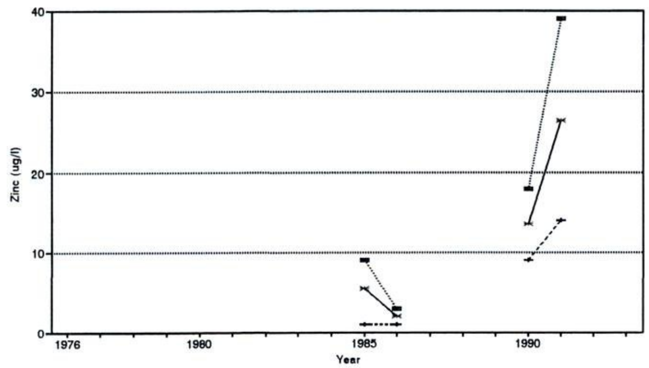




Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

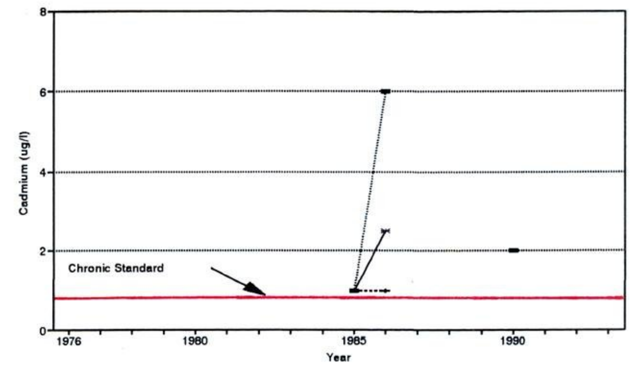
## Figure X-1 (cont'd)



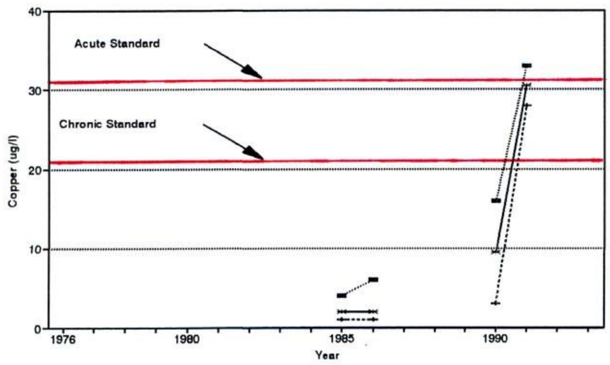



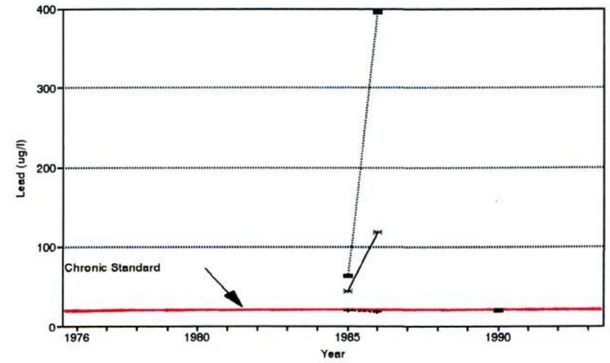




Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.

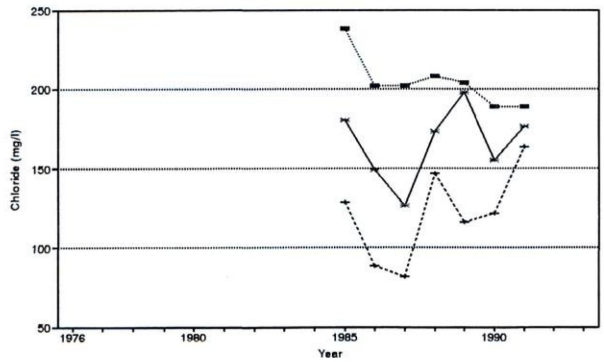



Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

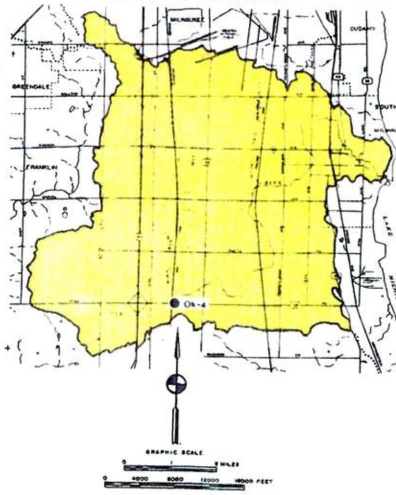
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

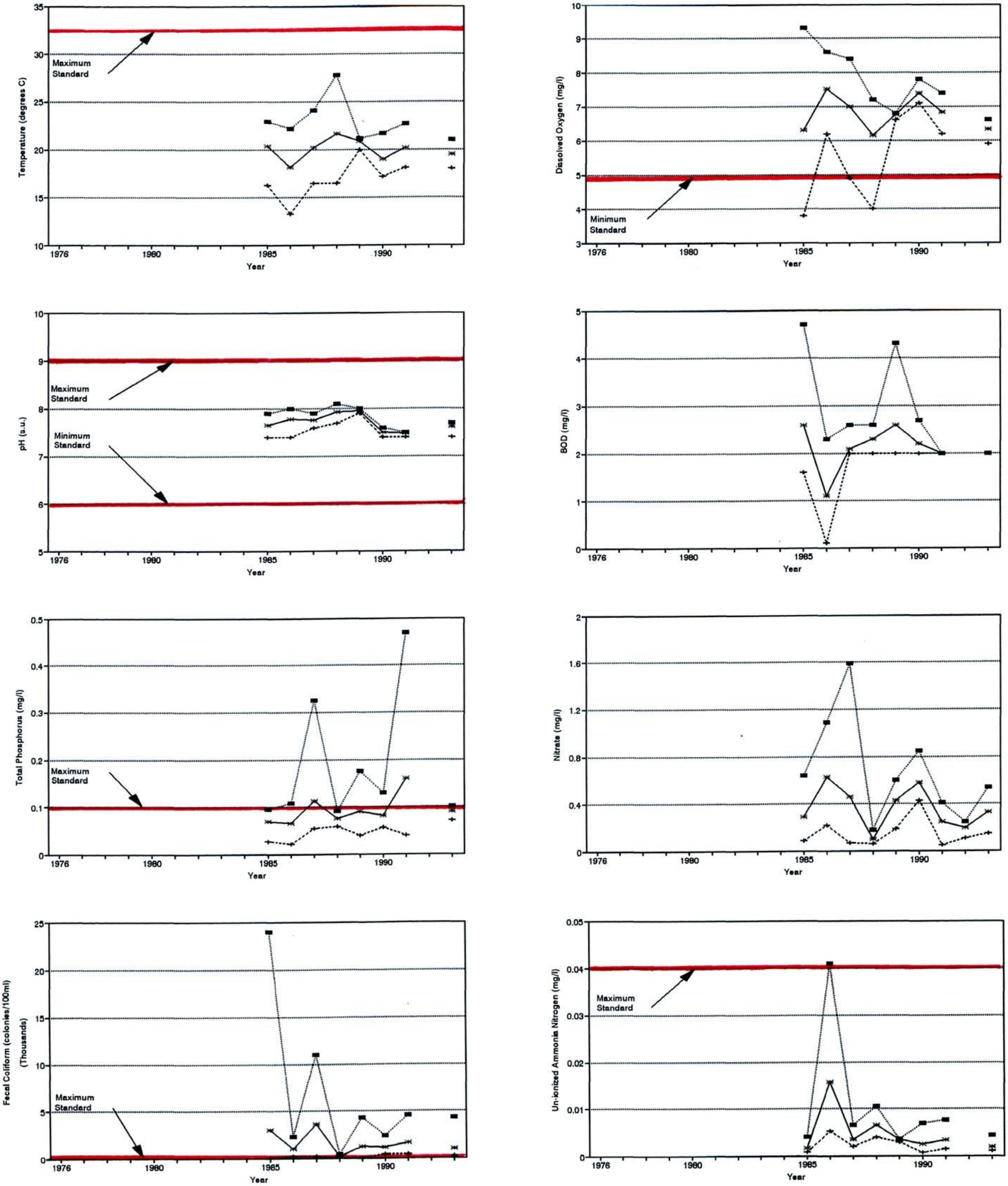
OAK CREEK WATERSHED




Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

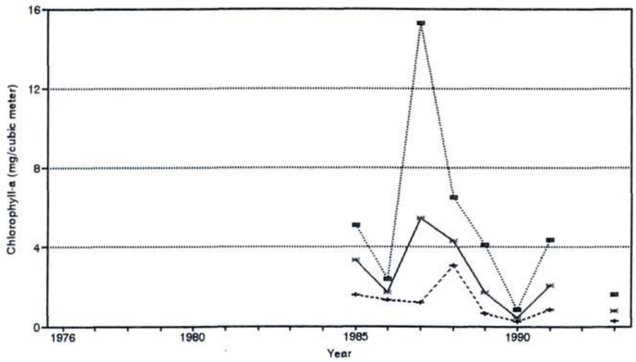
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

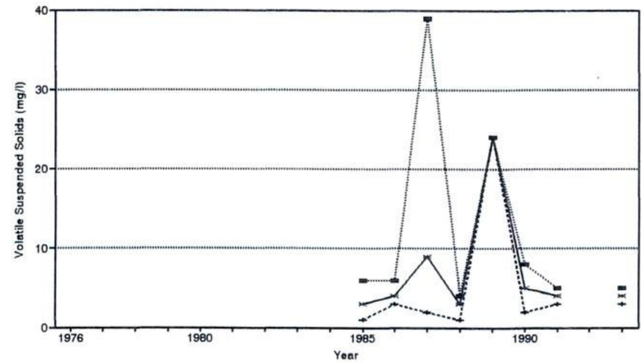
# Figure X-2
# WATER QUALITY DATA FOR THE OAK CREEK AT STATION Ok-1: 1976-1993

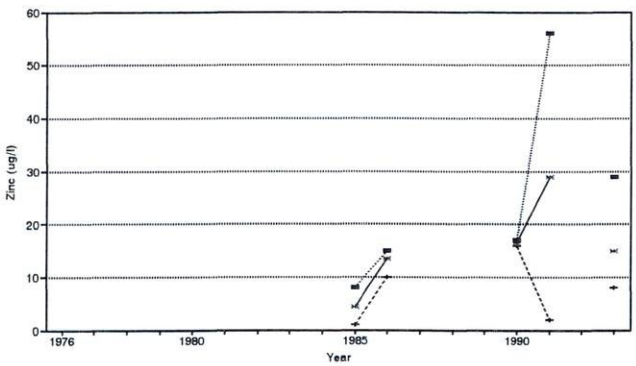



Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

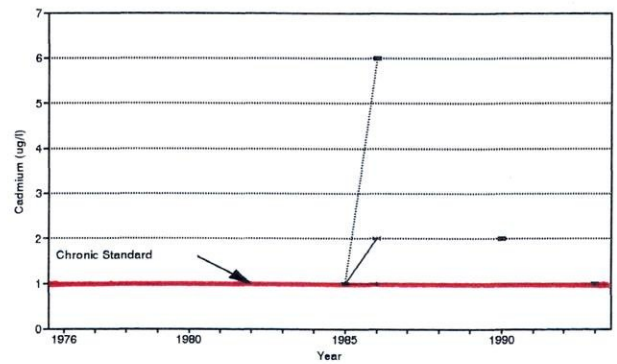
## Figure X-2 (cont'd)



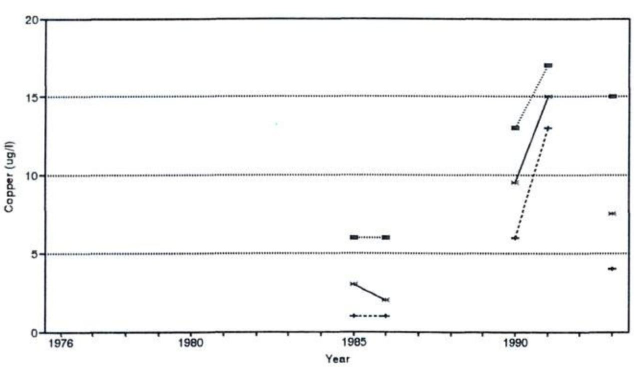



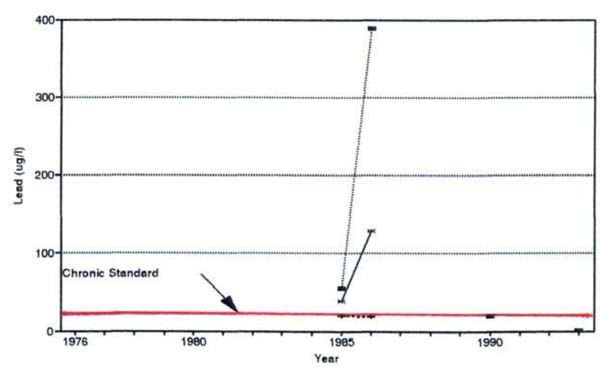

Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



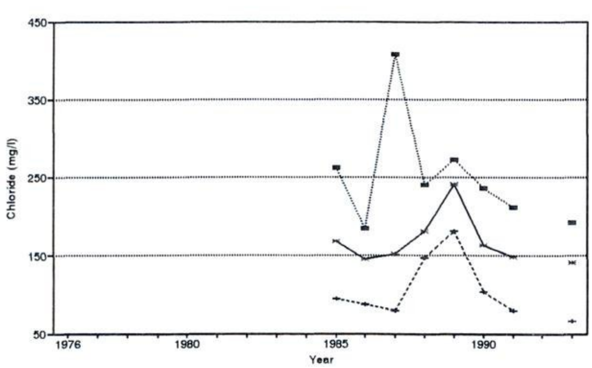

Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

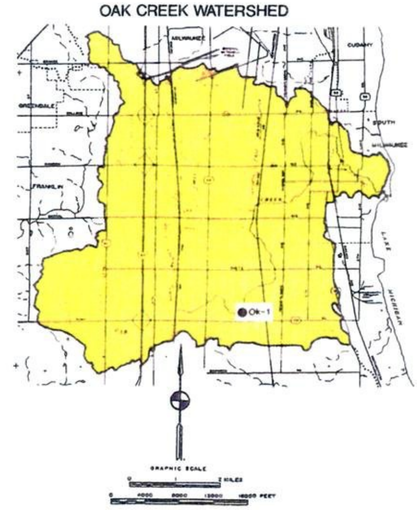
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

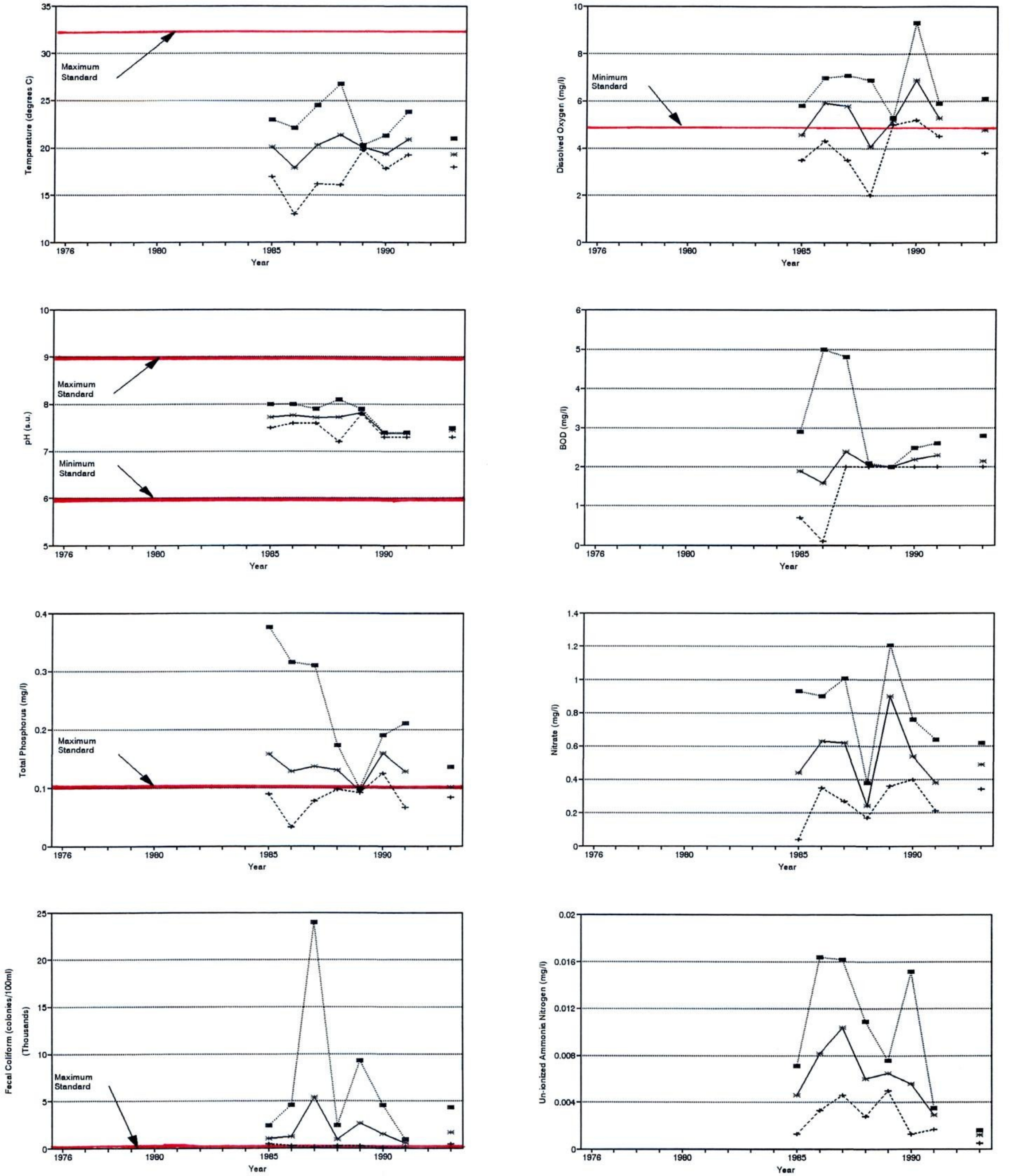
OAK CREEK WATERSHED




Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

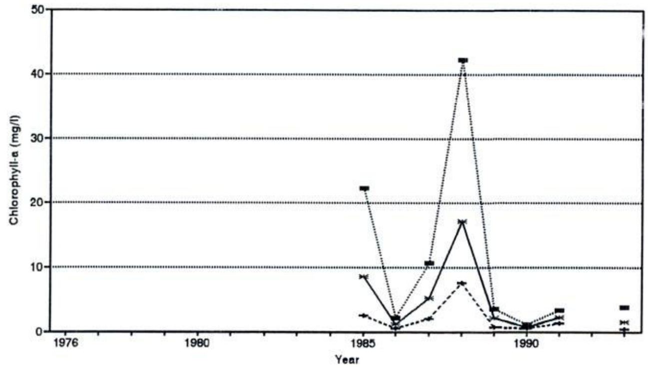
# Figure X-3
# WATER QUALITY DATA FOR THE OAK CREEK AT STATION Ok-3: 1976-1993

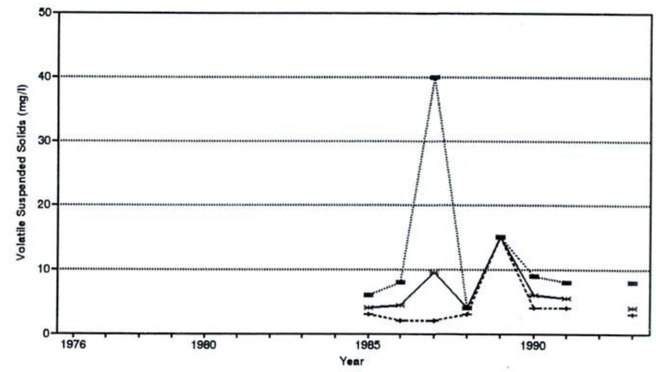


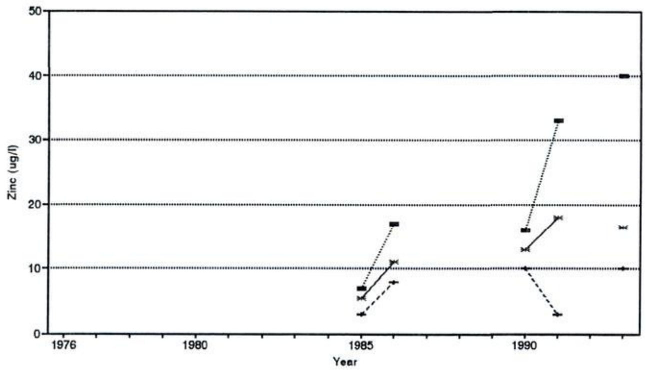

· Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

Note: The maximum standard of 0.04 mg/l was not violated in any year.

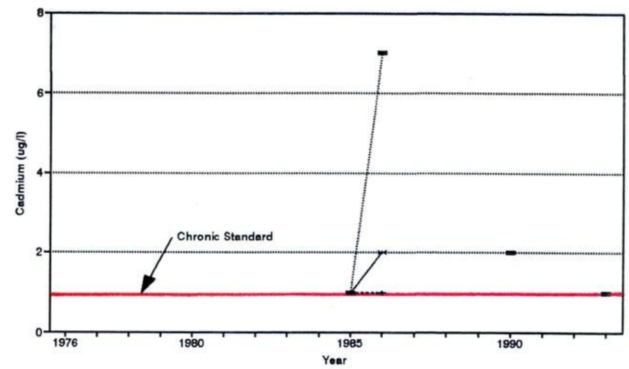
## Figure X-3 (cont'd)



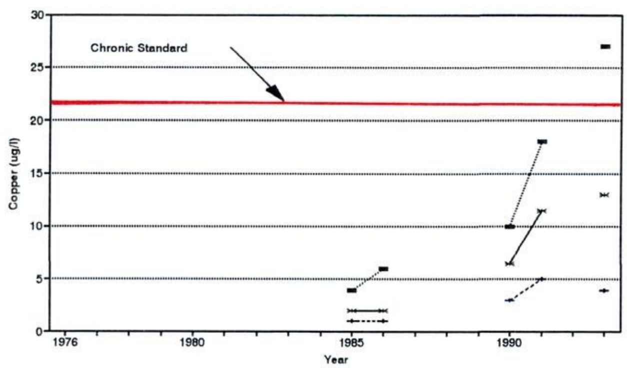



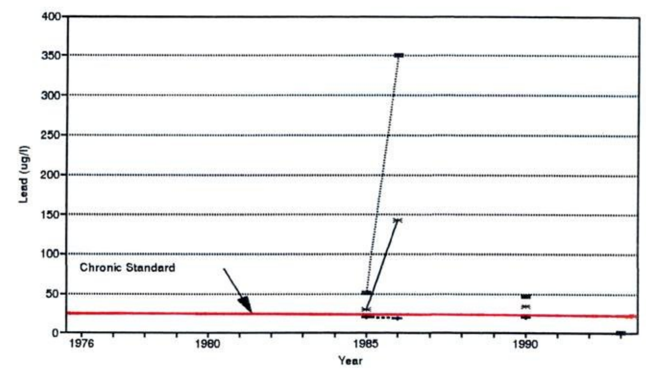

Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



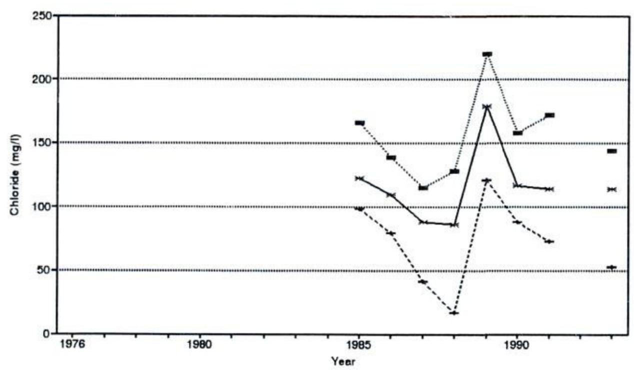

Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

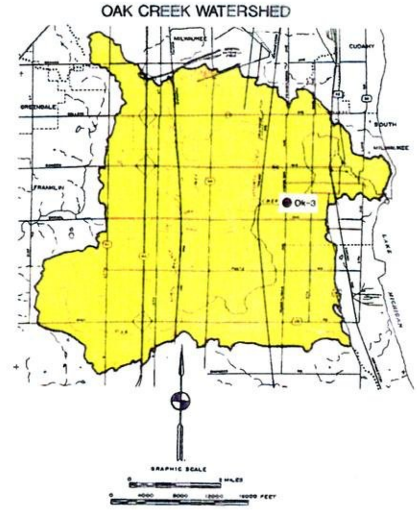
**LEGEND**

**MAXIMUM VALUE**

**MINIMUM VALUE**

**AVERAGE VALUE**

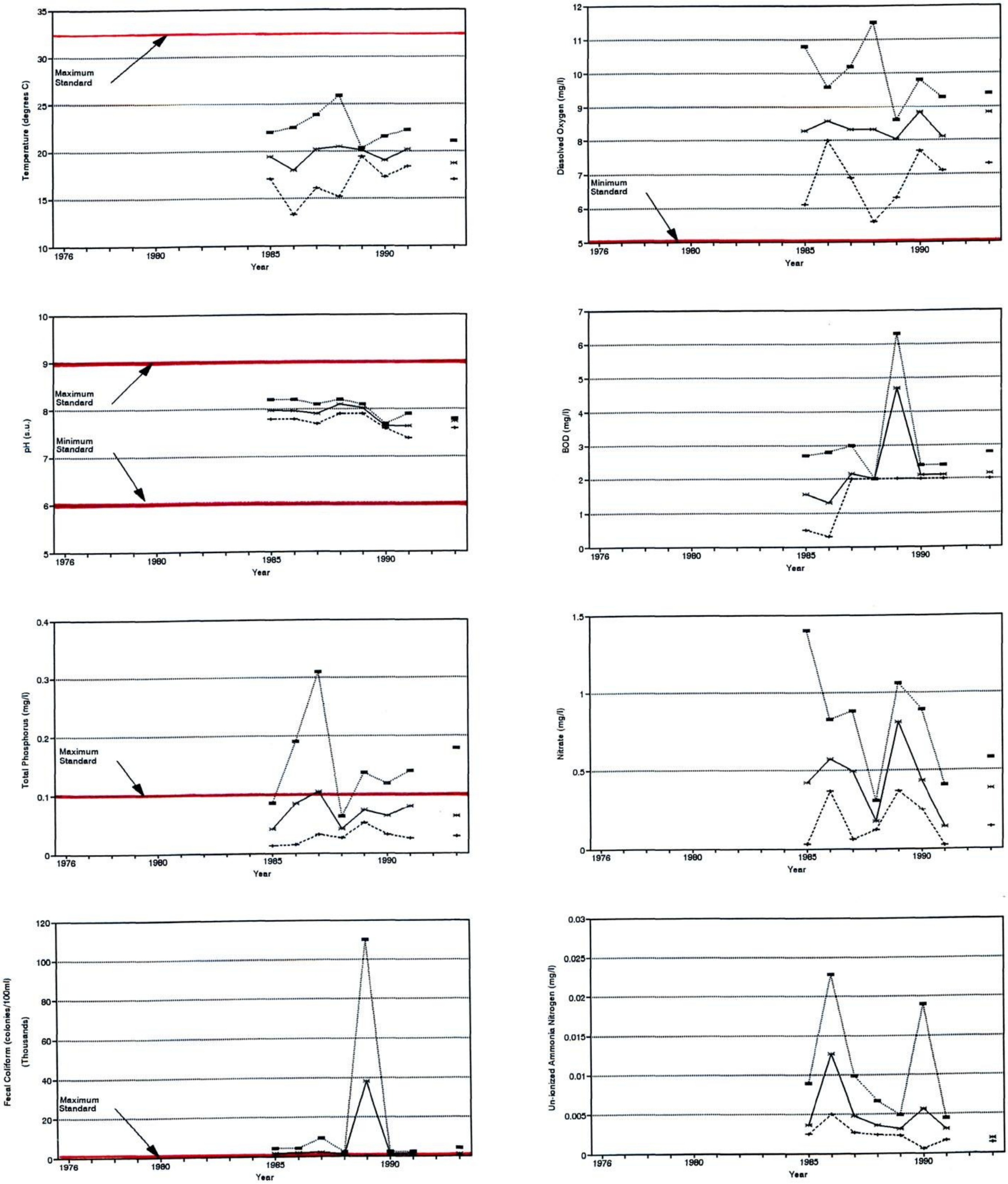
OAK CREEK WATERSHED



Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

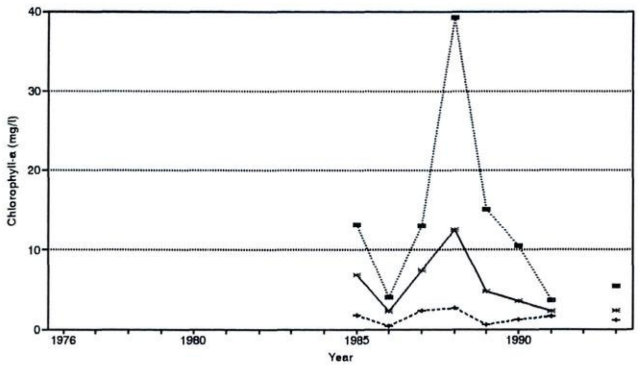
Figure X-4
WATER QUALITY DATA FOR THE OAK CREEK
AT STATION Ok-2: 1976-1993

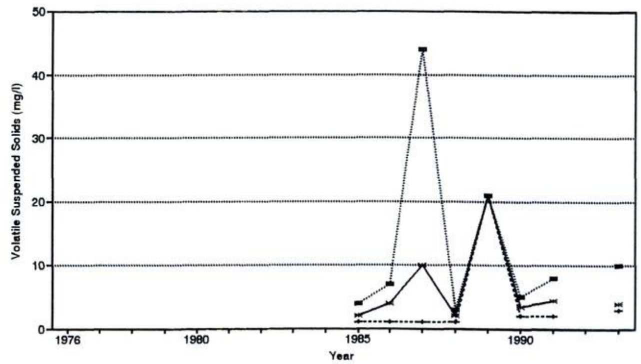


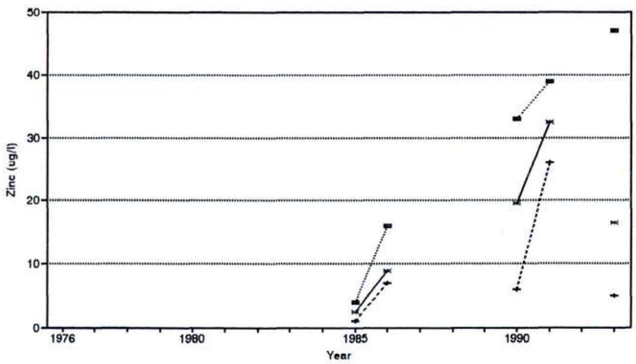

Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

Note: The maximum standard of 0.04 mg/l was not violated in any year.

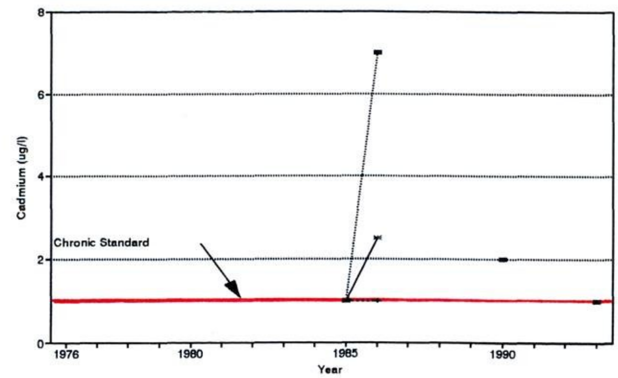
Figure X-4 (cont'd)



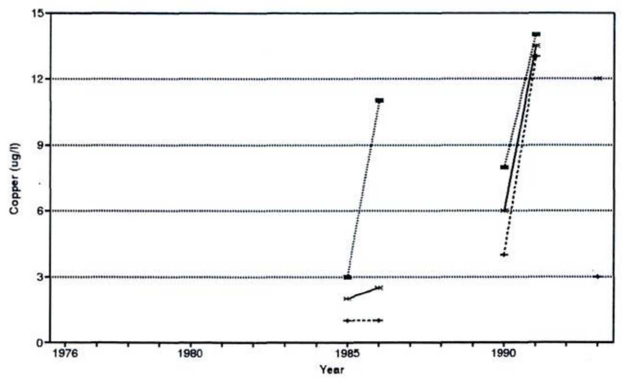



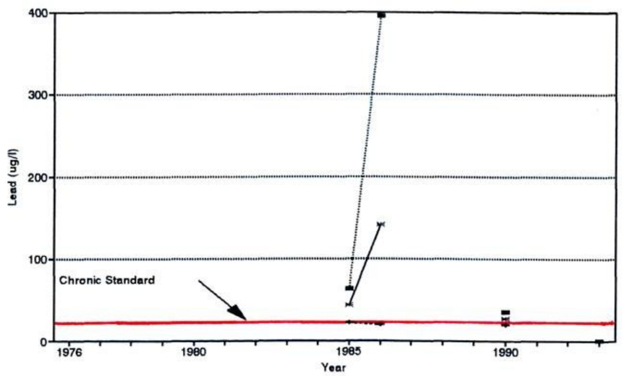

Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



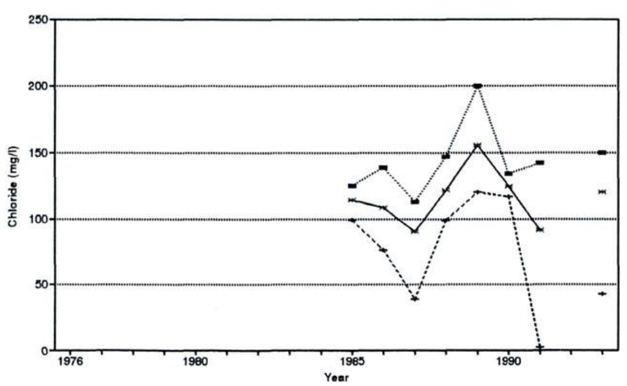

Note: The acute standard of 63.3 ug/l was not violated in any year.




Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.




Note: The acute standard of 408.6 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

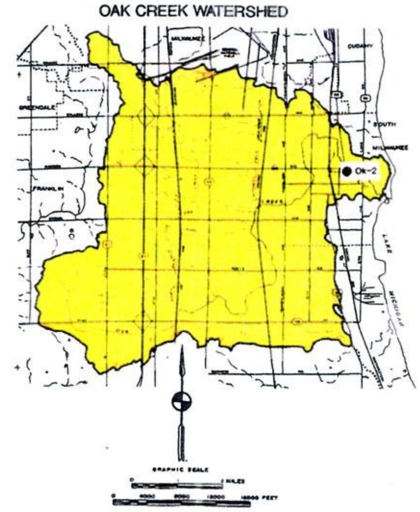
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

OAK CREEK WATERSHED

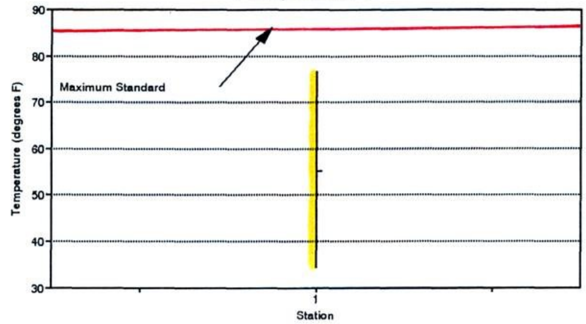



Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

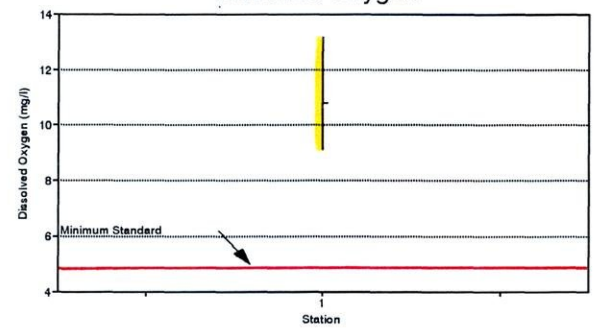
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

## Figure X-5
## Oak Creek Watershed Short-Term Water Quality Sampling Data: 1990

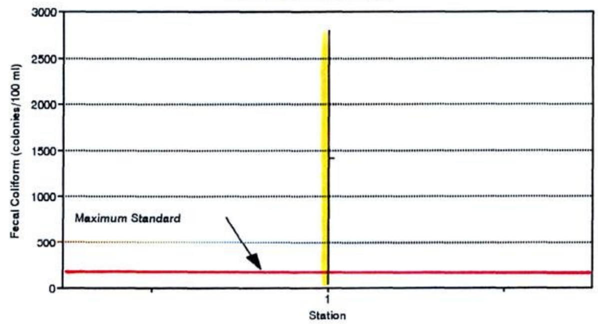
### Temperature



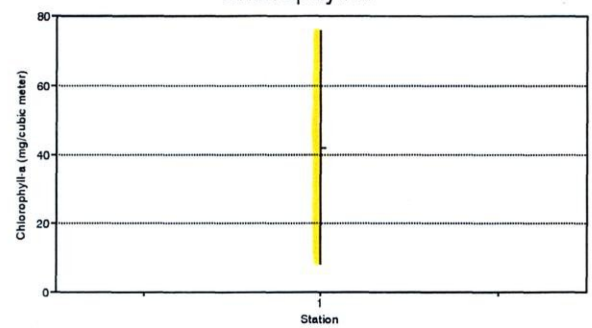

### Dissolved Oxygen



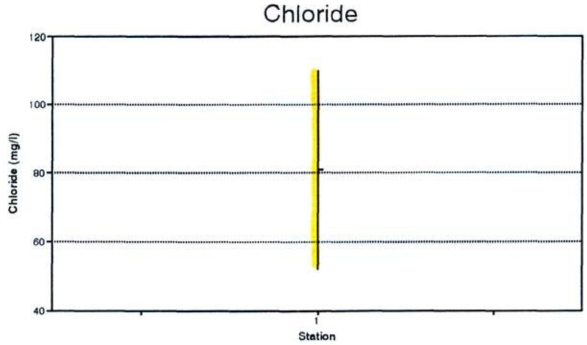

### Fecal Coliform




### Chlorophyll-a

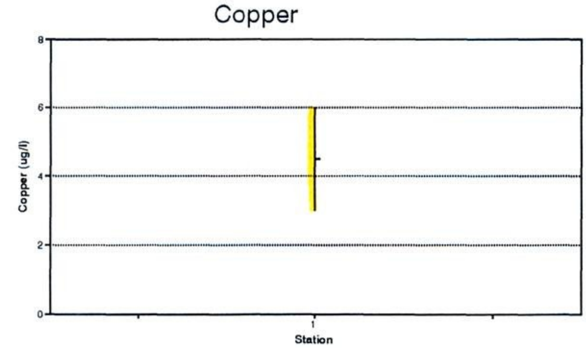



### Chloride



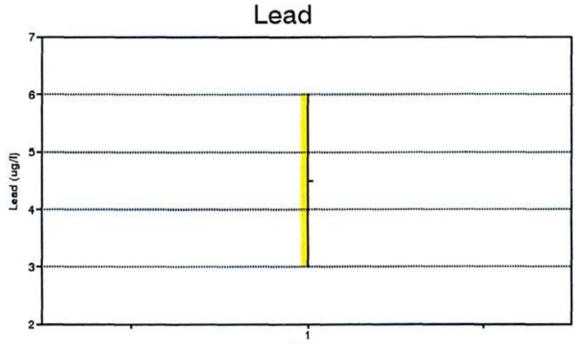

Note: The maximum standard of 1000 mg/l was not violated in any sample.

### Copper




Note: The acute standard of 31.9 ug/l and the chronic standard of 22.1 ug/l were not violated in any sample.

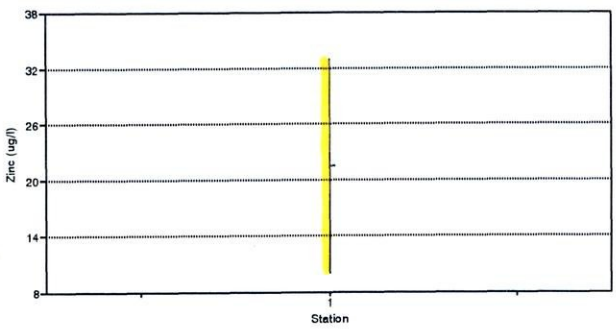
### Lead



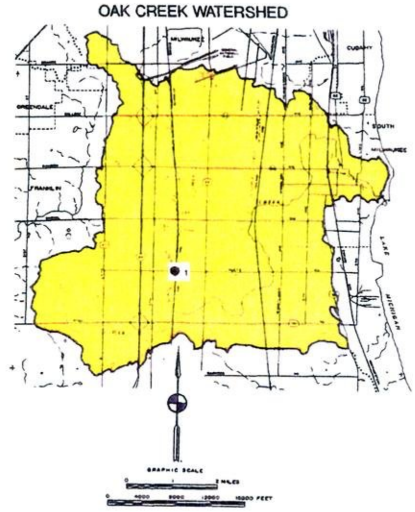

Note: The acute standard of 408.6 ug/l and the chronic standard of 24.4 ug/l were not violated in any sample.

# Figure X-5 (cont'd)

## Zinc




Note: The acute standard of 202.9 ug/l and the chronic standard of 89.2 ug/l were not violated in any sample.




LEGEND

Maximum

Average

Minimum

Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classification and water quality criteria. Refer to Table X-6 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table X-6

OAK CREEK WATERSHED SHORT-TERM STREAM WATER QUALITY SAMPLING DATA: 1988-1993

| Sampling Station Number | Parameter (Units) | Applicable Standards[a] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 1 | Temperature (°F) | Maximum of 89.0 | 34.3-76.8 | No | September-December 1990 | 3 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 9.1-13.2 | No | September-December 1990 | 3 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 40-2800 | Yes | September-December 1990 | 2 |
| | Chlorophyll-a (mg/cubic meter) | -- | 8.0-76.0 | -- | September-December 1990 | 2 |
| | Chloride (mg/l) | Maximum of 1000 | 52-110 | No | September-December 1990 | 2 |
| | Copper (ug/l) | Chronic maximum of 22.1; acute maximum of 31.9 | 3-6 | No | September-December 1990 | 2 |
| | Lead (ug/l) | Chronic maximum of 24.4; acute maximum of 408.6 | 3-6 | No | September-December 1990 | 2 |

[a]Standards indicated are those established for warmwater sport fish and full recreational use objectives. See Chapter II for relationships of these objectives and standards to current Wisconsin Department Of Natural Resources stream classifications and water quality criteria.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Department of Natural Resources. However, the limited data which were available for lead indicate improved levels after 1985.

Since the completion of the initial regional water quality management plan, nine spills of toxic substances into streams within the Oak Creek watershed have been documented by the Wisconsin Department of Natural Resources. All of these spills have occurred in the main stem of Oak Creek, one in the City of Oak Creek and eight in the City of South Milwaukee.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Oak Creek and its major tributaries were assessed with the results set forth in Table X-7. Fish population and diversity were poor throughout. No recent fish kills have been recorded in the watershed.

Standards were not fully met for fecal coliform counts, and un-ionized ammonia and total phosphorus concentrations along the main stem of the Oak Creek or in Mitchell Field Ditch or the North Branch of Oak Creek. Problems with toxic substances were indicated in all stream reaches where data were available.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were poor to fair, except for Oak Creek upstream of STH 100, which a poor to very poor rating. Moderate to high levels of stream bed sedimentation were noted throughout the watershed.

Table X-8 sets forth the water quality index classifications[5] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table X-8, recent data were available for four stations on the Oak Creek main stem; one at STH 38, one at the Oak Creek Parkway east of STH 32, one at Pennsylvania/Nicholson Avenue, and one on Ryan Road/STH 100. These stations and additional locations where water quality data were collected by the Milwaukee Metropolitan Sewerage District are shown on Map X-5. The limited data available indicate that water quality conditions at two of the four stations for which data were available in 1964 decreased from "good" to "fair" in 1974-75 and remained "fair" in 1990-91. Data from the two additional stations assessed during 1990-91 also resulted in a classification of the waters of Oak Creek as "fair" as set forth in Table X-8.

A summary of potential pollution sources in the Oak Creek watershed by stream reach is shown in tabular summary in Table X-9. Review of the data indicate that the majority of the conversion of lands from rural to urban uses is anticipated to occur within the portion of the watershed upstream of Pennsylvania Avenue and in the areas tributary to Mitchell Field Ditch and the North Branch of Oak Creek. It should be noted that the majority of the documented spills of toxic substances and the majority of the permitted industrial discharges occur in the Oak Creek main stem downstream of 15th Avenue in the City of South Milwaukee. Data on nonpoint source pollution and additional potential impacts to surface water quality are included in Table X-9.

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[5] For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table X-7

CHARACTERISTICS OF STREAM REACHES IN THE OAK CREEK WATERSHED

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating[c] | Streambed Sedimentation | Physical Modifications to Channel[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| a. Oak Creek upstream STH 100 | 2.8 | Poor | No | No | Yes | Yes | Yes | Yes | Poor-very poor | Moderate (rocks, sand, gravel) | Moderate |
| b. Oak Creek downstream STH 100 to Drexel Avenue | 4.5 | Poor | No | No | Yes | Yes | Yes | Yes | Poor | High (sand, silt, gravel, organics) | Major |
| c. Oak Creek d/s Drexel Ave. to Pennsylvania Avenue | 0.9 | Poor | No | No | Yes | Yes | Yes | Yes | -- | High (sand, silt, slimes, organics) | Major |
| d. Oak Creek d/s Pennsylvania Avenue to 15th Avenue | 1.9 | Poor | No | No | Yes | Yes | Yes | Yes | -- | High (sand, gravel, rubble) | Major |
| e. Oak Creek d/s 15th Avenue | 2.8 | Poor | No | No | Yes | Yes | Yes | Yes | Fair-poor | High (sand, gravel,organics) | Major |
| f. Mitchell Field Drainage Ditch | 2.3 | Poor | No | No | Yes | Yes | Yes | -- | -- | Moderate (sand, silt, clay, fine gravel) | Major |
| g. North Branch, Oak Creek | 5.7 | Poor | No | No | Yes | Yes | Yes | -- | Fair | Moderate (sand, silt, clay) | Major |
| TOTAL | 20.9 | | | | | | | | | | |

[a] Based upon professional judgement of area fish managers.

[b] The most recent water quality data available as described in Figures X-1 through X-5 were used to evaluate water quality in the Oak Creek system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for Oak Creek watershed stream reaches based upon year 2000 land use conditions and current levels of pollutant control.

[c] Biotic index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in Wisconsin Department of Natural Resources Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality In Streams," Hilsenhoff, 1982.

[d] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Table X-8

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE OAK CREEK WATERSHED 1964, 1974-1975, AND 1990-91

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Main Stem Stations | | | |
| Ok-1 | Good | Fair | Fair |
| Ok-2 | Good | Fair | Fair |
| Ok-3 | -- | -- | Fair |
| Ok-4 | -- | -- | Fair |
| Watershed Average | Good | Fair | Fair |

[a] See Map X-5 for sampling station locations.

Source: SEWRPC.

Table X-9

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE OAK CREEK WATERSHED: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Oak Creek upstream STH 100 | Significant | Major | -- | X | X | -- | -- | 1 | -- | | 1 |
| Oak Creek downstream STH 100 to Drexel Avenue | Insignificant | Major[d] | -- | X | X | -- | -- | 2 | -- | | 1 |
| Oak Creek downstream Drexel Avenue to Pennsylvania Ave. | Significant | Major | 1986-antifreeze | X | -- | -- | -- | 0 | -- | | 1 |
| Oak Creek downstream Pennsylvania Ave. to 15th Avenue | Insignificant[e] | Insignificant[e] | -- | X | -- | -- | -- | 0 | -- | | -- |
| Oak Creek downstream 15th Avenue | Insignificant[e] | Insignificant[e] | 1980-water glycol<br>1985-diesel fuel<br>1986-ferric chloride<br>1988-sheen on Oak Creek Lagoon<br>1991-oily sheen<br>1991-10W-20 oil<br>1992foundry sand | X | -- | -- | -- | 4 | -- | | -- |
| Mitchell Field Drainage Ditch | Signifiant | Major | -- | X | X | -- | -- | 1 | -- | | 1 |
| North Branch, Oak Creek | Significant | Major | -- | -- | X | -- | -- | 4 | -- | | 1 |

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] Number code refers to the following ongoing pollution abatement efforts:

1. Construction Erosion Control Ordinances in place

[d] The amount of post-1990 urban development is antidicpated to increase significantly in comparison to pre-1990 urban development.

[e] Considerable urban development existing pre-1976.

Compliance with Water Use Objectives

As indicated in Chapter II, all of the stream reaches in the Oak Creek watershed as of 1993 are recommended for warmwater sportfish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II.

Based upon the available data for sampling stations in the watershed, the main stem of the Oak Creek did not meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. Stream water quality data collected by the Milwaukee Metropolitan Sewerage District on the main stem of Oak Creek from 1985 to 1993, as shown in Figures X-1 through X-4, indicated that the main stem of the Oak Creek did not fully meet the recommended water use objectives. Based upon a review of the data summarized in Figure X-5 and Table X-6, and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the fecal coliform and phosphorus standards may also occur along the tributaries of the Oak Creek, and the recommended water use objectives continue not to be achieved in the majority of the major streams in the watershed.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, there are no major water quality issues remaining to be evaluated and addressed specific to the Oak Creek watershed. There remains a need to implement the nonpoint source pollution abatement recommendations set forth herein. A potential future amendment to the regional plan for the Oak Creek watershed may potentially be developed under the facility plan update initiated by the Milwaukee Metropolitan Sewerage District in 1995. That plan update is anticipated to institute an amendment to the regional plan once it is adopted by all of the agencies involved.

## Chapter XI

## PIKE RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

### INTRODUCTION

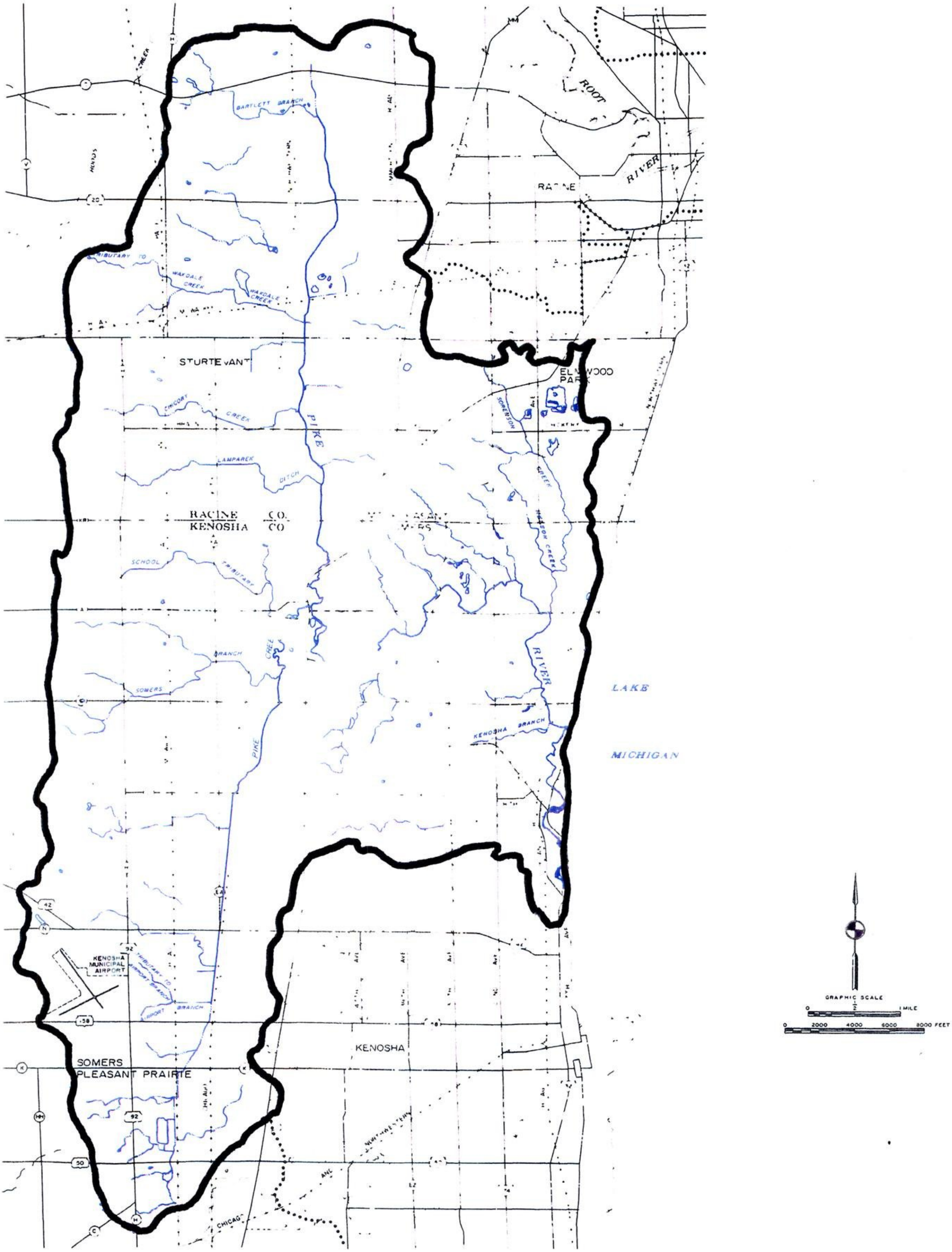
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Pike River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Pike River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited for the Pike River watershed as there are no major lakes located within the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Pike River watershed is located in the southeast portion of the Region and covers an area of approximately 51 square miles. The main stem of the Pike River rises in Racine County and flows approximately 16 miles southerly and easterly to enter Lake Michigan in the City of Kenosha in Kenosha County. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Pike River and its principal tributaries, are shown on Map XI-1. The Pike River watershed contains no lakes with a surface area of 50 acres or more.

### LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land uses which have occurred within the Pike River watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point source and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater

## Map XI-1
## PIKE RIVER WATERSHED



runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table XI-1 summarizes the existing land uses in the Pike River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the Pike River watershed contains numerous urbanized areas, 71 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 57 percent of the total area of the watershed in agricultural and related rural uses, about 3 percent in woodlands, about 3 percent in surface water and wetlands, and about 8 percent in open lands. The remaining 29 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XI-2.

Within the Pike River watershed, major concentrations of urban development exist in both Kenosha and Racine Counties, with the majority of urban development increases since 1975 occurring in Racine County. Urban development has been rapidly taking place in and around the City of Racine; in the Village of Mount Pleasant, along STH 20 and STH 31, and along STH 11; adjacent to and within the Village of Sturtevant; and in the southern portion of the watershed in the City of Kenosha and Village of Pleasant Prairie--the area generally between STH 50 and STH 142. The Pike River watershed contains a major industrial center, located just east of the Village of Sturtevant along STH 11, and a portion of the Regency Mall commercial center, located east of STH 31 in the City of Racine.

As shown in Table XI-1, from 1975 to 1990, urban land uses in the watershed increased from about 8,100 acres, or 13 square miles, to about 9,500 acres, or 15 square miles, or by about 17 percent. As shown in Table XI-1, residential land represents the largest urban land use in the watershed. Residential use increased within the watershed, from about 3,800 acres, or about six square miles in 1975, to about 4,400 acres, or about seven square miles in 1990, a 15 percent increase. Commercial lands increased significantly, from 120 acres, or about 0.2 square mile, to 252 acres, or about 0.4 square mile, an increase of 110 percent.

The 15 square miles of urban land uses in the watershed as of 1990 approximated the staged 1990 planned level of about 14.7 square miles envisioned in the adopted year 2000 land use plan. The current status of development in the Pike River watershed and in adjacent portions of Racine and Kenosha Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XI-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Pike River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban land uses are expected to increase in Racine County in the vicinity of STH 11 and STH 20 in the Town of Mount Pleasant, and along STH 31 in the Town of Mount Pleasant and the City of Racine; and in Kenosha County in the vicinity of STH 142 and STH 50 in the City of Kenosha and Village of Pleasant Prairie.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future

Table XI-1

LAND USE IN THE PIKE RIVER WATERSHED: 1975 and 1990[a]

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 3,795 | 11.5 | 4,373 | 13.3 | 578 | 15.2 |
| Commercial | 120 | 0.4 | 252 | 0.7 | 132 | 110.0 |
| Industrial | 447 | 1.4 | 438 | 1.3 | - 9 | - 2.0 |
| Transportation, Communication, and Utilities[b] | 2,416 | 7.3 | 3,053 | 9.3 | 637 | 26.4 |
| Governmental and Institutional | 698 | 2.1 | 712 | 2.2 | 14 | 2.0 |
| Recreational | 634 | 1.9 | 654 | 2.0 | 20 | 3.2 |
| Subtotal | 8,110 | 24.6 | 9,482 | 28.8 | 1,372 | 16.9 |
| Rural | | | | | | |
| Agricultural and Related | 21,169 | 64.3 | 18,764 | 57.0 | - 2,405 | - 11.4 |
| Lakes, Rivers, Streams and Wetlands | 878 | 2.7 | 944 | 2.9 | 66 | 7.5 |
| Woodlands | 945 | 2.9 | 919 | 2.8 | - 26 | - 2.8 |
| Open Lands[c], Landfills, Dumps, and Extractive | 1,807 | 5.5 | 2,800 | 8.5 | 993 | 55.0 |
| Subtotal | 24,799 | 75.4 | 23,427 | 71.2 | - 1,372 | - 5.5 |
| Total | 32,909 | 100.0 | 32,909 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

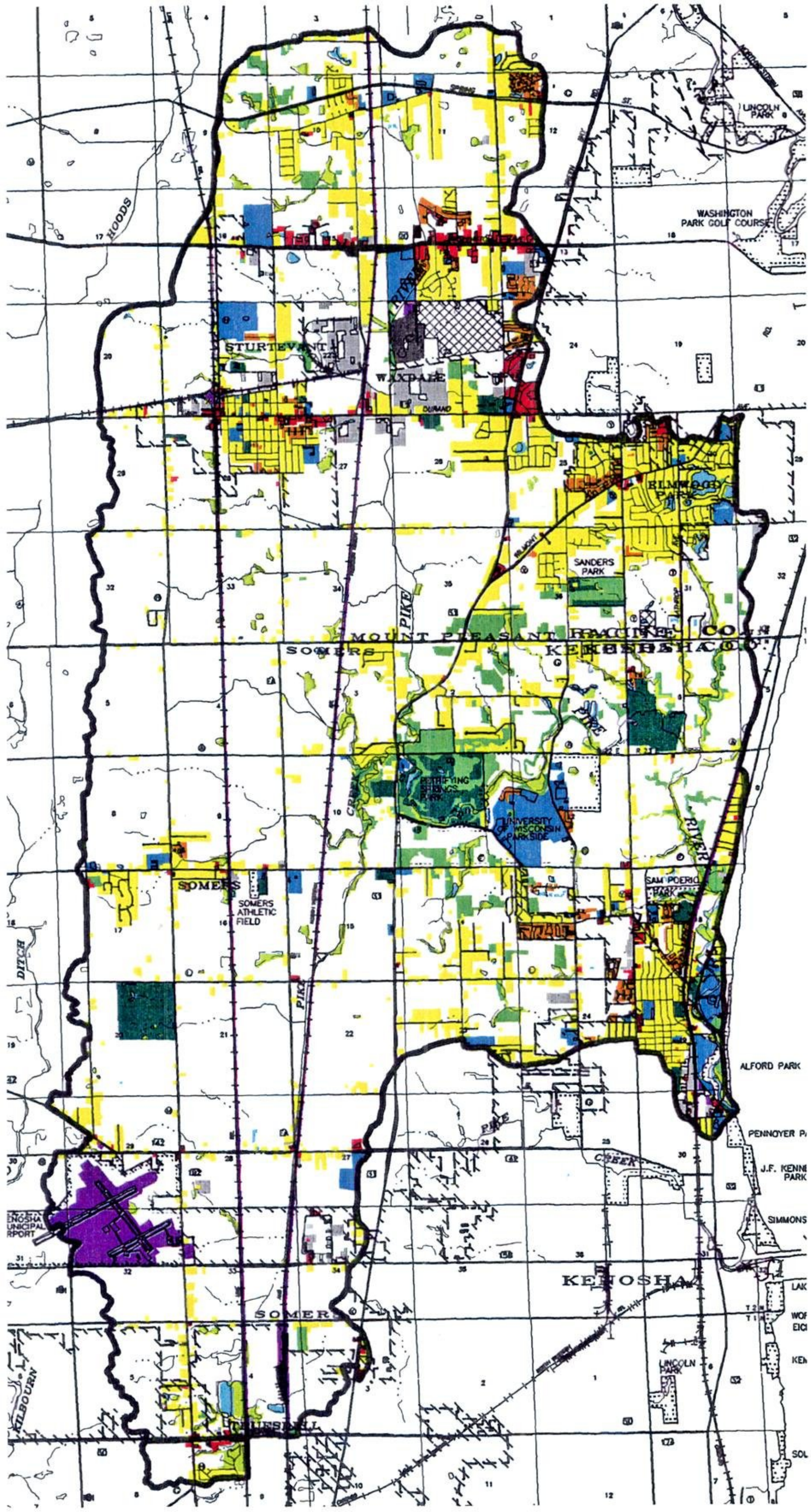
[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

# MAP XI-2

# LAND USES IN THE PIKE RIVER WATERSHED: 1990




–LEGEND–

- SINGLE–FAMILY RESIDENTIAL
- MULTI–FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREET AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

0 1 2

GRAPHIC SCALE IN MILES

The Pike River watershed is about 51 square miles in areal extent, or about 2 percent of the total Regic
In 1990, about 15 square miles, or about 29 percent of the watershed, was in urban land uses.



Source: SEWRPC.

Table XI-2

EXISTING AND PLANNED LAND USE IN THE PIKE RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 4,373 | 13.3 | 5,912 | 18.0 | 1,539 | 35.2 | 6,759 | 20.5 | 2,386 | 54.6 |
| Commercial | 252 | 0.7 | 283 | 0.9 | 31 | 12.3 | 316 | 0.9 | 64 | 25.4 |
| Industrial | 438 | 1.3 | 757 | 2.3 | 319 | 72.8 | 942 | 2.9 | 504 | 115.1 |
| Transportation, Communication, and Utilities[b] | 3,053 | 9.3 | 3,581 | 10.9 | 528 | 17.3 | 3,939 | 12.0 | 886 | 29.0 |
| Governmental and Institutional | 712 | 2.2 | 754 | 2.3 | 42 | 5.9 | 783 | 2.4 | 71 | 10.0 |
| Recreational | 654 | 2.0 | 842 | 2.5 | 188 | 28.7 | 893 | 2.7 | 239 | 36.5 |
| Subtotal | 9,482 | 28.8 | 12,129 | 36.9 | 2,647 | 27.9 | 13,632 | 41.4 | 4,150 | 43.8 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 18,764 | 57.0 | 17,843 | 54.2 | - 921 | - 4.9 | 16,558 | 50.3 | -2,206 | - 11.8 |
| Lakes, Rivers, Streams, and Wetlands | 944 | 2.9 | 894 | 2.7 | - 50 | - 5.3 | 894 | 2.7 | - 50 | - 5.3 |
| Woodlands | 919 | 2.8 | 905 | 2.7 | - 14 | - 1.5 | 882 | 2.7 | - 37 | - 4.0 |
| Open Lands,[c] Landfills, Dumps, and Extractive | 2,800 | 8.5 | 1,140 | 3.5 | -1,660 | - 59.3 | 943 | 2.9 | -1,857 | - 66.3 |
| Subtotal | 23,427 | 71.2 | 20,780 | 63.1 | -2,647 | - 11.3 | 19,277 | 58.6 | -4,150 | - 17.7 |
| Total | 32,909 | 100.0 | 32,909 | 100.0 | 0 | -- | 32,909 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

conditions, the amount of land devoted to urban use within the Pike River watershed, as indicated in Table XI-2, is projected to increase from the 1990 total of about 15 square miles, or about 29 percent of the total area of the watershed, to about 19 square miles, or about 37 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 21 square miles, or about 41 percent of the total watershed by year 2010. It is important to note that the 59 to 63 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and, as recommended in the year 2010 regional land use plan, is proposed to be largely in open space uses, preserved through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 36 square miles in 1990 to about 32 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 30 square miles under the high growth-decentralized land use plan, decreases of about 11 and 18 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Pike River watershed--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. This section also includes a status report on the public sanitary service areas located in the watershed.

### Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were two public sewage treatment facilities located in the Pike River watershed, as shown on Map XI-3. The Village of Sturtevant and Town of Somers sewage treatment plants discharged indirectly to the main stem of the Pike River via small tributaries. Both of these plants were abandoned after 1975, as recommended in the initial plan. The status of implementation with regard to the initial plan recommendations for public and private sewage treatment plants in the Pike River watershed is summarized in Table XI-3.

In addition to the publicly-owned sewage treatment facilities, two private sewage treatment plants were in existence in 1975 in the Pike River watershed. These plants served the American Motors Corporation-Transportation Division in the Town of Somers and St. Bonaventure Seminary in the Town of Mount Pleasant. As indicated in Table XI-3, both of the private sewage treatment plants in the watershed were recommended to be abandoned. As of 1990, both of these plants had been abandoned.

# Map XI-3

## SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE PIKE RIVER WATERSHED: 1990 AND 2010

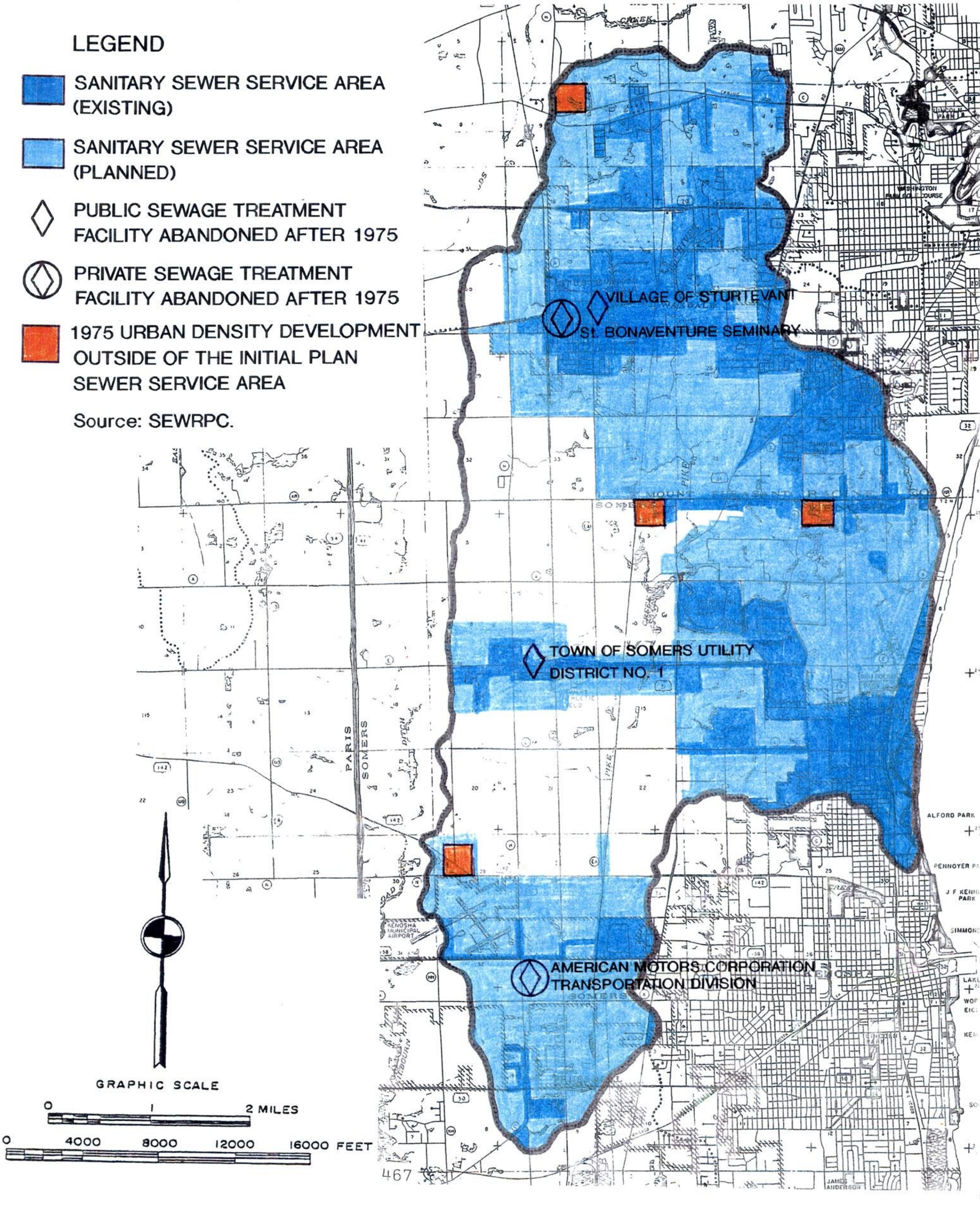


Table XI-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS
IN THE PIKE RIVER WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| Town of Somers Utility District No. 1 | Tributary of Pike Creek | Abandon Plant | Plant Abandoned (1986) |
| Village of Sturtevant | Tributary of Pike River | Abandon Plant | Plant Abandoned (1980) |
| **Private Sewage Treatment Plants** | **Disposal of Effluent** | **Plan Recommendation** | **Implementation Status** |
| American Motors Corporation Transportation Division | Tributary of Pike Creek | Abandon Plant | Plant Abandoned (1977) |
| St. Bonaventure Seminary | Tributary of Pike River | Abandon Plant | Plant Abandoned (1979) |

Source: SEWRPC.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were four sewer service areas identified within, or partially within, the Pike River watershed: Racine, Somers, Pleasant Prairie North, and Kenosha. Currently, all of these areas have undergone refinements as recommended. The boundaries of the sewer service areas through 1993 are shown on Map XI-3. Table XI-4 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer service area in the Pike River watershed, as refined through 1993, totals about 36 square miles, or about 71 percent of the total watershed area, as shown in Table XI-4.

Current Plan Recommendations: The current point source pollution abatement plan element, including the planned sanitary sewer service areas in the Pike River watershed are shown on Map XI-3. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. All or portions of the Bristol/Pleasant Prairie, Kenosha, and Racine sewer service areas are located in the Pike River watershed. Together, the planned service areas total about 36 square miles, or about 71 percent of the Pike River watershed.

As noted above, each of these service areas in the watershed has been refined as part of the ongoing regional water quality management plan updating process. However, additional changes to the planned sewer service areas, as well as to the trunk sewer system in the Pike River watershed have been recommended in two subregional sewerage system plans.[1] The recommendations of these two system plans are described in Chapter IV for the greater Kenosha area and in Chapter XIII for the greater Racine Area. Formally amending the regional water quality management plan is being held in abeyance until such time as intergovernmental agreements on the system plans is achieved by the local units involved, including the City of Racine for the greater Racine area plan recommendations and the City of Kenosha for the greater Kenosha area. No specific additional refinements are envisioned to be needed for the currently planned sewer service areas at this time. It is recommended that the sanitary sewer service areas and attendant planned population levels be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were eight known separate sewer flow relief devices located in the Pike River watershed: five crossovers to storm sewers discharging to the Pike River from the City of Kenosha; two bypasses to the Pike River, one from the Village of Sturtevant and one from the Town of Mount Pleasant; and one bypass to Pike Creek from the Town

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[1]Alvord, Burdick & Howson and Applied Technologies,Inc., A Coordinated Sanitary Sewerage and Water Supply System Plan for the Greater Racine Area, September 1992; and Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991.

Table XI-4

PLANNED SANITARY SEWER SERVICE AREAS IN THE PIKE RIVER WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Bristol IH 94<br>Pleasant Prairie North | 0.9 | Bristol/Pleasant Prairie | December 2, 1985 | SEWRPC CAPR No. 106, Sanitary Sewer Service Area for the City of Kenosha and Environs, Kenosha County, Wisconsin |
| Kenosha<br>Pleasant Park<br>Somers | 16.7 | Kenosha | December 2, 1985 | SEWRPC CAPR No. 106, Sanitary Sewer Service Area for the City of Kenosha and Environs, Kenosha County, Wisconsin |
| Racine<br>Caddy Vista | 18.4 | Racine<br>Caddy Vista | December 1, 1986 | SEWRPC CAPR No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin |
| Total | 36.0 | | | |

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

of Somers. These flow relief devices have all been eliminated, as recommended in the initial regional water quality management plan. As shown in Table XI-5, two points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Pike River watershed. One incident of bypassing was reported at the County Line Road lift station in the Town of Mount Pleasant Sewer Utility District No. 1 sewerage system due to a mechanical failure which was subsequently repaired. One incident of bypassing was reported at the Hulda Street lift station in the Village of Sturtevant due to excessive rainfall.

Current Plan Recommendations: It is recommended that the Village of Sturtevant and the Town of Mount Pleasant Sewer Utility District No. 1 continue to monitor their sewerage system operations to ensure that the use of the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading within the watershed be conducted with the assumption that there will be no planned bypasses of untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan, as updated, recommended the construction of two intercommunity trunk sewers in the Pike River watershed, as shown in Table XI-6. One trunk sewer would connect urban development in the Village of Sturtevant and in portions of the Town of Mount Pleasant to the City of Racine sewerage system, enabling the abandonment of the Village of Sturtevant sewage treatment plant, while the other would connect urban development in the Town of Somers to the City of Kenosha sewerage system, enabling the abandonment of the Town of Somers Utility District No. 1 sewage treatment plant. The trunk sewer connecting the Village of Sturtevant and portions of the Town of Mount Pleasant has been constructed. An interim connection of the Town of Somers Utility District No. 1 to the Kenosha sewerage system was also completed and the permanent Somers-Kenosha trunk sewer was partially completed by extension to CTH E.

Current Plan Recommendations: As noted earlier, there are now pending recommendations for additional trunk sewers to serve the service areas in the watershed as were recommended in separate subregional system plans for the greater Kenosha area and the greater Racine area. Amendment of the regional water quality management plan is being held in abeyance until such time as local agreement on the system plans is reached. Details regarding the trunk sewers recommended in those plans are shown in Chapter IV for the greater Kenosha area and Chapter XIII for the greater Racine area.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of four known point sources of pollution identified in the Pike River watershed other than public and private sewage treatment plants. All six of these outfalls were identified as discharging only cooling water to the surface water system. The initial regional water quality management plan includes a recommendation that these industrial sources of wastewater be monitored and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

Table XI-5

KNOWN SEWAGE FLOW RELIEF DEVICES IN
THE PIKE RIVER WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | Comments |
|---|---|---|---|---|---|---|---|
| | | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| Town of Mount Pleasant Utility District No. 1 | -- | -- | 1 | -- | -- | 1 | Used only in case of equipment failure |
| Village of Sturtevant | -- | -- | 1 | -- | -- | 1 | Used only in case of equipment failure or extreme wet weather conditions |
| Total | -- | -- | 2 | -- | -- | 2 | |

Source: SEWRPC.

Table XI-6

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE PIKE RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Sturtevant-Mt. Pleasant | Completed (1980) |
| Somers-Kenosha | Interim Connection Completed (1986) Portion of permanent trunk sewer completed to CTH E (1993) |

Source: SEWRPC.

As of 1990, there were ten such known point sources of wastewater discharging to the Pike River and its major tributaries and the groundwater system. Table XI-7 summarizes selected characteristics of these other point sources and Map XI-4 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 14 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Pike River watershed. These point sources of wastewater discharge, primarily industrial cooling, process, rinse, and wash water directly or following treatment to the groundwater or the surface waters. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

## Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were four enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, all of these areas had been added to the planned 2010 sewer service area as part of the plan amendment process. No new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map XI-3.

## Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Pike River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources. In some cases, toxic and hazardous substances have begun to leach into surrounding soils and aquifers and can potentially be transmitted to the surface waters.

There are currently two active and nine known abandoned landfills located in the Pike River watershed. None of the active or abandoned landfills are known to be negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Pike River watershed have the potential to affect water quality through the release of substances into the surrounding soils and ground water. Sites with leaking underground storage tanks are eligible for remediation under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the clean up of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing clean up efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground waters. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were 32 known leaking underground storage tank sites in the Pike River watershed. None of these involved the discharging of remediation wastewater directly to surface water or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the

Table XI-7

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE PIKE RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Pike River Watershed | | | | | | | | | |
| Eaton Corporation - Elec. Drives Div. | Kenosha | 1 | General | 0044938-3 | 9-30-95 | 3566 | Speed changers, drives & gears | Pike River via storm sewer | -- |
| Ken-Crete Products Co., Inc. | Kenosha | 2 | General | 0046507-2 | 9-30-95 | 3271/3273 | Concrete block, brick & ready-mix | Absorption pit | -- |
| Metal-lab, Inc. | Kenosha | 3 | General | 0044938-3 | 9-30-95 | 3398 | Metal heat treating | Pike River via unnamed tributary | -- |
| Racine Fluid Power | Kenosha | 4 | General | 0044938-3 | 9-30-95 | 3561 | Pumps & equip., valves & pipe fit. | Pike River | -- |
| Racine School Dist: J.I. Case H.S. | Kenosha | 5 | General | 0046523-1 | 9-30-95 | 3494 | Secondary school | Pike River via drainage ditch | -- |
| Spencer Residence | Kenosha | 6 | General | HEAT PUMP | 9-30-95 | 8811 | Private residence | Pike River via storm sewer | -- |
| UW Parkside Pool | Kenosha | 7 | General | 0046523-2 | 9-30-95 | 8221 | College or university | Pike River via drainage ditch | -- |
| J. I. Case Company-Transmission Plant | Racine | 1A | Specific | 0039691 | 8-31-94 | 3523 | Farm machinery & equipment | Lake Michigan via storm sewer | None |
| Land Reclamation Company | Racine | 2A | Specific | 0045420 | 12-31-94 | 4953 | Refuse systems | Pike River via drainage ditch | 1, 2 |
| S. C. Johnson & Son, Inc. - Waxdale | Racine | 3A | Specific | 0027758 | 12-31-93 | 2842 | Polishes and sanitation goods | Pike River via unnamed tributary | None |

[a] Table XI-7 includes 10 known, permitted point sources of wastewater discharging to the Pike River and its tributaries, or to the groundwater system in the Pike River watershed. As of 1993, there were 14 known, permitted point sources of pollution.

[b] See Map XI-4, Point sources of pollution other than sewage treatment facilities in the Pike River Watershed: 1990 and 2010.

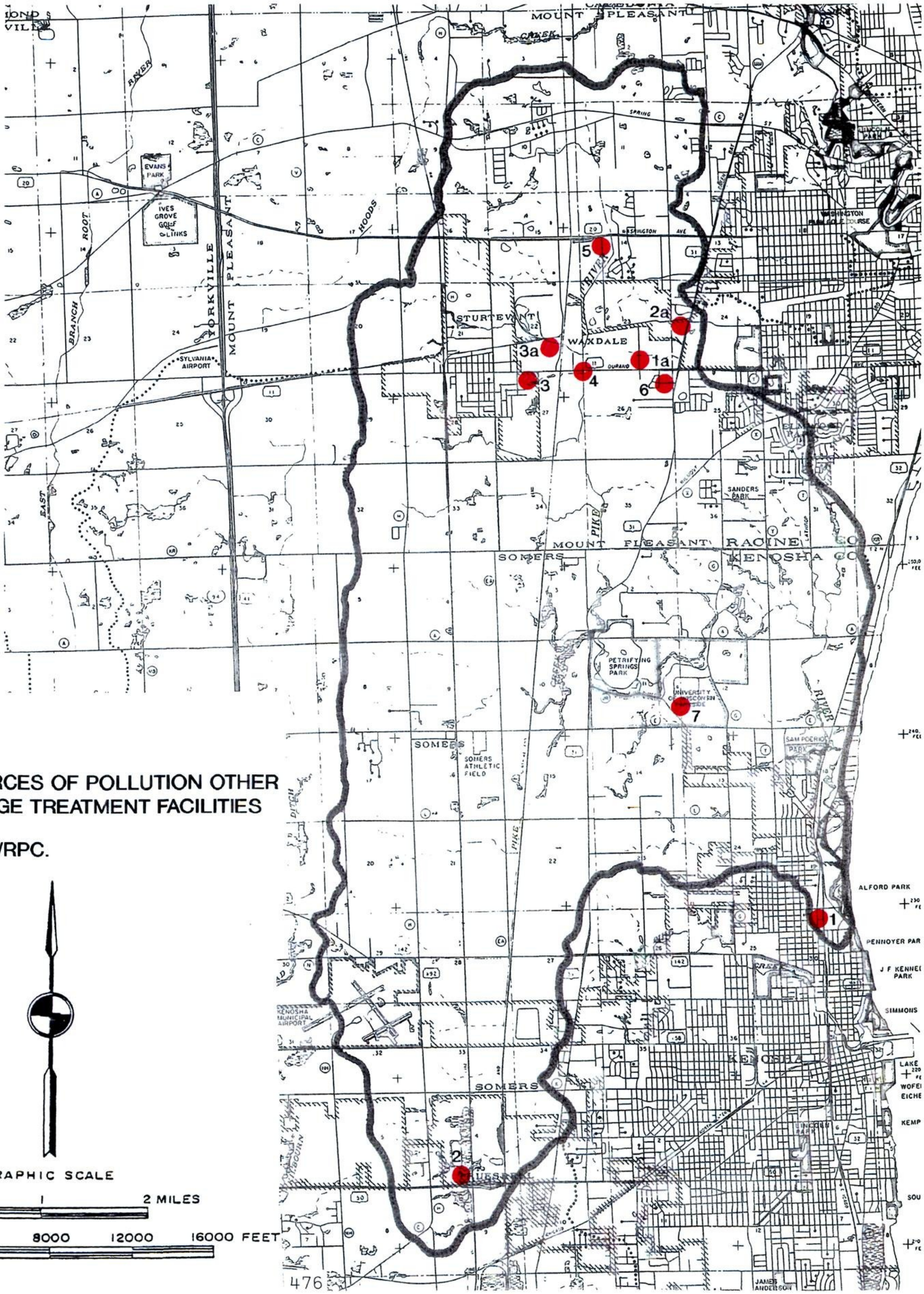
[c] The number code refers to the following treatment systems:

1. Gravity sedimentation
2. Holding pond

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map XI-4

# POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE PIKE RIVER WATERSHED: 1990




LEGEND

● POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters. As of 1993, there were no known such sites in the Pike River watershed.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

### Existing Conditions and Status of Plan Implementation

For the Pike River watershed, the initial plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to construction site erosion control, onsite sewage disposal system management, and streambank erosion control.

In 1983, the Commission prepared a comprehensive plan[2] for the Pike River watershed. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas and for rural nonpoint source management planning in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a very limited basis in the Pike River watershed through a variety of local and State regulations and programs. These programs include the regulation of onsite sewage disposal systems under programs currently administered by Kenosha and Racine Counties in the unincorporated areas and by the local units of government in incorporated areas served by onsite systems. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified. In addition, significant progress has also been made in the area of construction site erosion control. As of January 1993, the City of Kenosha and Village of Pleasant Prairie had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and the League of Wisconsin Municipalities.

With regard to rural nonpoint source control, programs such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are being utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have

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[2]SEWRPC Planning Report No. 35, A Comprehensive Plan for the Pike River Watershed, June 1983.

positive water quality impacts. Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade, and Consumer Protection as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Kenosha and Racine Counties. Thus, these plans have been prepared for all rural areas of the Pike River watershed. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While these local programs described above have resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin State Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. To date, the Pike River watershed has not been selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program.

Current Plan Recommendations

It is recommended that construction site erosion control, onsite sewage system management, and streambank erosion controls plus land management be carried out throughout the Pike River watershed. The types of practices recommended to be considered for this level of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, the watershed should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make State cost-sharing funds and related programs available for nonpoint source pollution control measures. In addition, detailed stormwater management plans in urban areas and farmland management practices in rural areas should be conducted to define the practices to be installed in the most cost-effective manner. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[3] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Pike River watershed in the high category, indicating that inclusion in the program will be possible when existing planning projects are completed and funds and staff become available within the Department of Natural Resources.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous section, the most direct measure of impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

As of 1993, no known monitoring has been carried out in the Pike River watershed on a sustained basis. However, the Wisconsin Department of Natural Resources conducted extensive stream habitat and fish community surveys in the watershed in June of 1990 and again in June of 1993.

### Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at four stations located on the main stem of the Pike River--at stations Pk-1, Pk-2, Pk-4, and at a location upstream of Pk-1 on the Pike River in Racine County, as shown on Map XI-5. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five to seven year intervals. These recommendations can be coordinated, and are consistent, with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five to seven year rotating cycle.

## LAKES MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of

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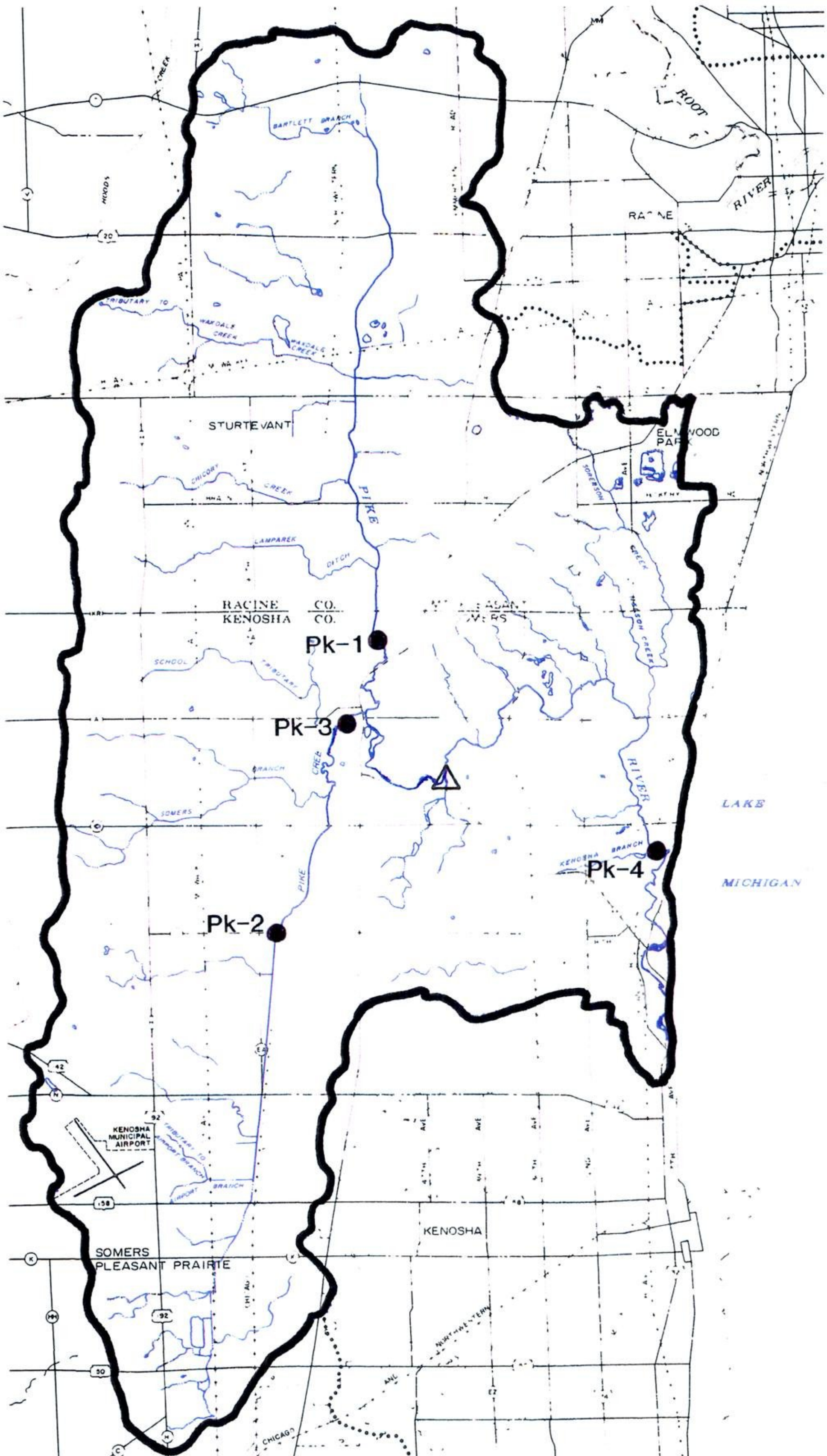
[3]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southwestern Wisconsin: 1993."

# Map XI-5
## LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE PIKE RIVER WATERSHED



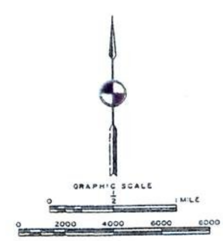

LEGEND

Sampling stations used in preparation of initial plan

● SEWRPC

△ USGS

Source: SEWRPC.



watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological condition monitoring programs to be established.

As noted above, there are no major lakes in the Pike River watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; the 1976 Commission monitoring program conducted under the regional water quality management planning effort; and the Wisconsin Department of Natural Resources (DNR) sampling programs in 1973 and 1976. Available data collected in those programs for the Pike River watershed included samplings at four Commission stations--two on the Pike Creek Tributary of the Pike River and two on the main stem of the Pike River--and at one USGS station on the Pike River main stem. The sampling station locations are shown on Map XI-5.

No post-1976 comparable water quality data were available for streams in the Pike River watershed. However, the Wisconsin Department of Natural Resources has conducted biological condition monitoring in the watershed, including stream habitat and biological community surveys conducted in June 1990 and June 1993 which were available for use in the assessment of current water quality conditions. In addition, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Pike River watershed.

Based upon review of the available current data, it is not possible to determine current conditions, or if any significant changes have occurred in the water quality conditions since the preparation of the initial plan.

<u>Toxic and Hazardous Substances</u>: Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Pike River watershed from 1973 through 1977. In the in-stream water quality samples for which toxic and hazardous substances were tested, levels of heptachlor epoxide, DDT, lindane and dieldrin, and persistent pesticides were exceeded in two of nine, one of nine, one of eight, and three of eight samples, respectively. Sample analyses for cadmium, chromium, copper, lead, mercury, nickel, zinc, PCBs, and DDE, DDD, aldrin,

heptachlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency recommended levels.

Since the completion of the initial plan, no known water column or sediment sampling for toxic and hazardous substances in streams within the Pike River watershed has been conducted.

The Wisconsin Department of Natural Resources has documented 12 spills of toxic substances into streams within the Pike River watershed since the completion of the initial regional water quality management plan. All of these spills have occurred in the Pike River main stem, upstream of Pike Creek in Racine County.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Pike River and its major tributaries were assessed with the results set forth in Table XI-8. Fish sampling and habitat evaluations were conducted by the Wisconsin Department of Natural Resources in the Pike River watershed during June of 1990. Results indicated that fish population and diversity are poor, except for Pike Creek where the population and diversity are fair. One fish kill incident has been documented in the Pike River watershed. This incident occurred in the main stem of the Pike River and its cause has not fully been determined.

Standards were not fully met for dissolved oxygen concentrations in the main stem of the Pike River both upstream and downstream of the Pike Creek confluence. Downstream of the Pike Creek confluence,and in Pike Creek, standards were not fully met for fecal coliform levels.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were very poor to fair, except for Pike Creek which had a poor rating. High levels of streambed sedimentation were noted throughout the watershed.

Table XI-9 sets forth the water quality index classifications[4] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. The limited data available indicate that water quality conditions have generally improved from "poor" in 1964 to "fair" in 1974-75, but no recent data were available to assess water quality conditions in 1990 and 1991.

A summary of potential pollution sources in the Pike River watershed by stream reach is shown in tabular summary in Table XI-10. Review of the data indicate the majority of the conversion of lands from rural to urban uses has occurred in the area tributary to the Pike River main stem downstream of the Pike Creek confluence. It should be noted that the majority of the documented spills of toxic substances and the majority of the permitted industrial discharges occur in the Pike River main stem in Racine County, in and around an area of industrial land uses. Data on nonpoint source pollution and additional potential impacts to surface water quality are included in Table XI-10.

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[4] For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table XI-8

CHARACTERISTICS OF STREAMS IN THE PIKE RIVER WATERSHED

| **SUBWATERSHED** Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating[c] | Streambed Sedimentation (substrate) | Physical Modifications to Channel[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| a. Pike River upstream Pike Creek | 14.2 | Poor | Yes[e] | Yes | No | No | Yes | -- | Very poor-fair | High (cobble, gravel, sand, clay) | Major |
| b. Pike River downstream Pike Creek | 13.8 | Poor | No | Yes | No | No | Yes | -- | Very poor-fair | High (cobble, gravel, sand, clay) | Moderate |
| c. Pike Creek | 10.5 | Fair | No | No | No | No | Yes | -- | Poor | High (gravel, sand, clay) | Major |
| TOTAL | 38.5 | | | | | | | | | | |

[a] Based upon 1990 Wisconsin Department of Natural Resources fishery survey.

[b] Simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for Pike River watershed stream reaches based upon year 2000 land use conditions and current level of pollution control.

[c] Biotic index ratings are based upon the Index of Biotic Integrity (IBI) discussed in U.S. Department of Agriculture, Forest Service, General Technical Report NC-149, "Using the Index of Biotic Integrity (IBI) To Measure Environmental Quality in Warmwater Streams of Wisconsin," Lyons, April 1992. Data provided in Wisconsin Department of Natural Resources Report A Resource Assessment for the Pike River Watershed, July 1994.

[d] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

[e] Potentially related to a chemical discharge. Source unknown.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XI-9

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE PIKE RIVER WATERSHED 1964, 1974-1975, AND 1990-1991

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Main Stem Stations | | | |
| Pk-1 | Poor | Fair | -- |
| Pk-4 | Fair | Fair | -- |
| Tributary Stations | | | |
| Pk-2 | Poor | Fair | -- |
| Pk-3 | Poor | Fair | -- |
| Watershed Average | Poor | Fair | -- |

[a] See Map IX-5 for sampling station locations.

Source: SEWRPC.

Table XI-10

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE PIKE RIVER WATERSHED: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Pike River upstream Pike Creek | Insignificant | Major[c] | 83-chlorine<br>86-soap suds<br>89-diesel fuel<br>90-emulsified wax<br>90-76 polymers-emulsion<br>90-hydraulic fluid<br>91-isopropyl alcohol<br>91-light oil<br>92-polymer wastewaters<br>92-glycol ether<br>92-diesel fuel<br>92-diesel fuel | X | X | -- | -- | 6 | -- | Village of Sturtevant public sewage treatment plant abandoned in 1980. St. Bonaventure Seminary private sewage treatment plant abandoned in 1979. | -- |
| Pike River downstream Pike Creek | Significant | Moderate | -- | -- | X | -- | -- | 3 | -- | | X[d] |
| Pike Creek | Insignificant | Significant | -- | X | X | -- | -- | 1 | -- | Town of Somers Utility District No. 1 public sewage treatment plant abandoned in 1986. American Motors Corporation-Transportation Division private sewage treatment plant abandoned in 1977. | -- |

[a] Includes the tributary drainage area of each stream reach.

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] The amount of post-1990 urban development is anticipated to increase significantly in comparison to pre-1990 urban development.

[d] Construction Erosion Control Ordinances in place

Source: Wisconsin Department of Natural Resources and SEWRPC.

Compliance with Water Use Objectives

As indicated in Chapter II, the main stem of the Pike River and Pike Creek downstream of STH 142 are recommended for warmwater sport fish and full recreational uses. The portion of the Pike Creek upstream of STH 142 has limitations for sport fish habitat and is recommended for warmwater forage fish and limited recreational use. The Bartlett Branch tributary to the Pike River is recommended for limited forage fish and limited recreational use due to its depth and channel characteristics. These water use objectives and the associated water quality standards are discussed in Chapter II.

Based upon the available data for sampling stations in the watershed, the streams in the Pike River watershed did not meet water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. Based upon review of the water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of dissolved oxygen and fecal coliform standards continue to occur in most of the major streams in the watershed and the water use objectives are being partially met.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, there are no major water quality issues remaining to be evaluated and addressed specific to the Pike River watershed. There remains a need to implement the nonpoint source pollution abatement recommendations set forth herein.

## Chapter XII

## ROCK RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

### INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Rock River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Rock River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement plan element and sludge management elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Rock River watershed is located in the westerly portion of the Region. The portion of the watershed contained within the Region--about 612 square miles--is only a small part of a much larger watershed. The main stem of the Rock River arises and flows outside of the Region. Seventeen tributaries of the Rock River originate in the Region. Rivers and streams in the watershed are part of the Mississippi River drainage system as the watershed lies west of the subcontinental divide. The boundaries of the basin and the principal tributaries of the Rock River are shown on Map XII-1.

Within the Southeastern Wisconsin Region, the Rock River watershed contains 38 major lakes having a surface area of 50 acres or more. These lakes are distributed within seven subwatersheds: the Ashippun River, Bark River, Oconomowoc River, Rubicon River, Scuppernong River, Turtle Creek, and Whitewater Creek subwatersheds. The major lakes in the Ashippun River subwatershed are Ashippun Lake and Druid Lake. The major lakes in the Bark River subwatershed are Bark Lake, Crooked Lake, Lake Five, Golden Lake, Hunters Lake, Lower Nashotah Lake, Lower Nemahbin Lake, Nagawicka Lake, Pretty Lake, School Section Lake, Upper Nashotah Lake, Upper Nemahbin Lake, and Waterville Pond. The major lakes in the Oconomowoc River subwatershed are Beaver Lake, Fowler Lake, Friess Lake, Lake Keesus, Lac La Belle, Lower Genesee Lake, Middle Genesee Lake, Moose Lake, North Lake, Oconomowoc Lake, Okauchee Lake, Pine Lake, and Silver Lake. The major lake in the Rubicon River subwatershed is Pike Lake and, in the Scuppernong River subwatershed, La Grange Lake. The major lakes in the Turtle Creek subwatershed are Comus Lake, Delavan Lake, and Turtle Lake. The major lakes in the Whitewater Creek subwatershed are Cravath Lake, Lake Lorraine, Rice Lake, Tripp Lake, and Whitewater Lake. Physical characteristics of the major lakes of the Rock River watershed are set forth in Table XII-1. The data indicate that major

## Map XII-1

## SUBWATERSHEDS IN THE ROCK RIVER WATERSHED

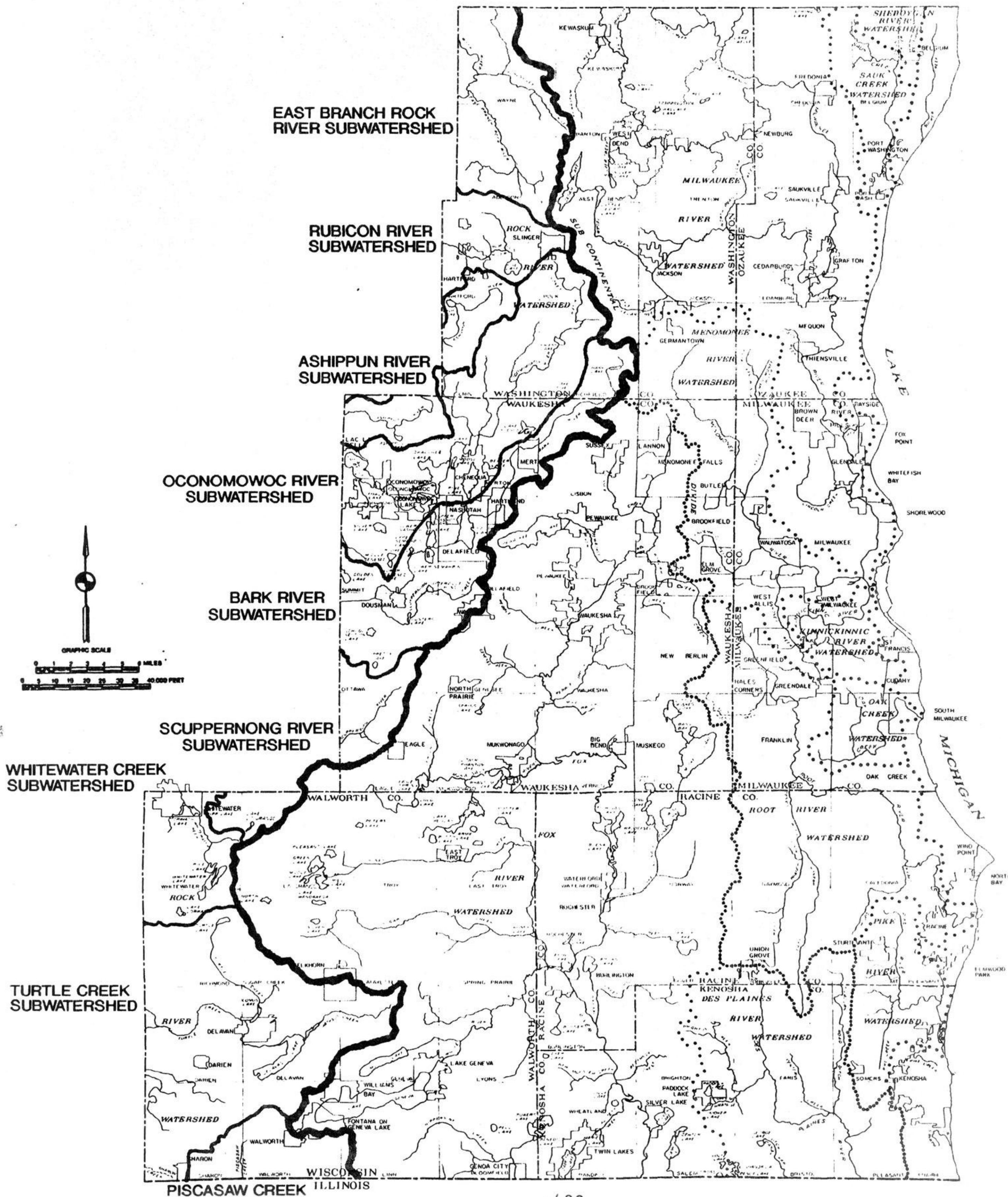


Table XII-1

PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE ROCK RIVER WATERSHED

| **WATERSHED** Lake Name | Surface Area (acres) | Direct Tributary Drainage Area (acres) | Shoreline (miles) | Maximum Depth (feet) | Mean Depth (feet) | Volume (acre-feet) |
|---|---|---|---|---|---|---|
| **ROCK RIVER** | | | | | | |
| Ashippun Lake | 84 | 347 | 1.5 | 35.0 | 17.1 | 1,436 |
| Bark Lake | 65 | 3,315 | 1.8 | 34 | 12.9 | 838 |
| Beaver Lake | 316 | 1,119 | 3.6 | 46 | 16 | 5,056 |
| Comus Lake | 117 | 1,107 | 5.1 | 6 | 5.2 | 608 |
| Cravath Lake | 65 | 546 | 2.5 | 10 | 2.7 | 176 |
| Crooked Lake | 58 | 794 | 2.3 | 16 | 7 | 406 |
| Delavan Lake | 2,072 | 12,357 | 10.1 | 56 | 25 | 51,800 |
| Druid Lake | 124 | 481 | 2.5 | 45 | 15 | 3,150 |
| Lake Five | 102 | 823 | 1.9 | 22 | 10.9 | 1,112 |
| Fowler Lake | 78 | 1,478 | 1.7 | 50 | 12.9 | 1,006 |
| Friess Lake | 119 | 843 | 2.3 | 48 | 26.1 | 3,105 |
| Lower Genesee Lake | 66 | 273 | 1.4 | 44 | 18.3 | 1,208 |
| Middle Genesee Lake | 102 | 529 | 1.8 | 38 | 14.4 | 1,469 |
| Golden Lake | 250[a] | 476 | 3.4 | 44 | 13.8 | 3,450 |
| Hunters Lake | 65 | 1,222 | 1.87 | 36 | 20.0 | 1,300 |
| Lake Keesus | 237 | 2,321 | 5.0 | 42 | 16.7 | 3,958 |
| Lac La Belle | 1,117 | 6,447 | 8.7 | 38 | 11.6 | 12,957 |
| La Grange Lake | 55 | 586 | 1.8 | 4.0 | 2.0 | 110 |
| Lake Lorraine | 133 | 1,415 | 3.2 | 7.5 | 3.0 | 399 |
| Moose Lake | 81 | 553 | 2.3 | 61 | 28.7 | 2,325 |

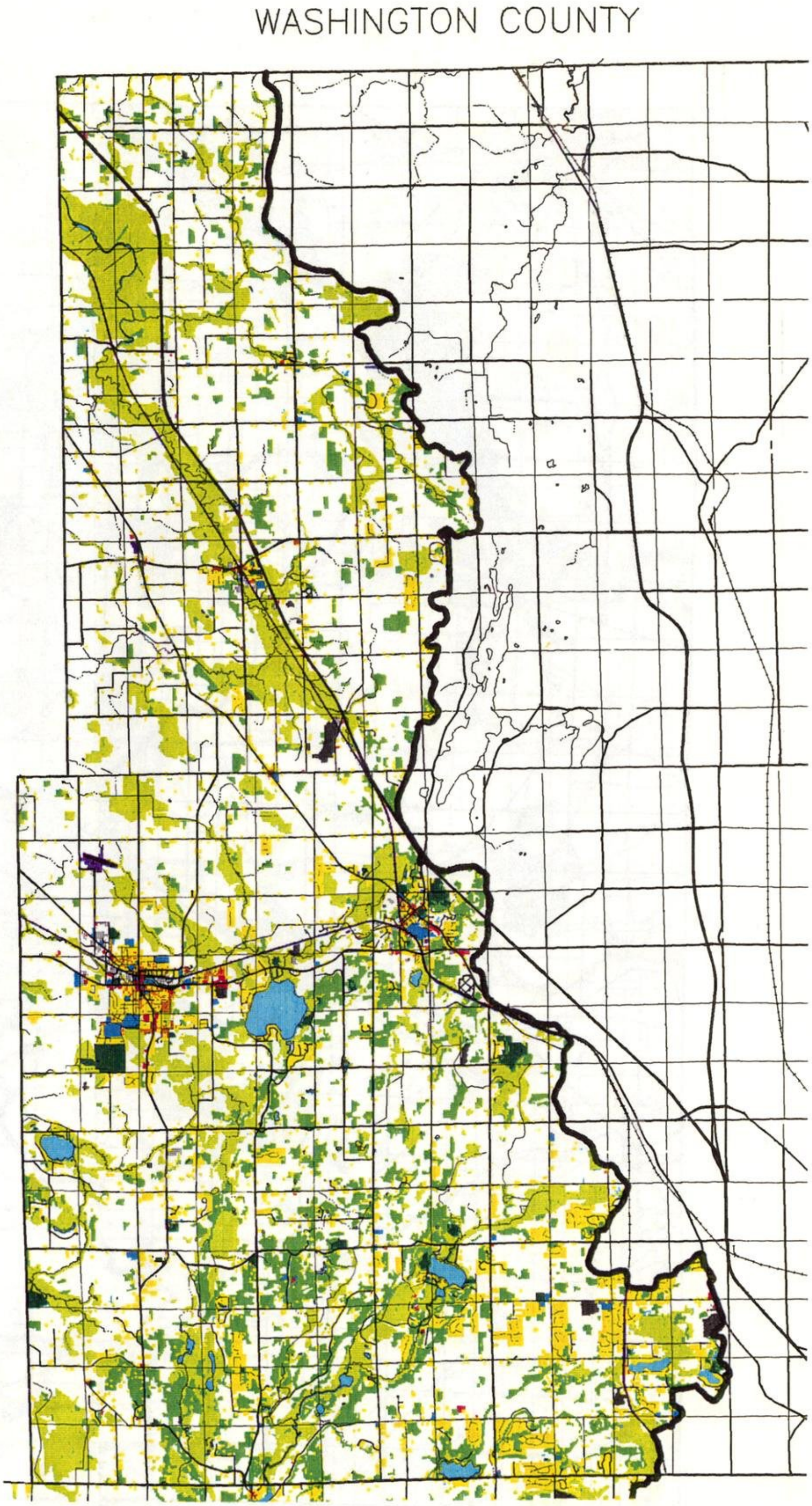
Table XII-1 (cont'd)

| **WATERSHED** Lake Name | Surface Area (acres) | Direct Tributary Drainage Area (acres) | Shoreline (miles) | Maximum Depth (feet) | Mean Depth (feet) | Volume (acre-feet) |
|---|---|---|---|---|---|---|
| **ROCK RIVER (con't)** | | | | | | |
| Nagawicka Lake | 957 | 5,352 | 8.6 | 90 | 48 | 45,936 |
| Lower Nashotah Lake | 90 | 185 | 2.3 | 43 | 20 | 1,800 |
| Upper Nashotah Lake | 133 | 1,257 | 2.3 | 53 | 21 | 2,820 |
| Lower Nemahbin Lake | 271 | 595 | 3.3 | 36 | 10.1 | 2,737 |
| Upper Nemahbin Lake | 283 | 1,208 | 2.9 | 60 | 29.6 | 8,377 |
| North Lake (Wauk. Co.) | 437 | 1,648 | 5.3 | 70 | 40 | 17,480 |
| Oconomowoc Lake | 767 | 1,934 | 7.0 | 60 | 32 | 24,697 |
| Okauchee Lake | 1,187 | 4,757 | 15.0 | 90 | 27.5 | 32,642 |
| Pike Lake | 522 | 2,455 | 3.8 | 45 | 13.3 | 6,942 |
| Pine Lake | 703 | 1,528 | 7.3 | 85 | 38.4 | 26,995 |
| Pretty Lake | 64 | 106 | 1.25 | 31 | 9.2 | 589 |
| Rice Lake | 137 | 348 | 3.0 | 10 | 4 | 548 |
| School Section Lake | 125 | 135 | 1.9 | 8.0 | 2.5 | 312 |
| Silver Lake (Wauk.Co.) | 222 | 1,161 | 2.7 | 44 | 31.5 | 6,993 |
| Tripp Lake | 115 | 554 | 2.9 | 8 | 3.3 | 380 |
| Turtle Lake | 140 | 748 | 2.3 | 35 | 14.4 | 2,016 |
| Waterville Pond | 68 | 1,357 | 1.87 | 12.0 | 4.0 | 274 |
| Whitewater Lake | 640 | 3,735 | 9.8 | 38.0 | 7.8 | 5,003 |
| **TOTAL** | 12,167 | 66,095 | 148.29 | ----- | ----- | 282,410 |

[a]Includes 52 acres in Jefferson County.

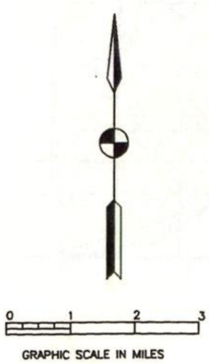
Source: SEWRPC

# MAP XII-2
# LAND USES IN THE ROCK RIVER WATERSHED: 1990




—LEGEND—

- SINGLE—FAMILY RESIDENTIAL
- MULTI—FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREET AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

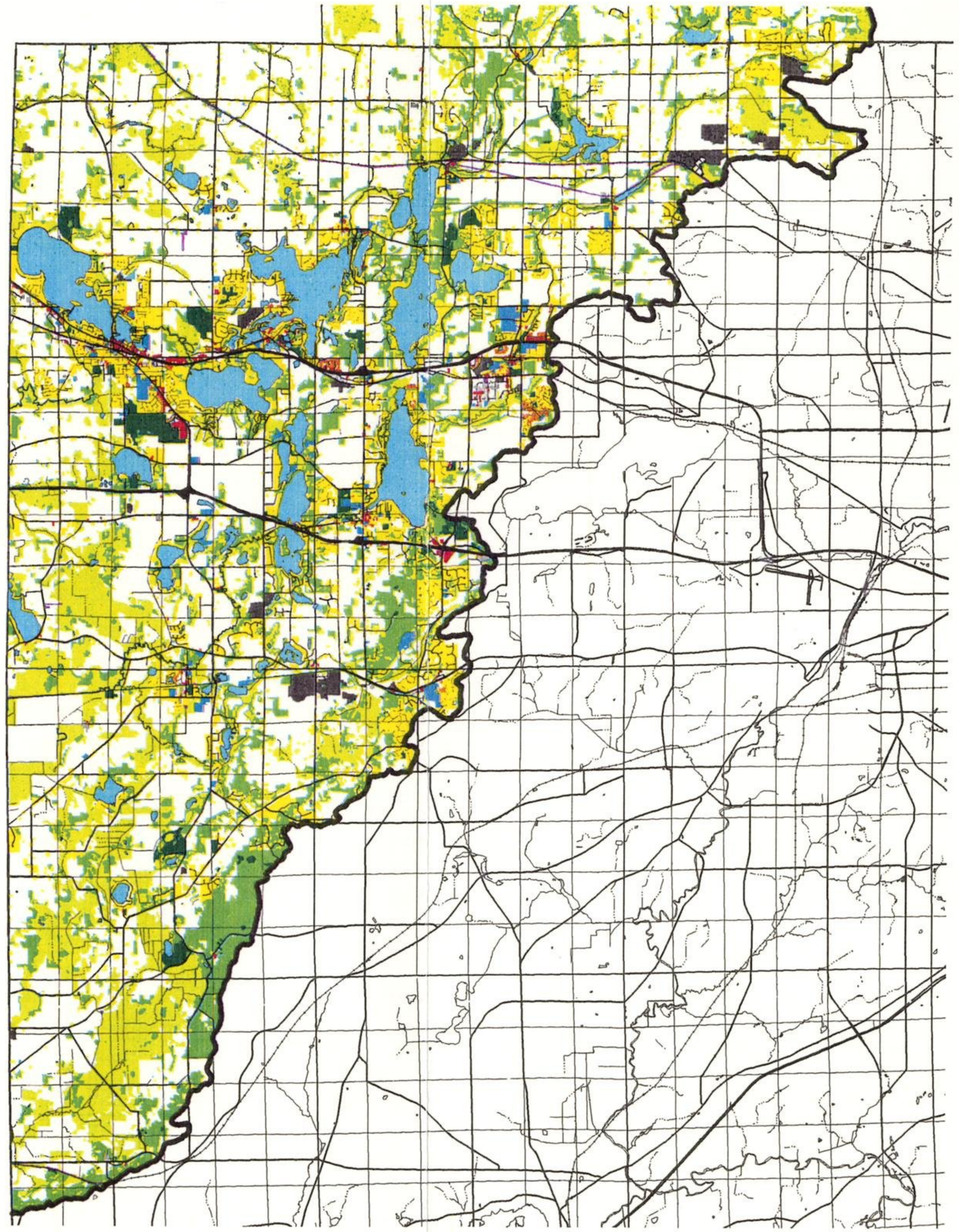



The Rock River watershed is about 612 square miles in areal extent, or about 23 percent of the total Region. In 1990, about 78 square miles, or about 13 percent of the watershed, is in urban land uses.

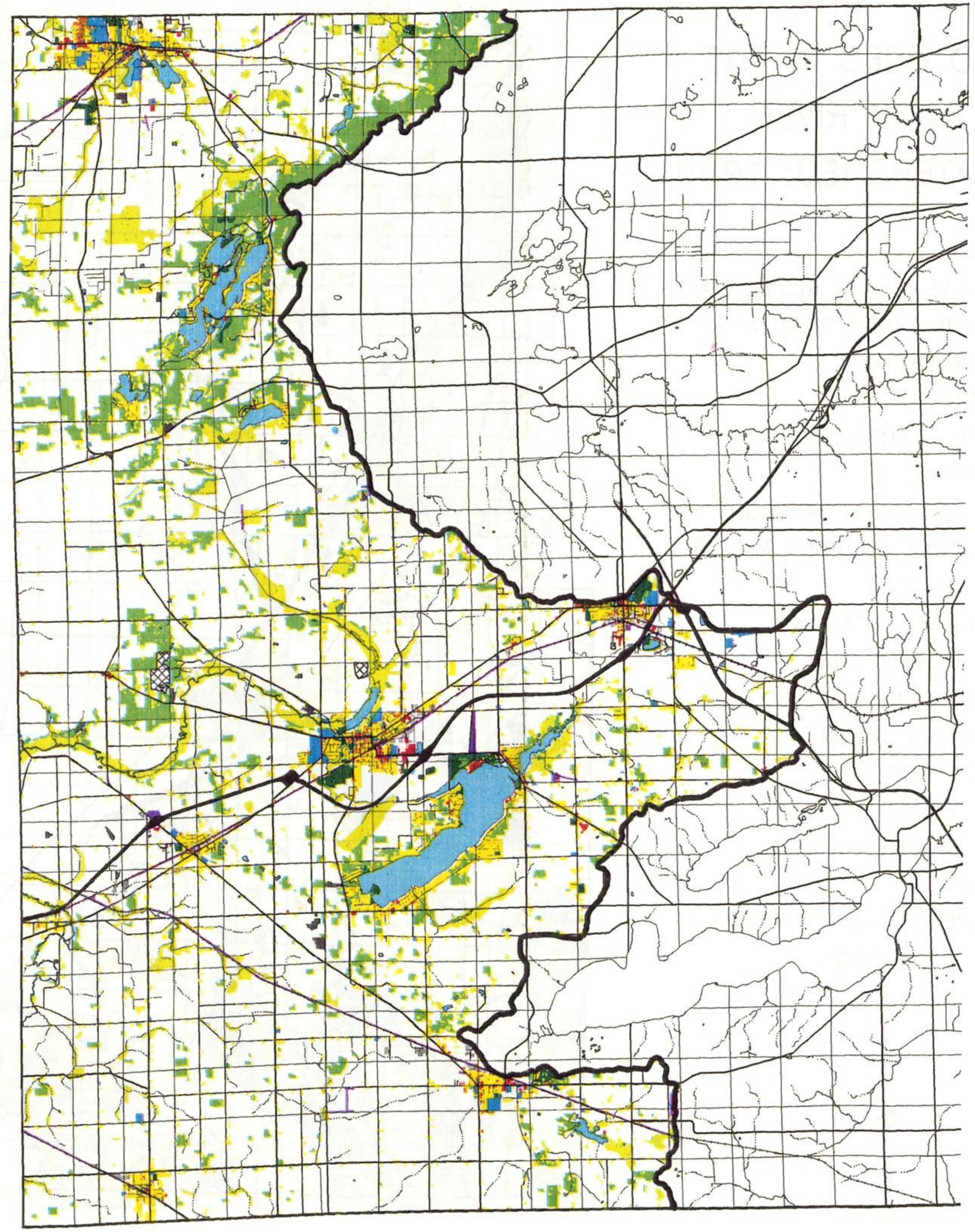


Source: SEWRPC

## MAP XII-2 continued



WAUKESHA COUNTY



WALWORTH COUNTY



Source: SEWRPC

The Wisconsin Department of Natural Resources has prepared two basin plans which have included consideration of the portion of the Rock River in Southeastern Wisconsin as part of plans for the entire Lower Rock River Basin[1] and the Upper Rock River Basin.[2] The study area for these two planning efforts extends to the entire Rock River basin. The preparation of these two plans was coordinated with the preparation of this plan update and it is intended that this plan update refine and update the information regarding the portion of the watershed in Southeastern Wisconsin set forth in these earlier documents.

LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendation, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land uses which have occurred within the Rock River watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data is presented for the watershed in order to permit consideration of the relationship of the changes in land use to other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, is also expected to increase with urbanization.

Table XII-2 summarizes the existing land uses in the watershed in 1990 and indicates the changes in such land uses since 1975. Although the watershed contains a number of urbanized areas, 87 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 60 percent of the total watershed area in agricultural and related rural uses, about 8 percent in woodlands, about 15 percent in surface water and wetlands, and about 4 percent in other open lands. The remaining 13 percent of the total watershed was devoted to urban uses. Existing land uses for 1990 in the Rock River watershed are shown in graphic summary on Map XII-2.

Within the Rock River watershed, urban development has occurred in portions of all three counties, with the majority of new development taking place in Waukesha County concentrated in the Village of Oconomowoc south and east of Lac La Belle. Other urban-related land use is generally located around the larger lakes in the northwest portion of the Waukesha County, including Lac La Belle, Oconomowoc, Okauchee, Nagawicka, Beaver, Upper and Lower Nemahbin Lakes, and Upper and Lower Nashotah Lakes. In the portion of Walworth County contained within the watershed, urban-related development is located in and around the Cities of Delavan, Elkhorn, and Whitewater, as well as additional urban develop-

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[1]Wisconsin Department of Natural Resources, Publication No. WR 280-91, <u>Lower Rock River Basin, Water Quality Management Plan</u>, November 1991.

[2]Wisconsin Department of Natural Resources, Publication No. WR 190-88, <u>Upper Rock River Basin, Areawide Water Quality Management Plan</u>, May 1989.

ment around Delavan Lake. In Washington County, urban development has occurred primarily in and around the City of Hartford and the Village of Slinger and in the Town of Richfield.

As shown in Table XII-2, from 1975 to 1990, urban land uses in the watershed increased from about 40,100 acres, or about 63 square miles to about 50,000 acres, or about 78 square miles, or by about 25 percent. As shown in Table XII-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 19,100 acres, or about 30 square miles in 1975 to about 26,500 acres, or about 41 square miles in 1990, a 39 percent increase, with commercial and industrial lands increasing from about 1,300 acres, or about 2.1 square miles to about 1,800 acres, or about 2.8 square miles, an increase of 38 percent.

The 78 square miles of urban land uses in the watershed as of 1990 approximate the planned level of about 80 square miles for the year 1990 stage of the year 2000 planned conditions set forth in the adopted regional water quality management plan. The current status of development in the Rock River watershed and in adjacent portions of Washington, Waukesha, and Walworth Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region.

Table XII-3 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Rock River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban uses are expected to increase within and around the Cities of Delavan, Whitewater and Elkhorn, in the Village of Darien in Walworth County, within and around the City of Hartford and Village of Slinger in Washington County. The adopted year 2010 land use plan also proposes the addition of a major industrial center to be located within or near the City of Hartford. Additional urban uses within the watershed are expected to increase within and around the Cities of Delafield and Oconomowoc and the Village of Hartland. Commercial, industrial, and residential urban development is also anticipated to increase along the IH-94 corridor in Waukesha County.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Rock River watershed, as indicated in Table XII-3, is projected to increase from the 1990 total of about 78 square miles, or about 13 percent of the total area of the watershed, to about 85 square miles, or about 14 percent of the total area of the watershed by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 104.6 square miles, or about 17 percent of the total watershed by year 2010. It is important to note that the 83 to 86 percent of the watershed remaining in rural use is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features and is proposed to be preserved largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside of the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a large portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 534 square miles in 1990 to about 527 square miles in

Table XII-3

EXISTING AND PLANNED LAND USE IN THE ROCK RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential......... | 26,481 | 6.0 | 28,311 | 7.2 | 1,830 | 6.9 | 36,401 | 9.3 | 9,920 | 37.5 |
| Commercial.......... | 824 | 0.2 | 822 | 0.2 | - 2 | - 0.2 | 998 | 0.3 | 174 | 21.1 |
| Industrial.......... | 1,002 | 0.3 | 1,692 | 0.4 | 690 | 68.9 | 2,594 | 0.7 | 1,592 | 158.9 |
| Transportation, Communication, and Utilities[b] ... | 16,691 | 4.3 | 17,973 | 4.6 | 1,282 | 7.7 | 20,892 | 5.3 | 4,201 | 25.2 |
| Governmental and Institutional..... | 1,793 | 0.5 | 1,868 | 0.5 | 75 | 4.2 | 2,088 | 0.5 | 295 | 16.5 |
| Recreational ....... | 3,173 | 0.8 | 3,582 | 0.9 | 409 | 12.9 | 3,965 | 1.0 | 792 | 25.0 |
| Subtotal | 49,964 | 12.8 | 54,248 | 13.9 | 4,284 | 8.6 | 66,938 | 17.1 | 16,974 | 34.0 |
| Rural | | | | | | | | | | |
| Agricultural and Related........ | 234,053 | 59.8 | 236,022 | 60.3 | 1,969 | 0.8 | 224,698 | 57.4 | - 9,355 | - 4.0 |
| Lakes, Rivers, Streams, and Wetlands............ | 58,919 | 15.1 | 58,861 | 15.0 | - 58 | - 0.1 | 58,861 | 15.0 | - 58 | - 0.1 |
| Woodlands............ | 32,957 | 8.4 | 32,068 | 8.2 | - 889 | - 2.7 | 31,976 | 8.2 | - 981 | - 3.0 |
| Open Lands,[c] Landfills, Dumps, and Extractive..... | 15,514 | 4.0 | 10,208 | 2.6 | - 5,306 | - 34.2 | 8,934 | 2.3 | - 6,580 | - 42.4 |
| Subtotal | 341,443 | 87.2 | 337,159 | 86.1 | - 4,284 | - 1.3 | 324,469 | 82.9 | - 16,974 | - 5.0 |
| Total | 391,407 | 100.0 | 391,407 | 100.0 | 0 | -- | 391,407 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

the year 2010 under the intermediate growth-centralized land use plan and to about 507 square miles under the high growth-decentralized land use plan, decreases of about 1 to 5 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Rock River watershed--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary sewer service areas located in the watershed.

### Public and Private Wastewater Treatment Systems and Sewer Services Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were twelve public sewage treatment facilities located in the Rock River watershed, as shown on Map XII-3. The City of Delavan plant discharged directly to Turtle Creek; the Village of Sharon plant discharged to Little Turtle Creek; the Village of Darien plant discharged to a tributary of Darien Creek; the City of Elkhorn plant discharged to a tributary of Jackson Creek; the two plants serving the Villages of Dousman and Hartland discharged to the Bark River; the City of Whitewater plant discharged to Whitewater Creek; the City of Hartford plant discharged to the Rubicon River while the Village of Slinger plant discharged indirectly to the Rubicon River; the Allenton Sanitary District plant discharged to the East Branch of the Rock River; the City of Oconomowoc plant discharged to the Oconomowoc River; and the Village of Walworth plant discharged to a tributary of Piscasaw Creek. Of these 12 plants, the plants operated by the Cities of Delavan and Elkhorn and the Villages of Hartland and Walworth were abandoned after 1975, as recommended in the initial plan. The status of implementation in regard to the abandonment, upgrading and expansion, and construction of the public and private sewage treatment plants in the Rock River watershed, as recommended in the initial regional water quality management plan, is shown in Table XII-4.

As can be seen by review of Table XII-4, full implementation of the initial plan would provide for the upgrading and expansion, as needed, of four plants: the Village of Sharon, Village of Darien,[3] Village of Dousman, and Allenton Sanitary District No. 1 sewage treatment plants. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the upgrading of the City of Hartford plant and the construction of seven new plants, six of which have been constructed. Facility planning to

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[3]Based upon a September 1994 amendment, the Village of Darien sewage treatment plant is recommended to be abandoned and the Village's sewerage system is recommended to be connected to the WalCoMet sewerage system for sewage treatment purposes.

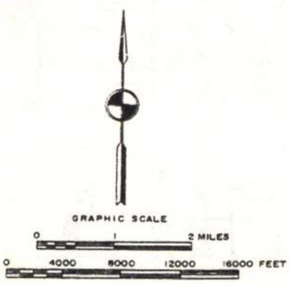
Map XII-3

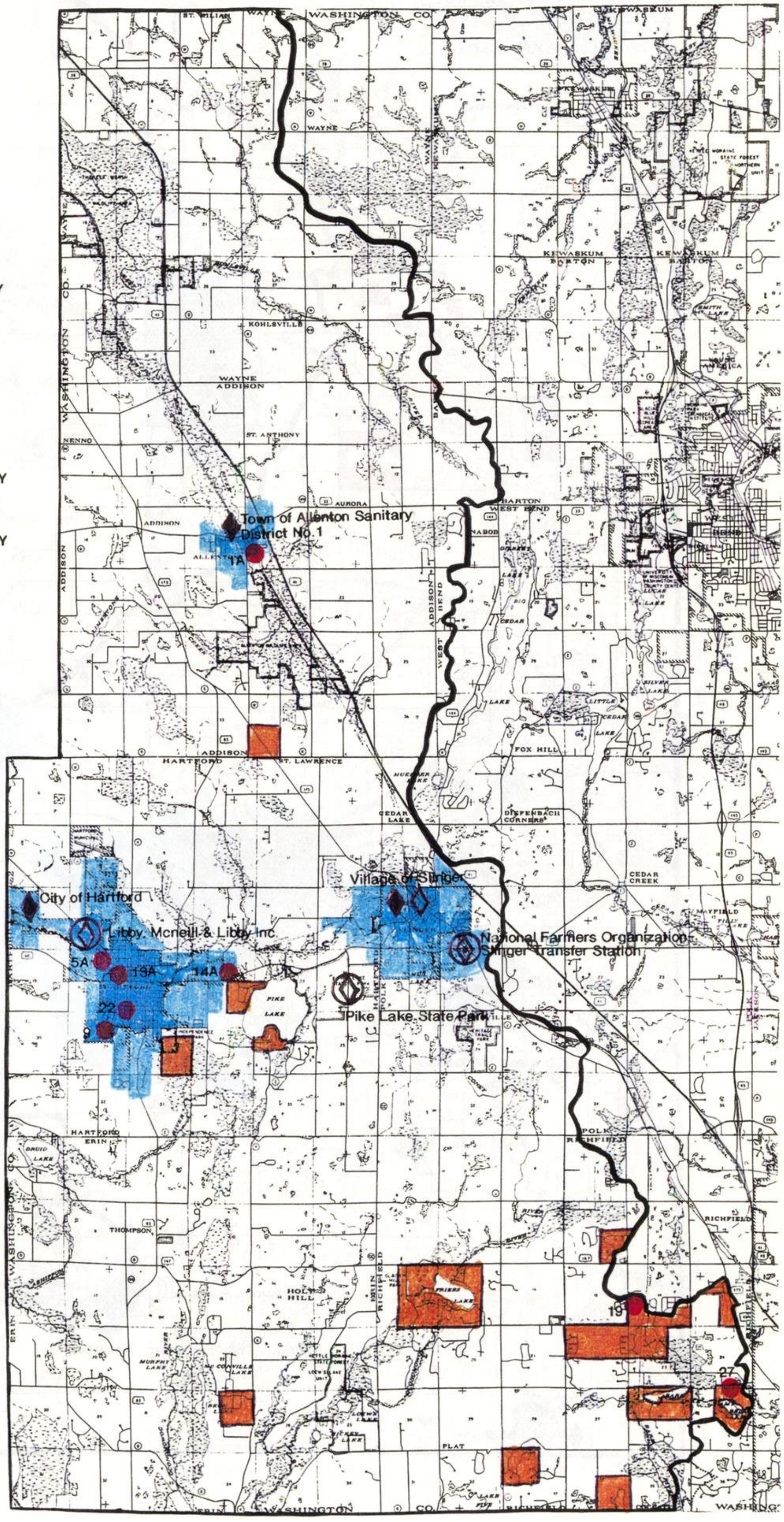
# SEWER SERVICE AREAS, SEWAGE TREATMENT PLANTS AND OTHER POINT SOURCES OF POLLUTION IN THE ROCK RIVER WATERSHED: 1990

LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE ABANDONED
- PUBLIC SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- PROPOSED NEW PUBLIC SEWAGE TREATMENT FACILITY
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- PRIVATE SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES
- LEAKING UNDERGROUND STORAGE TANKS DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUND WATER
- ADDITIONAL GROUNDWATER CONTAMINATION SITES DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA

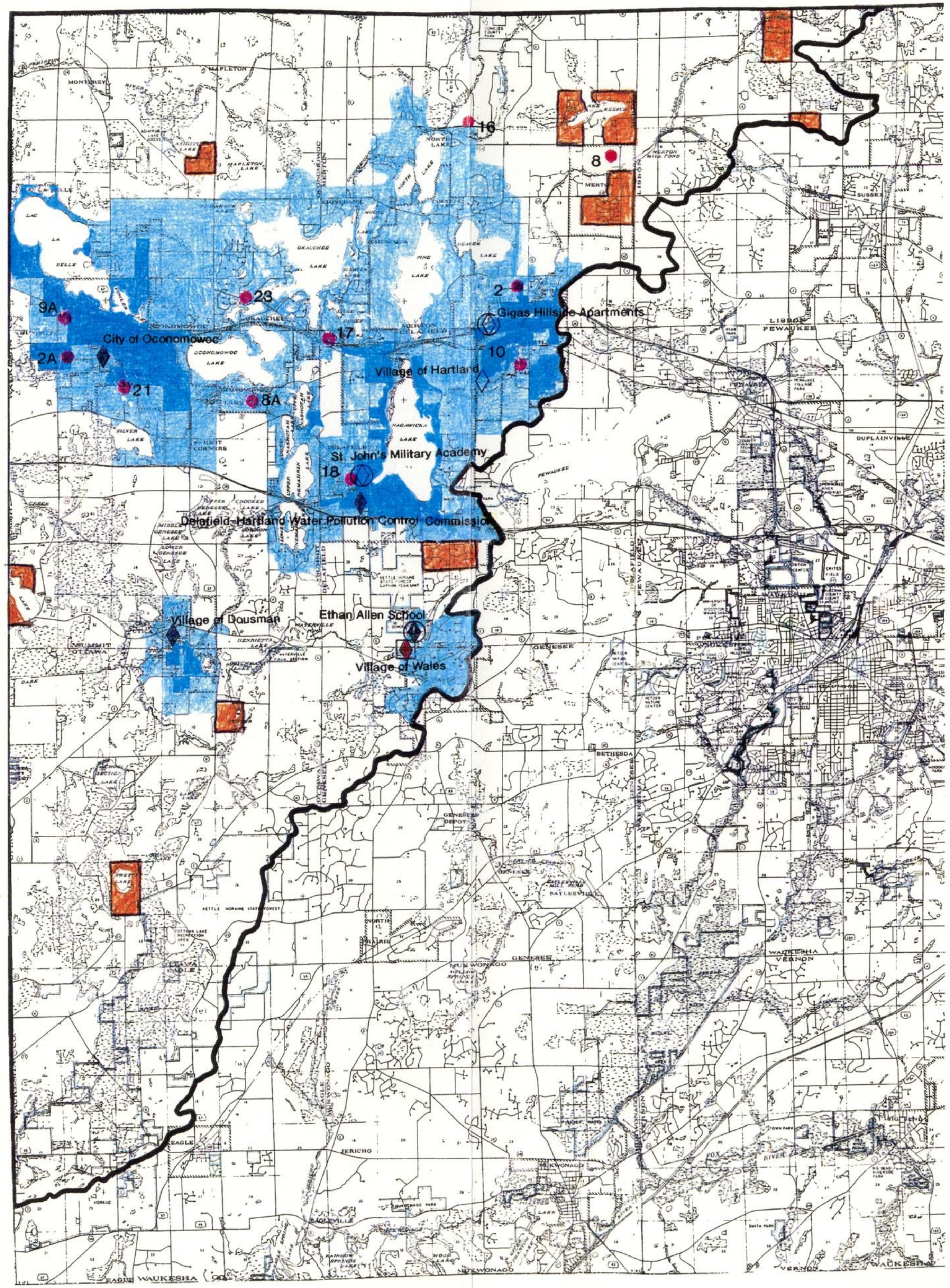
Source: SEWRPC.



Map XII-3 Continued

WAUKESHA COUNTY




WALWORTH COUNTY

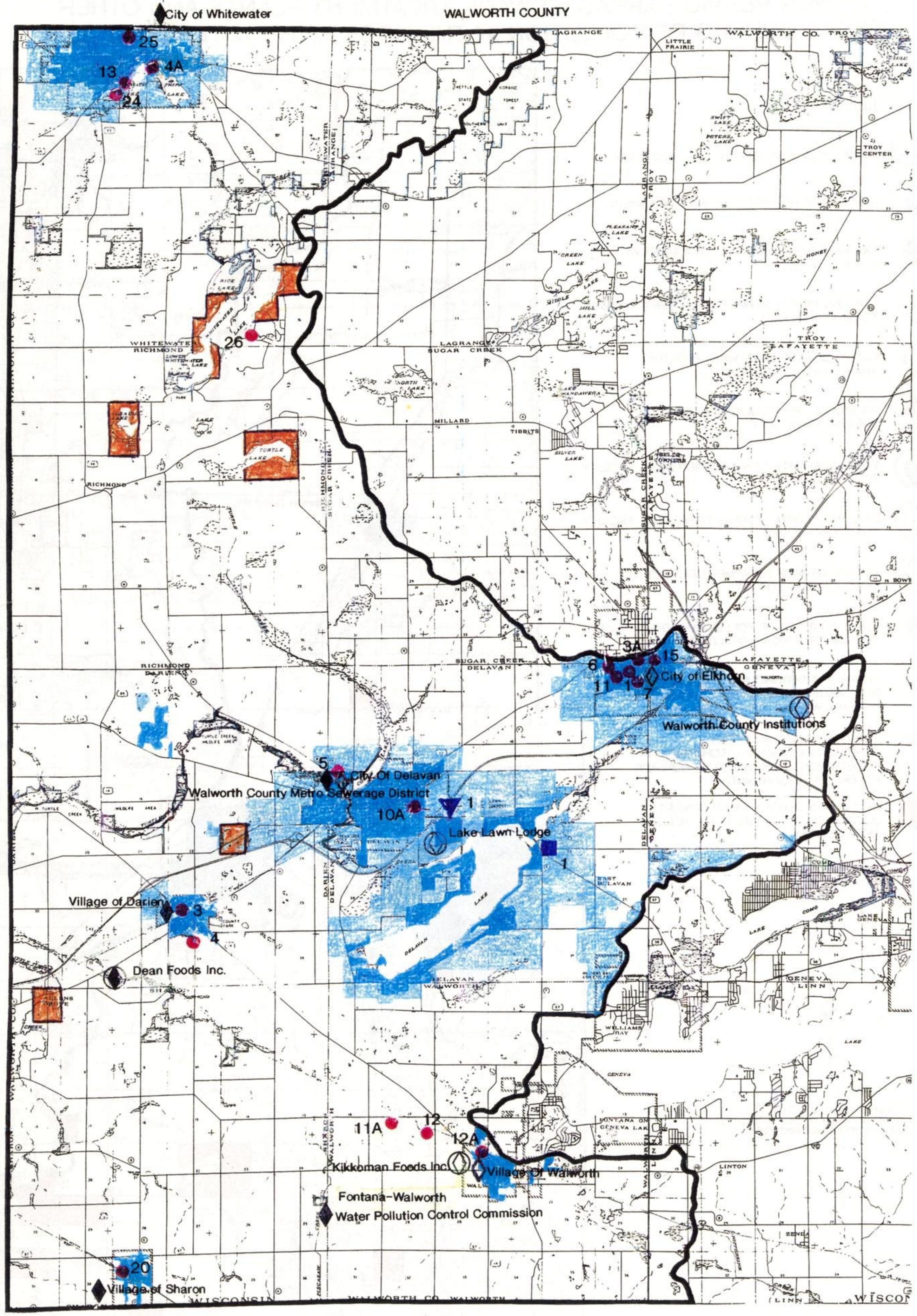


Table XII-4

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS IN THE ROCK RIVER WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| Allenton Sanitary District No. 1 | Rock River - East Branch | Upgrade and expand | Completed (1987) |
| Village of Darien | Tributary of Darien Creek | Upgrade and expand[a] | Local facility plan completed (1988) |
| Delafield-Hartland Water Pollution Control Commission | Bark River | Construct new plant | Plant in operation (1980) |
| Village of Dousman | Bark River | Upgrade and expand | Completed (1983) |
| Fontana-Walworth Water Pollution Control Commission | Tributary of Piscasaw Creek | Construct new plant | Plant in operation (1986) |
| City of Hartford | Rubicon River | Upgrade | Facility plan underway |
| City of Oconomowoc | Oconomowoc River | Construct new plant | Plant in operation (1976) |
| Village of Sharon | Little Turtle Creek | Upgrade and expand | Completed (1984) |
| Village of Slinger | Rubicon River | Construct new plant | Plant in operation (1981) |
| Village of Wales | Soil Absorption | Construct new plant | No action |
| Walworth County Metropolitan Sewerage District | Turtle Creek | Construct new plant | Plant in operation (1981) |
| City of Whitewater | Whitewater Creek | Construct new plant | Plant in operation (1982) |
| City of Delavan | Turtle Creek | Abandon plant-connection to new WalCoMet plant | Plant abandoned (1981) |
| City of Elkhorn | Tributary of Jackson Creek | Abandon plant-connection to new WalCoMet plant | Plant abandoned |
| Village of Hartland | Bark River | Abandon plant-connection to Delafield-Hartland plant | Plant abandoned (1980) |
| Village of Walworth | Tributary of Piscasaw Creek | Abandon plant-connection to new Fontana-Walworth plant | Plant abandoned (1986) |
| Private Sewage Treatment Plants | | | |
| Ethan Allen School | Soil Absorption | Maintain and upgrade as needed | Plant maintained |
| Libby, McNeill, & Libby, Inc. (Washington County) | Soil Absorption | Maintain and upgrade as needed | Not in operation |
| Dean Foods, Inc.[d] | Soil Absorption | Maintain and upgrade as needed | Plant maintained |
| Walworth County Correctional Center | Soil Absorption | Maintain and upgrade as needed | Not in operation |
| Gigas Hillside Apartments | Soil Absorption | Abandon plant | Plant abandoned (1980) |
| Kikkoman Foods, Inc. | Soil Absorption | Abandon plant | Plant abandoned |
| Lake Lawn Lodge | Delavan Lake | Abandon plant | Plant abandoned (1982) |
| National Farmers Organization-Slinger Transfer Station | Soil Absorption | Abandon plant | No action |
| Pike Lake State Park | Soil Absorption | Abandon plant[b] | Plant abandoned (1990) |
| St. John's Military Academy | Bark River and Soil Absorption | Abandon plant | Plant abandoned (1980) |
| Walworth County Institutions[c] | Jackson Creek | Abandon plant | Plant abandoned (1981) |

[a] Based upon a September 1994 amendment, the Village of Darien sewage treatment plant is recommended to be abandoned and connected to the WalCoMet sewerage system.

[b] The Pike Lake State Park sewage treatment plant was recommended to be abandoned in the initial plan. A 1988 amendment to the regional water quality management plan recommended that the plant be abandoned and the park connected to the City of Hartford sewerage system.

[c] Formerly Lakeland Nursing Home.

[d] Formerly Libby, McNeill, & Libby, Inc. (Walworth County)

Source: SEWRPC

upgrade the City of Hartford plant has been completed. No action has been taken with regard to the construction of the plant for the Village of Wales. The plants in the watershed have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluent to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site specific phosphorus limitations on all public sewage treatment plants, and in 1993 by the adoption of rules to allow for placement of such limitations. Thus, as specific sewage treatment plant permits are issued, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. Selected characteristics of the public sewage treatment plants currently existing in the watershed are given in Table XII-5 and their locations are shown on Map XII-3.

In addition to the publicly owned sewage treatment facilities, 11 private wastewater treatment plants were in existence in 1975 in the Rock River watershed. These plants served the following land uses: Kikkoman Foods, Inc., Lakeland Nursing Home (currently Walworth County Institutions), Lake Lawn Lodge, Libby, McNeill and Libby, Inc., and Walworth County Correction Center in Walworth County; Libby, McNeill and Libby, Inc. (currently Dean Foods, Inc.), National Farmers Organization-Slinger Transfer Station, Pike Lake State Park in Washington County; and Ethan Allen School, Gigas Hillside Apartments, and St. John's Military Academy in Waukesha County.

As indicated in Table XII-4, seven of the eleven private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan as amended. As of 1990, six of these plants have been abandoned. No action has been taken with regard to the abandonment of the National Farmers Organization-Slinger Transfer Station facility. The remaining four private plants were recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process. With the exception of Walworth County Correctional Center and the Libby, McNeill & Libby Hartford plant, which have ceased operation, the plants are continuing to operate in this manner.

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Rock River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Wisconsin Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such

Table XII-5

**SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS IN THE ROCK WATERSHED**

| Name of Public Sewage Treatment Plants | 1990 Estimated Total Area Served (square mile) | 1990 Estimated Total Population Served | Date of Construction and Major Modification | Sewage Treatment Unit Processes[a] | Name of Receiving Water to which Effluent is Disposed | WPDES Permit Expiration Date |
|---|---|---|---|---|---|---|
| Allenton Sanitary District No. 1 | 0.2 | 800 | 1961, 1987 | Activated sludge, clarification, chlorination, dechlorination | Rock River-East Branch | 3/31/94 |
| Village of Darien | 0.6 | 1,200 | 1969 | Activated sludge-contact stabilization, clarification, seepage lagoon-holding pond | Soil absorption and tributary of Darien Creek | 3/31/94 |
| Delafield-Hartland Water Pollution Control Commission | 4.1 | 10,200 | 1980 | Rotating biological contact process, clarification, sand filtration, chlorination, nitrification, post aeration | Bark River | 3/31/97 |
| Village of Dousman | 0.5 | 1,300 | 1961, 1972, 1983 | Oxidation ditch, clarification, micro screen filtration, chlorination | Bark River | 3/31/2000 |
| Fontana-Walworth Water Pollution Control Commission | 2.5 | 3,500 | 1986 | Oxidation ditch, clarification, chlorination, dechlorination, holding pond | Piscasaw Creek | 6/30/96 |
| City of Hartford | 2.1 | 8,200 | 1973 | Activated sludge, clarification, phosphorus removal, polishing pond, micro screen filtration, chlorination | Rubicon River | 9/30/98 |
| City of Oconomowoc | 5.5 | 11,500 | 1936, 1976 | Clarification, activated sludge, clarification, sand filtration, aeration basins, chlorination | Oconomowoc River | 6/30/97 |
| Village of Sharon | 0.5 | 1,300 | 1959, 1984 | Activated sludge contact stabilization, clarification | Little Turtle Creek | 3/31/99 |
| Village of Slinger | 1.2 | 2,300 | 1950, 1981 | Oxidation ditch, clarification, chlorination | Rubicon River | 9/30/98 |
| Walworth County Metropolitan Sewerage District | 6.8 | 19,100 | 1981 | Clarification, trickling filter, clarification, nitrification aeration basin, activated sludge, clarification, post aeration, sand filter, chlorination | Turtle Creek | 6/30/97 |
| City of Whitewater | 2.3 | 12,600 | 1937, 1956, 1968, 1982 | Rotating biological contactor, clarification, polishing lagoons, sand filter, chlorination | Whitewater Creek | 12/30/98 |

Table XII-5 (continued)

| Name of Public Sewage Treatment Plants | Hydraulic Loading[b] (mg/d) | | | | BOD5 Loading[b] (pounds/day) | | | | Suspended Solids Loading[b] (pounds/day) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | | | | Existing | | | | Existing | | | |
| | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in which the Monthly Average Flow Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in which the Monthly Average Flow Exceeded the Design Capacity | Average Annual | Maximum Monthly Average | Design Average Annual | Number of Months in 1990 in which the Monthly Average Flow Exceeded the Design Capacity |
| Allenton Sanitary District No. 1 | 0.15 | 0.18 | 0.36 | -- | 295 | 354 | 390 | -- | 240 | 296 | -- | -- |
| Village of Darien | 0.11 | 0.14 | 0.15 | -- | 167 | 275 | 255 | 1 | 151 | 374 | -- | -- |
| Delafield-Hartland Water Pollution Control Commission | 1.39 | 1.50 | 2.20 | -- | 2,252 | 2,466 | 3,740 | -- | 2,456 | 2,779 | 4,590 | -- |
| Village of Dousman | 0.22 | 0.26 | 0.35 | -- | 317 | 352 | 584 | -- | 228 | 283 | 730 | -- |
| Fontana-Walworth Water Pollution Control Commission | 1.02 | 1.27 | 1.71 | -- | 1,104 | 1,305 | 2,620 | -- | 1,594 | 1,906 | -- | -- |
| City of Hartford | 1.46 | 1.87 | 2.00 | -- | 2,449 | 3,050 | 10,000 | -- | 1,891 | 3,109 | -- | -- |
| City of Oconomowoc | 2.33 | 2.74 | 4.00 | -- | 3,930 | 5,164 | 8,340 | -- | 2,517 | 2,929 | 6,672 | -- |
| Village of Sharon | 0.16 | 0.32 | 0.26 | 2 | 244 | 547 | 360 | 2 | 246 | 555 | -- | -- |
| Village of Slinger | 0.33 | 0.45 | 0.76 | -- | 419 | 698 | 1,268 | -- | 660 | 1,311 | 1,585 | -- |
| Walworth County Metropolitan Sewerage District | 2.92 | 3.68 | 3.60 | 1 | 3,107 | 3,776 | 6,260 | -- | 3,283 | 3,826 | 6,515 | -- |
| City of Whitewater | 1.43 | 1.66 | 3.65 | -- | 5,644 | 7,132 | 11,500 | -- | 2,845 | 3,886 | 10,800 | -- |

[a] In addition, plants typically include headworks and miscellaneous processes such as pumping, flow-metering and sampling, screening, and grit removal, as well as sludge handling and disposal facilities.

[b] Loadings were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were 24 sewer service areas identified in, or partially in, the Rock River watershed--Allenton, Hartford, Slinger, Oconomowoc-Lac La Belle, Oconomowoc Lake, Okauchee Lake, North Lake, Pine Lake, Beaver Lake, Hartland, Delafield-Nashotah, Nashotah-Nemahbin Lakes, Silver Lake, Dousman, Wales, Williams Bay, Whitewater, Elkhorn, Delavan, Delavan Lake, Darien, Fontana, Walworth, Sharon and Walworth County Institutions. Currently, many of these areas have undergone refinements as recommended. North Lake, Okauchee Lake, Beaver Lake, Pine Lake, Oconomowoc Lake, Wales, Fontana, Walworth, and Sharon sewer service areas have currently not been refined. The boundaries of the sewer service areas as refined through 1993 are shown on Map XII-3. Table XII-6 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer service area in the Rock River watershed, as refined through 1993, totals about 90 square miles, or about 15 percent of the total watershed area, as shown in Table XII-6.

<u>Current Plan Recommendations</u>: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the Allenton Sanitary District No. 1, Village of Dousman, City of Hartford, and Village of Sharon sewage treatment plants, as well as the construction of a plant for the Village of Wales. This same recommendation applies to the plants constructed since the initial plan in accordance with the plan recommendations, including the Delafield-Hartland Water Pollution Control Commission, Fontana-Walworth Water Pollution Control Commission, City of Oconomowoc, Village of Slinger, Walworth County Metropolitan Sewerage District, and the City of Whitewater sewage treatment plants. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table XII-7. This recommendation regarding plant facility upgrading and expansion as needed, also applies to the treatment plant solids management element for the 11 public sewage treatment plants recommended to be retained.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map XII-4. Table XII-7 presents selected design data for the 11 public sewage treatment plants which are recommended to be maintained in the Rock River watershed and for one new sewage treatment plant. It is important to note that two of these plants recorded monthly average flows during 1990 which equaled or exceeded the average design capacities of the plants, as shown in Table XII-5. The WalCoMet sewage treatment plant is, as of 1994, under construction to expand its capacity.

Table XII-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the 11 public sewage treatment plants in the Rock River watershed. Under the intermediate growth-centralized land use plan, two plants are anticipated to have loading rates equal to or higher than the average annual design

Table XII-6

PLANNED SANITARY SEWER SERVICE AREAS IN
THE ROCK RIVER WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area | Planned Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Refined Sanitary Sewer Services Areas | | | | |
| Allenton | 0.8 | Allenton | March 11, 1985 | SEWRPC CAPR No. 103, Sanitary Sewer Service Area for the Allenton Area, Washington County, Wisconsin |
| Darien | 1.2 | Darien | September 23, 1992 | SEWRPC CAPR No. 123, 2nd Edition, Sanitary Sewer Service Area for the Village of Darien, Walworth County, Wisconsin |
| Delafield-Nashotah<br>Nashotah-Nemahbin Lakes | 13.8 | Delafield-Nashotah | January 18, 1993 | SEWRPC CAPR No. 127, Sanitary Sewer Service Area for the City of Delafield and the Village of Nashotah and Environs,Waukesha County, Wisconsin |
| Delavan<br>Delavan Lake<br>Elkhorn<br>Walworth County Institutions<br>Lake Como<br>Williams Bay<br>-- | 27.8 | Delavan-Delavan Lake<br>Elkhorn<br><br><br>Lake Como<br>Williams Bay<br>Geneva National-Interlaken | December 4, 1991 | SEWRPC CAPR No. 56, 2nd Edition, Sanitary Sewer Service Area for the Walworth County Metropolitan Sewerage District, Walworth County, Wisconsin |
| Dousman | 2.4 | Dousman | December 5, 1990 | SEWRPC CAPR No. 192, Sanitary Sewer Service Area for the Village of Dousman, Waukesha County, Wisconsin |
| Hartford | 10.5[a] | Hartford | June 21, 1984 | SEWRPC CAPR No. 92, Sanitary Sewer Service Area for the City of Hartford, Washington County, Wisconsin |
| Hartland | 4.5 | Hartland | June 17, 1985 | SEWRPC CAPR No. 93, Sanitary Sewer Service Area for the Village of Hartland, Waukesha County, Wisconsin |
| Oconomowoc-Lac La Belle<br>Silver Lake | 16.7 | Oconomowoc | March 6, 1989 | SEWRPC CAPR No. 172, Sanitary Sewer Service Area for the City of Oconomowoc and Environs, Waukesha County, Wisconsin |

Table XII-6 (continued)

| Name of Initially Defined Sanitary Sewer Service Area | Planned Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Pewaukee | 0.4 | Pewaukee | June 17, 1985 | SEWRPC CAPR No. 113, Sanitary Sewer Service Area for the Town of Pewaukee Sanitary District No. 3, Lake Pewaukee Sanitary District, and Village of Pewaukee, Waukesha County, Wisconsin |
| Slinger | 3.6 | Slinger | December 2, 1985 | SEWRPC CAPR No. 128, 2nd Edition, Sanitary Sewer Service Area for the Village of Slinger, Washington County, Wisconsin |
| Whitewater | 8.3[b] | Whitewater | September 14, 1987 | SEWRPC CAPR No. 94, Sanitary Sewer Service Area for the City of Whitewater, Walworth County, Wisconsin |
| Subtotal | 90.0 | | | |
| Unrefined Sanitary Sewer Service Areas | | | | |
| Beaver Lake | 2.5 | -- | -- | -- |
| Fontana | 0.2 | -- | -- | -- |
| North Lake | 1.2 | -- | -- | -- |
| Oconomowoc Lake | 1.5 | -- | -- | -- |
| Okauchee Lake | 4.8 | -- | -- | -- |
| Pine Lake | 1.2 | -- | -- | -- |
| Sharon | 1.2 | -- | -- | -- |
| Wales | 1.5 | -- | -- | -- |
| Walworth | 1.5 | -- | -- | -- |
| Subtotal | 15.6 | | | |
| Total | 105.6 | | | |

[a] Includes 1.3 square miles in Dodge County.

[b] Indludes 2.2 square miles in Jefferson County.

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

Table XII-7

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS IN THE ROCK RIVER WATERSHED: 1990 AND 2010

| Name of Public Sewage Treatment Plant | Sewer Service Area | Design Capacity-Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intermediate Growth Centralized Land Use Plan | | | High Growth Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Total Area Served (square mile) | Resident Population Served | Planned Sewer Service Area (square mile) | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| Allenton Sanitary District No. 1 | Allenton | 0.36 | 0.15 | 0.2 | 800 | 0.8 | 1,200 | 0.20 | >2010 | 2,400 | 0.36 | 2000 |
| Delafield-Hartland Water Pollution Control Commission | Delafield, Nashotah, Hartland | 2.20 | 1.39 | 4.1 | 10,200 | 19.1 | 18,200 | 2.40 | 1998 | 28,500 | 3.70 | 1997 |
| Village of Dousman | Dousman | 0.35 | 0.22 | 0.5 | 1,300 | 2.4 | 3,100 | 0.44 | 1997 | 5,600 | 0.76 | 1995 |
| Fontana-Walworth Water Pollution Control Commission | Fontana, Walworth | 1.71 | 1.02 | 2.5 | 3,500 | 6.3 | 4,600 | 1.16 | 2000 | 7,400 | 1.51 | 1997 |
| City of Hartford | Hartford | 2.00 | 1.46 | 2.1 | 8,200 | 10.5 | 12,400 | 2.00 | 1995 | 24,000 | 3.44 | 1995 |
| City of Oconomowoc | Oconomowoc, Oconomowoc Lake, Okauchee Lake, Beaver Lake, North Lake, Pine Lake | 4.00 | 2.33 | 5.5 | 11,500 | 27.9 | 23,600 | 3.84 | 2010 | 42,000 | 6.14 | 2000 |
| Village of Sharon | Sharon | 0.26 | 0.16 | 0.5 | 1,300 | 1.2 | 1,800 | 0.23 | 1997 | 2,900 | 0.37 | 1996 |
| Village of Slinger | Slinger (Proposed Plant[b] | 0.76 | 0.33 | 1.2 | 2,300 | 3.6 | 2,700 | 0.38 | 2000 | 4,400 | 0.60 | 2000 |
| Village of Wales | Wales | -- | -- | -- | -- | 2.8 | 3,600 | 0.45 | -- | 7,900 | 0.98 | -- |
| Walworth County Metropolitan Sewerage District | Delavan, Delavan Lake, Elkhorn, Lake Como, Geneva National, Williams Bay | 5.60[c] | 2.92 | 6.8 | 19,100 | 43.8[d] | 24,200[d] | 3.53[d] | 2010 | 46,400[d] | 6.33[d] | 2003 |
| City of Whitewater | Whitewater | 3.65 | 1.43 | 2.3 | 12,600[e] | 8.3 | 13,100[e] | 1.50 | 2000 | 21,600[e] | 2.56 | 2000 |

[a] Approximate year in which facility planning for a plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average and monthly design flows compared to average expected annual and maximum monthly flows and the age of facilities based upon data of last major construction.

[b] Alterantive of constructing a new plant and the alternatives of connection to an existing sewerage system and continued use of onsite sewage disposal systems are recommended to be evaluated in further subregional system planning.

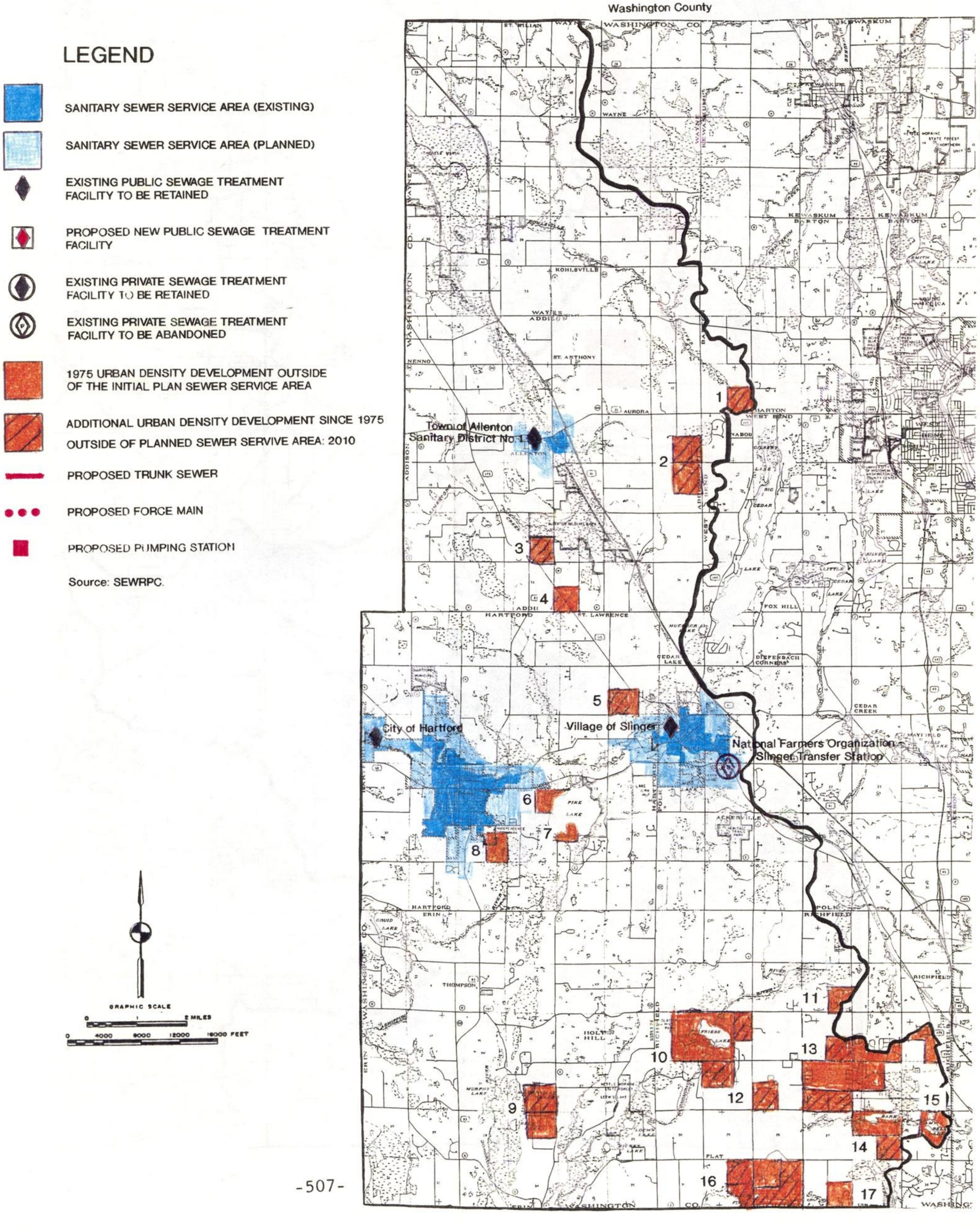
[c] As of 1994, WalCoMet sewage treatment plant was undergoing expansion and upgrading which will provide a capacity of 5.60 mgd.

[d] Including Village of Darien sewer service area.

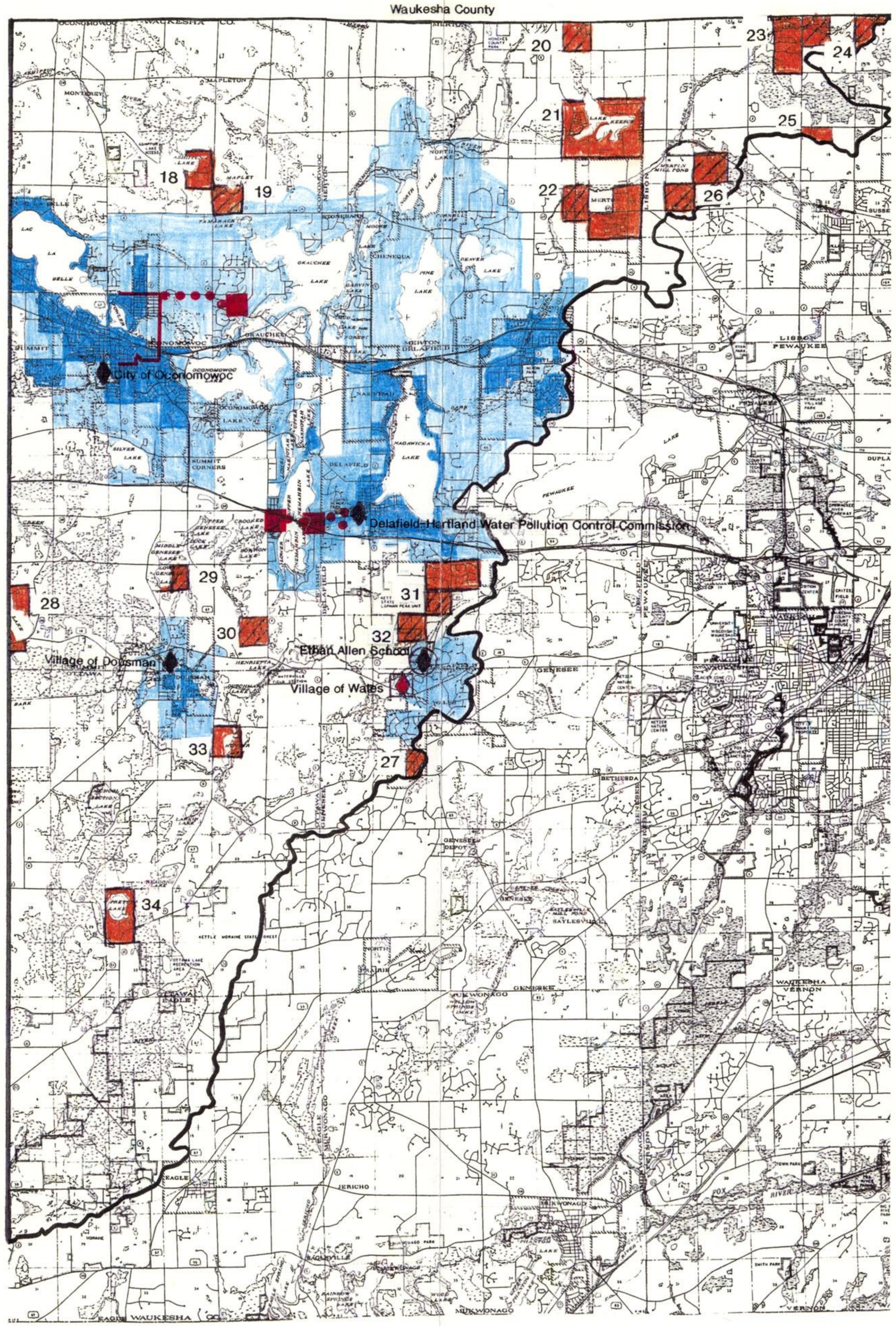
[e] Includes portion of Whitewater sewer service area in Jefferson County.

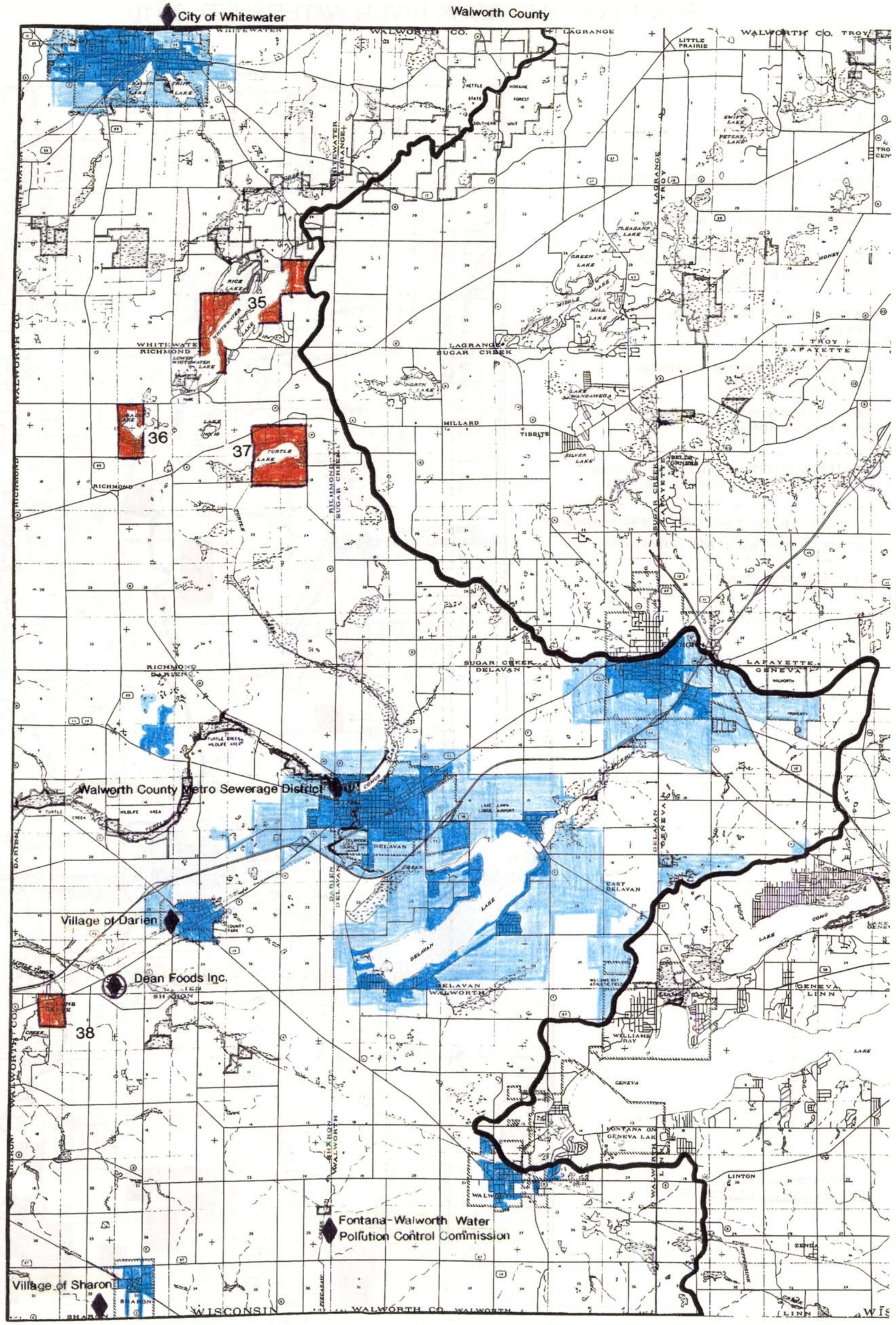
Source: SEWRPC.

# Map XII-4
# UPDATED REGIONAL WATER QUALITY MANAGEMENT PLAN FOR THE ROCK RIVER WATERSHED: 2010



Map XII-4 Continued



capacity. Under the high growth-decentralized land use plan, seven of the existing plants are anticipated to have loading rates equal to or higher than the average annual design capacity. Thus, there is expected to be significant additional sewage treatment plant expansion and associated costs under the higher growth decentralized future scenario than would be expected under the intermediate growth-centralized land use plan.

Based upon review and analysis of the data in Tables XII-5 and XII-7, including estimates of future condition loadings on an annual average and maximum monthly basis, and based upon the age of the current facilities, estimates of the timing of needed facility planning were made. It appears that facility planning should be initiated during the next three years by the Delafield-Hartland Water Pollution Control Commission, the Village of Dousman, the City of Hartford, and the Village of Sharon to consider the need for expansion and upgrading of their sewage treatment plants. The remaining six sewage treatment plants are expected to begin facility planning to consider the need for plant expansion after the year 1997, assuming that development occurs in accordance with the recommended year 2010 land use plan as described for the intermediate growth-centralized land use future condition. Should development occur as envisioned under the high growth-decentralized land use future scenario, facility planning for nearly all of the public sewage treatment plants in the Rock River watershed should be initiated within the next three years, except for the Allenton Sanitary District No. 1, the City of Oconomowoc, the Village of Slinger, the City of Whitewater plants, and the Walworth County Metropolitan Sewerage District. Continued review of plant operations and State required compliance maintenance reports for all plants will provide the basis for determining the timing for initiating facility planning programs to explore plant expansion alternatives.

The current planned sanitary sewer service areas in the Rock River watershed are shown on Map XII-4. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. All or portions of the following sewer service areas are located in the Rock River watershed: Allenton, Beaver Lake, Darien, Delafield-Nashotah, Delavan-Delavan Lake, Elkhorn, Williams Bay, Dousman, Geneva National-Interlaken, Fontana, Hartford, Hartland, Oconomowoc, Oconomowoc Lake, Okauchee Lake, North Lake, Pewaukee, Pine Lake, Sharon, Slinger, Wales, Walworth, and Whitewater. Together, the planned service areas within the watershed total about 106 square miles, or about 17 percent of the Rock River watershed.

As noted above, most of the sewer service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Additional refinements are envisioned to be needed for the North Lake, Okauchee Lake, Beaver Lake, Pine Lake, Oconomowoc Lake, Wales, Fontana, Walworth, and Sharon sewer service areas identified in the initial plan. It is recommended that these refinements be conducted through the year 2010, with the currently sewered areas being refined during 1995 and 1996, and the unsewered areas being refined at such time as sewer service is envisioned to be provided. It is recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plants, there were three private sewage treatment plants in operation within the Rock River watershed in 1990. These facilities generally serve isolated enclaves of urban land uses which are located beyond the current limits of the planned sanitary public sewer service areas. In 1990, of the three plants in operation, one plant was recommended for abandonment--the National Farmers Organization-Slinger Transfer Station. Due to the relatively close proximity of this plant to the Village of Slinger sewer service area, abandonment of the plant and connection to the public sanitary sewer system is recommended. For the remaining two private sewage treatment plants serving the Ethan Allen School and the Dean Foods, Inc. plant (formerly Libby, McNeill, and Libby, Inc.), the need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 16 known sanitary sewer system flow relief devices located in the Rock River watershed: two bypasses draining to Turtle Creek; one bypass to Little Turtle Creek from the Village of Sharon; one bypass to Piscasaw Creek from the Village of Walworth; one bypass to Jackson Creek from the City of Elkhorn; five bypasses to Whitewater Creek from the City of Whitewater; two bypasses to the Bark River, one from the Village of Hartland and one from the Village of Dousman; and three bypasses from the City of Oconomowoc, one to the Oconomowoc River, one to Lac La Belle, and one to Fowler Lake. During the period of 1988 through 1993, the only flow relief devices which existed in the sanitary sewer systems were selected bypasses and portable pumping station sites which physically remained in the sewerage system but which function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table XII-8, seven reported points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Rock River watershed. These flow relief points are located in four sewerage systems. However, these flow relief points have only been in operation infrequently, with the average discharge occurrence frequency over this five-year period being about once per four years per flow relief location. This equates to an average of about two isolated overflow occurrences per year considering all reported bypassing.

Current Plan Recommendations: It is recommended that the Cities of Hartford and Whitewater, the Village of Dousman, and the Walworth County Metropolitan Sewerage District continue to monitor the sewerage system operations to ensure that the use of the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading be conducted with the assumption that there will be no planned bypasses of untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of 13 intercommunity trunk sewers in the Rock River watershed, as shown in Table XII-9. One trunk sewer would permit the relocation of the Slinger wastewater treatment plant; two would extend the service from the City of Oconomowoc sewerage system along the Lac La Belle shoreline to the Town of Oconomowoc and

Table XII-8

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE ROCK RIVER WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | Comments |
|---|---|---|---|---|---|---|---|
| | | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| Village of Dousman | -- | -- | -- | -- | 1 | 1 | No reported by-passing occurred in 1988 through 1993 |
| City of Hartford | 1 | -- | -- | -- | -- | 1 | Used only in case of equipment failure or extreme wet weather conditions |
| Walworth County Metropolitan Sewerage District | 1 | -- | 1 | 2 | -- | 4 | Used only in case of equipment failure or extreme wet weather conditions |
| City of Whitewater | -- | -- | -- | 1 | -- | 1 | Used only in case of extreme wet weather |
| Total | 2 | -- | 1 | 3 | 1 | 7 | |

Source: SEWRPC.

Table XII-9

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE ROCK RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Slinger | Completed (1981) |
| Lac La Belle-Oconomowoc East | Completed (1989) |
| Lac La Belle-Oconomowoc West | Completed (1988) |
| North Lake-Oconomowoc | Facility Planning Completed for Initial Port of Sewer (1989) |
| Silver Lake-Oconomowoc (Oconomowoc-South) | Completed (1990) |
| Hartland-Delafield | Completed (1980) |
| Nashotah-Delafield | Completed (1980) |
| Summit-Delafield | No Action |
| Whitewater | Completed (1982) |
| Walworth County Institutions | Completed (1981) |
| Elkhorn | Completed (1981) |
| Delavan Lake | Completed (1981) |
| Walworth | Completed (1986) |

Source: SEWRPC.

Village of Lac La Belle; one would extend the service from Oconomowoc to connect the urban development along the shorelines of Oconomowoc, Okauchee, North, Pine and Beaver Lakes; one would extend the service from Oconomowoc to the south of the City of Oconomowoc including the Silver Lake shorelands; one would extend service from the Delafield-Hartland sewerage system to portions of the City of Delafield and Village of Hartland and permit the abandonment of the Village of Hartland plant; one would connect the portions of the City of Delafield and Village of Nashotah; one would extend service from the Delafield-Hartland sewerage system to the shorelands of Nashotah and Nemahbin Lakes; one would permit the relocation of the Whitewater treatment plant; three would connect the Walworth County Institutions, City of Elkhorn and Delavan Sanitary District to the Walworth County Metropolitan sewage treatment plant, thus permitting the abandonment of the City of Elkhorn and City of Delavan sewage treatment plants; and one would connect the Walworth sewer service area to the Fontana-Walworth Water Pollution Control Commission, thus permitting the abandonment of the Walworth and Fontana sewage treatment plants. The only recommended trunk sewers that remain to be constructed as of 1990 are those connecting the shorelands of Nashotah and Nemahbin Lakes to the Delafield-Hartland sewerage system, and urban development along the shorelines of Oconomowoc, Okauchee, North, Pine, and Beaver Lakes to the City of Oconomowoc sewerage system. It should also be noted that portions of the trunk sewers connecting urban development in the Como Lake South area and the Village of Williams Bay to the Walworth County Metropolitan sewerage system and a portion of the trunk sewer connecting the Village of Fontana on Geneva Lake to the Fontana-Walworth Water Pollution Control Commission sewerage system are located in the Rock River watershed.

Current Plan Recommendations: The current regional water quality management plan includes recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Rock River watershed. Two intercommunity trunk sewers in the Rock River watershed are currently recommended to be constructed. These trunk sewers include connections from the shorelands of Nashotah and Nemahbin Lakes to the Delafield-Hartland plant and from urban development along the shorelines of Oconomowoc, Okauchee, North, Pine, and Beaver Lakes to the City of Oconomowoc plant, as shown on Map XII-4.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Current Conditions and Status of Plan Implementation: In 1975, there were a total of 24 known point sources of pollution identified in the Rock River watershed other than public and private sewage treatment plants. These other point sources discharged industrial cooling, process, rinse, wash waters, and filter backwash waters through 26 outfalls directly or indirectly to the surface water or groundwater systems. Of these, 12 were identified as discharging only cooling water. The remaining 12 were discharging other types of wastewater. The initial regional water quality management plan includes a recommendation that these industrial sources of wastewater be monitored and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 39 such point sources of wastewater discharging to the Rock River and its major tributaries or the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table XII-10 summarizes selected characteristics of these other point sources and Map XII-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources

Table XII-10

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE ROCK RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID No.[b] | Permit Type | Permit Number | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| A.K. Rubber Products Company | Walworth | 1 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Jackson Creek via unnamed tributary | -- |
| Arrowhead High School | Waukesha | 2 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Bark River | -- |
| Darien Water Treatment Plant: Well #1 | Walworth | 3 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Warner Creek via Darien Creek | -- |
| Darien Water Treatment Plant: Well #2 | Walworth | 4 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Warner Creek via Darien Creek | -- |
| Delavan PWD: Well #5 Iron Filter | Walworth | 5 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Wetland discharge to Turtle Creek | -- |
| Elkhorn City Swimming Pool | Walworth | 6 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Jackson Creek via unnamed tributary | -- |
| Elkhorn Water Treatment Plant | Walworth | 7 | General | SPEC PERM | -- | 4941 | Water supply | Jackson Creek via unnamed tributary | -- |
| Essential Industries, Inc. | Waukesha | 8 | General | 0044938-3 | 9-30-95 | 2841 | Soap and other detergents | Bark River | -- |
| Hartford Union High School | Washington | 9 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Groundwater discharge | -- |
| Hasslinger Crushing Company | Waukesha | 10 | General | 0046515-1 | 9-30-95 | 1429 | Crushed and broken stone | Groundwater discharge | -- |
| J.W. Reichel & Sons, Inc. | Walworth | 11 | General | 0044938-2 | 9-30-95 | 3363/3364 | Aluminum & nonferrous die castings | Jackson Creek via unnamed tributary | -- |
| Kikkoman Foods, Inc. | Walworth | 12 | General | 0044938-3 | 9-30-95 | 2035 | Pickles, sauces, and salad dressing | Groundwater discharge | -- |
| Lycon, Inc. - Whitewater | Walworth | 13 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Maxi-One, Inc. | Walworth | 14 | General | 0046566-2 | 9-30-95 | -- | N/A | Delavan Lake via storm sewer | -- |
| Mesa Industries, Inc. | Walworth | 15 | General | 0044938-3 | 9-30-95 | -- | N/A | Jackson Creek via unnamed tributary | -- |
| North Lake Sand & Gravel | Waukesha | 16 | General | 0046515-2 | 9-30-95 | 3281 | Cut stone and stone products | Oconomowoc River | -- |
| Okauchee Redi-Mix | Waukesha | 17 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| St. Johns Military Academy | Waukesha | 18 | General | 0046523-1 | 9-30-95 | 8211 | Secondary school | Bark River | -- |
| Schmitz Ready Mix - Richfield | Washington | 19 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mixed concrete | Groundwater discharge | -- |
| Sharon Foundry | Walworth | 20 | General | 0044938-3 & 0046531-1 | 9-30-95 | 3321 | Gray and ductile iron foundry | Little Turtle Creek via unnamed tributary | -- |
| Town & Country YMCA | Waukesha | 21 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Oconomowoc River via unnamed tributary | -- |
| Veterans Memorial Pool | Washington | 22 | General | 0046523-2 | 9-30-95 | -- | Municipal pool | Rubicon River via storm sewer | -- |
| Vogt, Inc. | Waukesha | 23 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Whitewater Limestone, Inc. | Walworth | 24 | General | 0046515-2 | 9-30-95 | 3281 | Cut stone & stone products | Cravath Lake | -- |
| Whitewater Water Utility Well #6 & #8 | Walworth | 25 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Whitewater Creek | -- |
| Witte Residence | Walworth | 26 | General | HEAT PUMP | -- | 8811 | Private household | Whitewater Lake | -- |
| YMCA Camp Minikani | Washington | 27 | General | 0046523-2 | 9-30-95 | 7032 | Sporting & recreational camps | Amy Belle Lake | -- |
| Allcast, Inc. | Washington | 1A | Specific | 0041378 | 12-31-90 | 3363 | Aluminum die casting | East Branch Rock River | None |
| Carnation Company Instant Products | Waukesha | 2A | Specific | 0002500 | 9-30-92 | 2023 | Dry, condensed, evap. products | Oconomowoc River via storm sewer | None |
| Elkhorn Water Treatment Plant | Walworth | 3A | Specific | 0048500 | 9-30-95 | 4941 | Water supply | Jackson Creek via unnamed tributary | None |
| Hawthorn Melody Farms Dairy of WI | Walworth | 4A | Specific | 0002461 | 3-31-95 | 2024 | Ice cream & frozen desserts | Whitewater Creek | None |
| International Stamping Co., Inc. | Washington | 5A | Specific | 0002691 | 6-30-92 | 3714 | Motor vehicle parts & accessories | Rubicon River | 9 |
| Pabst Farms, Inc. | Waukesha | 8A | Specific | 0053627 | 12-31-93 | 2026 | Fluid milk | Groundwater discharge | 3, 2, 5 |
| Silgan Containers, Inc. | Waukesha | 9A | Specific | 0047058 | 9-30-92 | 3411 | Metal cans | Oconomowoc River | None |
| Sta-Rite Industries, Inc. | Walworth | 10A | Specific | 0055816 | 7-31-95 | 3648 | Lighting equipment | Swan Creek via storm sewer | None |
| Tankcraft Corporation | Walworth | 11A | Specific | 0057614 | 9-30-95 | 3443 | Fabricated plate work | Piscasaw Creek via unnamed tributary | None |
| U.S.G. Interiors, Inc. | Walworth | 12A | Specific | 0050601 | 12-31-89 | 3081 | Unsupported plastics film & sheet | Groundwater discharge | 1, 2, 3 |
| W. B. Place Company | Washington | 13A | Specific | 0057258 | 6-30-92 | 3111 | Leather tanning and finishing | Groundwater discharge | 7, 4 |
| Zunker Contractors | Washington | 14A | Specific | 0047805 | 9-30-95 | -- | N/A | Rubicon River | None |

Footnotes follow.

Table XII-10 (continued)

[a] Table XII-10 includes 39 known, permitted sources of wastewater discharging to the Rock River and its tributaries, or to groundwater systems in the Rock River watershed. As of 1993, there were 69 known, permitted point sources of water pollution.

[b] See Map XII-3, Sewer Service Areas and Point Sources of Pollution in the Fox River Watershed: 1990.

[c] The number code refers to the following treatment systems:

1. ACT sludge extended air
2. Absorption pond
3. Holding pond
4. Land spreading
5. Ridge & furrow
6. Screening
7. Solids Treatment/Removal
8. Spray Irrigation
9. Stabilization lagoon

[d] Permitted as Leaking Underground Storage Tank (LUST) remediation site discharging to surface or groundwater as of 1990. As of 1993, there were five additional LUST remediation sites discharging to surface or groundwaters in the Rock River watershed. See Table XII-11, "Miscellaneous Potential Pollution Sources in the Rock River Watershed: 1990" for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993 there were 69 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Rock River watershed. These point sources of wastewater discharge, primarily industrial cooling process, rinse, and wash water, discharge directly or following treatment to the groundwater or the surface waters of the Rock River watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were 25 enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, one of these areas had been added to the planned 2010 sewer service area as part of the plan amendment process. Due to increased unsewered urban growth within the watershed since 1975, 14 new enclaves of urban development have been created beyond the planned sewer service areas and eight of the urban development enclaves identified in the initial plan have been expanded, as shown on Map XII-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table XII-11. As shown in Table XII-11, approximately one-half of these areas--16 of the 38 areas--are covered by soils, and have lot sizes, which indicate a high probability of meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. The remaining areas have soils and lot sizes having a high probability of not meeting these criteria and alternative wastewater disposal methods should be considered. Many of these latter areas are located adjacent to lakes where alternative forms of wastewater management should be investigated during the planning period including the urban enclaves around Lake Keesus, Golden Lake, Lower Genesee Lake, Hunters Lake, Pretty Lake, Whitewater Lake, Lake Lorraine, and Turtle Lake. Generally, for all of the enclaves located in areas where soils and lot sizes are not considered to meet current criteria, it is recommended that an inspection and maintenance plan be instituted and that further site-specific planning be conducted to determine the best wastewater management practice at such time as significant problems become evident.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Rock River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and potentially can be subsequently transported to surface waters.

There are four active landfills and 78 known abandoned landfills located in the Rock River watershed. None of the landfills in the Rock River watershed, through 1993, have been reported as negatively impacting surrounding surface waters.

Table XII-11

EXISTING URBAN DEVELOPMENT OUTSIDE OF THE PLANNED PUBLIC SANITARY SEWER SERVICE AREA IN THE ROCK RIVER WATERSHED: 2010

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| | Washington County | | |
| 1[c] | Town of Barton-Section 7 | 104 | 3.0 |
| 2 | Town of Addison-Sections 13, 24 | 250 | 2.0 |
| 3[c] | Town of Addison-Section 28 | 153 | 1.5 |
| 4 | Town of Addison-St. Lawrence | 174 | 2.0 |
| 5[c] | Town of Hartford-Section 12 | 136 | -- |
| 6 | Pike Lake | 194 | -- |
| 7 | Pike Lake - South | 151 | 0.7 |
| 8[c] | City of Hartford | 33 | -- |
| 9 | Town of Erin-Sections 22, 27 | 269 | 5.0 |
| 10[c] | Friess Lake | 723 | 4.5 |
| 11[c] | Town of Richfield-Section 10 | 228 | 4.25 |
| 12 | Town of Richfield-Section 21 | 113 | 5.75 |
| 13 | Town of Richfield-Sections 13, 14, 15, 22, 23 | 2274 | 5.25 |
| 14[c] | Bark Lake | 497 | 7.0 |
| 15[c] | Amy Bell Lake | 125 | 7.25 |
| 16[c] | Town of Richfield-Sections 32, 33 | 980 | 7.25 |
| 17[c] | Town of Richfield-Section 34 | 160 | 8.0 |
| | Waukesha County | | |
| 18[c] | Ashippun Lake | 196 | 0.5 |
| 19 | Town of Oconomowoc-Section 23 | 131 | -- |
| 20 | Town of Merton-Section 2 | 169 | 2.0 |

Table XII-11 (continued)

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| 21[c] | Lake Keesus | 708 | 1.5 |
| 22 | Village of Merton | 1076 | 0.75 |
| 23 | Town of Lisbon-Sections 3,4 | 722 | 5.5 |
| 24 | Town of Lisbon-Section 2 | 234 | 6.75 |
| 25 | Town of Lisbon-Section 15 | 134 | 6.0 |
| 26[c] | Town of Lisbon-Sections 17, 19 | 327 | 2.65 |
| 27 | Town of Genesee-Section 8 | 258 | 0.2 |
| 28[c] | Golden Lake | 121 | 2.5 |
| 29[c] | Lower Genesee Lake | 107 | 0.5 |
| 30 | Town of Summit-Section 35 | 139 | 0.5 |
| 31[c] | Town of Delafield-Section 28 | 744 | -- |
| 32[c] | Town of Delafield-Section 32 | 313 | -- |
| 33[c] | Hunters Lake | 59 | -- |
| 34[c] | Pretty Lake | 270 | 2.75 |
| | Walworth County | | |
| 35[c] | Whitewater Lake | 404 | 3.5 |
| 36[c] | Lorraine Lake | 210 | 5.5 |
| 37[c] | Turtle Lake | 208 | 5.0 |
| 38 | Allens Grove | 55 | 2.0 |
| | Total | 13,149 | -- |

[a] See Map XII-4

[b] Urban development is defined in this context as concentrations of urban land uses within any given U.S. Public Land Survey quarter section that has at least 32 housing units, or an average of one housing unit per five gross acres, and is not served by public sanitary sewers.

[c] Based upon consideration of soils, lot sizes, and density, area which should, during the planning period, conduct further site specific planning to determine the best means of providing for wastewater management.

Source: SEWRPC.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Rock River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the WPDES to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there was one known permitted leaking underground storage tank site that was discharging remediation waters to surface water, as indicated in Table XII-12 and shown on Map XII-3. As of 1993, there were five additional leaking underground storage tanks in the Rock River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table XII-12.

As of 1993, there were 183 additional leaking underground storage tanks in the Rock River watershed identified by the Department of Natural Resources that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks have the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters. As of 1990, there was one permitted site discharging to surface water in the Rock River watershed, as indicated in Table XII-12 and shown on Map XII-3. This site was the Delavan Municipal Well No. 4, which was designated as a high priority site for the U.S. Environmental Protection Superfund program in 1984 which provides for the identification and cleanup of hazardous waste sites. Contamination of soil and groundwater by Volatile Organic Compounds (VOCs) were detected at the well in 1982, resulting from a discharge of cleaning solvents by Sta-Rite, Inc. Remediation efforts are currently underway at this site.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the adopted regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

### Existing Conditions and Status of Plan Implementation

For the Rock River watershed, the initial plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, streambank erosion control, and onsite sewage disposal system management. In addition, the plan recommended

Table XII-12

MISCELLANEOUS POTENTIAL POLLUTION SOURCES
IN THE ROCK RIVER WATERSHED: 1990

| Map Identification No.[a] | Landfills Indicated to be Potential Pollution Sources | Civil Division Location | Surface Water Potentially Impacted |
|---|---|---|---|
| | None | | |
| | Leaking Underground Storage Tank Sites[b,c] | | |
| 1 | Maxi-One, Inc. | Town of Delavan | Delavan Lake |
| | Additional Groundwater Contamination Sites[b] | | |
| 1 | Delavan Municipal Well No. 4[d] | City of Delavan | Turtle Creek |

[a]Refers to Map XII-3, "Sewer Service Areas and Point Sources of Pollution in the Rock River Watershed: 1990."

[b]Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or groundwaters.

[c]As of 1993, there were five additional leaking underground storage tank sites in the Rock River watershed whose remediation discharges were permitted under the WPDES: Dairyland Fuels in the City of Delafield, Waukesha County, which is permitted to discharge to the Bark River; The Holiday Company in the Village of Williams Bay, Walworth County, which is permitted to discharge to Swan Creek via a storm sewer; the Holiday Company in the City of Oconomowoc, Waukesha County, which is permitted to discharge to Fowler Lake via a storm sewer; Silver Lake Service Station in the City of Oconomowoc, Waukesha County, which is permitted to discharge to Fowler Lake via a storm sewer; and Theresa State Bank in the Town of Wayne, Washington County, is permitted to discharge to Theresa Marsh.

[d]Superfund site.

Source: Wisconsin Department of Natural Resources and SEWRPC.

that additional rural nonpoint source controls be provided in the Bark Lake drainage area, which would reduce nonpoint sources of pollution by about 75 percent.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Rock River watershed through a variety of local and State regulations and programs. These programs include the regulation of onsite sewage disposal systems under programs currently administered by Walworth, Washington, and Waukesha Counties. These programs provide for the system installation requirements set forth in Chapter ILHR 83 of the Wisconsin Administrative Code for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified. Significant progress has also been made in the area of construction site erosion control. As of January 1993, Walworth and Waukesha Counties had erosion control ordinances based on the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities, while Washington County had an ordinance that pre-dated the model ordinance. In addition, the Cities of Delafield, Elkhorn, Oconomowoc and Whitewater, and Towns of Delafield and Delavan had adopted construction erosion control ordinances which are based upon the model ordinance developed by the League of Wisconsin Municipalities. The Village of Hartland and the Towns of Oconomowoc and Lisbon had ordinances which were not based on the model, while the City of Hartford was in the process of drafting an ordinance based on the model ordinance. In addition, Waukesha County and Walworth County have adopted erosion control ordinances applicable in the unincorporated areas to certain developments.

With regard to rural nonpoint sources of pollution, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations and sets forth criteria whereby the Wisconsin Department of Natural Resources may issue permits for animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program and other programs such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and the wetland restoration program administered by the Wisconsin Department of Natural Resources and others, are being utilized in the Rock River watershed primarily for cropland soil erosion control and wildlife habitat purposes, respectively, and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances, or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection, as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Waukesha and Washington Counties. In addition, an agricultural soil erosion control plan for Walworth County was prepared by a consultant. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for the cost of an individual project or land management practice to local governments and private landowners upon completion of the detailed plans. The funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. As of 1993, two priority watershed projects shave been conducted in the Rock River watershed--the Turtle Creek Priority Watershed Project[4] and the Oconomowoc River Priority Watershed Project.[5]

The Turtle Creek Priority Watershed Plan: The Turtle Creek watershed was selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in 1982, and the watershed plan was completed in 1984. The project implementation phase was carried out from 1984 until April 1992 and included the following recommended components:

- Provision of streambank erosion control practices for selected sites.

- Provision of wind erosion controls on lands in the Comus Lake subwatershed.

- Preparation of detailed conservation plans to develop management practices on about 21,000 acres of cropland which are estimated to have soil losses of greater than six tons per acre per year. The target soil loss for these lands was established at five tons per acre per year which was estimated to result in a reduction in total sediment losses from cropland by about 53 percent.

- Installation of facilities and management practices for 75 barnyards representing a reduction of about 80 percent of the phosphorus loading from barnyards in the study subwatershed.

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[4] Wisconsin Department of Natural Resources Publication, Turtle Creek Priority Watershed Plan, March 1984.

[5] Wisconsin Department of Natural Resources Publication No. WR-194-86, A Nonpoint Source Control Plan for the Oconomowoc River Priority Watershed Project, March 1986.

- Installation of facilities and management practices for selected livestock operations to change manure spreading practices.

- In urban and urbanizing areas, the implementation of construction erosion controls; the institution of public information and education programs on nonpoint source pollution abatement; and the institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers.

A final report and evaluation of the Turtle Creek priority watershed project are currently being prepared by the Wisconsin Department of Natural Resources.

<u>The Oconomowoc River Priority Watershed Program</u>: The Oconomowoc watershed was selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in 1983, and the plan was completed in 1986. The project implementation phase began in 1986 and is currently scheduled for completion in December 1994. The program established pollutant reduction goals of between 30 and 50 percent for sediment loadings and between 28 and 76 percent for phosphorus loadings. Generally, the higher phosphorus load reductions were proposed for the more urban, lower portions of the watershed--below Okauchee Lake--while the higher sediment load reductions were proposed for the upper, more rural portions of the watershed--upstream of Oconomowoc Lake. The recommendations varied with each subwatershed and generally included the following:

- Provision of fencing and other streambank erosion control practices for selected reaches of eroding streambank.

- Formation of detailed conservation plans to develop the best management practices for cropland areas identified as having excessive erosion.

- Installation of facilities and management practices for selected barnyards identified to be contributing significant phosphorus loadings.

- Installation of facilities and management practices for selected livestock operations to change manure spreading practices.

- In urban and urbanizing areas, the implementation of construction erosion controls; the institution of public information and education programs on nonpoint source pollution abatement; and the institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers.

<u>Current Plan Recommendations</u>

It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control in addition to land management, to provide about a 25 percent reduction in nonpoint source pollutant loadings are recommended to be carried out throughout the watershed. Additional practices providing for about a 75 percent reduction in rural nonpoint source pollutant loadings are recommended to be provided in the Bark Lake drainage area. In addition, it is recommended that the need for further nonpoint source pollution abatement efforts in the Turtle Creek and Oconomowoc River watersheds be reviewed and reevaluated following preparation of a project final report and evaluation for the priority watershed projects prepared for those subwatersheds.

The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, additional portions of the watershed should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make State cost-sharing programs available for nonpoint source pollution control measures. In addition, it is recommended that stormwater management plans be carried out in urban areas and farmland management plans be carried out in rural areas to define the practices to be installed. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[6] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included portions of the Rock River watershed--including the Bark River, East Branch Rock River and Rubicon River--in the high rating category, indicating that their inclusion in the program will be possible in the near future, when the existing planning projects are completed, or additional funds and staff become available with the Department of Natural Resources and its sister agencies. The inclusion of the remaining portions of the watershed--including Whitewater Creek, which was ranked as having a medium rating, and the Ashippun and Scuppernong Rivers, which were ranked as low--will probably be delayed until late in the planning period or beyond unless the process of selection is changed and/or funding levels are increased.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program. As of 1993, long-term monitoring has been carried out in the Rock River watershed on a sustained basis only by the U.S. Geological Survey at one station located at Rockton, Illinois, on the Rock River main stem about 4.0 miles downstream of the Wisconsin-Illinois State line, and by the Wisconsin Department of Natural Resources at one station on the Rock River at Afton, about 4.0 miles downstream of Janesville, in Rock County, as shown on Map XII-5. Only limited significant short-term monitoring data has been carried out on the stream system in the watershed since the completion of the initial plan. This data was primarily used to evaluate lake phosphorus water quality conditions and pollutant loadings at Delavan Lake and in the Oconomowoc River lake chain.

Currently, water quality monitoring is being carried out on several lakes as part of the WDNR Self-help Monitoring Program, including Ashippun, Delavan, Druid, Lake Five, Friess, Golden, Green, Hunters, Keesus, Lac La Belle, Lower Genesee, Nagawicka, Lower Nashotah, Lower Nemahbin, Upper Nemahbin, North, Oconomowoc, Pike, Pretty, Rice, School Section, Silver (Waukesha County) Silver (Washington County), Turtle, and Whitewater. In addition, limited additional

[6]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

water quality monitoring has been carried out on some of the major lakes in the watershed by the U.S. Geological Survey, the Department of Natural Resources, local lake management agencies, and the Commission.

Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the Wisconsin Department of Natural Resources and the U.S. Geological Survey at stations Rk-14 and Rk-15 on a continuing long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at these two stations and at 12 selected additional stations, with one station each located on Jackson Creek, Turtle Creek, Whitewater Creek, Scuppernong River, Scuppernong Creek, Bark River, Ashippun River, Oconomowoc River, Coney River, Rubicon River, East Branch of Rock River, and Kohlsville River. It is recommended that this program be conducted within the next five to seven years and repeated at five-to seven-year intervals. These recommendations can be coordinated with and are consistent with the Department of Natural Resources' current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each basin in the Region in an approximately five- to seven-year rotating cycle.

The lake monitoring program for each lake should consist, at a minimum, of one intensive monitoring effort to establish baseline conditions and of the long-term participation in the DNR Self-help Monitoring Program that can be conducted by citizen-volunteer residents on the lakes. As noted earlier, several lakes already participate in this program. For each lake, it is recommended that the monitoring program be expanded to establish current conditions during a two-year or more period of intensive monitoring followed by a continual long-term monitoring program designed to detect changes in water quality conditions. In this regard, the monitoring program should be tailored to provide data needed for preparation or updating of comprehensive lake management plans for the major lakes in the watershed. Such programs are being undertaken by the U.S. Geological Survey on Druid, Keesus, Okauchee, Oconomowoc, Fowler, Silver (Waukesha County), Upper Nemahbin, and Delavan Lake; and the Department of Natural Resources under the Long-Term Trends Program on Friess, Lac La Belle, Nagawicka, Pike, and Whitewater Lakes. The water quality sampling program should be carried out at spring turnover (April) and during June, July, and August, during two subsequent years, with samples collected weekly.

LAKES MANAGEMENT PLAN ELEMENT

Existing Condition and Status of Plan Implementation

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of the major lakes in the Rock River watershed and for consideration of other lake management measures. Institutional recommendations were also made for the formation of new special purpose units of government where none exist to carry out the plan implementation measures. For each major lake in the Rock River watershed, the initial plan recommended that a comprehensive lake management plan be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. As noted in the previous sections, the preparation of such a comprehensive plan requires that supporting water quality monitoring programs be established.

The status of lake management, protection, and rehabilitation efforts on and around the major lakes in the Rock River watershed is discussed for each major lake in the following paragraphs:

<u>Ashippun Lake:</u> The Ashippun Lake Protection and Rehabilitation District conducts regular water clarity monitoring under the DNR Self-help Monitoring Program. A comprehensive lake management plan has been prepared for this lake.[7]

<u>Bark Lake:</u> No data were available from which to assess the present conditions in Bark Lake. The Bark Lake Sanitary District which was formed of the properties around the lake is currently inactive. It is recommended that the Bark Lake Association enroll in the DNR Self-help Monitoring Program.

<u>Beaver Lake:</u> The lake is within the Oconomowoc River priority watershed project area. No plan data have been recorded to assess water quality conditions for this lake as of 1993. It is recommended that Beaver Lake be enrolled in the DNR Self-help Monitoring Program. The urban development around this lake is recommended to be provided with public sanitary sewer service, which would be connected to the Oconomowoc sewerage system. The implementation of this recommendation may not occur until late in the planning period.

<u>Comus Lake:</u> The southern portions of the lakeshore are provided with a public sanitary sewer system, and sewer extensions are planned for most of the remaining lake shore. Lake Comus is in the Turtle Creek priority project area. It is recommended that the Comus Lake Protection and Rehabilitation District enroll in the DNR Self-help Monitoring Program.

<u>Cravath Lake:</u> The northwestern lakeshore lies within the current public sanitary sewer service area of the City of Whitewater, and extensions are planned to encompass the entire lakeshore. It is recommended that Cravath Lake enroll in the DNR Self-help Monitoring Program.

<u>Crooked Lake:</u> The lake was formerly enrolled in the DNR Self-help Monitoring Program but does not appear on the most recent list of participants. Re-enrollment is recommended.

<u>Delavan Lake:</u> A comprehensive program of lake management was carried out on the lake during the early 1990s by the Delavan Lake Sanitary District in cooperation with State and Federal agencies, and extensive water quality data have been collected. Lake rehabilitation measures including drawdown and alum treatment, wetland creation at the lake inlet area, lake inflow control routing structures, and fishery stocking has been carried out. The urban development around this lake has been provided with a public sanitary sewer system as recommended in the initial plan. Delavan Lake is within the Turtle Creek priority watershed project area. An aquatic plant management plan has been completed for the lake,[8] and the Delavan Lake Sanitary District maintains an on-going water clarity monitoring program under the DNR Self-help Monitoring Program.

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[7] SEWRPC Community Assistance Planning Report No. 48, <u>A Water Quality Management Plan for Ashippun Lake, Waukesha County, Wisconsin</u>, January 1982.

[8] Aron & Associates, <u>Delavan Lake Aquatic Plant Management Plan</u>, 1993.

Druid Lake: The Druid Lake Property Owners Association is enrolled in the DNR Self-help Monitoring Program and maintains an on-going water clarity monitoring program. The Druid Lake Protection and Rehabilitation District has also conducted water quality investigations with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program.

Lake Five: Water clarity monitoring is conducted by the Lake Five Advancement Association under the DNR Self-help Monitoring Program.

Fowler Lake: An aquatic plant management plan has been prepared for the lake, and a lake management plan has been prepared.[9] The lake lies within the City of Oconomowoc public sanitary sewer service area and is in the Oconomowoc River priority watershed project area. Further water quality investigations are being conducted with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Enrollment of the Fowler Lake Management District in the DNR Self-help Monitoring Program is recommended. The District operates an aquatic plant management program including harvesting and limited spraying.

Friess Lake: The lake lies within the Oconomowoc River priority watershed, and is a WDNR Long-term Trends Monitoring lake. The Friess Lake Association participated in the DNR Self-help Monitoring Program. Friess Lake has an approved aquatic plant management plan, and has been the subject of a comprehensive lake management plan prepared by the Commission.[10] During 1995, this plan is being updated, with partial funding under the Chapter NR 119 Lake Planning Grant Program.

Golden Lake: The Golden Lake Association is enrolled in the DNR Self-help Monitoring Program. The Association is investigating possible actions necessary to control purple loosestrife, Lythrum sp., in the vicinity of the lake.

Hunters Lake: Data with which to re-assess the water quality conditions in Hunters Lake were not available as of 1993. As of 1994, however, Hunters Lake Association participates in the DNR Self-help Monitoring Program and is in the planning stage of developing a public access site and lake protection plan.

Lake Keesus: Water quality and use data for Lake Keesus had been developed under water quality investigations conducted with financial assistance from the Chapter NR 119 Lake Management Planning Grant Program, a UW-Stevens Point lake resident questionnaire survey, and on-going water clarity monitoring conducted by the Lake Keesus Advancement Association and Lake Keesus Management District under the DNR Self-help Monitoring Program. Lake Keesus is within the Oconomowoc River priority watershed project area. An aquatic plant management plan has been prepared for the lake.[11]

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[9]SEWRPC Community Assistance Planning Report No. 187, A Management Plan for Fowler Lake, Waukesha County, Wisconsin, March 1994.

[10] SEWRPC Community Assistance Planning Report No. 98, A Water Quality Management Plan for Friess Lake, Washington County, Wisconsin, August 1983.

[11]Aron & Associates, Lake Keesus Plant Management Plan, October 1994.

Lac La Belle: A water quality management plan has been prepared for Lac La Belle.[12] There is also an approved aquatic plant management plan for this lake, which is being used to experimentally assess the effects of aquascaping to manipulate the growth of more desirable aquatic plant species. Large-leaf pondweed, Potamogeton amplifolius, was planted in the lake during 1991 by the Lac La Belle Management District. The District has also received a Chapter NR 119 lake management planning grant to partially fund conducting recreational use surveys, water quality data analyses, and public information campaigns.[13] On-going water clarity monitoring is done by the District through the DNR Self-help Monitoring Program, and the Department's Long-term Trends Monitoring Program. Lac La Belle lies within the Oconomowoc River priority watershed project area and the City of Oconomowoc public sanitary sewer service area. Most of the urban development around the lake is provided with public sewers, except for portions of the Town of Oconomowoc on the eastern and northeastern shoreline.

La Grange Lake: There are no records of water quality data or other plan implementation activities on this lake as of 1993.

Lake Lorraine: There are no records of water quality data or other plan implementation action as of 1993. It is recommended that the Lorraine Lake Property Owners Association enroll in the DNR Self-help Monitoring Program.

Genesee Lakes: The three Genesee lakes--Upper, Middle, and Lower--are located in the Town of Summit, Waukesha County. Lower and Middle Genesee Lakes are participants in the DNR Self-help Monitoring Program. A lake management district was created around Middle Genesee Lake during 1994. The District plans to develop a comprehensive lake management plan for that Lake which could ultimately be extended to the entire lake chain.

Nashotah Lakes: Lower Nashotah Lake is actively enrolled in the DNR Self-help Monitoring Program. Upper Nashotah Lake was formerly enrolled in the program but does not appear on the most recent list of participants. Re-enrollment is recommended. The urban development around these lakes is recommended to be provided with a public sanitary sewer system which would be connected to the Delafield-Hartland Water Pollution Control Commission sewerage system.

Upper and Lower Nemahbin Lakes: The Nemahbin Lakes have active lake organizations that are enrolled in the DNR Self-help Monitoring Program. Additional nonpoint source contaminant investigations have been proposed by the Upper Nemahbin Lake District. This project has been funded through the Chapter NR 119 Lake Management Planning Grant Program.[14] The urban development around these lakes is recommended to be provided with a public sanitary sewerage system which would be connected to the Delafield-Hartland Water Pollution Control Commission sewerage system.

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[12] SEWRPC Community Assistance Planning Report No. 47, A Water Quality Management Plan for Lac La Belle, Waukesha County, Wisconsin, December 1980.

[13] Aron & Associates, Lac La Belle Planning Grant Developed for the Lac La Belle Management District, 1993

[14] SEWRPC Memorandum Report No. 101, Upper Nemahbin Lake Watershed Inventory Findings, Waukesha County, Wisconsin, December 1994.

Moose Lake: The Moose Lake Association currently participates in the DNR Self-help Monitoring Program. Aquatic plant problems continue to occur within the littoral zone of Moose Lake. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

Nagawicka Lake: Nagawicka Lake has been included as a DNR Long-term Trends Monitoring lake, and on-going water quality monitoring is conducted by the Nagawicka Lake Improvement Association under the DNR Self-help Monitoring Program. The developed portions of the lakeshore are provided with a public sanitary sewer system as recommended in the initial plan. Nagawicka Lake has an approved aquatic plant management plan.[15]

North Lake (Waukesha County): An approved aquatic plant management plan has been prepared for the Lake, as has a water quality management plan.[16] The North Lake Management District undertakes regular water clarity measurements under the DNR Self-help Monitoring Program. North Lake is located within the Oconomowoc River priority watershed project area. The District has also undertaken paleolimnological investigations with financial assistance provided by a Chapter NR 119 lake management planning grant.[17] Following the removal of the upstream Funk's Dam in 1991, additional engineering studies are being designed to address the potential impacts on North Lake.[18] The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system. Implementation of this recommendation may not occur until late in the planning period.

Oconomowoc Lake: On-going water quality monitoring is conducted under the DNR Self-help Monitoring Program. The eastern embayment, Upper Oconomowoc Lake, has been the subject of an aquatic plant management plan. A water quality management plan has been prepared for the lake.[19] The Village of Oconomowoc, in cooperation with the Oconomowoc-Waukesha Lake Association, has conducted water quality studies on the lake with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Oconomowoc Lake is located within the Oconomowoc River priority watershed project area. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

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[15]Aron & Associates, Nagawicka Lake Plant Management Plan, August 1993.

[16] SEWRPC Community Assistance Planning Report No. 54, A Water Quality Management Plan for North Lake, Waukesha County, Wisconsin, July 1982.

[17]Aquatic Environmental Consulting, Inc., North Lake Project: Paleolimnology, Geochronology, Sediment Size Fractionation, and Suspended Sediment Load, sine datum.

[18]R.A. Smith & Associates, Inc., (Draft Report) Former Funk's Dam Impoundment Study, January 1995.

[19] SEWRPC Community Assistance Planning Report No. 181, A Water Quality Management Plan for Oconomowoc Lake, Waukesha County, Wisconsin, March 1990.

Okauchee Lake: A water quality management plan was developed for this lake in 1981.[20] An approved aquatic plant management plan has also been prepared for this Lake.[21] Okauchee Lake is also located within the Oconomowoc River priority watershed project area. The lake has developed an approved aquatic plant management plant with funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Water clarity monitoring by the lake organizations established on this lake and conducted under the DNR Self-help Monitoring Program is recommended. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

Pike Lake: Pike Lake is monitored by the Wisconsin Department of Natural Resources under the Long-term Trends Monitoring Program and by the Pike Lake Protection District under the DNR Self-help Monitoring Program. Most of the urban development around the lake has been provided with a public sanitary sewer system which is connected to the City of Hartford sewerage system.

Pine Lake: As the lake has not been retained in any State monitoring programs, enrollment of the lake in the DNR Self-help Monitoring Program is recommended. Pine Lake is located within the Oconomowoc River priority watershed project area. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system. Implementation of this recommendation may not occur until late in the planning period.

Pretty Lake: The Pretty Lake Management District is continuing to monitor water clarity in the Lake through the DNR Self-help Monitoring Program. The district has received Chapter NR 119 planning grant funding to partially fund conducting more intensive water quality monitoring of the lake. The district is presently exploring the possibility of purchasing specific properties for lake protection purposes using NR 50-51 Stewardship or NR 191 Lake Protection Grant Program cost-shared funding.

Rice Lake: The lake is regularly monitored for water clarity by the Whitewater-Rice Lakes Management District, which is also undertaking more extensive lake management-related water quality investigations with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program.[22] The District also undertakes aquatic plant harvesting and management operations and has an approved aquatic plant management plan.

School Section Lake: The School Section Lake Management District is a participant in the DNR Self-help Monitoring Program. The District has recently received an Inland Waterways Commission grant to undertake limited dredging

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[20] SEWRPC Community Assistance Planning Report No. 53, A Water Quality Management Plan for Okauchee Lake, Waukesha County, Wisconsin, August 1981.

[21] Aron & Associates, Okauchee Lake Plant Management Plan, June 1993.

[22] USGS Water Resources Investigations Report, (draft) Hydrology and Water Quality of Whitewater and Rice Lakes in Southeastern Wisconsin, 1990-91, June 1993.

within the lake basin to improve boat access. An approved aquatic plant management plan has been completed for this lake.[23]

Silver Lake (Waukesha County): The Silver Lake Association is a participant in the DNR Self-help Monitoring Program. Through the Town of Summit, the Association has received a Chapter NR 119 Lake Management Planning Grant to undertake watershed-based lake quality-related investigations which have resulted in the publication of a lake protection plan for Silver Lake.[24] The lake is located within the Oconomowoc River priority watershed project area, and has limited areas which are provided with a public sewer system along the northern lakeshore. The remaining urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

Tripp Lake: The northern lakeshore is provided with a public sanitary sewer system, and extensions are planned along most of the remainder of the lake shoreline. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended.

Turtle Lake: The lake is situated in the Turtle Creek priority watershed project area. Enrollment of the Turtle Lake Improvement Association in the DNR Self-help Monitoring Program is recommended.

Waterville Pond: Data with which to assess the water quality condition and other plan implementation actions for this waterbody were not available as of 1993. Enrollment in the DNR Self-help Monitoring Program is recommended for Waterville Pond.

Whitewater Lake: Whitewater Lake is situated upstream of Rice Lake (see above). The Whitewater-Rice Lakes Management District also has an approved aquatic plant management plan, and the Wisconsin Department of Natural Resources has recently completed a sensitive areas investigation of the lake. Whitewater Lake is both a DNR Self-help Monitoring Program lake and a Long-term Trends Monitoring Lake. The District has recently conducted even more intensive monitoring of the lake using cost-shared funding provided under the Chapter NR 119 Lake Management Planning Grant Program.[25]

Current Plan Recommendations

Management measures recommended and in-lake measures which are considered potentially applicable and should be considered in more detail are shown in Table XII-13 for the 38 major lakes in the Rock River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality, biological conditions,

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[23]Aron & Associates, School Section Lake Plant Management Plan, October 1994.

[24] SEWRPC Memorandum Report No. 82, A Lake Protection Plan for Silver Lake, Waukesha County, Wisconsin, July 1993.

[25]USGS Water Resources Investigations Report, (Draft) Hydrology and Water Quality of Whitewater and Rice Lakes in Southeastern Wisconsin, 1990-91, June 1993.

Table XII-13

MANAGEMENT MEASURES TO BE CONSIDERED IN LOCAL MANAGEMENT PLANS FOR THE MAJOR LAKES IN THE ROCK RIVER WATERSHED: 1993[a]

| | | | | Watershed-based Measures | | | | | | In-lake Management Measures | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUBWATERSHED Lake Name | Area (acre) | Water Quality Monitoring | Prepare Comprehensive Management Plan | Public Sanitary Sewer Service | Onsite Sewage System Mgmt | Rural NPS Mgmt | Urban NPS Mgmt | Construction Site NPS Management | Live-stock Mgmt | Macro-phyte Harvest | Aeration | Nutrient Inactiva-tion | Dredge | Sediment Cover | Water Level Mgmt | Fish Management |
| ASHIPPUN RIVER | | | | | | | | | | | | | | | | |
| Ashippun Lake | 84 | 0 | + | - | + | + | + | - | - | + | - | - | + | - | - | + |
| Druid Lake | 124 | 0 | 0 | - | + | + | + | - | + | + | - | + | - | + | - | + |
| BARK RIVER | | | | | | | | | | | | | | | | |
| Bark Lake | 65 | + | + | - | + | + | + | - | + | + | - | + | + | + | - | + |
| Crooked Lake | 58 | + | + | - | + | + | + | - | - | + | - | + | + | + | - | + |
| Golden Lake | 250 | 0 | + | - | + | + | + | - | - | + | - | - | + | - | - | + |
| Hunters Lake | 65 | + | + | - | + | + | + | - | + | + | - | + | - | + | - | + |
| Lower Nashotah Lake | 90 | 0 | + | + | + | + | + | + | - | + | - | + | - | + | - | + |
| Lower Nemahbin Lake | 271 | 0 | + | + | + | + | + | + | - | + | - | + | + | + | - | + |
| Nagawicka Lake | 957 | 0 | + | 0 | - | + | + | 0 | + | 0 | - | + | - | + | - | + |
| Pretty Lake | 64 | 0 | 0 | - | + | + | + | - | - | + | - | + | + | + | - | + |
| School Section Lake | 125 | 0 | 0 | - | + | + | + | - | - | 0 | - | - | 0 | + | - | + |
| Upper Nashotah Lake | 133 | + | + | + | + | + | + | + | + | + | - | + | - | + | - | + |
| Upper Nemahbin Lake | 283 | 0 | 0 | + | + | + | + | + | + | + | - | + | - | + | - | + |
| Waterville Pond | 68 | + | + | - | + | + | + | - | + | + | - | - | + | + | - | + |
| OCONOMOWOC RIVER | | | | | | | | | | | | | | | | |
| Beaver Lake | 316 | + | + | + | + | 0 | 0 | + | - | + | - | + | - | + | - | + |
| Lake Five | 102 | 0 | + | - | + | + | + | - | - | + | - | + | + | + | - | + |
| Fowler Lake | 78 | 0 | 0 | 0 | - | - | 0 | 0 | - | 0 | - | + | + | + | - | + |
| Friess Lake | 119 | 0 | + | - | + | 0 | 0 | - | + | - | - | + | - | - | - | + |
| Keesus Lake | 237 | 0 | 0 | - | + | 0 | 0 | - | + | 0 | - | + | - | + | - | + |
| Lac La Belle | 1117 | 0 | 0 | 0 | - | 0 | 0 | 0 | + | 0 | - | - | - | + | - | + |
| Lower Genesee Lake | 66 | 0 | + | - | + | + | + | - | - | + | - | - | - | - | + | + |
| Middle Genesee Lake | 102 | + | + | - | + | + | + | - | - | + | - | - | - | - | - | + |
| Moose Lake | 81 | + | + | + | + | 0 | 0 | + | - | + | - | + | - | + | - | + |
| North Lake (Wauk) | 437 | 0 | 0 | + | + | 0 | 0 | + | - | 0 | - | - | - | - | + | + |
| Oconomowoc Lake | 767 | 0 | 0 | + | + | 0 | 0 | + | - | 0 | - | - | - | + | - | + |
| Okauchee Lake | 1187 | + | 0 | + | + | 0 | 0 | 0 | - | 0 | - | + | - | + | - | + |
| Pine Lake | 703 | 0 | + | + | + | 0 | 0 | + | - | + | - | - | - | + | - | + |
| Silver Lake (Wauk.) | 222 | 0 | 0 | + | + | 0 | 0 | + | - | + | - | + | - | + | - | + |
| RUBICON RIVER | | | | | | | | | | | | | | | | |
| Pike Lake | 522 | 0 | + | + | + | + | + | 0 | + | - | - | - | - | - | - | + |
| SCUPPERNONG RIVER | | | | | | | | | | | | | | | | |
| La Grange Lake | 55 | + | + | - | + | + | + | - | + | - | - | + | + | - | - | + |

Table XII-13 (continued)

| SUBWATERSHED Lake Name | Area (acre) | Water Quality Monitoring | Prepare Comprehensive Management Plan | Watershed-based Measures | | | | | | In-lake Management Measures | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Public Sanitary Sewer Service | Onsite Sewage System Mgmt | Rural NPS Mgmt | Urban NPS Mgmt | Construction Site NPS Management | Live-stock Mgmt | Macro-phyte Harvest | Aeration | Nutrient Inactiva-tion | Dredge | Sediment Cover | Water Level Mgmt | Fish Management |
| TURTLE CREEK | | | | | | | | | | | | | | | | |
| Comus Lake | 117 | + | + | 0 | - | 0 | 0 | - | + | + | - | - | + | + | - | + |
| Delavan Lake | 2072 | 0 | 0 | 0 | - | + | + | + | + | 0 | - | 0 | 0 | + | - | + |
| Turtle Lake | 140 | + | + | - | + | 0 | 0 | - | + | + | - | + | - | + | - | + |
| WHITEWATER CREEK | | | | | | | | | | | | | | | | |
| Cravath Lake | 65 | + | + | 0 | - | + | + | 0 | - | + | - | + | + | + | + | + |
| Lake Lorraine | 133 | + | + | - | + | + | + | - | + | + | - | + | + | - | - | + |
| Rice Lake | 137 | 0 | 0 | - | + | + | + | - | + | o | - | + | + | + | - | + |
| Tripp Lake | 115 | + | + | 0 | + | + | + | 0 | - | + | - | + | + | + | + | + |
| Whitewater Lake | 640 | 0 | 0 | - | + | + | + | - | + | o | - | + | + | + | - | + |

0 = completed or on-going management measures

+ = management measures proposed or recommended for further consideration

- = management measures not specifically recommended for future consideration

[a] Management Measures recommended for further consideration in local management plans are summarized from those adopted in SEWRPC Planning Report No. 30, modified, as necessary, as the result of subsequent implementation actions, monitoring programs, and planning studies referenced in the previous section of the text.

Source: SEWRPC.

and water budget monitoring programs are reaffirmed in the updated plan recommendations for the Rock River watershed. The management recommendations for the lakes are based upon review of the lake planning set forth in the initial plan and the current status of implementation of recommendations, as well as any subsequent local planning.

It is recognized that the preparation of comprehensive lake management plans may need to be conducted in a staged manner in order to best utilize available resources. In this regard, the water quality monitoring, aquatic plant management, and lake watershed protection measure planning and implementation are considered to be logical components of the comprehensive plans which can be conducted under separate planning programs, if designed to be integrated into a comprehensive lake management plan.

In addition to the recommendations noted for the major lakes in the Rock River watershed, it is recommended that water quality planning and supporting monitoring be conducted for those lakes and similar water bodies in the watershed which are less than 50 acres in size, where such activities are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the watershed can be considered for lake management purposes.

WATER QUALITY AND BIOLOGICAL CONDITIONS

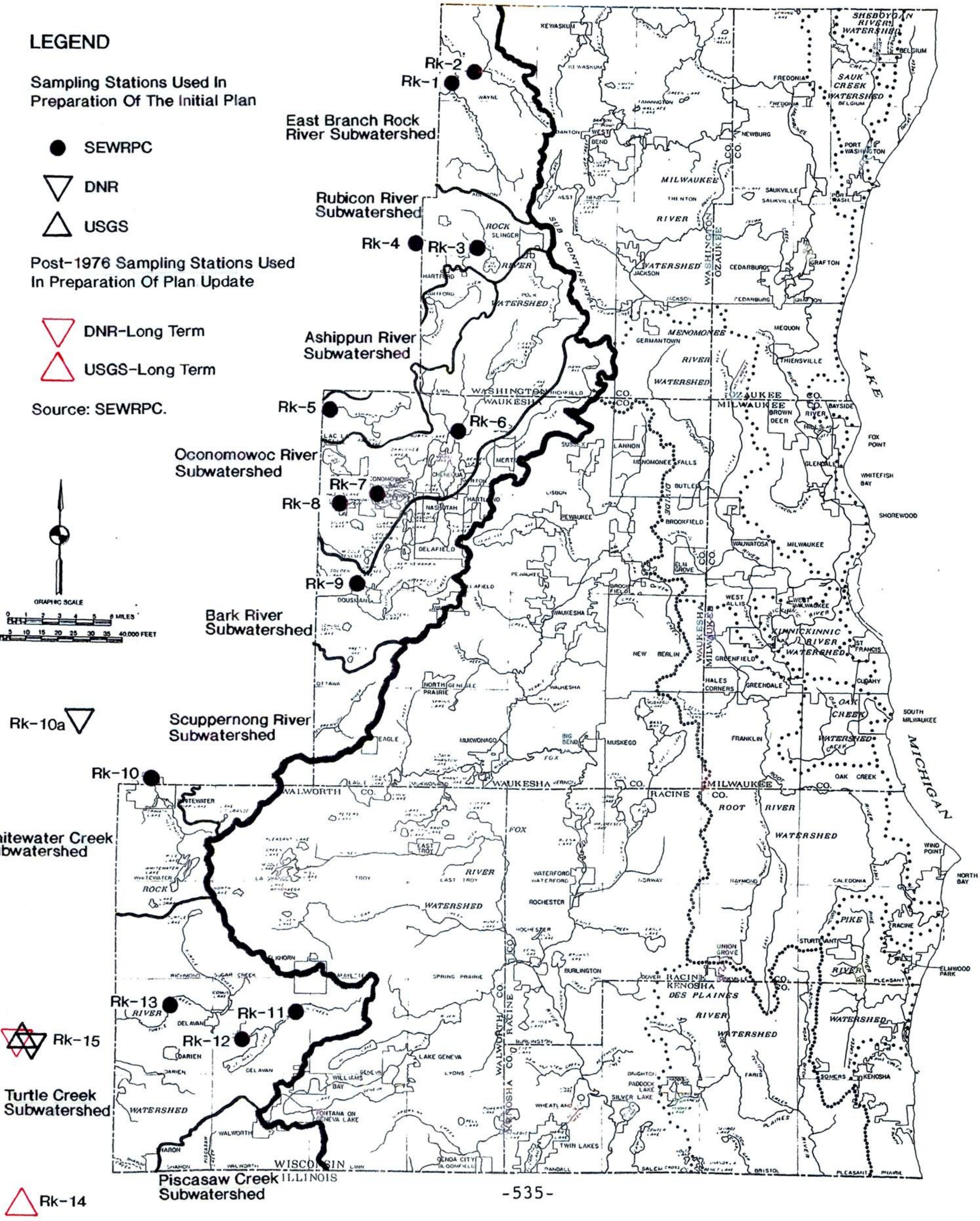
Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study, the 1965 through 1975 Commission stream water quality monitoring effort, the 1976 Commission monitoring program conducted under the regional water quality management plan, and the Wisconsin Department of Natural Resources and U.S. Geological Survey sampling programs. Available data collected in those programs for the Rock River watershed included samplings at 13 Commission stations in the Region; at two Department of Natural Resources stations on the Rock River--one in Jefferson County and one in Rock County; and one U.S. Geological Survey station on the Rock River in Rock County. The sampling station locations are shown on Map XII-5.

No long-term post-1976 water quality data were available for stations within the Region; however, for comparative purposes, available water quality data collected at a DNR station on the main stem of the Rock River at Afton in Rock County, Rk-15, about 4.0 miles downstream of the City of Janesville, and at a U.S. Geological Survey sampling station on the Rock River at Rockton, Illinois, Rk-14, about 4.0 miles south of the Wisconsin-Illinois State line were used in the preparation of the plan update. Water quality data collected by the U.S. Geological Survey and biological condition data collected by the Department of Natural Resources were also available for use in the assessment of current water quality conditions. In addition to the data obtained since the preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. Review of these data can provide insight into the current

## Map XII-5

## LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE ROCK RIVER WATERSHED



water quality conditions and the current potential for achieving the established water use objectives in the Rock River watershed.The long-term water quality data obtained at the U.S. Geological Survey sampling station Rk-14 at Rockton, Illinois, and at the Department of Natural Resources sampling station Rk-15 at Afton, in Rock County, for the period 1976 through 1991, are summarized in Figure XII-1 and Figure XII-2. The sampling data have been used, to the extent the data permits, to present a measure of current water quality conditions to evaluate water quality trends and the occurrence of changes over time, and to evaluate current conditions with respect to water quality standards. Because of the large tributary area above these two stations from subwatersheds located outside the Southeastern Wisconsin Region, the data are not considered to necessarily represent conditions for the portion of the watershed within the Region. However, the data are presented for information purposes. The water quality standards indicated in Figure XII-1 and Figure XII-2 are those set forth for specific biological and recreational use objectives as described in Chapter II.

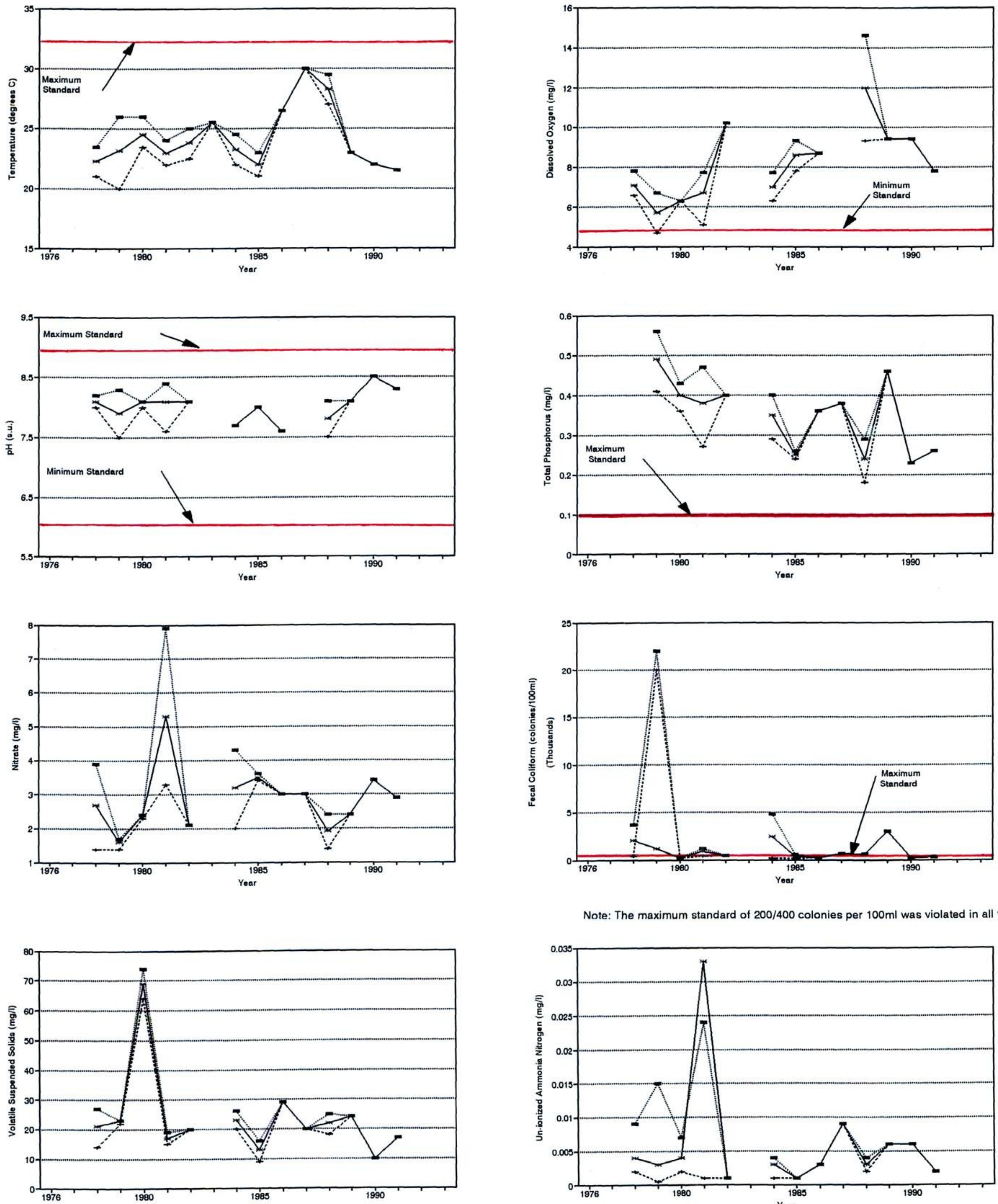
Review of the data for station Rk-14 indicates that, with the exception of dissolved oxygen and phosphorus levels, there were no apparent significant changes in water quality conditions from 1976 to 1991. Sampling data of dissolved oxygen and total phosphorus showed improvements in overall concentrations. The sampling data indicate that the standards for temperature and dissolved oxygen are generally met. Fecal coliform and phosphorus standards are frequently not met. Chronic toxicity standards for selected metals were exceeded some of the time, as discussed in the following section.

Review of the available data for station Rk-15 indicates no apparent significant changes in water quality conditions from 1976 to 1991, with the exception of chloride levels which appear to be increasing. However, the levels of chloride are still within acceptable limits as defined by the standards associated with the water use objectives for the Rock River set forth in Chapter II. The increase in chlorides may be the result of new urban development which has occurred in the watershed and the impacts of increased winter road maintenance salt-spreading operations associated with urban development. The sampling data indicate that the standards for temperature, dissolved oxygen, and ammonia nitrogen are generally met, while fecal coliform and phosphorus standards are frequently not met.

<u>Toxic and Hazardous Substances</u>: Sampling and analysis for pesticides, polychlorinated biphenyls (PCB's), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Rock River watershed between 1973 and 1978. In the in-stream water quality samples for which toxic and hazardous substances were tested, recommended levels of mercury were exceeded in approximately four of 78 samples, and for the persistent pesticides of heptachlor, heptachlor epoxide, lindane, metholychlor, and phthalate recommended levels were exceeded in one of 77, one of 76, one of 76, and three of 62 samples collected, respectively. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, PCB's, DDT, DDE, DDD, aldrin, and dieldrin showed no violations of U.S. Environmental Protection Agency recommended levels.

No analyses were conducted for toxic and hazardous substances in the bottom sediments of the Rock River watershed. Recent data on toxic and hazardous substances were collected by the U.S. Geological Survey at station Rk-14, as shown in Figure XII-1. These data indicatestation Rk-14. Lead levels have not violated the standard since 1987. Prior to 1987, the exceedances of the lead

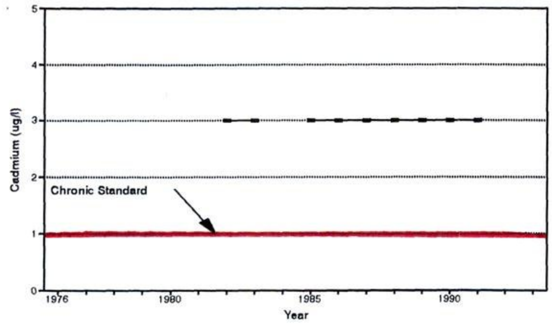
## Figure XII-1
## WATER QUALITY DATA FOR THE ROCK RIVER AT STATION Rk-14: 1976-1993



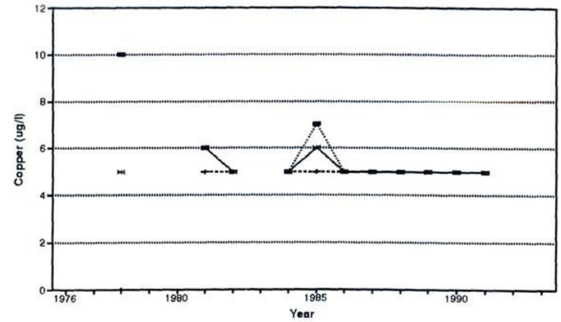

Note: The maximum standard of 200/400 colonies per 100ml was violated in all years.

Note: The maximum standard of 0.04 mg/l was not violated in any year.

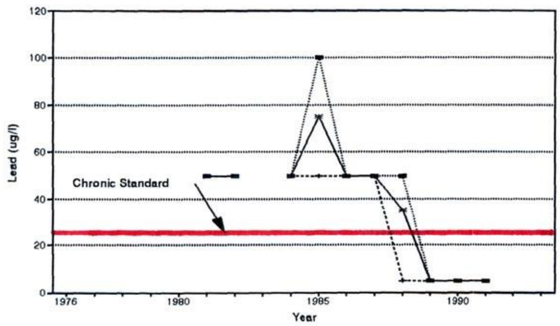
# Figure XII-1 (cont'd)



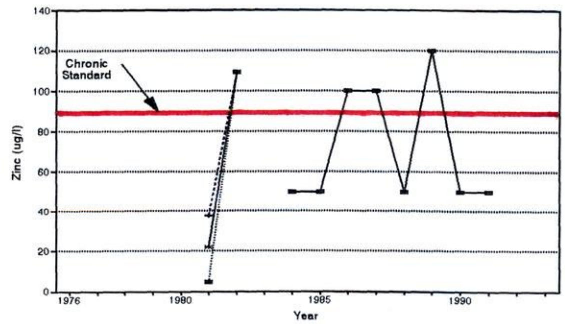

Note: The acute standard of 63.3 ug/l was not violated in any year.
Values graphed at 3.0 ug/l were indicated to be less than 3.0 ug/l.



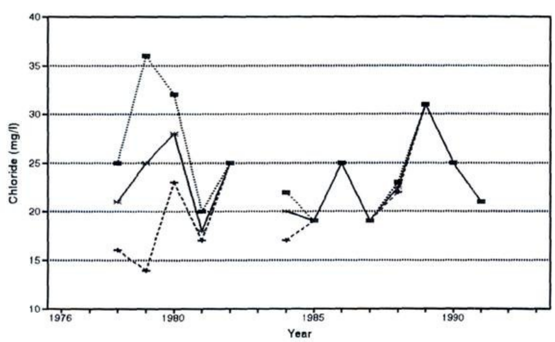

Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.
Values graphed at 5.0 ug/l were indicated to be less than 5.0 ug/l.




Note: The acute standard of 408.6 was not violated in any year.
Values graphed at 50 ug/l prior to 1988 were indicated to be less than 50 ug/l and values graphed at 5.0 ug/l after 1988 were indicated to be less than 5.0 ug/l.




Note: The acute standard of 202.9 ug/l was not violated in any year.




Note: The maximum standard of 1000 mg/l was not violated in any year.

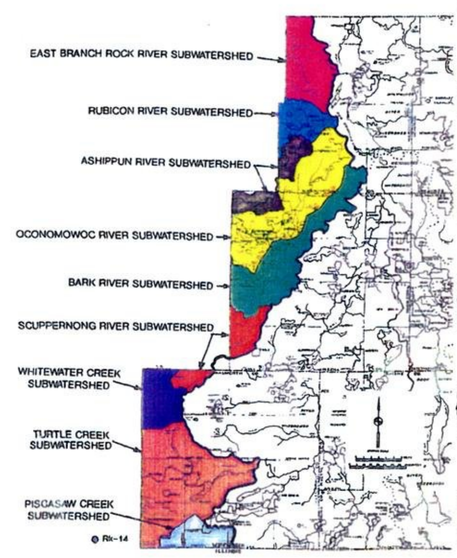
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

SUBWATERSHEDS IN THE ROCK RIVER WATERSHED

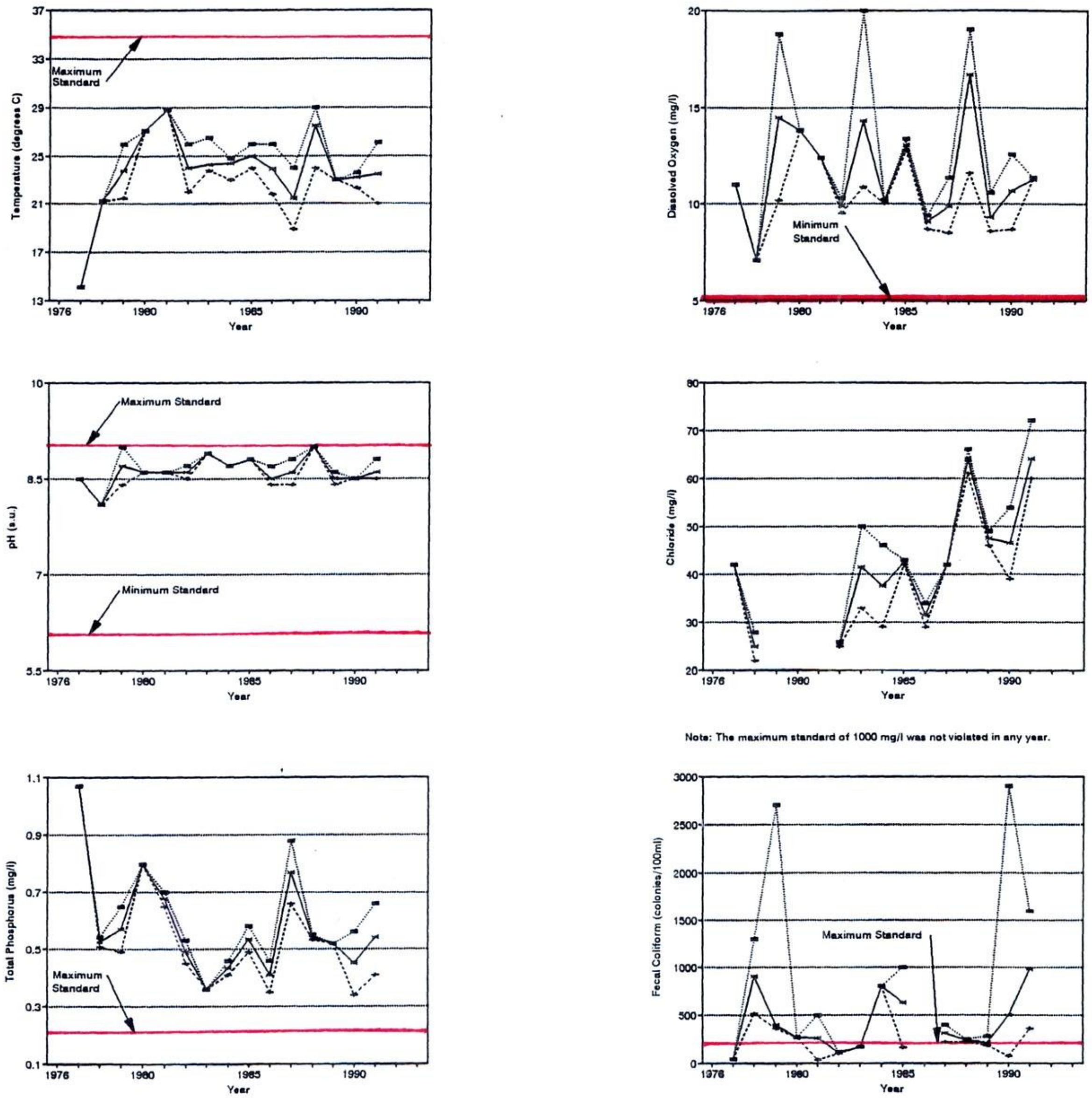



Note: Graphs indicate maximum, minimum and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

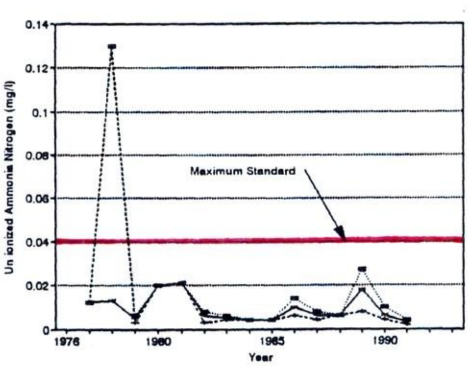
Source: U.S. Geological Survey and SEWRPC.

Figure XII-2

# WATER QUALITY DATA FOR THE ROCK RIVER AT STATION Rk-15: 1976-1993




Note: The maximum standard of 1000 mg/l was not violated in any year.



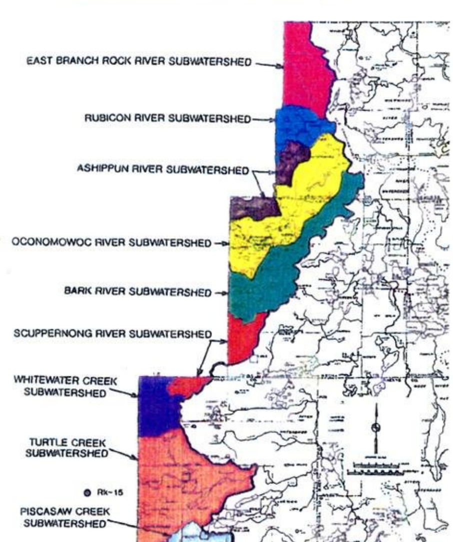

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

SUBWATERSHEDS IN THE ROCK RIVER WATERSHED




Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Wisconsin Department of Natural Resources and SEWRPC.

standard was reported. No recent data were available on toxic and hazardous substances for station Rk-15.

Since the completion of the initial water quality management plan, seven spills of toxic substances into streams within the Rock River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, three have occurred in the Bark River, two in the Ashippun River, and one each in the East Branch of the Rock River and the Rubicon River. The majority of the spills were of oil or diesel fuel.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Rock River and its major tributaries were assessed, with the results set forth in Table XII-14. Where data were available, fish populations and diversity range from poor in the Kohlsville River to generally good elsewhere, except for Whitewater Creek, Jackson Creek, Swan Creek, and Turtle Creek upstream of Comus Lake, where the populations and diversities are fair. Bluff Creek upstream of CTH P supports a Class I trout fishery; and the remaining portion of Bluff Creek and portions of Allenton Creek, Steel Brook Creek, and the Scuppernong River support Class II trout fisheries. Class III trout fisheries are supported by portions of the Scuppernong River and Steel Brook Creek.

Fish kills were documented in four streams in the Rock River watershed--Scuppernong River, Steel Brook Creek, Darien Creek, and the East Branch of the Rock River. The specific cause of each documented fish kill is shown in Table XII-14.

Standards were not fully met for dissolved oxygen concentrations in the Rubicon River, the East Branch of the Rock River, Kohlsville River, Whitewater Creek, the Oconomowoc River downstream of US 16, and along portions of the Bark and Ashippun Rivers. Ammonia nitrogen levels were within acceptable limits in those streams of the watershed for which data were available, except for portions of the Rubicon River downstream of Pike Lake and in the Oconomowoc River downstream of US 16 to Fowler Lake. For all streams where data were available, phosphorus levels did not appear to pose problems in any of the stream reaches, while fecal coliform levels appeared to generally exceed the standard.

No comprehensive data were available on toxic pollutants, with the exception of some evidence of nonpoint source toxic pollutants occurring in the Ashippun River downstream of the Waukesha County Line, in two tributaries of the Oconomowoc River, and in portions of the Rubicon River. Additional data collected by the U.S. Geological Survey at station Rk-14 on the Rock River at Rockton, Illinois, indicate that the standards for chronic toxicity, as defined in Chapter II, for zinc, and cadmium were consistently violated.

The biotic index ratings, which are biological indicators of water quality within a stream system, ranged from good to excellent within the Oconomowoc River subwatershed, except for the Oconomowoc River upstream of Friess Lake, which had a good to fair rating. In the rest of the watershed, no data were available to determine biotic index ratings. Low to moderate levels of streambed sedimentation were observed throughout the watershed, with moderate to high and high levels of streambed sedimentation occurring in Turtle Creek.

Table XII-14

CHARACTERISTICS OF STREAMS IN SUBWATERSHEDS WITHIN THE ROCK RIVER WATERSHED

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation Substrate | Physical Modifications to Channel[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| **ASHIPPUN RIVER** | | | | | | | | | | | |
| a. Ashippun River upstream Druid Lake | 4.3 | -- | No | -- | -- | -- | -- | -- | -- | -- | -- |
| b. Ashippun River downstream Druid Lake to Washington County Line | 5.2 | -- | No | -- | -- | -- | -- | -- | -- | -- | -- |
| c. Ashippun River downstream Waukesha County Line to Ashippun Lake inflow | 7.2 | -- | No | Yes | No | -- | -- | Yes | -- | -- | Moderate |
| d. Ashippun River downstream Ashippun Lake inflow | 4.2 | -- | No | -- | -- | -- | -- | -- | -- | -- | Moderate |
| TOTAL | 20.9 | | | | | | | | | | |
| **BARK RIVER** | | | | | | | | | | | |
| a. Bark River upstream Nagawicka Lake | 19.3 | Good | No | No | -- | No | No | -- | -- | Moderate (sand, gravel, silt) | Moderate |
| b. Bark River downstream Nagawicka Lake | 12.3 | Good | No | Yes | No | No | No | -- | -- | Unkown deposition (sand, gravel, rubble) | Moderate |
| c. Scuppernong Creek | 12.5 | Good | No | No | No | No | No | -- | -- | Low to Moderate (sand, gravel, silt) | Major |
| TOTAL | 44.1 | | | | | | | | | | |
| **OCONOMOWOC RIVER** | | | | | | | | | | | |
| a. Coney River | 6.2 | -- | -- | No | No | -- | -- | Yes | -- | -- | Major |
| b. Oconomowoc River u/s Friess Lake | 2.8 | -- | No | No | No | -- | -- | -- | Good to Fair | -- | -- |
| c. Oconomowoc River d/s Friess Lake to North Lake | 15.2 | -- | No | No | No | -- | -- | -- | Good | -- | Moderate |
| d. Oconomowoc River d/s North Lake to Okauchee Lake | 1.8 | -- | No | No | No | -- | -- | -- | Good | -- | -- |
| e. Oconomowoc R. d/s Okauchee Lake to Oconomowoc Lake | 0.4 | -- | No | No | No | -- | -- | -- | -- | -- | -- |
| f. Oconomowoc River d/s US 16 to Fowler Lake | 1.7 | -- | -- | Yes | Yes | -- | -- | -- | -- | -- | -- |
| g. Oconomowoc R. d/s Lac La Belle to Waukesha Co. Line | 5.0 | -- | -- | Yes | No | -- | -- | -- | -- | -- | -- |
| h. Little Oconomowoc River | 5.7 | -- | -- | No | No | -- | -- | -- | Excellent | -- | -- |
| i. Mason Creek | 6.5 | -- | -- | -- | -- | -- | | Yes | Very good to good | -- | -- |
| TOTAL | 45.3 | | | | | | | | | | |
| **PISCASAW CREEK** | | | | | | | | | | | |
| a. Piscasaw Creek | 2.5 | -- | No | -- | -- | -- | -- | -- | -- | -- | Moderate |

Table XII-14 (continued)

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] | | | | | Biotic Index Rating[d] | Streambed Sedimentation Substrate | Physical Modifications to Channel[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| **ROCK RIVER EAST BRANCH** | | | | | | | | | | | |
| a. East Branch Rock River downstream CTH D | 4.4 | -- | No | Yes | No | -- | -- | -- | -- | -- | -- |
| b. Limestone Creek | 5.8 | Good | No | Yes | -- | -- | Yes | -- | -- | -- | Low |
| c. East Branch Rock River upstream CTH D | 14.3 | -- | Yes | Yes | No | -- | -- | -- | -- | Moderate | -- |
| d. Allenton Creek | 3.4 | Good[g] | No | No | No | -- | -- | -- | -- | Moderate | Moderate |
| e. Kohlsville River | 10.2 | Poor | No | Yes | -- | -- | -- | -- | -- | -- | -- |
| f. Wayne Creek | 6.5 | Good | No | -- | -- | -- | -- | -- | | Low (gravel) | Moderate |
| TOTAL | 44.6 | | | | | | | | | | |
| **RUBICON RIVER** | | | | | | | | | | | |
| a. Rubicon River upstream Pike Lake | 2.8 | -- | No | Yes | No | No | No | -- | -- | Moderate | Major |
| b. Rubicon River d/s Pike Lake | 5.0 | -- | No | Yes | Yes | No | No | Yes | -- | Moderate | Moderate |
| TOTAL | 12.6 | | | | | | | | | | |
| **SCUPPERNONG RIVER** | | | | | | | | | | | |
| a. Scuppernong River | 14.9 | Good[h] | Yes | No | No | -- | -- | -- | -- | Low to moderate (sand, gravel, silt) | Moderate (upper) |
| b. Steel Brook Creek | 7.1 | Good[i] | Yes[j] | -- | -- | -- | -- | -- | -- | -- | -- |
| TOTAL | 22.0 | | | | | | | | | | |
| **TURTLE CREEK** | | | | | | | | | | | |
| a. Jackson Creek | 5.7 | Fair | No | No | No | No | Yes | -- | -- | Moderate | -- |
| b. Swan Creek | 4.2 | Fair | No | No | No | No | No | -- | -- | Low | -- |
| c. Turtle Creek upstream Comus Lake | 10.2 | Fair | No | No | No | No | No | -- | -- | High | Moderate |
| d. Turtle Creek downstream Comus Lake to STH 11 | 3.3 | Fair-good | No | No | No | No | No | -- | -- | Moderate to high | -- |
| e. Turtle Creek downstream STH 11 to Walworth County Border | 7.1 | Fair-good | No | No | No | No | No | -- | -- | Moderate to high | -- |
| f. Little Turtle Creek + Ladd Creek | 8.6 | Fair | No | No | No | No | Yes | -- | -- | -- | Moderate |
| g. Darien Creek | 8.8 | -- | Yes[k] | No | No | No | Yes | -- | -- | Unknown Deposition | -- |
| h. Sharon Creek | 2.1 | -- | No | -- | -- | -- | -- | -- | -- | -- | -- |
| TOTAL | 50.0 | | | | | | | | | | |

Table XII-14 (continued)

| SUBWATERSHED Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills[b] | Water Quality Problems[c] DO | $NH_3$ | Total P | Fecal Coliform | Toxics | Biotic Index Rating[d] | Streambed Sedimentation Substrate | Physical Modifications to Channel[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **WHITEWATER CREEK** | | | | | | | | | | | |
| a. Whitewater Creek | 10.2 | Fair | No | Yes | No | -- | -- | -- | -- | -- | -- |
| b. Bluff Creek | 1.9 | Good[l] | No | -- | -- | -- | -- | -- | -- | -- | -- |
| c. Galloway Creek | 1.4 | -- | No | -- | -- | -- | -- | -- | -- | -- | -- |
| TOTAL | 13.5 | | | | | | | | | | |

[a]Based upon available dates and professional judgement of area fish managers.

[b]Unless otherwise noted, fish kills are assumed to be the result of natural fluctuations in water conditions.

[c]Estimated violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for Rock River watershed stream reaches based upon year 2000 land use conditions, and if data developed in the initial plan were used to evaluate current water quality for Rock River watershed stream reaches based upon year 2000 land use conditions, and if appropriate, were applied using less than a 95 percent compliance level of the dissolved oxygen and un-ionzed ammonia nitrogen standards and less than a 90 percent compliance level for the fecal coliform and phosphorus standards as an indication of water quality problems.

[d]Except where otherwise indicated, biotic index ratings are based upon the Index of Biotic Integrity (IBI) discussed in U.S. Department of Agriculture, Forest Service, General Technical Report NC-149, "Using the Index of Biotic Integrity (IBI) To Measure Environmental Quality in Warmwater Streams of Wisconsin," Lyons, April 1992.

[e]Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

[f]Biotic index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in Wisconsin Department of Natural Resources Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality in Streams," Hilsenhoff, 1982.

[g]Allenton Creek is a Class II trout stream.

[h]Scuppernong River from above CTH N downstream to Scuppernong Springs Pond is a Class II trout stream. Scuppernong River downstream of Scuppernong Springs Pond is a Class III trout stream.

[i]Steel Brook Creek is a Class II trout stream upstream of Bluff Road and a Class III trout stream downstream of Bluff Road.

[j]Spill potentially related to a fertilizer spill.

[k]Due to point source discharge from canning plant.

[l]Bluff Creek is a Class I trout stream upstream of CTH P and a Class II trout stream downstream of CTH P.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XII-15 sets forth the water quality index classifications[26] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table XII-14, recent data were available only for stations Rk-14 and Rk-15. These stations are shown on Map XII-5. The limited data available indicate that at station Rk-14, water quality conditions have improved from "fair" to "good" from 1978-79 to 1990-91 and at station Rk-15, water quality conditions have maintained a "fair" rating from 1977-78 to 1990-91. As noted earlier, these stations may not be representative of water quality conditions in the subwatersheds located within Southeastern Wisconsin since relatively large subwatersheds from outside the Region are tributary to the station locations. However, the data and the quality indices are presented for information purposes.

A summary of potential pollution sources in the Rock River watershed by stream reach is shown in tabular summary in Table XII-16. Review of the data indicate a majority of the conversion of lands from rural to urban uses has occurred in the Oconomowoc and Bark River subwatersheds, primarily in the northwest portion of Waukesha County. It should also be noted that the majority of the permitted industrial discharges occur in streams in the Turtle Creek subwatershed. Data on nonpoint source pollution, public and private sewage treatment plants discharging to surface waters, and additional potential impacts to surface water quality are included in Table XII-16.

<u>Lakes</u>
Lake water quality data available for use in preparing the initial regional water quality management plan were obtained from the Wisconsin Department of Natural Resources' quarterly lake monitoring program for selected lakes; U.S. Environmental Protection Agency (EPA) National Eutrophication Survey and Southeastern Wisconsin Regional Planning Commission and Wisconsin Department of Natural Resources lake use reports. Post-1975 data on phosphorus and chlorophyll-<u>a</u> concentrations and water clarity for major lakes in the Rock River watershed, where available are presented in Table XII-17.

<u>Toxic and Hazardous Substances</u>: A number of lakes in this watershed were subject to substance spills. These included an hydraulic fluid spill into Fowler Lake in 1982, two diesel oil spills into Lower Nemahbin Lake in 1982 and 1990; two oil and one diesel fuel spills into Okauchee Lake in 1983 and 1991, respectively; a spill of an unknown substance into North Lake in 1984; and a gasoline and hydraulic oil spill in Pretty Lake in 1982 and 1986, respectively--but these appear to be isolated incidences that do not warrant special planning consideration at this time.

Fish kills, primarily related to seasonal fluctuations in water temperature and levels of dissolved oxygen, as well as spawning activity periodically occur in lakes in the Rock River watershed. Since the initial plan, recorded fish kills in major lakes in the Rock River watershed occurred in Okauchee Lake in 1981 and 1985, Delavan Lake in 1990, and Pine Lake in 1984. However, these occurrences do not appear to be chronic. Thus, despite the obvious concern that these

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[26]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, <u>Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975</u>, June 1978.

Table XII-15

WATER QUALITY INDEX CLASSIFICATIONS[a] FOR THE SAMPLING STATIONS OF THE ROCK RIVER WATERSHED 1964, 1974-1975, AND 1990-91

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Rk-1 | Excellent | Fair | -- |
| Rk-2 | Excellent | Fair | -- |
| Rk-3 | Excellent | Fair | -- |
| Rk-4 | Fair | Fair | -- |
| Rk-5 | Good | Fair | -- |
| Rk-6 | Excellent | Fair | -- |
| Rk-7 | Good | Excellent | -- |
| Rk-8 | Fair | Fair | -- |
| Rk-9 | Good | Fair | -- |
| Rk-10 | Fair | Fair | -- |
| Rk-11 | Poor | Poor | -- |
| Rk-12 | Good | Fair | -- |
| Rk-13 | Fair | Fair | -- |
| Watershed Average | Good | Fair | -- |
| Sampling Stations Outside of Region | | | |
| Rk-14 | -- | Fair[b] | Good |
| Rk-15 | -- | Fair[c] | Fair |

[a]See Map XII-5 for sampling station locations.

[b]Water quality index calculated from July and August 1978-1979.

[c]Water quality index calculated from July and August 1977-1978.

Source: SEWRPC.

Table XII-16

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE ROCK RIVER WATERSHED: 1990

| SUBWATERSHED Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| ASHIPPUN RIVER Ashippun River upstream Druid Lake | Insignificant | Insignificant | 1987-blue chemical | -- | X | -- | -- | -- | -- | | 1 |
| Ashippun River downstream Druid Lake | Moderate | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| Ashippun River downstream Waukesha County Line to Ashippun Lake inflow | Insignificant | Insignificant | 1986-diesel fuel | -- | X | -- | -- | -- | -- | -- | 1 |
| Ashippun River downstream Ashippun Lake inflow | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| BARK RIVER Bark River upstream Nagawicka Lake | Moderate | Significant | 1984-oil 1984-waste oil | X | X | -- | -- | 1 | -- | Village of Hartland public sewage treatment plant abandoned in 1980. | 1 |
| Bark River downstream Nagawicka Lake | Significant | Insignificant | 1986-drums | X | X | 2 | -- | 1 | -- | St John's private sewage treatment plant abandoned in 1980. | 1 |
| Scuppernong Creek | Moderate[d] | Significant | -- | X | X | -- | -- | -- | -- | -- | 1 |
| OCONOMOWOC RIVER Coney River | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 2,3 |
| Oconomowoc River Upstream Friess Lake | Moderate[d] | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 2,3 |
| Oconomowoc River Downstream Friess Lake to North Lake | Significant | Insignificant | -- | -- | X | -- | -- | 1 | -- | -- | 2,3 |
| Oconomowoc River Downstream North Lake to Okauchee Lake | Insignificant | Significant | -- | X | X | -- | -- | -- | -- | -- | 1,2,3 |

Table V-16 (continued)

| SUBWATERSHED Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Oconomowoc River Downstream Okauchee Lake to Oconomowoc Lake | Significant[e] | Insignificant[e] | -- | X | X | -- | -- | -- | -- | -- | 1,2,3 |
| Oconomowoc River Downstream US 16 to Fowler Lake | Insignificant | Significant | -- | X | X | -- | -- | -- | -- | -- | 1,2,3 |
| Oconomowoc River Downstream Lac La Belle to Waukesha County Line | Significant | Significant | -- | X | X | 1 | -- | 3 | -- | -- | 1,2,3 |
| Little Oconomowoc River | Significant[d] | Insignificant | -- | X | X | -- | -- | -- | -- | -- | 1,2,3 |
| Mason Creek | Significant[d] | Insignificant | -- | X | X | -- | -- | -- | -- | -- | 1,2,3 |
| PISCASAW CREEK Piscasaw Creek | Insignificant | Insignificant | -- | -- | X | 1 | -- | 1 | -- | Village of Walworth public sewage treatment plant replaced in 1986 | 1 |
| ROCK RIVER EAST BRANCH East Branch Rock River Downstream CTH D | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| Limestone Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| East Branch Rock River Upstream CTH D | Insignificant | Insignificant | 1991-diesel fuel | X | X | 1 | -- | 1 | -- | -- | 1 |
| Allenton Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| Kohlsville River | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| Wayne Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| RUBICON RIVER Rubicon River Upstream Pike Lake | Moderate | Significant | -- | X | X | 1 | -- | -- | -- | -- | 1 |
| Rubicon River Downstream Pike Lake | Insignificant | Significant | 1991-hydraulic oil | X | X | 1 | -- | 3 | -- | -- | 1,4 |
| SCUPPERNONG RIVER Scuppernong River | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| Steel Brook Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |

Table V-16 (continued)

| SUBWATERSHED Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| TURTLE CREEK Jackson Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | 6 | -- | City of Elkhorn public sewage treatment plant abandoned in 1981 Walworth County Institutions private sewage treatment plant abandoned in 1981 | 1,2,3 |
| Swan Creek | Significant | Significant | -- | X | X | -- | -- | 1 | -- | -- | 1,2,3 |
| Turtle Creek Upstream Comus Lake | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | | 1,2,3 |
| Turtle Creek Downstream Comus Lake to STH 11 | Insignificant | Insignificant | -- | X | X | 1 | -- | 1 | Delavan Municipal Well No. 4 | City of Delavan public sewage treatment plant abandoned in 1981 | 1,2,3 |
| Turtle Creek Downstream STH 11 | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1,2,3 |
| Little Turtle Creek and Ladd Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| Darien Creek | Insignificant | Insignificant | -- | X | X | 1 | -- | 3 | -- | -- | 1,4 |
| Sharon Creek | Insignificant | Insignificant | -- | -- | X | 1 | -- | 1 | -- | -- | 1 |
| WHITEWATER CREEK Whitewater Creek | Insignificant | Insignificant | -- | X | X | 1 | -- | 2 | -- | -- | 1 |
| Bluff Creek | Insignificant | Insignificant | -- | -- | X | -- | -- | -- | -- | -- | 1 |
| Galloway Creek | Insignificant | Insignificant | -- | X | X | -- | -- | -- | -- | -- | 1 |

[a] Includes the tributary drainage area of each stream reach.
[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c] Letter codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place; 2 - Urban Nonpoint Source Controls Implemented; 3 - Rural Nonpoint Source Controls Implemented; 4 - Sewage Treatment Plant Upgrading or Abandonment Underway

[d] Considerable urban development existing pre-1976.
[e] The amount of post-1976 urban development has increased significantly in comparison to pre-1976 urban development.

Source: Wisconsin Department of Natural Resources and SEWRPC.

episodes create among lake users, they do not appear to warrant special planning considerations at this time.

Water Quality Assessments: Data from Table XII-17 were used in the calculation of trophic state indices for each of the major lakes where data were available. Trophic states, indicating degrees of nutrient enrichment in the lakes, were assigned using the Wisconsin Trophic State Index[27] for each major lake in the Rock River watershed where data were available, as indicated in Table XII-18. The available trophic state index values using the Carlson Trophic State Index are also provided for current and historic conditions, as shown in Table XII-19. These data are presented using the Carlson Trophic State Index in order to present the newer data on a comparable basis to the historic data which used that Index.

The data available, as shown in Table XII-18, indicate that all of the lakes may be classified in the mesotrophic to eutrophic range. Mesotrophic lakes have moderate levels of nutrient enrichment, whereas, eutrophic lakes are nutrient-rich lakes. Crooked, Lower Nashotah, Lower Nemahbin, Nagawicka, Upper Nemahbin, Fowler, Keesus, Lac La Belle, North, Oconomowoc, and Okauchee Lakes are all drainage lakes in the mesotrophic range. Golden, Pretty, Beaver, Lower Genesee, Middle Genesee, Moose, Pine, and Silver Lakes and Lake Five are mesotrophic seepage lakes; and Ashippun, Bark, School Section, Upper Nashotah, Pike, and Turtle Lakes are mesotrophic drained lakes.

Druid, Friess, Comus, Delavan, Cravath, Rice, and Tripp Lakes are all drainage lakes classified in the eutrophic range. Whitewater Lake is classified as an eutrophic drained lake. No current data are available to make assessments of trophic status for Hunters Lake, La Grange Lake, or Lake Lorraine, all seepage lakes, or for Waterville Pond, a drainage lake.

No conclusions regarding changes in water quality conditions between 1976 and 1991 can be drawn based on the limited data available. However, based upon the data set forth in Table XII-19, water quality does not appear to have changed significantly despite considerable urbanization in this watershed. Slight improvements in water quality in fact may have occurred in Druid Lake, Golden Lake, Upper Nashotah Lake, and Lake Keesus.

In addition, periodic fish kills primarily related to seasonal fluctuations in water temperature and levels of dissolved oxygen, as well as spawning activity, have occurred on Pine Lake in 1984, Okauchee Lake in 1985, and Whitewater Lake in 1986. A fish kill related to an herbicide application occurred on Okauchee Lake in 1981. A fish kill related to lake management activities on Delavan Lake occurred in August 1990. These occurrences do not appear to be chronic. Thus, despite the obvious concern that these episodes create among lake users, they do not appear to warrant special planning considerations at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Rock River watershed as of 1993, are generally recommended for warmwater sport fish and full recreational uses. These water use objectives and associated water quality

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[27]The Wisconsin State Index is set forth in "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," R.A. Lillie et al, Research Management Findings, No. 35, May 1993.

Table XII-17

WATER QUALITY OF THE MAJOR LAKES IN THE ROCK RIVER WATERSHED

| SUBWATERSHED Lake Name | Area (acre) | Total Phosphorus (mg/l) | | | | | Chlorophyll-a (µg/l) | | | | | Secchi Disk (feet) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] |
| **ASHIPPUN RIVER** | | | | | | | | | | | | | | | | |
| Ashippun Lake | 84 | 0.13 | 0.01 | 0.03(140) | 1973-79 | LSF,ERA | 28.26 | 5.28 | 16.77(2) | 1976 | LSF | 14.25 | 3.25 | 6.97(30) | 1989-92 | SELF-HELP |
| Druid Lake | 124 | 0.44 | 0.02 | 0.13(24) | 1973-75 | LSF | -- | -- | -- | -- | -- | 10.25 | 8.75 | 9.5(6) | 1992 | SELF-HELP |
| **BARK RIVER** | | | | | | | | | | | | | | | | |
| Bark Lake | 65 | 0.16 | 0.03 | 0.07(3) | 1979 | LSF | 8.0 | 5.4 | 6.7(2) | 1980 | LSF | -- | -- | 9.5(1) | 1980 | LSF |
| Crooked Lake | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- | | 12.0 | 4.0 | 7.6(20) | 1988-89 | SELF-HELP |
| Golden Lake | 250 | 0.10 | <0.01 | 0.03(26) | 1973-75 | LSF | -- | -- | 3.0(1) | 1980 | LSF | 14 | 9.5 | 11.7(13) | 1989,92 | SELF-HELP |
| Hunter's Lake | 65 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Lower Nashotah Lake | 90 | 0.12 | <0.01 | 0.04(9) | 1980 | AquaTech | 5.8 | 2.8 | 4.6(7) | 1980-81 | AquaTech | 22 | 4.75 | 11.8(8) | 1987-89 | SELF-HELP |
| Lower Nemahbin Lake | 271 | 0.85 | <0.01 | 0.09(26) | 1973-75 | LSF | -- | -- | 6.0(1) | 1980 | LSF | 12 | 8.2 | 8.2(21) | 1988-89 | SELF-HELP |
| Nagawicka Lake | 957 | 0.20 | 0.01 | 0.04(75) | 1986-87 | LTT | 17.0 | 2.0 | 8.6(22) | 1986-87 | LTT | 19.7 | 4.9 | 10.1(49) | 1986-87 | LTT |
| Pretty Lake | 64 | 0.03 | <0.01 | 0.02(13) | 1974-80 | LSF | 5.2 | 1.6 | 3.4(2) | 1979-80 | LSF | 23.0 | 6.0 | 11.71(7) | 1989 | SELF-HELP |
| School Section Lake | 125 | 0.04 | 0.01 | 0.02(10) | 1979-80 | LSF | -- | -- | 7.0(1) | 1980 | STORET | 8.0 | 4.5 | 5.37(33) | 1987-91 | SELF-HELP |
| Upper Nashotah Lake | 133 | 0.31 | <0.01 | 0.03(25) | 1973-75 | LSF | -- | -- | -- | -- | -- | 11.0 | 4.25 | 8.75(3) | 1988-89 | SELF-HELP |
| Upper Nemahbin Lake | 283 | 0.49 | <0.01 | 0.07(35) | 1973-79 | LSF | -- | -- | 4.0(1) | 1980 | STORET | 14.0 | 3.75 | 8.73(23) | 1986-88 | SELF-HELP |
| Waterville Pond | 68 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **OCONOMOWOC RIVER** | | | | | | | | | | | | | | | | |
| Beaver Lake | 316 | 0.06 | 0.01 | 0.03(26) | 1973-75 | LSF | -- | -- | -- | -- | -- | 12.5 | 5.0 | 9.2(10) | 1973-75 | LSF |
| Lake Five | 102 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 13.75 | 5.25 | 8.18(15) | 1991-92 | SELF-HELP |
| Fowler Lake | 78 | 0.23 | 0.003 | 0.03(89) | 1984-91 | USGS | 6.0 | <0.10 | 1.85(31) | 1984-90 | USGS | 24.9 | 5.9 | 12.2(18) | 1987-90 | USGS |
| Friess Lake | 119 | 0.40 | 0.015 | 0.105(69) | 1986-87 | LTT | 69.0 | 2.0 | 22.0(22) | 1986-87 | LTT | 16.1 | 1.8 | 6.5(70) | 1986-87 | LTT |
| Lake Keesus | 237 | 0.49 | 0.01 | 0.045(8) | 1991-92 | USGS | 9.0 | 3.0 | 6.0(8) | 1991-92 | USGS | 10.5 | 6.6 | 8.4(8) | 1991-92 | USGS |
| Lac La Belle | 1117 | 0.40 | 0.01 | 0.015(43) | 1986-89 | LTT | 12.0 | 2.0 | 6.0(40) | 1986-89 | LTT | 16.4 | 4.5 | 7.7(127) | 1986-89 | LTT |
| Lower Genesee Lake | 66 | 0.05 | 0.02 | 0.035(2) | 1974 | LSF | -- | -- | 3.0(1) | 1980 | STORET | 20.25 | 6.5 | 12.2(4) | 1987 | STORET |
| Middle Genesee Lake | 102 | 0.03 | 0.02 | 0.025(2) | 1974 | LSF | -- | -- | 3.0(1) | 1980 | STORET | -- | -- | 7.2(1) | 1980 | STORET |
| Moose Lake | 81 | 0.04 | 0.01 | 0.018(4) | 1979 | LSF | -- | -- | -- | -- | -- | 9.0 | 7.0 | 8.0(2) | 1979 | DNR |
| North Lake (Waukesha) | 437 | 0.26 | 0.01 | 0.06(55) | 1973-75 | LSF | 14.0 | 6.0 | 10.0(2) | 1980 | STORET | 21.5 | 4.0 | 11.48(119) | 1986-92 | SELF-HELP |
| Oconomowoc Lake | 767 | 0.12 | <0.001 | 0.02(82) | 1986-92 | USGS | 6.0 | 1.0 | 2.67(33) | 1986-90 | USGS | 22.25 | 5.0 | 10.64(181) | 1986-92 | SELF-HELP |
| Okauchee Lake | 1187 | 0.23 | <0.005 | 0.02(123) | 1986-91 | USGS | 15.0 | 3.0 | 5.68(77) | 1986-90 | USGS | 14.11 | 3.94 | 6.92(91) | 1986-90 | USGS |
| Pine Lake | 703 | 0.36 | 0.017 | 0.076(39) | 1978-81 | STORET | 13.0 | 3.0 | 5.0(32) | 1978-81 | STORET | 18.0 | 5.91 | 10.21(45) | 1979-81 | STORET |
| Silver Lake (Wauk.) | 222 | 0.12 | <0.01 | 0.02(36) | 1973-92 | LSF | -- | -- | 4.0(1) | 1980 | STORET | -- | -- | 10.54(6) | 1991 | SELF-HELP |
| **RUBICON RIVER** | | | | | | | | | | | | | | | | |
| Pike Lake | 522 | 0.83 | 0.01 | 0.052(96) | 1985-87 | LTT | 22 | 4.8 | 11.3(26) | 1985-87 | LTT | 33 | 2.6 | 7.5(67) | 1985-87 | LTT |
| **SCUPPERNONG RIVER** | | | | | | | | | | | | | | | | |
| La Grange Lake | 55 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Table XII-17 (continued)

| SUBWATERSHED Lake Name | Area (acre) | Total Phosphorus (mg/l) | | | | | Chlorophyll-a (µg/l) | | | | | Secchi Disk (feet) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] | Maximum | Minimum | Average[a] | Date of Data | Source[b] |
| **TURTLE CREEK** | | | | | | | | | | | | | | | | |
| Comus Lake | 117 | 0.24 | 0.04 | 0.10(11) | 1977-79 | LSF | -- | -- | 95(1) | 1977 | LSF | 2.7 | 0.5 | 1.7(6) | 1977-79 | LSF |
| Delavan Lake | 2072 | 3.30 | 0.007 | 0.16(641) | 1983-89 | USGS | 300 | 0.2 | 24.33(91) | 1987-90 | USGS | 27.5 | 0.5 | 7.73(114) | 1986-92 | SELF-HELP |
| Turtle Lake | 140 | 0.19 | <0.01 | 0.06(5) | 1974-78 | LSF | -- | -- | 6(1) | 1980 | STORET | -- | -- | 33.47(1) | 1980 | STORET |
| **WHITEWATER CREEK** | | | | | | | | | | | | | | | | |
| Cravath Lake | 65 | 0.61 | 0.24 | 0.45(3) | 1966-73 | UWW,LSF | -- | -- | -- | -- | -- | -- | -- | 1.05(--) | 1973 | UWW |
| Lake Lorraine | 133 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Rice Lake | 137 | 0.05 | 0.04 | 0.045(2) | 1974 | LSF | 170.0 | 57.0 | 113.5(2) | 1980-81 | STORET | 10.5 | 1.0 | 3.82(28) | 1988-92 | SELF-HELP |
| Tripp Lake | 115 | 0.15 | 0.15 | 0.15(3) | 1966-73 | UWW,LSF | -- | -- | -- | -- | -- | -- | -- | 3.21(--) | 1973 | UWW |
| Whitewater Lake | 640 | 0.15 | 0.018 | 0.039(51) | 1986-87 | LTT | 67.0 | 12 | 29.3(16) | 1986-87 | LTT | 6.6 | 1.5 | 3.2(63) | 1986-87 | LTT |

[a] Number in parentheses refers to number of samples taken.

[b] The following sources were cited:

AquaTech......Water Quality Monitoring Reports by AquaTech Inc.
DNR...........Department of Natural Resources
LSF...........WI Department of Natural Resources, Lake Survey Forms
LTT...........Long Term Trends Lake Monitoring Program Data: 1985-1987
SELF-HELP.....Wisconsin Self-Help Lake Monitoring Program Data: 1986-1988
STORET........U.S. EPA Water Information Storage and Retrieval System
USGS..........U.S. Geological Survey, Water Resources Data - Wisconsin (annual)
UWW...........UW-Whitewater, W.L. Gross et al., "The Ecology of Tripp and Cravath Lakes with Recommendations for Management", 1974

Source: SEWRPC.

standards are discussed in Chapter II. The Scuppernong River, Steel Brook Creek, Bluff Creek, Mason Creek, Allenton Creek, and portions of the Kohlsville River, Scuppernong Creek, and Whitewater Creek are recommended for coldwater fish and full recreational uses because of their potential to support trout populations. Bluff Creek upstream of CTH P has been designated as a Class I trout stream, and the remaining portion of Bluff Creek and portions of Allenton Creek, Steel Brook Creek, and Scuppernong River are designated as Class II trout streams. Class III trout stream designations have been given to portions of the Scuppernong River and Steel Brook Creek. Wayne, Little Turtle, Spring Brook, Galloway, Ladd Creek, Darien Creek, Sharon Creek, a portion of Limestone Creek, and the Rubicon River, in addition to the Little Oconomowoc River and the Oconomowoc River downstream of Friess Lake, have limitations for sport fish habitat and are recommended for warmwater forage fish and full recreational uses. The remaining streams are recommended for warmwater sport fish and full recreational uses. In addition, as noted in Chapter II, Bluff Creek in Walworth county is designated as an "Outstanding Resource Water" and the Oconomowoc River from North Lake to Okauchee Lake, in Waukesha County, is designated as an "Exceptional Resource Water".

Based upon the available data for sampling stations in the watershed, the majority of the Rock River tributaries in the Region did not fully meet water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. Based upon a review of the water quality data available and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that some water quality improvements have been made in most of the stream reaches. However, it is likely that, in general, fecal coliform and phosphorus standards are not met in most stream reaches and the dissolved oxygen standards are not met in a limited number of stream reaches. However, the recommended water use objectives are likely to be met in the Scuppernong and Kohlsville Rivers, and in Allenton, Steel Brook, Mason, and Bluff Creeks, based upon the observed uses in those streams. The recommended water use objectives may potentially also be met in portions of the Bark River, Turtle Creek, and Oconomowoc River systems downstream of major lakes since the only major point sources have been removed and since the lakes serve to remove pollutants by sedimentation.

There are currently three stream for which the water use objectives set forth herein are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. Chapter NR 104 classifies the Rubicon River upstream of the confluence with a tributary in U. S. Public Land Survey Section 13, Township 10 North, Range 18 East, Town of Hartford, as capable of supporting only a limited aquatic life community and downstream of the tributary as supporting a limited forage fish community. The objectives set forth herein recommend a warmwater forage fish community upstream of Hilldale Road, about 0.4 mile downstream of the aforementioned tributary confluence, and a warmwater sport fish community downstream of Hilldale Road. Darien Creek and Sharon Creek in Walworth County are classified as capable of supporting a limited forage fish community and limited aquatic life community, respectively. The objectives set forth herein recommend a warmwater forage fish objective for both streams. All three streams are recommended for upgrading in the Upper Rock River Basin Plan.[28] It is recommended that further stream appraisals for the Rubicon River, Darien Creek, and Sharon Creek be conducted by the DNR staff as part of the next one-year monitoring period envisioned to be carried out in the Rock River watershed.

The waters of the lakes in the Rock River watershed are all recommended for the maintenance of a warmwater sport fishery and full recreational use. The twenty-one lakes for which complete water quality data were available between 1965 and 1975--Ashippun, Beaver, Delavan, Druid, Fowler, Friess, Golden, Keesus, La Belle, Upper and Lower Nashotah, Upper and Lower Nemahbin, Nagawicka, North, Oconomowoc, Okauchee, Pike, Pine, Silver-Waukesha, and Whitewater Lakes--violated the 0.02 mg/l standard for total phosphorus, and Nagawicka Lake violated the 5 mg/l dissolved oxygen standard, recommended by the Commission, on at least one occasion between 1965 and 1975. Modeling data developed in the initial plan indicated that most of the other lakes also failed to meet the phosphorus standard.

As shown in Table XII-17, recent monitoring data are available for Lower Nashotah, Nagawicka, Pretty, School Section, Upper Nemahbin, Fowler, Friess, Keesus, Lac La Belle, Oconomowoc, Okauchee, Pine, Silver, Delavan, and Whitewater Lakes to assess the current compliance with water quality standards for the major lakes in the Rock River watershed. All of these lakes exceeded the total phosphorus standard on at least one occasion and Delavan Lake had phosphorus concentrations constantly in excess of the recommended standard. Based upon these data and review of the previous modeling data and the status of plan implementation, it may be expected that the majority of the lakes in the watershed would, at some times, have total phosphorus levels exceeding the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, current land use planning and local nonpoint source pollution and abatement and sewerage system planning, there are three major issues which remain to be addressed in the Rock River watershed. One issue relates to the need for system level sewerage system planning in the northwestern Waukesha County area and one relates to the nonpoint source pollution control which should be carried out in the Turtle Creek and Oconomowoc River watersheds. In addition, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological conditions survey on the upstream reaches of the Rubicon River to reassess the water use objectives currently set forth in the Wisconsin Administrative Code.

### Northwestern Waukesha County Sewerage System Evaluation

The Regional Planning Commission has, at the request of and in cooperation with local units of government in northwestern Waukesha County, prepared a Prospectus for the Preparation of A Sanitary Sewerage System Plan for the Northwestern Waukesha County Area. The prospectus documents the need for conducting a system level sewerage system planning program for the northwestern Waukesha County

[28]Wisconsin Department of Natural Resources, Upper Rock River Basin Areawide Water Quality Management Plan, Publication No. WR-190-88, May 1989.

Table XII-18

TROPHIC STATE INDEX VALUES FOR MAJOR LAKES WITHIN THE ROCK RIVER WATERSHED[a]

| Lake Name | Wisconsin Trophic State Index Values[b] | | | |
|---|---|---|---|---|
| | Total-P | Chlorophyll-a | Secchi | Mean |
| Ashippun Lake | 54.6 | 55.9 | 47.8 | 52.8 |
| Bark Lake | 61.2 | 49.0 | 44.8 | 51.7 |
| Beaver Lake | 54.6 | -- | 43.9 | 49.3 |
| Comus Lake | 64.0 | 68.9 | 69.4 | 67.4 |
| Cravath Lake | 75.7 | -- | 76.4 | 76.0 |
| Crooked Lake | -- | -- | 47.8 | 47.8 |
| Delavan lake | 67.7 | 58.7 | 40.2 | 55.5 |
| Druid Lake | 66.0 | 50.4 | 46.0 | 54.0 |
| Lake Five | -- | -- | 45.3 | 45.3 |
| Fowler Lake | 54.6 | 41.4 | 42.4 | 46.1 |
| Friess Lake | 61.7 | 57.9 | 50.1 | 56.6 |
| Lower Genesee Lake | 55.8 | 43.0 | 41.1 | 46.6 |
| Middle Genesee Lake | 53.2 | 43.0 | 48.8 | 48.3 |
| Golden Lake | 54.6 | 43.0 | 40.3 | 46.0 |
| Hunters Lake | -- | -- | -- | -- |
| Lake Keesus | 64.0 | 48.2 | 47.4 | 53.2 |
| Lac La Belle | 49.3+ | 48.2+ | 47.9 | 48.5 |
| La Grange Lake | -- | -- | -- | -- |
| Lake Lorraine | -- | -- | -- | -- |
| Moose Lake | 50.6 | -- | 47.3 | 49.0 |
| Nagawicka Lake | 54.0 | 50.9 | 43.9 | 49.6 |
| Lower Nashotah Lake | 56.8 | 46.2 | 41.5 | 48.2 |
| Upper Nashotah Lake | 54.6 | -- | 45.8 | 50.2 |
| Lower Nemahbin Lake | 63.2 | 48.2 | 46.8 | 52.7 |
| Upper Nemahbin Lake | 61.2 | 45.2 | 45.9 | 50.7 |

Table XII-18 (continued)

| Lake Name | Wisconsin Trophic State Index Values[b] | | | |
|---|---|---|---|---|
| | Total-P | Chlorophyll-a | Secchi | Mean |
| North Lake (Waukesha) | 60.0 | 52.0 | 40.4 | 50.8 |
| Oconomowoc Lake | 50.7 | 41.9 | 43.3 | 45.3 |
| Okauchee Lake | 51.3 | 47.5 | 49.6 | 49.5 |
| Pike Lake | 57.2 | 52.9 | 48.7 | 52.9 |
| Pine Lake | 61.8 | 46.8 | 43.7 | 50.8 |
| Pretty Lake | 51.5 | 43.9 | 41.6 | 45.7 |
| Rice Lake | 57.8 | 70.2 | 61.2 | 63.1 |
| School Section Lake | 51.5 | 49.4 | 51.9 | 50.9 |
| Silver Lake (Waukesha) | 52.9 | 44.1 | 44.1 | 47.0 |
| Tripp Lake | 67.1 | -- | 60.4 | 63.8 |
| Turtle Lake | 60.0 | 48.2 | 26.7 | 45.0 |
| Waterville Pond | -- | -- | -- | -- |
| Whitewater Lake | 56.4 | 60.1 | 59.6 | 58.7 |

[a]Wisconsin Trophic State Index values were calculated using water chemistry data shown in Table XII-17.

[b] Wisconsin Trophic State Index ranges:

below 44 = oligotrophic
44 - 53 = mesotrophic
54 - 75 = eutrophic
above 75 = hypertrophic

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XII-19

COMPARISON OF TROPHIC STATE INDEX VALUES FOR MAJOR LAKES IN THE ROCK RIVER WATERSHED[a]

| Subwatershed Lake Name | Carlson Trophic State Index Values[b] | | |
|---|---|---|---|
| | Satellite Information 1979 - 1981 | Water Chemistry pre - 1981 | Water Chemistry 1981 - 1991 |
| **ASHIPPUN RIVER** | | | |
| Ashippun Lake | 49 | 51 | 49 |
| Druid Lake | 52 | 72 | 47 |
| **BARK RIVER** | | | |
| Bark Lake | 50 | 53 | -- |
| Crooked Lake | 48 | -- | 51 |
| Golden Lake | 46 | 56 | 42 |
| Hunters Lake | 50 | -- | -- |
| Nagawicka Lake | 48 | 65 | 60 |
| Lower Nashotah Lake | 44 | 48 | 51 |
| Upper Nashotah Lake | 44 | 56 | 45 |
| Lower Nemahbin Lake | 47 | 55 | 54 |
| Upper Nemahbin Lake | 47 | 53 | 45 |
| Pretty Lake | 47 | 46 | 42 |
| School Section Lake | 50 | 58 | 53 |
| Waterville Pond | 50 | -- | -- |
| **OCONOMOWOC RIVER** | | | |
| Beaver Lake | 44 | 56 | -- |
| Lake Five | 48 | -- | 47 |
| Fowler Lake | 47 | -- | 43 |
| Friess Lake | 49 | 54 | 59 |
| Lower Genesee Lake | 45 | 48 | 41 |
| Middle Genesee Lake | 45 | 46 | -- |
| Lake Keesus | 47 | 70 | 50 |
| Lac La Belle | 51 | 49 | 54 |
| Moose Lake | 44 | 60 | -- |
| North Lake (Wauk. Co.) | 49 | 58 | 54 |
| Oconomowoc Lake | 46 | -- | 44 |
| Okauchee Lake | 47 | -- | 58 |
| Pine Lake | 46 | 53 | -- |
| Silver Lake (Wauk. Co.) | 47 | 50 | 43 |
| **SCUPPERNONG RIVER** | | | |
| La Grange Lake | -- | -- | -- |
| **RUBICON RIVER** | | | |
| Pike Lake | 54 | 60 | 52 |

Table XII-19 (continued)

| Subwatershed Lake Name | Carlson Trophic State Index Values[b] | | |
|---|---|---|---|
| | Satellite Information 1979 - 1981 | Water Chemistry pre - 1981 | Water Chemistry 1981 - 1991 |
| **TURTLE CREEK** | | | |
| Comus Lake | -- | 71 | -- |
| Delavan Lake | 55 | -- | 64 |
| Turtle Lake | 48 | 66 | -- |
| **WHITEWATER CREEK** | | | |
| Cravath Lake | 56 | 89 | -- |
| Lake Lorraine | 48 | -- | -- |
| Rice Lake | 55 | 67 | 60 |
| Tripp Lake | -- | 71 | -- |
| Whitewater Lake | 52 | 69 | 61 |

[a] Carlson TSI values were calculated from available data from spring measurements for phosphorus and from summer measurements for chlorophyll-a and water clarity. Water chemistry values were calculated from data shown in Table XII-17. Satellite information values were determined from Wisconsin Lakes - A Trophic Assessment Using Landsat Digital Data, 1983.

[b] Carlson Trophic State Index ranges:

below 40 = oligotrophic
40 - 50 = mesotrophic
50 - 60 = eutrophic
above 60 = hypertrophic

Source: Wisconsin Department of Natural Resources, U.S. Environmental Protection Agency, and SEWRPC.

area. In addition, the prospectus sets forth the planning program required to prepare a coordinated sanitary sewerage system plan for the area concerned. The plan is intended to address the intergovernmental, administrative, legal, and fiscal problems inherent in the development of the planned sewerage system, or systems, as well as to identify the configuration, capacity, and level of treatment to be provided by the planned sewerage system, or systems.

Reassessment of the Future Needs for Nonpoint Source Controls in the Oconomowoc and Turtle Creek Watershed Areas

Nonpoint source priority watershed program implementation periods have now been completed for the Turtle Creek and Oconomowoc River watersheds. The Wisconsin Department of Natural Resources is currently preparing project finalization and evaluation reports. Following completion of those reports and following the conduct of water quality and biological condition monitoring in the Rock River watershed under the Wisconsin Department of Natural Resources ongoing monitoring program, it is recommended that the need for further nonpoint source controls be assessed based upon the current level of plan implementation and water quality and biological conditions data.

Stream Reclassification Evaluation

Sharon Creek, Darien Creek, and portions of the upper Rubicon River are currently included under the limited forage fish or limited aquatic life classifications in Chapter NR 104 of the Wisconsin Administrative Code. However, it is recommended that the objectives for these streams be upgraded to provide for warmwater sport fish and warmwater forage fish classifications. It is recommended that the Wisconsin Department of Natural Resources include further stream appraisals for the upper Rubicon River and Darien Creek as part of the monitoring program during the next period when the Department is conducting monitoring efforts in the Rock River watershed as is envisioned within the next five to seven years.

Chapter XIII

# ROOT RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

## INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Root River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Root River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited for the Root River watershed as there are no major lakes within the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

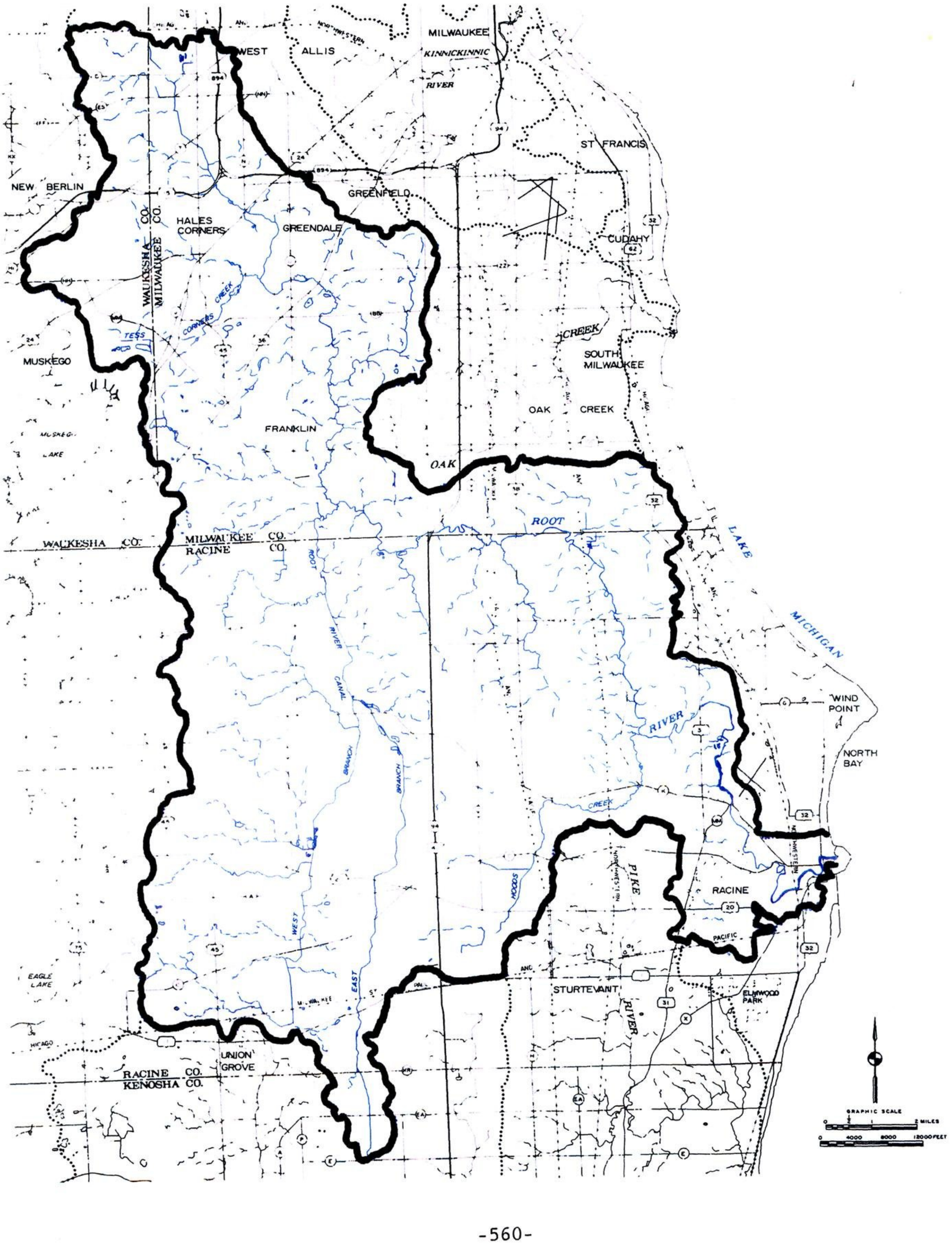
The Root River watershed is located in the east-central portion of the Region and covers an area of approximately 196 square miles. The main stem of the Root River rises in Milwaukee County within the City of Milwaukee urbanized area and flows approximately 44 miles southerly and then easterly to discharge into Lake Michigan in the City of Racine in Racine County. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Root River and its principal tributaries, are shown on Map XIII-1. The Root River watershed contains no lakes with a surface area of 50 acres or more.

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Root River watershed since 1975, the base year of the initial regional water quality management plan, as well as planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater gener-

# Map XIII-1

## ROOT RIVER WATERSHED



addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table XIII-1 summarizes the existing land uses in the Root River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains numerous urbanized areas, 72 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 56 percent of the total area of the watershed in agricultural and related rural uses, about 4 percent in woodlands, about 6 percent in surface water and wetlands, and about 6 percent in other open lands. The remaining 28 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XIII-2.

Within the Root River watershed, major concentrations of urban development exist in portions of three counties, with the majority of development located in Milwaukee and Racine Counties. Urban development has been taking place rapidly in and around the Cities of Franklin, Greenfield, Milwaukee, Muskego, New Berlin, Oak Creek, Racine, Milwaukee, and West Allis; the Villages of Union Grove, Greendale and Hales Corners; and in the Towns of Caledonia and Mount Pleasant adjacent to the City of Racine. The watershed contains a major industrial center, Racine East, in the City of Racine, and two major commercial centers, the Central Business District located in the City of Racine, and a portion of the Regency Mall Commercial Center, located east of STH 31 in the City of Racine.

In the portion of the watershed contained in Waukesha County, urban-related land uses are located primarily in and around the northern and eastern portions of the City of Muskego and in the City of New Berlin. In the portion of the watershed contained in Racine County, urban-related land uses are located primarily in and around the Village of Union Grove, as well as in the portion of the City of Racine contained within the watershed and the areas directly adjacent to the City of Racine in the Towns of Caledonia and Mount Pleasant. In the portion of the watershed contained in Milwaukee County, urban-related land uses are located in and around the Villages of Greendale and Hales Corners, and the Cities of Greenfield, Milwaukee, and West Allis, and scattered development has occurred in the City of Franklin. Rapid urban development has also occurred along the STH 100 corridor in the Cities of West Allis and Greenfield, and in the Village of Hales Corners.

As shown in Table XIII-1, from 1975 to 1990, urban land uses in the watershed increased from about 31,500 acres, or 49 square miles, to about 35,400 acres, or 55 square miles, or by about 12 percent. As shown in Table XIII-1, residential land represents the largest urban land use in the watershed. Residential use has increased within the watershed, from about 17,100 acres, or 27 square miles, in 1975, to about 19,300 acres, or 30 square miles, in 1990, a 13 percent increase. Commercial and industrial lands increased from about 1,200 acres, or two square miles, to about 1,700 acres, or three square miles, an increase of 36 percent.

The 55.2 square miles of urban land uses in the watershed as of 1990 approximated the staged 1990 planned level of about 55.7 square miles envisioned in the

Table XIII-1

**LAND USE IN THE ROOT RIVER WATERSHED: 1975 and 1990[a]**

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential . . . . . | 17,073 | 13.6 | 19,303 | 15.4 | 2,230 | 13.16 |
| Commercial . . . . . | 735 | 0.6 | 935 | 0.7 | 200 | 29.2 |
| Industrial . . . . . | 490 | 0.4 | 730 | 0.6 | 240 | 49.0 |
| Transportation, Communication, and Utilities[b] . . | 9,294 | 7.4 | 10,190 | 8.1 | 896 | 9.6 |
| Governmental and Institutional . . . | 1,422 | 1.1 | 1,443 | 1.2 | 21 | 1.5 |
| Recreational . . . . . | 2,537 | 2.0 | 2,760 | 2.2 | 223 | 8.9 |
| Subtotal | 31,551 | 25.1 | 35,361 | 28.2 | 3,810 | 12.1 |
| Rural | | | | | | |
| Agricultural and Related . . . . | 75,781 | 60.4 | 70,253 | 55.9 | - 5,528 | 7.36 |
| Lakes, Rivers, Streams and Wetlands . . . . . . | 6,930 | 5.5 | 7,509 | 6.0 | 579 | 8.4 |
| Woodlands . . . . . . | 5,143 | 4.1 | 5,157 | 4.1 | 14 | 0.3 |
| Open Lands[c], Landfills, Dumps, and Extractive | 6,168 | 4.9 | 7,318 | 5.8 | 1,150 | 18.6 |
| Subtotal | 94,022 | 74.9 | 90,237 | 71.8 | - 3,785 | - 4.0 |
| Total | 125,573 | 100.0 | 125,598 | 100.0 | 25[d] | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

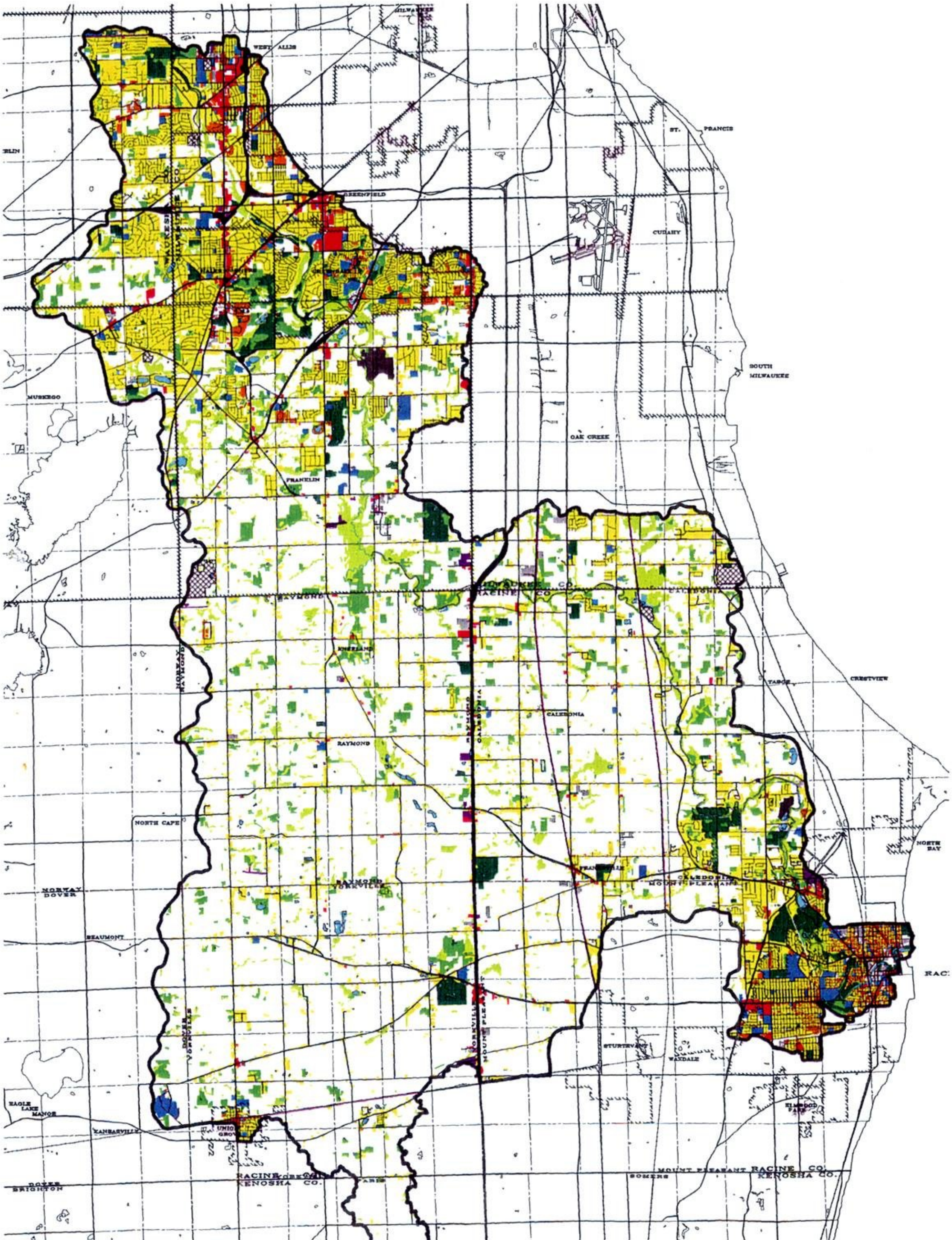
[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

[d] The change in total area of the watershed from 1975 to 1990 is the net effect of Lake Michigan shoreline erosion and accretion and of landfill activities.

Source: SEWRPC.

# MAP XIII-2
# LAND USES IN ROOT RIVER WATERSHED: 1990



-LEGEND-

- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREETS AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION, COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

0 1 2

GRAPHIC SCALE IN MILES

The Root River watershed is about 196 square miles in areal extent, or about 7 percent of the total Region. In 1990, about 55 square miles, or about 29 percent of the watershed, was in urban land uses.

Source: SEWRPC

adopted year 2000 land use plan. The current status of development in the Root River watershed and in adjacent portions of Racine, Kenosha, Milwaukee, and Waukesha Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XIII-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Root River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban uses are expected to increase in Racine County in and around the southern portion of the Town of Caledonia and the Town of Mt. Pleasant in the northern portion of the City of Racine. Additional development is anticipated in the IH 94 corridor area north of STH 11.

In Milwaukee County, the adopted year 2010 land use plan anticipates increased urbanization in the City of Greenfield, and the northern and eastern portions of the City of Franklin and the southern portion of the City of Oak Creek. Additional urban development is also expected for Waukesha County in the eastern portions of the City of New Berlin.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Root River watershed, as indicated in Table XIII-2, is projected to increase from the 1990 total of about 55 square miles, or about 28 percent, of the total area of the watershed, to about 63 square miles, or about 32 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 66 square miles, or about 34 percent, of the total watershed by year 2010. It is important to note that the 66 to 68 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and, as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands, and floodplains outside of the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 141 square miles in 1990 to about 133 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 130 square miles under the high growth-decentralized land use plan, decreases of about 6 and 8 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Root River watershed--including consideration of public and private sewage treatment

Table XIII-2

**EXISTING AND PLANNED LAND USE IN THE ROOT RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]**

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential . . . . . . . . . | 19,303 | 15.4 | 22,478 | 17.9 | 3,175 | 16.4 | 23,397 | 18.6 | 4,094 | 21.2 |
| Commercial . . . . . . . . | 935 | 0.7 | 971 | 0.8 | 36 | 3.9 | 1,088 | 0.9 | 153 | 16.4 |
| Industrial . . . . . . . . | 730 | 0.6 | 970 | 0.8 | 240 | 32.9 | 1,394 | 1.1 | 664 | 91.0 |
| Transportation, Communication, and Utilities[b] . . . . . | 10,190 | 8.1 | 11,398 | 9.1 | 1,208 | 11.9 | 11,955 | 9.5 | 1,765 | 17.3 |
| Governmental and Institutional . . . . . . | 1,443 | 1.2 | 1,562 | 1.2 | 119 | 8.2 | 1,582 | 1.3 | 139 | 9.6 |
| Recreational . . . . . . . | 2,760 | 2.2 | 2,990 | 2.3 | 230 | 8.3 | 3,010 | 2.4 | 250 | 9.1 |
| Subtotal | 35,361 | 28.2 | 40,369 | 30.1 | 5,008 | 14.1 | 42,426 | 33.8 | 7,065 | 20.0 |
| Rural | | | | | | | | | | |
| Agricultural and Related . . . . . . | 70,253 | 55.9 | 68,707 | 54.7 | - 1,546 | - 2.2 | 66,505 | 52.9 | - 3,748 | - 5.3 |
| Lakes, Rivers, Streams, and Wetlands . . | 7,509 | 6.0 | 7,135 | 5.7 | - 374 | - 5.0 | 7,135 | 5.7 | - 374 | - 5.0 |
| Woodlands . . . . . . . . . . | 5,157 | 4.1 | 4,986 | 4.0 | - 171 | - 3.3 | 4,924 | 3.9 | - 233 | - 4.5 |
| Open Lands[c], Landfills, Dumps, and Extractive . . | 7,318 | 5.8 | 4,401 | 3.5 | - 2,917 | - 39.9 | 4,608 | 3.7 | - 2,710 | - 67.9 |
| Subtotal | 90,237 | 71.8 | 85,229 | 67.9 | - 5,008 | - 5.5 | 83,172 | 66.2 | - 7,065 | - 7.8 |
| Total | 125,598 | 100.0 | 125,598 | 100.0 | 0 | -- | 125,598 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary service areas located in the watershed.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on an update of its Section 201 sewerage facility plan[1] for the entire Milwaukee metropolitan area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that that facility plan re-examine certain system level decisions that were made in the past including trunk sewer needs, and the retention of the one remaining small sewage treatment plan in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewage facilities plan update is intended, then, upon its adoption by all of the agencies concerned, to constitute an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Root River watershed.

<u>Public and Private Wastewater Treatment Systems and Sewer Service Areas</u>

<u>Existing Conditions and Status of Plan Implementation</u>: In 1975, there were five public sewage treatment facilities located in the Root River watershed, as shown on Map XIII-3. The Caddy Vista Sanitary District treatment plant which served the Town of Caledonia discharged effluent to the main stem of the Root River; the Village of Union Grove treatment plant discharged to the West Branch Root River Canal; the Village of Hales Corners and Rawson Homes Sewer and Water Trust treatment plants discharged to tributaries of Whitnall Park Creek; and the City of Muskego-Northeast District treatment plant discharged directly to Tess Corners Creek. Of these five plants, the City of Muskego-Northeast District, the Village of Hales Corners, the Caddy Vista Sanitary District, and Rawson Homes Sewer and Water Trust plants were abandoned after 1975, as recommended in the initial plan. The status of implementation in regard to the abandonment, upgrading and expansion, and construction of the public and private sewage treatment plants in the Root River watershed, as recommended in the initial regional water quality management plan, is summarized in Table XIII-3.

As can be seen by review of Table XIII-3, full implementation of the initial plan would provide for the construction of a new and subsequent expansion for the Village of Union Grove sewage treatment plant, and the upgrading and expansion of the Racine County Highway and Park Commission private sewage treatment plant which was converted to the Town of Yorkville Sewer Utility District No. 1 public sewage treatment plant. Implementation of these recommendations has been largely completed. The Village of Union Grove and the Town of Yorkville Sewer Utility District No. 1 public sewage treatment plants have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluents to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus

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[1]Milwaukee Metropolitan Sewerage District, <u>MMSD Wastewater System Plan</u>, June 1980.

## Map XIII-3

## SEWER SERVICE ARES, SEWAGE TREATMENT PLANTS AND OTHER POINT SOURCES OF POLLUTION IN THE ROOT RIVER WATERSHED: 1990

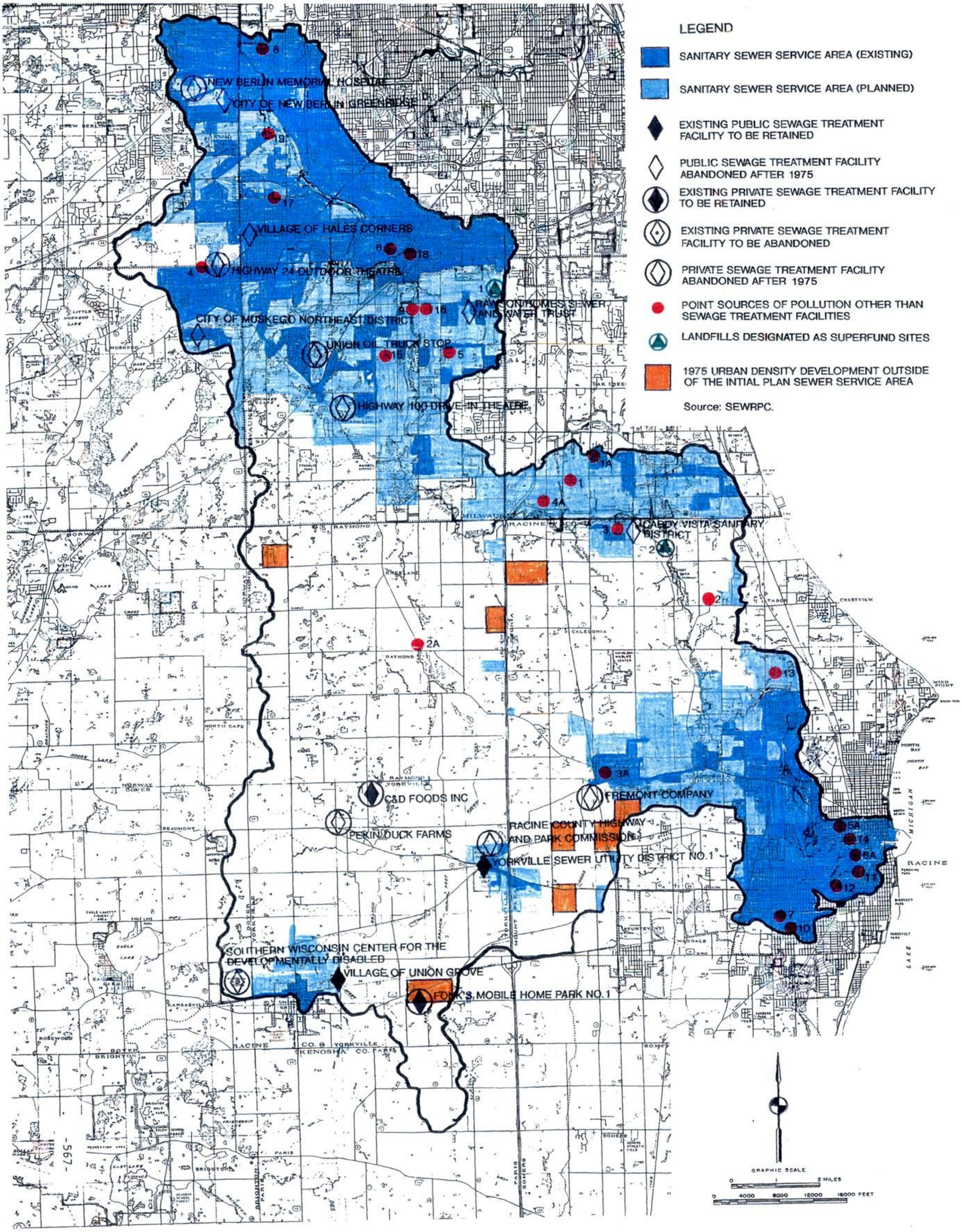

Table XIII-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS
IN THE ROOT RIVER WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| Village of Union Grove | West Branch of Root River Canal | Construct new plant, expand | Plant in operation, plant expansion under construction in 1994 |
| Town of Yorkville Sewer Utility District No. 1 | Hoods Creek | Upgrade and expand[a] | Completed |
| Caddy Vista Sanitary District | Root River | Abandon plant | Plant abandoned (1982) |
| Village of Hales Corners | Whitnall Park Creek tributary | Abandon plant | Plant abandoned (1981) |
| City of Muskego-Northeast District | Tess Corners Creek | Abandon plant | Plant abandoned (1985) |
| Rawson Homes Sewer and Water Trust | East Branch Root River | Abandon plant | Plant abandoned (1977) |
| Private Sewage Treatment Plants | | | |
| C&D Foods Inc., and York Duck Farms | Tributary of West Branch Root River Canal | Maintain and upgrade as needed | Plant maintained |
| Fonk's Mobile Home Park No. 1 | East Branch Root River Canal | Maintain and upgrade as needed | Plant maintained |
| Pekin Duck Farm, Inc. | Soil Absorption | Maintain and upgrade as needed | Plant abandoned (1989) |
| Racine County Highway and Park Commission | Hoods Creek | Maintain and expand as a public plant to serve Town of Yorkville Sanitary District No. 1 | Facility upgraded and expanded as a public plant |
| The Fremont Company[b] | Hoods Creek | Abandon plant | Plant abandoned (1985) |
| Highway 100 Drive-In Theater | Soil Absorption | Abandon plant | Plant abandoned |
| Highway 24 Outdoor Theater | Soil Absorption | Abandon plant | Plant abandoned (1984) |
| New Berlin Memorial Hospital | Tributary of Root River | Abandon plant | Plant abandoned |
| Southern Wisconsin Center for the Developmentally Disabled[c] | West Branch Root River Canal | Abandon plant | Facility planning underway to enable abandonment |
| Union Oil Truck Stop | Tributary of Root River | Abandon plant | Plant abandoned (1980) |

[a] The initial regional water quality management plan recommended the conversion and expansion of the Racine County Highway and Park Commission private sewage treatment facility to a public sewage treatment facility that would serve the entire Yorkville sewer service area. A proposed revision to the initial regional water quality management plan, documented in A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area, recommends the abandonment of the Town of Yorkville treatment plant, and for the Yorkville sewer service area to be served by the City of Racine sewage treatment plant.

[b] Formerly Frank's Pure Food Company.

[c] Formerly Southern Colony Training School and Treatment Facility.

Source: SEWRPC.

control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site specific phosphorus limitations on all public sewage treatment plants, and in 1993, by the adoption of rules to allow for placement of such limitations. Thus, as sewage treatment plant permits are issued, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. Selected characteristics of the two public sewage treatment plants currently existing in the watershed are given in Table XIII-4.

In addition to the publicly-owned sewage treatment facilities, 10 private sewage treatment facilities were in existence in 1975 in the Root River watershed. These plants served the following land uses: C & D Foods Inc., Fonk's Mobile Home Park No. 1, Pekin Duck Farm Inc., Racine County Highway and Park Commission, The Frank Pure Food Company (currently the Fremont Company), Highway 100 Drive-In Theater, Highway 24 Outdoor Theater, New Berlin Memorial Hospital, Southern Wisconsin Center for the Developmentally Disabled, and Union Oil Truck Stop.

As indicated in Table XIII-3, six of the 10 private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. As of 1990, five of these plants had been abandoned. The connection of the Southern Wisconsin Center private sewage treatment plant to the Village of Union Grove sewerage system, enabling the abandonment of the private plant, was under construction in 1994. The Racine County Highway and Park Commission private plant was recommended to be expanded as a public plant in the initial plan. As of 1990, this facility had been upgraded and expanded as the Town of Yorkville Sewer Utility District No. 1 public sewage treatment plant. The remaining private plants were recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES).

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Root River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for both of the public and private sewage treatment plants currently within the watershed.

Table XIII-4

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE
TREATMENT PLANTS IN THE ROOT RIVER WATERSHED

| Name of Public Sewage Treatment Plant | 1990 Estimated Total Area Served (square mile) | 1990 Estimated Total Population Served | Date of Construction and Major Modification | Sewage Treatment Unit Processes[a] | Name of Receiving Water to which Effluent is Disposed | WPDES Permit Expiration Date |
|---|---|---|---|---|---|---|
| Village of Union Grove[b] | 1.1 | 3,700 | 1937, 1962, 1979 | Activated sludge contact stabilization, rotating biological contactors, phoshorus removal, sand filtration, chlorination | West Branch Root River Canal | 3-31-96 |
| Town of Yorkville Sewer Utility District No. 1 | 0.3 | 100 | 1965, 1972, 1983 | Activated sludge extended air, clarification, chlorination | Tributary of Hoods Creek | 6-30-93 |

| Name of Public Sewage Treatment Plant | Hydraulic Loading[c] (mgd) | | | | $BOD_5$ Loading[c] (pounds/day) | | | | Suspended Solids Loading[c] (pounds/day) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity | Existing | | Design Average Annual | Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity | Existing | | Design Average Annual | Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity |
| | Average Annual | Maximum Monthly Average | | | Average Annual | Maximum Monthly Average | | | Average Annual | Maximum Monthly Average | | |
| Village of Union Grove | 0.67 | 0.99 | 0.88 | 2 | 593 | 824 | 1,205 | 0 | 652 | 914 | 2,000 | 0 |
| Town of Yorkville Sewer Utility District No. 1 | 0.04 | 0.06 | 0.15 | 0 | 86 | 123 | 720 | 0 | 60 | 100 | 344 | 0 |

[a]In addition, plants typically include headworks and miscellaneous processes such as pumping, flow metering and sampling, screening and grit removal, as well as sludge handling and disposal facilities.

[b] Expansion of the Village of Union Grove public sewage treatment plant was under construction in 1994.

[c] Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were eight sewer service areas identified within, or partially within, the Root River watershed: Milwaukee Metropolitan Sewerage District, Muskego, New Berlin, Caddy Vista, Union Grove, Center for the Developmentally Disabled, Racine, and Yorkville. As of 1993, all of these areas, with the exception of the Milwaukee Metropolitan Sewerage District service area and a portion of the Yorkville sanitary sewer service area, had undergone refinements as recommended. In addition, the Franklin sewer service area, which was initially included as part of the Milwaukee Metropolitan Sewerage District service areas, was identified and refined since the completion of the initial plan.[2] The boundaries of the sewer service areas through 1993 are shown on Map XIII-3. Table XIII-5 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer service areas in the Root River watershed, as refined through 1993, total about 64 square miles, or about 33 percent of the total watershed area, as shown in Table XIII-5.

<u>Current Plan Recommendations</u>: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the Village of Union Grove sewage treatment plant. In addition, the plan recommendations continue to provide for the continued operation of the Yorkville Sewer Utility District No. 1 sewage treatment plan. The recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for these two sewage treatment plants.

With regard to the treatment plant operated by the Town of Yorkville Sewer Utility District No. 1, further consideration should be given to evaluating a potential change in the recommendations set forth in the initial plan. That potential change is based upon the findings of a 1992 sanitary sewerage and water supply system plan which was completed for the greater Racine area. The findings and recommendations of the planning work are contained in a report prepared by Alvord, Burdick & Howson, entitled <u>A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area</u>. That report, which was prepared for a study area including all of the eastern portion Racine County extending from Lake Michigan to a distance of about two miles west of IH 94, includes major portions of the Root River watershed. The report identified the sanitary sewer and water supply needs of that planning area, and evaluated alternative means of meeting those needs; recommended a coordinated set of design year 2010 sewerage and water supply system plans for the area; identified the intergovernmental, administrative, legal, and fiscal issues inherent in the implementation of the system plans; and recommended an institutional structure for implementation of those plans. The recommended sewerage system and planned service area developed in

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[2]In September 1994, the sewer service area for the City of Oak Creek, which was initially included as part of the Milwaukee Metropolitan Sewerage District service area, was identified and refined as set forth in SEWRPC Community Assistance Planning Report No. 213, <u>A Sanitary Sewer Service Area for the City of Oak Creek, Milwaukee County, Wisconsin</u>.

Table XIII-5

PLANNED SANITARY SEWER SERVICE AREAS IN
THE ROOT RIVER WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sanitary Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Refined Sanitary Sewer Service Areas | | | | |
| Milwaukee Metropolitan Sewerage District (portion) | 24.3 | Franklin | December 5, 1990 | SEWRPC CAPR No. 176, Sanitary Sewer Service Area for the City of Franklin, Milwaukee County |
| Muskego | 3.7 | Muskego | March 3, 1986 | SEWRPC CAPR No. 64, 2nd Edition, Sanitary Sewer Service Area for the City of Muskego, Waukesha County, Wisconsin |
| New Berlin | 10.0 | New Berlin | December 7, 1987 | SEWRPC CAPR No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin |
| Racine<br>Caddy Vista | 23.6 | Racine<br>Caddy Vista | December 1, 1986 | SEWRPC CAPR No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin |
| Union Grove<br>Center for the Developmentally Disabled | 2.3 | Union Grove<br>Southern Wisconsin Center | September 12, 1990 | SEWRPC CAPR No. 180, Sanitary Sewer Service Area for the Village of Union Grove and Environs, Racine County, Wisconsin |
| Yorkville | 0.4 | Yorkville | December 5, 1990 | Amendment to the Regional Water Quality Management Plan-2000, Towns of Yorkville and Mt. Pleasant |
| Subtotal | 64.3 | | | |
| Unrefined Sanitary Sewer Service Areas | | | | |
| Milwaukee Metropolitan Sewerage District (portion)[a] | 25.9 | | | |
| Yorkville (portion) | 0.7 | | | |
| Subtotal | 26.6 | | | |
| Total | 90.9 | | | |

Note: CAPR - Community Assistance Planning Report

[a] As of September 1994, the City of Oak Creek sanitary sewer service area portion of the Milwaukee Metropolitan Sewerage District was refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area Plan for the City of Oak Creek, Milwaukee County, Wisconsin. This refined Oak Creek sanitary sewer service area encompasses 8.1 square miles within the Root River watershed.

Source: SEWRPC.

this subregional system plan are shown on Map XIII-4A. As of December 1994, the intergovernmental actions and approvals needed to proceed with the attendant changes to the regional water quality management plan had not been put in place. Thus, the inclusion of these plan recommendations in the updated plan is pending intergovernmental agreement on the recommendations.

On the basis of the recommendations contained in this subregional sewerage system plan, the following revisions to the initially adopted plan are proposed, pending approval of the system plan by the local units of government involved:

1. The sewer service areas as set forth in the adopted plan are to be revised to conform with those set forth under the recommended Racine area sewerage system plan as shown in Map XIII-4.

2. The Racine Water and Wastewater Utility sewage treatment plant is to be designated as the sole public sewage treatment plant to serve the area considered, as shown on Map XIII-4; and the public sewage treatment plant operated by the Town of Yorkville Sewer Utility District No. 1 is recommended to be abandoned during the planning period.

3. The intercommunity trunk sewers needed to provide service, as shown on Map XIII-4, are recommended to be added to the regional plan recommendations.

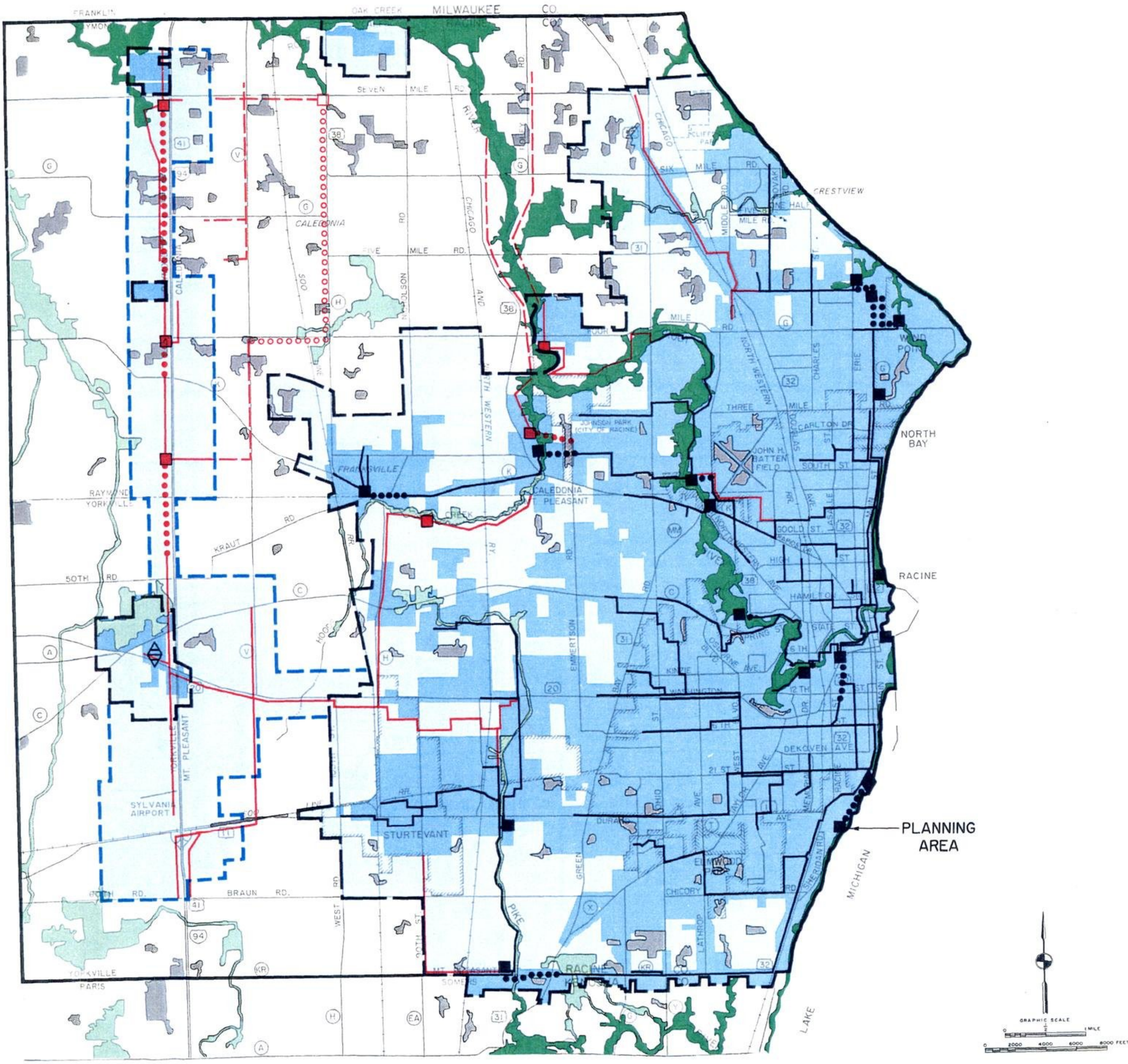
The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map XIII-4. Table XIII-6 presents selected design data for the public sewage treatment plants recommended to be maintained in the Root River watershed. It is important to note that in 1990 the Village of Union Grove plant has recorded monthly average flows which exceeded the average design capacity of the plant. However, the Village has, during 1993 and 1994, carried out sewerage system improvements to reduce infiltration and inflow and to increase the system capacity.

Table XIII-6 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the two public treatment plants in the Root River watershed. During 1994, the Yorkville Utility District No. 1 was conducting facility planning to determine its future sewage system needs and alternatives. In addition, the Village of Union Grove was constructing sewerage system improvements, including improvements to reduce infiltration and inflow and sewage treatment plant modifications.

The current planned sanitary sewer service areas in the Root River watershed are shown on Map XIII-4. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. All or portions of the Muskego, New Berlin, Milwaukee Metropolitan Sewerage District, Franklin, Racine, Caddy Vista, Union Grove, Southern Wisconsin Center, and Yorkville sewer service areas are located in the Root River watershed. Together, the planned service areas within the watershed total about 91 square miles, or about 46 percent of the Root River watershed.

## Map XIII-4A

## RECOMMENDED SEWERAGE SYSTEM FACILITIES FOR THE GREATER RACINE UTILITY PLANNING AREA AS DEVELOPED IN 1992 SUBREGIONAL SYSTEM PLAN




LEGEND

- PRIMARY ENVIRONMENTAL CORRIDOR
- SECONDARY ENVIRONMENTAL CORRIDOR
- ISOLATED NATURAL AREA
- CURRENTLY APPROVED GROSS SANITARY SEWER SERVICE AREA BOUNDARY
- NET SANITARY SEWER SERVICE AREA (EXISTING)
- NET SANITARY SEWER SERVICE AREA (PROPOSED)
- BOUNDARY OF AREA TO BE ADDED TO THE CURRENTLY APPROVED GROSS SANITARY SEWER SERVICE AREA
- EXISTING PUBLIC SEWAGE TREATMENT PLANT
- EXISTING PUBLIC SEWAGE TREATMENT PLANT TO BE ABANDONED
- EXISTING GRAVITY SEWER
- EXISTING FORCE MAIN
- EXISTING LIFT OR PUMPING STATION
- PROPOSED GRAVITY SEWER: 2010
- PROPOSED FORCE MAIN: 2010
- PROPOSED PUMPING STATION: 2010
- PROPOSED GRAVITY SEWER: BEYOND 2010
- PROPOSED FORCE MAIN: BEYOND 2010
- PROPOSED PUMPING STATION: BEYOND 2010

Map XIII-4

UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE ROOT RIVER WATERSHED: 2010

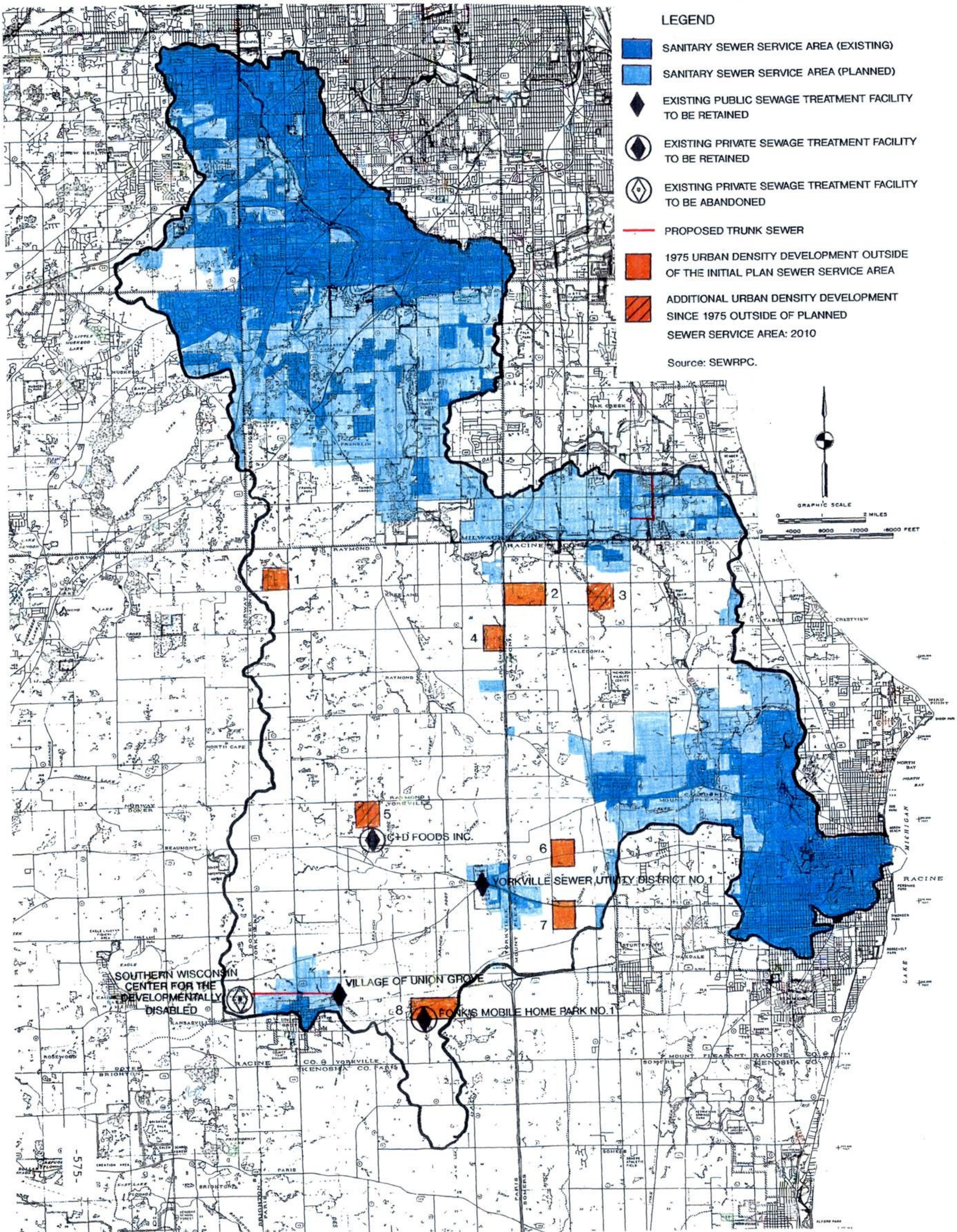


Table XIII-6

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE ROOT RIVER WATERSHED: 1990 AND 2010

| Name of Public Sewage Treatment Plant | Sewer Service Area | Design Capacity-Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intermediate Growth Centralized Land Use Plan | | | High Growth Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Total Area Served (square miles) | Resident Population Served | Planned Sewer Service Area (square mile) | Resident Population Served | Design Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Design Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| Village of Union Grove | Union Grove Southern Wisconsin Center | 0.88 | 0.67 | 1.1 | 3,700 | 3.9 | 5,900 | 0.94 | 2000[b] | 8,100 | 1.22 | 1998[b] |
| Town of Yorkville Utility District No. 1 | Yorkville | 0.15 | 0.05 | 0.4 | 100 | 1.1 | 100 | 0.33 | 1995[c] | 200 | 0.67 | 1995[c] |

[a]Approximate year in which facility planning for a plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average design flows compared to average annual and maximum monthly flows, and age of facilities based upon date of last major construction.

[b]During 1993, the Village of Union Grove completed facility planning for sewerage system improvements including sewer system improvements to reduce infiltration and inflow and sewage treatment plant improvements.

[c]As of 1994, the Yorkville Utility District No. 1 had initiated facility planning to evaluate its future sewerage system needs and alternatives.

Source: SEWRPC.

As noted above, most of the service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Additional refinements are envisioned to be needed for the Milwaukee Metropolitan Sewerage District sewer service area and for the unrefined portion of Yorkville. It is recommended that these refinements be conducted in 1995 and 1996. It is recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension design. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plants, there were three private sewage treatment plants in operation within the Root River watershed in 1990. These facilities generally serve isolated enclaves of urban land uses which are located beyond the current limits of the planned sanitary public sewer service areas. In 1990, of the three plants in operation, the plant serving the Center for the Developmentally Disabled was recommended for abandonment with connection to the Village of Union Grove sewerage system. In 1994, the connection of this facility to the Union Grove sewerage system was under construction. For the two remaining private sewage treatment plants serving Fonk's Mobile Home Park No. 1 and C & D Foods Inc., the need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were eight known combined sewer outfalls and 53 known sanitary sewer system flow relief devices located in the Root River watershed: of the latter, 20 were sanitary sewerage system bypasses; 11 were portable pumping stations; and 22 were crossovers. Of the total of 61 flow relief devices and combined sewer outfalls, 56 discharged directly to the main stem of the Root River; two discharged directly to the East Branch Root River Canal; two discharged directly to Hoods Creek; and one discharged directly to the West Branch Root River Canal. During the period of 1988 through 1993, the majority of the bypasses were eliminated as the plants were upgraded or abandoned, as recommended in the initial regional water quality management plan. As shown in Table XIII-7, 22 points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Root River watershed. These flow relief points are located in five sewerage systems. However, these flow relief points have only been in operation infrequently, with the average discharge occurrence frequency over this five-year period being about once per three years per flow relief location. This equates to an average of about seven isolated overflow occurrences per year considering all reported bypassing.

Current Plan Recommendations: It is recommended that the Cities of Milwaukee, Muskego, and Racine, and the Villages of Hales Corners and Union Grove continue to monitor their sewerage system operations to ensure that the use of the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading within the watershed be conducted with the assumption that there will be no planned bypasses of

Table XIII-7

KNOWN SEWAGE FLOW RELIEF DEVICES
IN THE ROOT RIVER WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | Total | Comments |
|---|---|---|---|---|---|---|---|
| | | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | | |
| City of Milwaukee | -- | 3[a] | -- | -- | -- | 3 | Used only in case of extreme wet weather |
| City of Muskego | -- | -- | 1 | 2 | -- | 3 | Used only in case of equipment failure or extreme wet weather |
| Village of Hales Corners | -- | -- | 2 | -- | 1 | 3 | Used only in case of extreme wet weather |
| City of Racine | -- | 3 | 2 | 5 | -- | 10 | Used in case of equipment failure or extreme wet weather |
| Village of Union Grove | 1 | -- | -- | 1 | -- | 2 | Used in case of equipment failure or extreme wet weather |
| Town of Caledonia Sewer Utility District No. 1 | -- | -- | 1 | -- | -- | 1 | Used only in case of extreme wet weather |
| TOTAL | 1 | 6 | 6 | 8 | 1 | 22 | |

[a] Crossovers are quipped with electric pumps to allow for bypassing.

Source: SEWRPC.

untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure. In 1994, the City of Racine conducted sewer system facility planning which resulted in recommendations for sewer rehabilitation, relief sewer construction, and pumping station upgrading. This project should result in the elimination of the use of flow relief devices in that system.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management program, as updated, recommended the construction of eight intercommunity trunk sewers within or partially within the Root River watershed, as shown in Table XIII-8. The New Berlin and Hales Corners trunk sewer would permit the abandonment of the Hales Corners sewage treatment plant, as well as the Regal Manors plant located in the Fox River watershed. The Franklin-Muskego trunk sewer would permit the abandonment of the City of Muskego Northeast District sewage treatment plant and the Big Muskego sewage treatment plant located in the Fox River watershed. Similarly, the Caddy Vista Sanitary District trunk sewer would permit the abandonment of the Caddy Vista sewage treatment plant. The Center for the Developmentally Disabled trunk sewer would convey wastewater from the Center to the Village of Union Grove sewerage system permitting the abandonment of the private sewage treatment plant serving the Center. The Union Grove trunk sewer would convey wastewater from the Village and the Center for the Developmentally Disabled to the Village's current plant site. The Root River and Franklin-Northeast trunk sewers would provide needed relief sewer capacity to serve existing and planned urban development, reducing bypassing and basement backup of sewage and providing capacity for areas served by onsite sewage disposal systems. These trunk sewers have all been completed, with the exception of the Center for the Developmentally Disabled-Union Grove trunk sewer.

Current Plan Recommendations: The current regional water quality management plan includes recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Root River watershed as shown on Map XIII-4. As of 1990, all of the trunk sewers recommended to be constructed in the watershed under the initial plan had been constructed, with the exception of the trunk sewer providing the connection of the Center for the Developmentally Disabled plant to the Union Grove facility. Construction of this trunk sewer was underway in 1994. As previously discussed in Chapter X, and as shown on Map XIII-4, a new trunk sewer--the Oak Creek Southeast trunk sewer--is included as part of this plan update. Upon local approval of a plan amendment document, based upon the aforementioned 1992 sanitary sewer and water supply system plan for the greater Racine area, new trunk sewers would be added to the plan to convey wastewater from existing and proposed sewer service areas in the vicinity of IH-94 to the City of Racine sewerage system, enabling the abandonment of the Town of Yorkville plant, as shown on Map XIII-4A.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of 13 known point sources of pollution identified in the Root River watershed other than public and private sewage treatment plants. These sources dis-

Table XIII-8

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE ROOT RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
|---|---|
| Root River | Completed (1984) |
| Hales Corners | Completed (1981) |
| New Berlin | Completed (1984) |
| Franklin-Muskego | Completed (1984) |
| Franklin-Northeast | Completed (1984) |
| Caddy Vista Sanitary District | Completed (1982) |
| Center for the Developmentally Disabled-Union Grove | Construction underway |
| Union Grove | Completed (1979) |

Source: SEWRPC.

charged industrial cooling, process, rinse, wash waters, and filter backwash waters through 20 outfalls directly or indirectly to the surface water or groundwater system. Of these 20 outfalls, 13 were identified as discharging only cooling water. The remaining seven were other types of wastewater discharges. Four of these discharged directly to the Root River main stem, 11 to the Root River indirectly via storm sewers, drainage ditches, or unnamed tributaries, three discharge to the River via tributaries, and two utilized soil absorption systems. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 25 such known point sources of wastewater discharging to the Root River and its major tributaries or the groundwater system in the watershed. Table XIII-9 summarizes selected characteristics of these other point sources and Map XIII-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions were made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 49 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters or groundwater in the Root River watershed. These point sources of wastewater discharge, primarily industrial cooling, process, rinse, and wash water, discharge directly, or following treatment, to the groundwater or the surface waters of the Root River watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

### Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were seven enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service areas. As of 1990, one of these urban areas had been added to the planned 2010 sewer service area as part of the plan amendment process. Due to increased urban growth within the watershed since 1975, two new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map XIII-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table XIII-10. One of these urban enclaves is served by a private sewage treatment plant. The remaining seven of these areas are covered by soils or have lot sizes which indicate a high probability of not meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. Thus, it is recommended that these areas consider an intensive inspection and maintenance program for the onsite systems and that further site-specific planning be conducted to determine the best wastewater management practice at such time as significant problems become evident.

### Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Root River watershed, including those currently abandoned, have the potential to affect surface water quality through the release

Table XIII-9

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE ROOT RIVER WATERSHED: 1990[a]

| Facility Name | County | Map ID No.[b] | Permit Type | Permit No. | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Root River Watershed | | | | | | | | | |
| Air Products & Chemicals, Inc. | Milwaukee | 1 | General | 0046531-1 | -- | 2813 | Industrial gases | Root River via unnamed tributary | - - |
| Best Block Company - Racine Plant | Racine | 2 | General | 0046507-2 | 9-30-95 | 3271 | Concrete block and brick | Groundwater discharge | - - |
| Caddy Vista Water Treatment Plant | Racine | 3 | General | 0046540-1 | 9-30-95 | 4941 | Water supply | Root River | - - |
| Carri-Crete Corp. | Waukesha | 4 | General | 0046507-2 | 9-30-95 | 3273 | Ready-mix concrete | Groundwater discharge | - - |
| Franklin High School (Pool) | Milwaukee | 5 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | East Branch Root River | - - |
| Greendale High School (Pool) | Milwaukee | 6 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Dale Creek | - - |
| Moxness Prod. Div.-Vers. Tech., Inc. | Racine | 7 | General | 0044938-3 | 9-30-95 | 3069 | Fabricated rubber products | Root River via storm sewer | - - |
| Nathan Hale High School (Pool) | Milwaukee | 8 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Root River via storm sewer | - - |
| Payne & Dolan-Franklin Aggregates | Milwaukee | 9 | General | 0046515-2 | 9-30-95 | 1429 | Crushed & broken stone | Root River via unnamed tributary | - - |
| Printing Developments, Inc. | Racine | 10 | General | 0044938-3 | 9-30-95 | 2796/3861 | Plate making serv.;photo equip. | Root River via storm sewer | - - |
| Racine Heat Treating Company | Racine | 11 | General | 0044938-3 | 9-30-95 | 3398 | Metal heat treating | Root River | - - |
| Racine School District: Park H.S. | Racine | 12 | General | 0046523-1 | 9-30-95 | 8211 | Secondary school | Root River | - - |
| Racine Stamping Corp. | Racine | 13 | General | 0044938-3 | 9-30-95 | 3469 | Metal stampings | Root River via storm sewer | - - |
| Rainfair, Inc. - Albert Street | Racine | 14 | General | 0044938-3 | 9-30-95 | 2385 | Waterproof outerwear | Root River via storm sewer | - - |
| Tuckaway Country Club | Milwaukee | 15 | General | 0046523-2 | 9-30-95 | 7997 | Membership sports & rec. club | Root River via unnamed tributary | - - |
| Vulcan Materials Co., Rawson Plant | Milwaukee | 16 | General | 0046515-2 | 9-30-95 | 3281 | Cut stone & stone products | Root River via unnamed tributary | - - |
| Whitnall High School (Pool) | Milwaukee | 17 | General | 0046523-2 | 9-30-95 | 8211 | Secondary school | Root River via unnamed tributary | - - |
| Wikk Industries, Inc. | Milwaukee | 18 | General | 0044938-3 | 9-30-95 | 3429 | Hardware | Dale Creek | - - |
| YMCA of Milw. - SW Family Branch | Milwaukee | 19 | General | 0046523-2 | 9-30-95 | 7991 | Physical fitness facility | Root River | - - |
| Accutec (A Federal Hoffman Fac.) | Milwaukee | 1A | Specific | 0046493 | 12-31-92 | 3499 | Fabricated metal products | Root River via unnamed tributary | 2 |
| Fohrs Meat Service, Inc. | Racine | 2A | Specific | 0053287 | 9-30-93 | 2011 | Meat packing plant | Groundwater discharge | 3 |
| Harry Hansen Meat Service, Inc. | Racine | 3A | Specific | 0053295 | 9-30-93 | 2011 | Meat packing plant | Groundwater discharge | 3 |
| PPG Industries Inc. | Milwaukee | 4A | Specific | 0029149 | 12-31-82 | 2851 | Paints & allied products | Root River via storm sewer | 5 |
| Racine Steel Castings | Racine | 5A | Specific | 0042170 | 9-30-91 | 3325 | Steel foundry | Root River via storm sewer | None |
| Western Publishing Inc. - Main Plant | Racine | 6A | Specific | 0026107 | 1-31-95 | 2731 | Book publishing | Root River | None |

[a] Table XIII-9 includes 25 known, permitted point sources of wastewater discharging to the Root River and its tributaries, or to the groundwater system in the Root River watershed. As of 1993, there were 49 known, permitted point sources of water pollution

[b] See Map XIII-3, Sewer Service Areas, Sewage Treatment Plants, and Other Point Sources of Pollution in the Root River Watershed: 1975 and 1990.

[c] The number code refers to the following treatment systems:

1. Aerated lagoon
2. Holding pond
3. Land spreading
4. Multimedia filters
5. Oil and grease removal
6. Secondary clarification
7. Spray Irrigation
8. Stabilization lagoon

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XIII-10

EXISTING URBAN DEVELOPMENT OUTSIDE OF THE PLANNED PUBLIC SANITARY SEWER SERVICE AREA IN THE ROOT RIVER WATERSHED: 2010

| Number[a] | Major Urban Concentration[b] | 1990 Estimated Resident Population | Distance from Year 2010 Sewer Service Area (miles) |
|---|---|---|---|
| 1 | Town of Raymond-Section 6[c] | 125 | 2.5 |
| 2 | Town of Caledonia-T4N, R22E, Section 7[c] | 207 | 1.0 |
| 3 | Town of Caledonia-T4N, R22E, Section 9[c] | 116 | 0.3 |
| 4 | Town of Raymond, Section 13[c] | 102 | 2.0 |
| 5 | Town of Yorkville-Section 4[c] | 117 | 2.6 |
| 6 | Town of Mt. Pleasant-T3N, R22E, Sec. 8[c] | 62 | 0.5 |
| 7 | Town of Mt. Pleasant-T3N, R22E, Section 17[c] | 86 | 0.2 |
| 8 | Town of Yorkville-Sections 26 and 27[c,d] | 457 | 0.6 |
| | Total | 815 | 6.0 |

[a] See Map XIII-4

[b] Urban development is defined in this context as concentrations of urban land uses within
any given U.S. Public Land Survey quarter section that has at least 32 housing units, or
an average of one housing unit per five gross acres, and is not served by public sanitary
sewers.

[c] Based upon consideration of soils, lot sizes, and density, further site specific planning should be conducted during the planning period to determine the best means of providing for wastewater management.

[d] Served by a private sewage treatment plant.

Source: SEWRPC.

of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources. In some cases, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can potentially be transmitted to the surface waters.

There are currently two active landfills and 42 known abandoned landfills located in the Root River watershed. Two of the abandoned landfills, the Fadrowski Drum Disposal Site in the City of Franklin and the Hunt's Disposal-Caledonia Landfill in the Town of Caledonia, were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean up of hazardous waste sites. The location of these landfills is shown on Map XIII-3 and in Table XIII-11.

In 1986, the Fadrowski Drum Disposal Site was designated as a high priority site for the Superfund Program. The landfill was in operation between 1970 and 1982 and received various industrial wastes, including hazardous waste. Lubricant sludges and several hundred drums of waste materials were reportedly buried on the site. Analyses conducted between 1988 and 1991 to determine the impacts of the landfill on surface water found low levels of cyanide and volatile organic compounds (VOCs) in a tributary stream to the Root River along the western boundary of the site. Elevated levels of mercury, benzene, chromium, and barium were also found in groundwater down gradient of the site. Remedial actions are currently underway at this landfill site. These remedial actions include: excavation, removal and treatment of containerized waste and contaminated soils; construction of a landfill cover; limitations on land and groundwater use; and monitoring of groundwater and surface water.

The Hunt's Disposal Landfill was designated as a Superfund site in 1987. During its operation from 1959 to 1974, municipal and industrial wastes were accepted at the site, including newspaper ink solvents and arsenic acid sludges. Samples collected from residential wells and surface water near the site, including the Root River main stem, indicated contamination of surface and ground waters with volatile organic compounds (VOCs) and semi-volatile organic compounds including acetone, 1,2-dichloroethene, carbon disulphide, methylene chloride, pentachlorophenol, toluene and vinyl chloride, and 4-methylphenol, benzoic acid, and naphthalene; heavy metals including chromium, copper, lead, manganese and nickel; and several polyaromatic hydrocarbons (PAHs). Remediation actions are currently underway at this landfill site. The actions under design include: fencing; excavation and consolidation of contaminated soil; construction of a multi-layer landfill cap and slurry wall barrier; groundwater extraction; and residential well monitoring. The preliminary remediation plans recommend treatment of the extracted groundwater followed by discharge to a drainageway leading to the Root River main stem at a location just to the west of the site.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Root River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) program, designed to facilitate the clean up of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing clean up

Table XIII-11

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE ROOT RIVER WATERSHED: 1990

| Map ID Number[a] | Landfills Indicated To Be Potential Pollution Sources | Civil Division Location | Surface Water Potentially Impacted |
|---|---|---|---|
| 1 | Fadrowski Drum Disposal Site[b] | City of Franklin, Milwaukee County | Root River |
| 2 | Hunt's Disposal Landfill Site[b] | Town of Caledonia, Racine County | Root River |
| | Leaking Underground Storage Tank Sites[c,d] | | Receiving Water |
| | none | | |
| | Additional Groundwater Contamination Sites[c] | | Receiving Water |
| | none | | |

[a] Refers to Map XIII-3, Sewer Service Areas, Sewage Treatment Plants and Other Point Sources of Pollution in the Root River Watershed: 1990.

[b] Superfund site.

[c] Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters.

[d] As of 1993, there were three leaking underground storage tank sites in the Root River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Bob's Mobil Inc. in the Village of Union Grove, Racine County which is permitted to discharge to the Root River via a storm sewer; Speedy Lube Gas Station (currently the Pahle Small Animal Clinic) in the City of West Allis, Milwaukee County which is permitted to discharge to the Root River; and Phillips 66 Gas Station in the City of New Berlin, Waukesha County which is permitted to discharge to the Root River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or groundwater. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were three known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters in the Root River watershed, as indicated in Table XIII-11.

As of 1993, there were 180 leaking underground storage tanks in the Root River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters. As of 1993, there were no known such sites in the Root River watershed.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

### Existing Conditions and Status of Plan Implementation

For the Root River watershed, the initial plan recommended nonpoint source pollution control practices for urban lands designed to reduce the pollutant loadings from nonpoint sources by about 50 percent, in addition to urban construction erosion control, onsite sewerage disposal system management, and streambank erosion controls. For rural lands, the plan generally recommended nonpoint source control practices designed to reduce pollutant loadings by about 25 percent. Within the rural areas of the Root River Canal drainage area, the plan recommends additional measures to provide a reduction in nonpoint source pollutants of about 50 percent, in addition to streambank erosion control.

In 1966, the Commission prepared a comprehensive watershed plan for the Root River watershed[3] in cooperation with various Federal, State, and local authorities. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas in the watershed. Such subsequent planning was and will

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[3]See SEWRPC Planning Report No. 9, A Comprehensive Plan for the Root River Watershed, September 1966.

continue to be directed toward reducing nonpoint source pollutant loadings as well as providing for local drainage needs in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Root River watershed through local regulation and programs. In the area of construction site erosion control, significant progress has been made. As of January 1993, the Cities of Franklin, Greenfield, Milwaukee, Muskego, New Berlin, Oak Creek, and West Allis had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. There are also ongoing programs of onsite sewage disposal system regulation administered by Kenosha, Racine, and Waukesha Counties.

With regard to rural nonpoint source control, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program and other programs, such as the Conservation reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and the wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection, as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Kenosha, Racine, and Waukesha Counties. Thus, these plans have been prepared for all rural areas of the Root River watershed. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning and grant funding program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. The Root River watershed was designated a "priority watershed" in 1979. Planning for the Root River Priority Watershed Project was completed in 1980, and implementation of practices occurred from 1980 through 1989.

The Root River priority watershed program established nonpoint source pollutant reduction goals for the entire watershed by subwatershed. A pollutant reduction goal of 50 percent was established for urban areas of the watershed. In order to meet this goal, the plan recommended onsite sewage disposal system management, construction erosion controls, and the implementation of various land management practices including increased street sweeping, streambank and roadside drainageway erosion controls, industrial and commercial site housekeeping practices, installation of oil and chemical disposal stations, and public education and information programs. For rural areas, pollutant reduction goals of 25 percent were established for the watershed. Additional reduction goals of 50 percent were established for the drainage areas tributary to the East Branch, West Branch, and main stem of the Root River Canal. In order to achieve this level of control, the plan recommends the following measures:

| Nonpoint Source Measure | Amount |
|---|---|
| Crop rotation | 750 acres |
| Contour Strip Cropping | 490 acres |
| Conservation Tillage | 11,900 acres |
| Diversions | 50,000 feet of diversion |
| Terraces | 1,224,200 feet of terraces |
| Grass Waterways | 182 acres |
| Grade Stabilization Structures | 111 structures |
| Stream Fending for Livestock Exclusion | 3,350 feet |
| Stream Bank Shaping and Seeding | 26,370 feet |
| Stream Bank Riprap | 13,650 feet |
| Stream Cattle Crossings | 10 crossings |
| Critical Area Planting | 18 acres |
| Vegetative Buffer Strips | 170 acres |
| Livestock Waste Runoff Management | 44 systems |
| Livestock Waste Storage | 23 systems |

With the exception of the stabilization of critical areas, participation in the Priority Watershed Program was generally under 50 percent for the practices recommended being installed. Very limited implementation of the urban practices was achieved. The urban measures that were implemented included streambank protection projects, one retention pond, limited street sweeping programs, and oil disposal stations. The DNR final report on the project suggests that the Root River water quality and biological condition have not improved significantly between 1981 and 1990.

Current Plan Recommendations

Given the limited implementation of the nonpoint source priority watershed plan recommendations, it is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, in addition to land management which, when coupled with the urban practices implemented during the priority watershed project, will provide about a 50 percent reduction in nonpoint source pollutant loadings in the urban area of the Root River watershed. Review of the characteristics of the Root River watershed indicates that it would meet the criteria for the "high" priority watershed ranking as documented in a memorandum[4] prepared by the Regional Planning Commission for use by the Wisconsin Department of Natural Resources in prioritizing the watershed for selection under the priority watershed program. Thus, it is recommended that the Wisconsin Department of Natural Resources consider reopening the commitment--or "sign-up" period for urban practices on the Root River watershed for a two-year period followed by a five-year implementation period. It is also recommended that the need for further nonpoint source reductions in the rural areas of the watershed be reviewed and reevaluated given the levels of nonpoint source control achieved during the priority watershed plan preparation. It is further recommended that these levels of reduction in the urban areas be refined in subsequent detailed stormwater management planning. The reevaluation of the levels of nonpoint source pollution control needed should be based upon additional monitoring which would be conducted as described in the next section. Such refinement would include further consideration of toxics reduction requirements.

The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

WATER QUALITY MONITORING PLAN ELEMENT

Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

As of 1993, long-term monitoring has been carried out in the Root River watershed on a sustained basis by the Wisconsin Department of Natural Resources at one station along the main stem of the Root River at Johnson Park, as shown on Map XIII-5. Short-term monitoring has also been conducted at 11 sites by the DNR during 1981 and 1982, as shown on Map XIII-5 and described later in this chapter.

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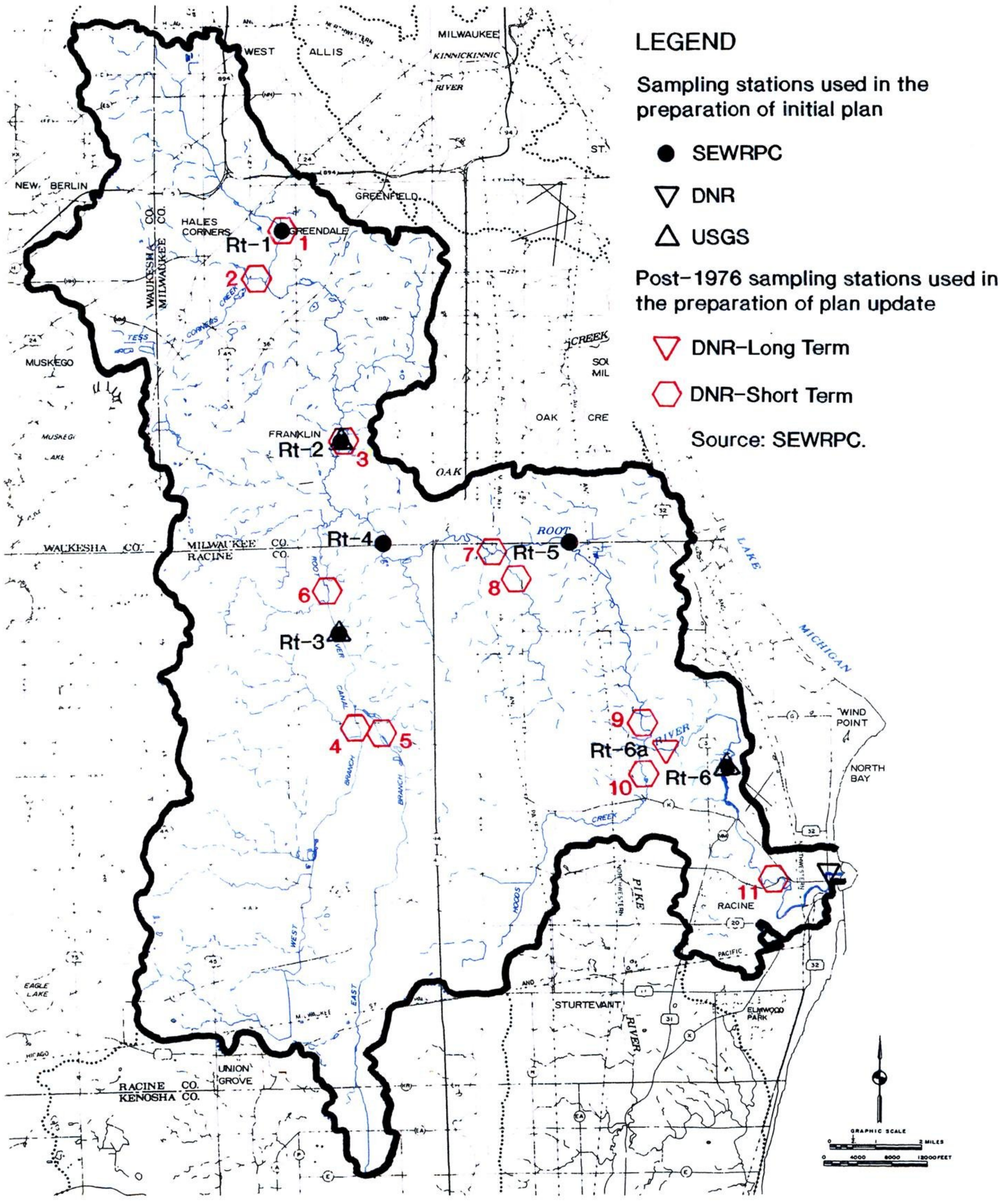
[4]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

# Map XIII-5
# LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE ROOT RIVER WATERSHED



Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the Wisconsin Department of Natural Resources at Station Rt-6a on a continuing long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at this station and at eight selected additional stations, with four stations located on the main stem of the Root River and one station each located on the Root River Canal, Tess Corners Creek, Hoods Creek, and the West Branch Root River Canal. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated, and are consistent, with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five to seven year rotating cycle.

LAKES MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological conditions monitoring programs to be established.

As noted above, there are no major lakes in the Root River watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

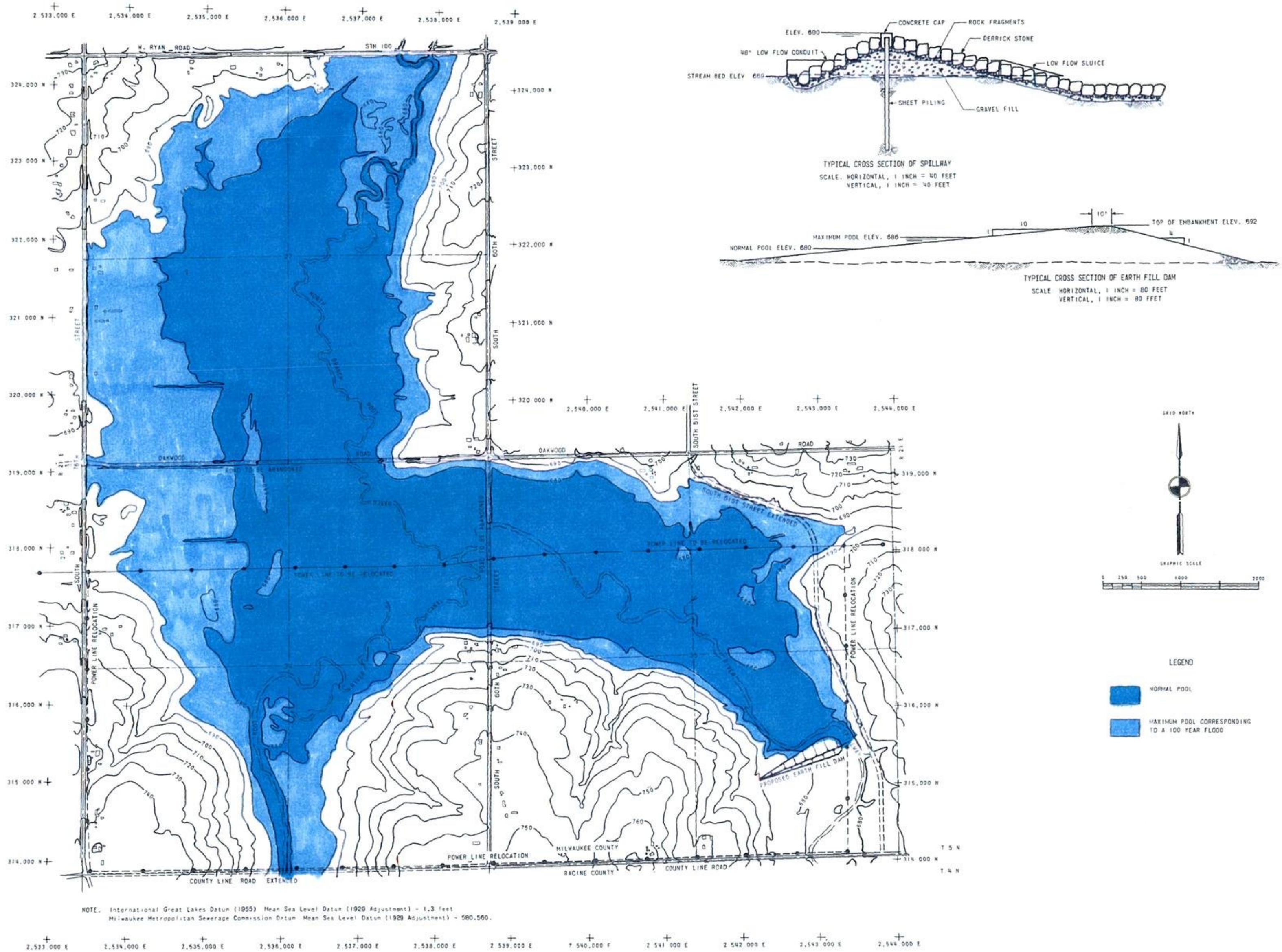
Oakwood Lake Considerations

The Commission's adopted comprehensive plan for the Root River watershed recommended the development of a permanent multipurpose reservoir near the confluence of the Root River and the North Branch of the Root River in the City of Franklin. Lowlands lying in this area form a natural reservoir during flood periods, the outflow of which is regulated by a narrow cross section of the Root River channel and floodplain near W. County Line Road. The recommended reservoir, which has been named Oakwood Lake, is shown on Map XIII-6. This lake would artificially increase the flood regulation effect of the natural reservoir and would provide a water body for recreation, conservation, and low-flow augmentation purposes.

As proposed in the adopted Root River watershed plan, the normal water surface area of the lake would be about 660 acres. It was proposed that about 400 acres

## Map XIII-6

## GENERAL PLAN OF OAKWOOD LAKE AS PROPOSED IN THE COMPREHENSIVE PLAN FOR THE ROOT RIVER WATERSHED




*Source: SEWRPC.*

of land underlying the lake be excavated to provide for such recreational pursuits as boating and fishing. The remaining 260 acres of lake area were envisioned to provide shallow water for fish and wildlife habitat. The normal water surface of the lake would be held between elevations of 679 feet and 680 feet above National Geodetic Vertical Datum by means of a low rock dam. Water stored between these elevations would be available for release for streamflow augmentation at a rate varying from three to five cubic feet per second (cfs), depending upon lake level. A flow of three cfs would result in a stream 24 feet wide and 6 inches deep flowing at a velocity of 0.25 foot per second. In the recreation portion of the proposed lake, a mean bottom elevation of 675 feet would be established to provide a mean water depth of four to five feet. As proposed in the plan, the lake would have a normal shoreline of about five miles. The plan envisioned that a portion of the shoreline would be developed for recreational use, with the remainder left in a natural state.

At the present time, there is no interest being expressed by Milwaukee County, the Wisconsin Department of Natural Resources, or other agencies to carry out this long-standing recommendation. This proposal has been reconsidered a number of times since the initial recommendations were made. The last such reconsideration was made as part of the stormwater drainage and flood control plan for the Milwaukee Metropolitan Sewerage District completed in 1990.[5] At that time, it was again found that the construction of the reservoir would result in no major flood damage-abatement benefits. It was noted, however, that the reservoir would provide recreational and water quality benefits and it was recommended that the development of Oakwood Lake continue to be pursued by State and local officials. Given this action, Oakwood Lake is recommended to remain a component of the regional water quality management plan.

## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; the 1976 Commission monitoring program conducted under the regional water quality management planning effort; and the U. S. Geological Survey and Wisconsin Department of Natural Resources sampling programs. Available data collected in those programs for the Root River watershed included samplings at six Commission stations, five of which were located on the main stem of the Root River and one on the West Branch of the Root River Canal downstream of its confluence with the East Branch Root River Canal; at one Department of Natural Resources station; and at three U. S. Geological Survey stations. The sampling station locations are shown on Map XIII-5.

Long-term post-1976 comparable water quality data have been collected at the current DNR sampling station Rt-6a on the Root River at Johnson Park in Racine

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[5]SEWRPC Community Assistance Planning Report No. 152, A Stormwater Drainage and Flood Control System Plan for the Milwaukee Metropolitan Sewerage District, December 1990.

County. The DNR has also collected water quality data on a short-term basis at 11 locations in the Root River watershed. Data collected at these sites in 1981 and 1982 were used, along with the long-term data previously noted, to characterize water quality conditions. These sites are shown on Map XIII-5. Biological condition data collected by the DNR in 1981 and 1990 were also available for use in the assessment of current water quality conditions. In addition to the data obtained since preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Root River watershed.

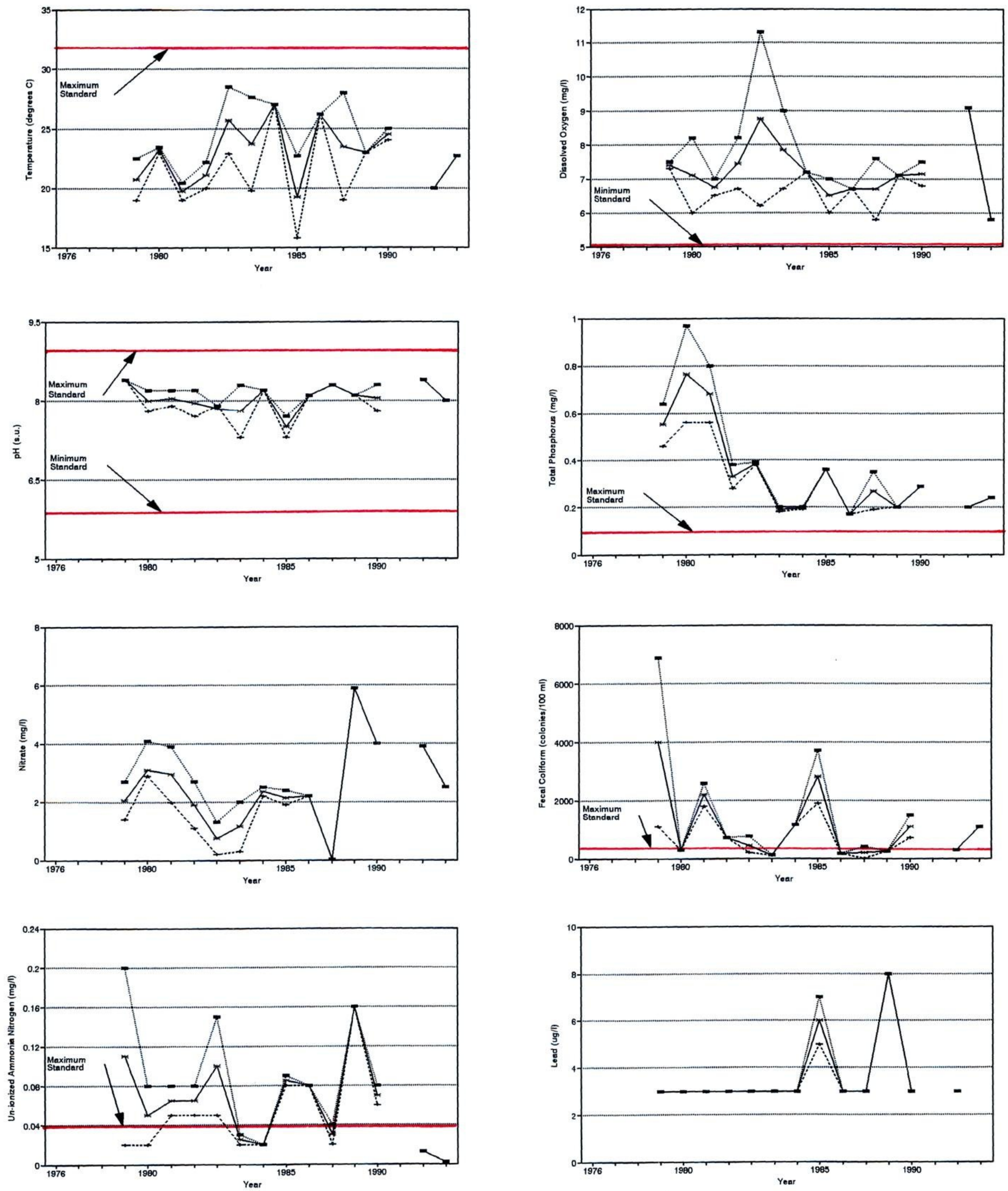
The long-term water quality data obtained at the Department of Natural Resources sampling station Rt-6a on the Root River at Johnson Park, for the period 1976 through 1993, are summarized in Figure XIII-1. The short-term data collected by the DNR in 1981 and 1982 are summarized in Figures XIII-1 through XIII-3 and in Table XIII-12. The water quality standards indicated in Figures XIII-1 through XIII-3 and in Table XIII-12 are those set forth for specific biological and recreational use objectives as described in Chapter II.

Review of those data for station Rt-6a indicate that the only change perceived from 1979 to 1993 is an improvement following 1981, as evidenced by lower total phosphorus levels and less variability in dissolved oxygen levels. This improvement may be attributed, in part, to the abandonment of several sewage treatment plants including the plants serving City of Muskego-Northeast District, Village of Hales Corners, the Rawson Homes Sewer and Water Trust, and Caddy Vista Sanitary District. Several private sewage treatment plants were also abandoned including those serving the Highway 100 Drive-In Theater, Union Oil Truck Stop, Highway 24 Outdoor Theater, and New Berlin Memorial Hospital. It should be noted that levels of total phosphorus, un-ionized ammonia and fecal coliform bacteria still exceed the standards associated with warmwater sport fish and full recreational water use objectives, as set forth in Chapter II. Temperature, dissolved oxygen, pH, and chloride levels remained variable with no apparent trends, but appear to meet the standards. The remaining water quality data collected on a short-term basis throughout the watershed illustrate that the phosphorus and fecal coliform standards are exceeded throughout the watershed.

Biological condition monitoring conducted by the DNR in 1981 and 1990 as part of the Root River priority watershed project, indicated slight decreases in water quality in Hoods Creek, the East Branch Root river Canal, and portions of the Root River main stem. Slight water quality improvements were noted in Husher Creek and in the Root river Canal. Monitoring conducted on the remaining stream reaches in the watershed indicated no change in conditions.

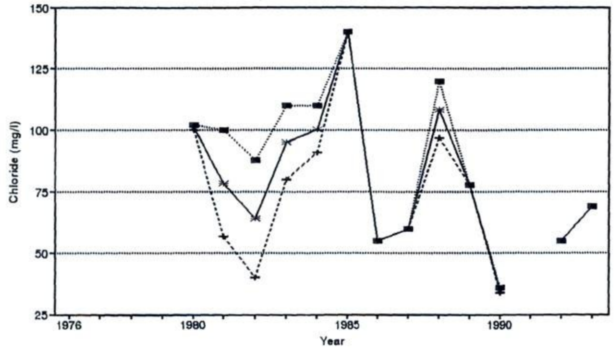
Toxic and Hazardous Substances: Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Root River watershed in 1973. The

Figure XIII-1
WATER QUALITY DATA FOR THE ROOT RIVER
AT STATION Rt-6a: 1976-1993




Note: The acute standard of 408.6 ug/l was not violated in any year.
The chronic standard of 24.4 ug/l was not violated in any year.

## Figure XIII-1 (cont'd)




Note: The maximum standard of 1000 mg/l was not violated in any year.

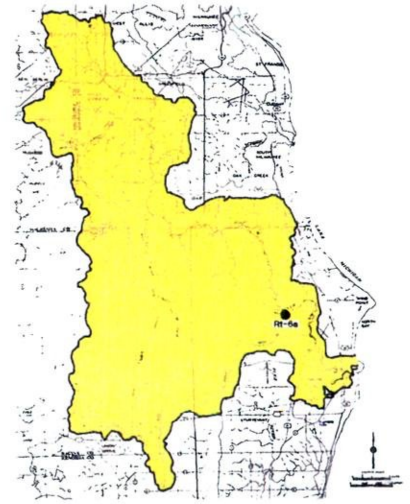
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

ROOT RIVER WATERSHED

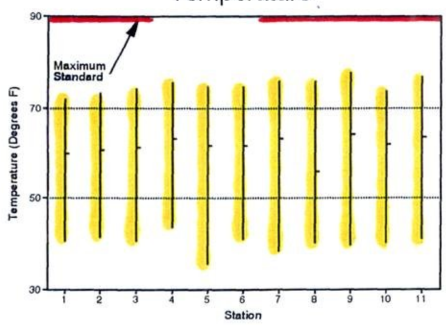


Source: Wisconsin Department of Natural Resources and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

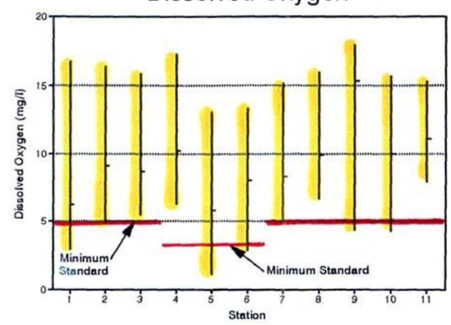
# Figure XIII-2
# Root River Watershed Short-Term Water Quality Sampling Data: 1981

## Temperature

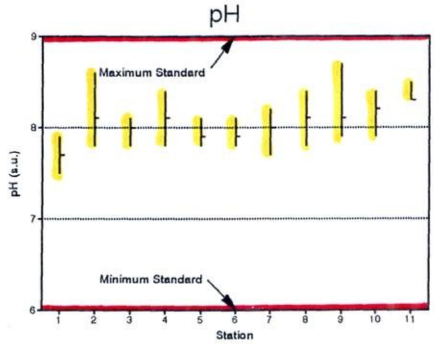



Note: No standard has been established for surface waters classified as limited forage fish communities.

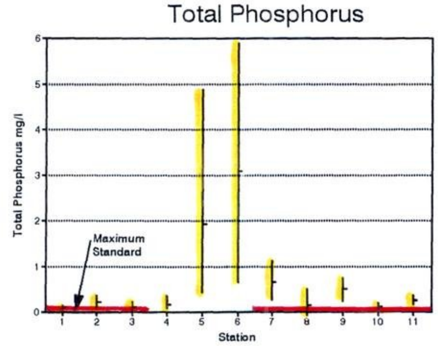
## Dissolved Oxygen




## pH

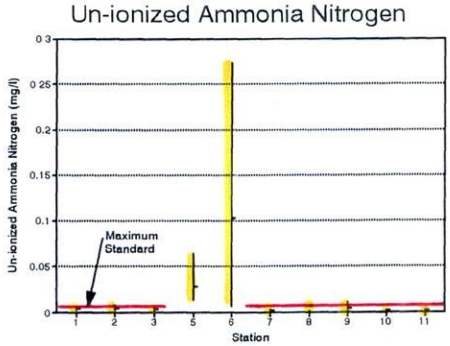



## Total Phosphorus



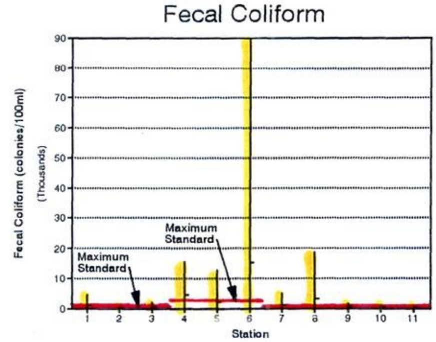

Note: No standard has been established for surface waters recommended for limited recreational uses.

## Un-ionized Ammonia Nitrogen




Note: No standard has been established for surface waters classified as limited forage fish communities.

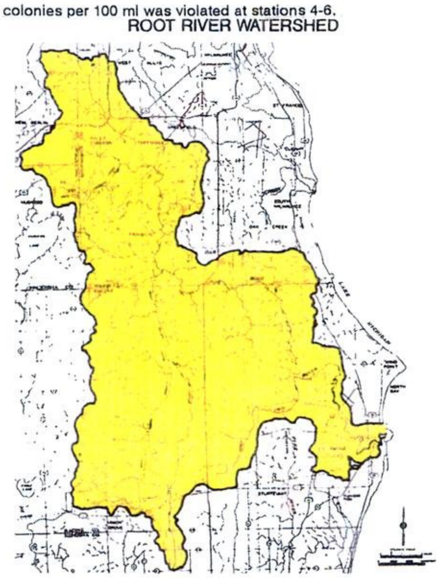
## Fecal Coliform




Note: The maximum standard of 200/400 colonies per 100 ml was violated at stations 1-3 and 7-11 and the maximum standard of 1000/2000 colonies per 100 ml was violated at stations 4-6.

LEGEND
Maximum
Average
Minimum

ROOT RIVER WATERSHED

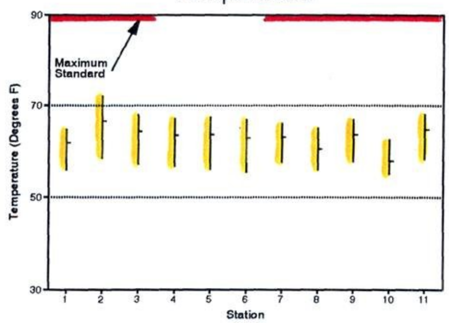


Standards indicated are those established for warmwater sport fish or warmwater forage fish and full recreational use objectives, with the exception of stations 4-6. Standards indicated for stations 4-6 are those established for limited forage fish and limited recreational use objectives. See Chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table XIII-12 for summarized water quality data.

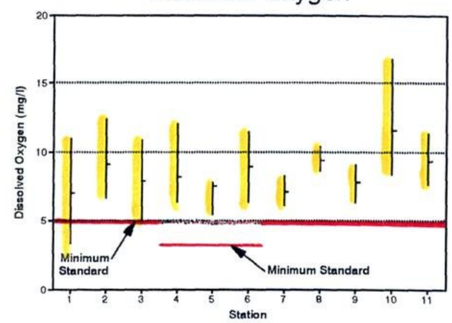
Source: Wisconsin Department of Natural Resources and SEWRPC.

# Figure XIII-3
## Root River Watershed Short-Term Water Quality Sampling Data: 1982

### Temperature

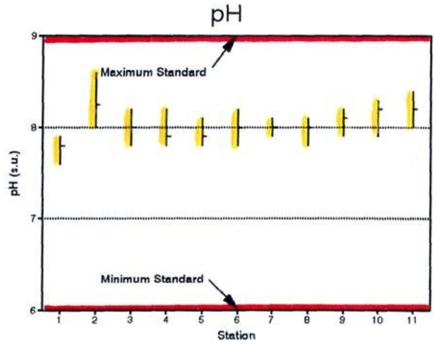



### Dissolved Oxygen

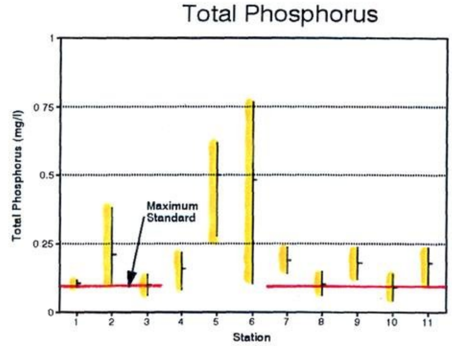



Note: No standard has been established for surface waters classified as limited forage fish communities.

### pH

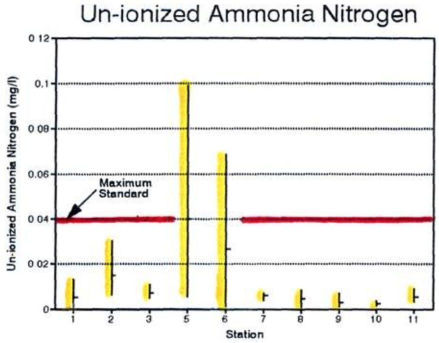



### Total Phosphorus

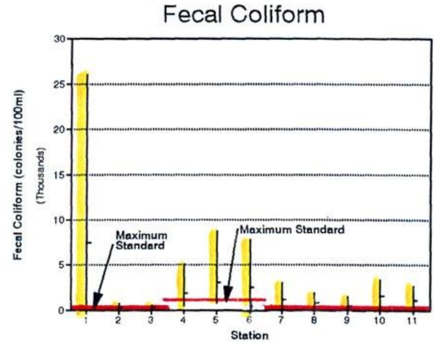



Note: No standard has been established for surface waters recommended for limited recreational uses.

### Un-ionized Ammonia Nitrogen

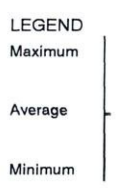



### Fecal Coliform




Note: No standard has been established for surface waters classified as limited forage fish communities.

Note: The maximum standard of 200/400 colonies per 100 ml was violated at stations 1-3 and 7-11 and the maximum standard of 1000/2000 colonies per 100 ml was violated at stations 4-6.




Standards indicated are those established for warmwater sport fish or warmwater forage fish and full recreational use objectives, with the exception of stations 4-6. Standards indicated for stations 4-6 are those established for limited forage fish and limited recreational use objectives. See Chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table XII-12 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

ROOT RIVER WATERSHED

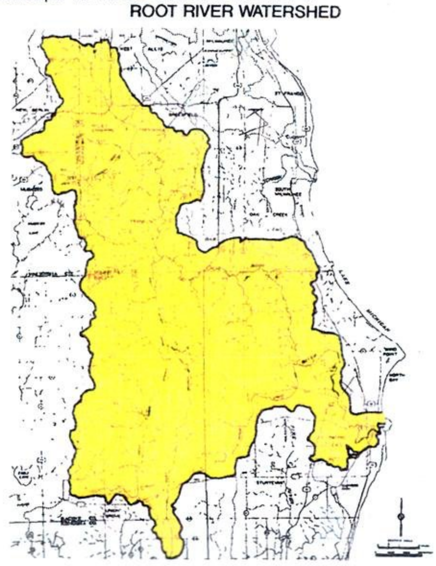


Table XIII-12

ROOT RIVER WATERSHED SHORT-TERM STREAM WATER QUALITY SAMPLING DATA: 1981-1982

| Sampling Station Number[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 1 | Temperature (°F) | Maximum of 89.0 | 40.6 - 72.1<br>55.9 - 64.9 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 2.9 - 16.8<br>3.3 - 11.0 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.5 - 7.9<br>7.6 - 7.9 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.04 - 0.16<br>0.09 - 0.12 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .002 - .006<br>.001 - .013 | No<br>No | July - August 1981<br>May 1982 | 4<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 170 - 4600<br>580 - 26,000 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| 2 | Temperature (°F) | Maximum of 89.0 | 41.1 - 73.4<br>58.6 - 72.0 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 4.9 - 16.4<br>6.6 - 12.4 | Yes<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.8 - 8.6<br>8.0 - 8.6 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.38 - 0.06<br>0.38 - 0.1 | Yes<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .002 - .008<br>.006 - .031 | No<br>No | July - November 1981<br>May 1982 | 5<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 10 - 630<br>20 - 750 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| 3 | Temperature (°F) | Maximum of 89.0 | 40.6 - 74.3<br>14.0 - 20.0 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 5.4 - 15.9<br>4.8 - 10.9 | No<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.8 - 8.1<br>7.8 - 8.2 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.03 - 0.24<br>0.06 - 0.14 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .002 - .005<br>.005 - .011 | No<br>No | July - August 1981<br>May 1982 | 4<br>3 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 30 - 2200<br>20 - 560 | Yes<br>Yes | July - November 1981<br>May 1982 | 11<br>4 |
| 4 | Temperature (°F) | Maximum of 89.0 | 35.6 - 74.8<br>55.6 - 67.1 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 2.8 - 13.4<br>6.3 - 11.5 | Yes<br>No | July - November 1981<br>May 1982 | 11<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.8 - 8.1<br>7.8 - 8.2 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.62 - 5.9<br>0.1 - 0.77 | Yes<br>Yes | July - November 1981<br>May 1982 | 11<br>4 |

Table XIII-12 (continued)

| Sampling Station Number[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 4 | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .006 - .273<br>.001 - .069 | Yes<br>Yes | July - November 1981<br>May 1982 | 7<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 450 - 90,000<br>200 - 7800 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| 5 | Temperature (°F) | -- | 43.6 - 75.7<br>56.7 - 67.3 | --<br>-- | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 3.0 | 6.2 - 17.3<br>6.3 - 12.1 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.8 - 8.4<br>7.8 - 8.2 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | -- | 0.06 - 0.37<br>0.08 - 0.22 | --<br>-- | July - November 1981<br>May 1982 | 12<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 1000/2000 | 70 - 15,600<br>380 - 5100 | --<br>-- | July - November 1981<br>May 1982 | 12<br>4 |
| 6 | Temperature (°F) | -- | 41.0 - 74.8<br>56.1 - 67.5 | --<br>-- | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 3.0 | 1.1 - 13.1<br>5.4 - 7.8 | Yes<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.8 - 8.1<br>7.8 - 8.1 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.43 - 4.9<br>0.28 - 0.62 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | -- | .013 - .065<br>.005 - .099 | --<br>-- | July - November 1981<br>May 1982 | 6<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 390 - 13,000<br>740 - 8800 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| 7 | Temperature (°F) | Maximum of 89.0 | 38.3 - 76.1<br>57.6 - 66.2 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 4.9 - 15.2<br>6.1 - 8.3 | Yes<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.7 - 8.2<br>7.9 - 8.1 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.27 - 1.14<br>0.14 - 0.24 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .0005 - .0036<br>.0035 - .007 | No<br>No | July - November 1981<br>May 1982 | 5<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 120 - 5200<br>30 - 3000 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| 8 | Temperature (°F) | Maximum of 89.0 | 40.1 - 76.1<br>56.1 - 65.3 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 6.6 - 16.0<br>8.6 - 10.4 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.8 - 8.4<br>7.8 - 8.1 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.05 - 0.53<br>0.06 - 0.15 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |

Table XIII-12 (continued)

| Sampling Station Number[a] | Parameter (Units) | Applicable Standards[b] | Range | Violation of Accepted Standard | Sampling Dates | Total Number of Samples |
|---|---|---|---|---|---|---|
| 8 | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .0005 - .0018<br>.0008 - .0086 | No<br>No | July - November 1981<br>May 1982 | 5<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 270 - 19,000<br>200 - 1900 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| 9 | Temperature (°F) | Maximum of 89.0 | 39.6 - 77.9<br>57.7 - 67.1 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 4.3 - 18.0<br>6.3 - 9.1 | Yes<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.9 - 8.7<br>7.9 - 8.2 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.23 - 0.76<br>0.12 - 0.24 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .0017 - .0108<br>.009 - .0073 | No<br>No | July - November 1981<br>May 1982 | 5<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 140 - 1700<br>20 - 1500 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| 10 | Temperature (°F) | Maximum of 89.0 | 40.1 - 73.9<br>55.0 - 62.8 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 4.2 - 15.7<br>8.3 - 16.8 | Yes<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 7.9 - 8.4<br>7.9 - 8.3 | No<br>No | July - November 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.06 - 0.22<br>0.04 - 0.14 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .0014 - .0027<br>.0012 - .0037 | No<br>No | July - August 1981<br>May 1982 | 4<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 90 - 1300<br>90 - 3400 | Yes<br>Yes | July - August 1981<br>May 1982 | 12<br>4 |
| 11 | Temperature (°F) | Maximum of 89.0 | 41.0 - 77.0<br>58.3 - 68.2 | No<br>No | July - August 1981<br>May 1982 | 12<br>4 |
| | Dissolved Oxygen (mg/l) | Minimum of 5.0 | 7.9 - 15.3<br>7.6 - 11.4 | No<br>No | July - August 1981<br>May 1982 | 12<br>4 |
| | pH (s.u.) | Maximum of 9.0<br>Minimum of 6.0 | 8.0 - 8.5<br>8.0 - 8.4 | No<br>No | July - August 1981<br>May 1982 | 12<br>4 |
| | Total Phosphorus (mg/l) | Maximum of 0.1 | 0.17 - 0.39<br>0.1 - 0.24 | Yes<br>Yes | July - August 1981<br>May 1982 | 12<br>4 |
| | Un-ionized Ammonia Nitrogen (mg/l) | Maximum of 0.04 | .0008 - .0031<br>.009 - .0032 | No<br>No | August, November 1981<br>May 1982 | 2<br>4 |
| | Fecal Coliform (colonies per 100 ml) | Maximum of 200/400 | 20 - 790<br>220 - 2700 | Yes<br>Yes | July - November 1981<br>May 1982 | 12<br>4 |

[a] See Map XIII-5 for sampling station locations.
[b]Standards indicated for stations 1-3 and stations 7-11 are those established for warmwater sport fish and full recreational use objectives. Standards indicated for station 4 are those established for limited forage fish and full recreational use, while standards for stations 5 and 6 are those established for limited aqautic life and limited recreational use. See Chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Wisconsin Department of Natural Resources and SEWRPC.

analyses indicated that recommended level of heptachlor epoxide was exceeded in one of 11 samples. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, DDT, DDE, DDD, aldrin, heptachlor, lindane, dieldrin, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels.

Recent data for lead levels in the Root River watershed are shown in Figure XIII-1 and indicate that levels of lead did not exceed the chronic or acute toxicity levels. No current sampling results were available for additional metals in the Root River watershed. No sampling of bottom sediments was conducted on the Root River.

Since the completion of the initial regional water quality management plan, 47 spills of toxic substances into streams within the Root River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 46 have occurred in the main stem of the Root River, 32 in the City of Racine, eight in the Town of Caledonia, three in the City of Franklin, and one each in the City of West Allis, the City of Greenfield, and the Town of Mt. Pleasant. One toxic substance spill occurred in a tributary stream, in the West Branch of the Root River Canal in the Village of Union Grove. The majority of the substances that were spilled into surface waters were oil and related petroleum products.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Root River and its major tributaries were assessed, with the results set forth in Table XIII-13. Fish populations and diversity were poor throughout the watershed. One fish kill has been documented in the Root River watershed since the completion of the initial plan. This fish kill occurred in Hoods Creek due to an unknown cause.

Standards for fecal coliform were estimated to be exceeded in the majority of the streams in the Root River watershed. Total phosphorus concentrations exceeded the standards in the Root River upstream of County Line Road, downstream of Nicholson Road, and in Tess Corners Creek. Dissolved oxygen levels were estimated to be below the standards in the Root River Canals and portions of the Upper Root River main stem but were expected to meet standards in Tess Corners Creek and in the lower Root River main stem.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were fair to poor throughout, with the exception of the East Branch Root River Canal which was very poor.

Table XIII-14 sets forth the water quality index classifications[6] used in the initial plan for 1964, 1974-75, and for 1989-1990 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table XIII-14, recent comparative water quality data were available from one station on the Root River main stem at Johnson Park, Rt-6a. This

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[6] For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table XIII-13

**CHARACTERISTICS OF STREAMS REACHES IN THE ROOT RIVER WATERSHED**

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating[c] | Streambed Sedimentation | Physical Modifications to Channel[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| Root River upstream Grange Avenue . . . . . . . . . . . | 4.8 | Poor | No | Yes | No | Yes | Yes | - - | Fairly poor | - - | - - |
| Root River downstream Grange Avenue to Ryan Road . | 9.8 | Poor | No | No | No | Yes | Yes | - - | Fair | - - | - - |
| Root River downstream Ryan Road to County Line Road . . | 3.4 | Poor | No | Yes | No | Yes | Yes | - - | Fairly poor | - - | - - |
| Root River downstream County Line Road to Nicholson Road | 5.7 | Poor | No | Yes | No | No | No | - - | Fairly poor | - - | - - |
| Root River downstream Nicholson Road to STH 38 . . | 12.5 | Poor | No | No | Yes | Yes | Yes | - - | Fairly poor | - - | - - |
| Root River downstream STH 38 | 6.0 | Poor | No | No | No | Yes | Yes | - - | Fairly poor | - - | - - |
| West Branch Root River Canal | 13.5 | Poor | No | Yes | No | - - | Yes | - - | Fairly poor | - - | - - |
| Root River Canal . . . . . . | 4.9 | Poor | No | Yes | No | - - | Yes | - - | Fairly poor | - - | - - |
| East Branch Root River Canal . | 11.6 | Poor | No | Yes | No | - - | Yes | - - | Very poor | - - | - - |
| Tess Corners/Whitnall Park Creek . . . . . . . . . . . | 9.9 | Poor | No | No | No | Yes | Yes | - - | Fair | - - | - - |
| Husher Creek . . . . . . . . | 3.4 | Poor | No | Yes | No | No | No | - - | Fair | - - | - - |
| Hoods Creek . . . . . . . . . | 8.6 | Poor | Yes[e] | Yes | No | No | Yes | - - | Fairly poor | - - | - - |
| TOTAL | 94.8 | | | | | | | | | | |

[a] Based upon professional judgment of area fish managers.

[b] The most recent water quality data available as described in Figure XIII-1 were used to evaluate water quality in the Root River system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to estimate current water quality for Root River stream reaches based upon year 2000 land use conditions and current level of pollution control

[c] Biotic Index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in Wisconsin Department of Natural Resources Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality in Streams," Hilsenhoff, 1982. Biotic index ratings are from sampling conducted in 1990. Sampling was also conducted in the watershed in 1987.

[d] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

[e] Unknown cause.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XIII-14

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS
OF THE ROOT RIVER WATERSHED 1964, 1974-1975, AND 1990

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July and August of 1989-1990 |
|---|---|---|---|
| Main Stem Stations | | | |
| Rt-1 | Fair | Poor | - - |
| Rt-2 | Poor | Poor | - - |
| Rt-4 | Fair | Fair | - - |
| Rt-5 | Fair | Poor | - - |
| Rt-6 | Fair | Fair | Good |
| Tributary Station | | | |
| Rt-3 | Poor | Poor | - - |
| Watershed Average | Fair | Fair | - - |

[a] See Map XIII-5 for sampling station locations.

Source: SEWRPC.

station and additional locations where water quality data were collected by the Wisconsin Department of Natural Resources are shown on Map XIII-5. The data obtained for the DNR sampling station Rt-6a were used for comparative purposes in conjunction with earlier data from Station Rt-6 located on the Root River at Nicholson Road. The limited data available indicate that water quality conditions improved from "fair" in 1964 and 1974 through 1975 to "good" in 1989 and 1990 at station Rt-6.

A summary of potential pollution sources in the Root River watershed by stream reach is shown in tabular summary in Table XIII-15. Review of the data indicate the majority of the conversion of lands from rural to urban uses has occurred in the area tributary to the Root River main stem in Milwaukee County. It should be noted that the majority of the documented spills of toxic substances and the majority of the permitted industrial discharges have occurred in the Root River main stem in and around the City of Racine. Data on nonpoint source pollution, public and private sewage treatment plants discharging to surface waters, and additional potential impacts to surface water quality are included in Table XIII-15.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Root River watershed as of 1993, are generally recommended for warmwater sport fish or warmwater forage fish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. Tess Corners Creek and Hoods Creek have limitations for sport fish habitat and are recommended for warmwater forage fish and full recreational uses. The Root River Canal, the East Branch Root River Canal downstream of STH 20, and the West Branch of the Root River Canal downstream of CTH C have further limitations for warmwater sport or forage fish and recreational utilities and are therefore recommended for limited forage fish and limited recreational uses. The West Branch of the Root River Canal upstream of CTH C and the East Branch Root River Canal upstream of STH 20 are recommended for limited aquatic life and limited recreational uses.

Based upon the available data for sampling stations in the watershed, the main stem of the Root River and the Root River Canal did not meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. Based upon a review of the data summarized in Figures XIII-1 through XIII-3 and in Table XIII-12, and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the fecal coliform and phosphorus standards occur along the majority of the main stem of the Root River and the recommended water use objectives continue to be only partially met in the majority of the major streams in the watershed.

There are currently two stream reaches for which the water use objectives set forth herein are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. These include Tess Corners Creek and Hoods Creek. Chapter NR 104 classifies both streams as capable of supporting limited forage fish communities, while the objectives set forth herein recommend warmwater forage fish objectives for both streams. It is recommended that stream appraisals to further assess the potential for higher use objectives be conducted for

Table XIII-15

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE ROOT RIVER WATERSHED: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b]: Historical 1976-1990 | Extent of Conversion of Lands from Rural to Urban[b]: Expected 1990-2010 | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources: Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Root River u/s Grange Avenue | Moderate[d] | Insignificant[a] | 1987-cloudy substance | X | X | - - | - - | 2 | | New Berlin Memorial Hospital private sewage treatment plant abandoned in 1984 | 1, 2 |
| Root River d/s Grange Avenue to Ryan Road | Moderate | Major | 1986-cleaning fluid<br>1990-antifreeze<br>1990-fuel oil<br>1991-gasoline | X | X | - - | - - | 5 | Fadrowski Drum Disposal site[e] | Rawson Homes Sewer and Water Trust public sewage treatment plant abandoned in 1977 Union Oil Truck Stop private sewage treatment plant abandoned | 1, 2 |
| Root River d/s Ryan Road to County Line Road | Insignificant | Significant | - - | - - | X | - - | - - | 0 | | | 1, 2 |
| Root River d/s County Line Road to Nicholson Rd | Insignificant | Moderate | 1982-heavy oil<br>1992-Baby Fresh lotion | X | X | - - | - - | 3 | | | 1, 2 |
| Root River d/s Nicholson Road to STH 38 | Insignificant | Significant | 1984-waste oil<br>1986-diesel fuel<br>1987-petroleum<br>1987-waste oil<br>1987-waste oil<br>1987-unknown<br>1990-gasoline | X | X | - - | - - | 3 | Hunt's Disposal landfill site[e] | Caddy Vista Sanitary District public sewage treatment plant abandoned in 1982 | 2 |
| Root River d/s STH 38 | Insignificant[d] | Insignificant[d] | 1983-diesel fuel<br>1983-diesel fuel<br>1983-oil<br>1983-machine oil<br>1983-unknown<br>1983-oil<br>1983-gasoline<br>1983-oil<br>1983-oil<br>1984-oil<br>1984-waste oil<br>1984-oil<br>1984-oil-like substance<br>1984-cooking grease<br>1984-cooking grease<br>1986-hydraulic oil<br>1986-gasoline | X | X | - - | - - | 7 | | | 2 |

Table XIII-15 (continued)

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] Historical 1976-1990 | Expected 1990-2010 | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources: Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Root River d/s STH 38 (continued() | | | 1986-diesel fuel<br>1986-hydraulic fluid<br>1986-diesel oil<br>1986-acid<br>1986-cooking grease<br>1986-hydraulic oil<br>1987-light oil<br>1988-acid<br>1988-petroleum<br>1988-brown slime substance<br>1988-oil<br>1989'diesel fuel<br>1990-petroleum product<br>1990-pertroleum product<br>1990-white oily substance on water | | | | | | | | |
| West Branch Root River Canal | Insignificant | Insignificant | 1984-fuel oil | X | X | 1 | 2 | 0 | | | 2, 3 |
| Root River Canal | Insignificant | Insignificant | - - | - - | X | - - | - - | 1 | | | 2 |
| East Branch Root River Canal | Insignificant | Insignificant | - - | - - | X | - - | 1 | 1 | | | 2 |
| Tess Corners/ Whitnall Park Creek | Moderate | Significant | - - | X | X | - - | - - | 1 | | Village of Hales Corners public sewage treatment plan abandoned in 1981 City of Muskego-Northeast District public sewage tretment plant abandoned in 1985 | 1, 2 |
| Husher Creek | Insignificant | Insignificant | - - | - - | X | - - | - - | 0 | | | 2 |
| Hoods Creek | Insignificant | Significant | - - | X | X | 1 | - - | 0 | | The Fremont Company private sewage treatment plant abandoned in 1985 | 2 |

Table XIII-15 (continued)

[a]Includes the tributary drainage area of each stream reach.

[b]Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c]Number codes refer to the following ongoing pollution abatement efforts:

1. Construction Erosion Control Ordinances in place
2. Rural Nonpoint Source Controls Implemented
3. Abandonment of Private Sewage Treatment Plant Underway

[d]Considerable urban development existing pre-1976.

[e]Superfund site

Source: Wisconsin Department of Natural Resources and SEWRPC.

both streams as part of the next one-year monitoring period envisioned to be carried out in the Root River watershed.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, current land use planning, local nonpoint source pollution abatement and sewerage system planning, there are three major issues which remain to be addressed in the Root River watershed. The first issue relates to the implementation of the findings and recommendations of the sanitary sewerage and water supply system plan for the greater Racine area. The second issue relates to the degree of nonpoint source pollution abatement still required in the watershed. The third issue relates to potential changes to the plan based upon recommendations set forth in the ongoing Milwaukee Metropolitan Sewerage District facility plan updating. In addition, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological conditions survey on Hoods Creek and Tess Corners and to re-assess the water use objectives currently set forth in the Wisconsin Administrative Code.

### Sanitary Sewerage and Water Supply System Plan Implementation

The only major issue remaining to be resolved with regard to point sources of pollution deals with the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Alvord, Burdick & Howson and Applied Technologies, Inc. entitle, A Coordinated Sanitary Sewerage and Water Supply System Plan, Greater Racine Area, Wisconsin, September 1992. The recommendations of that plan include revisions to the planned sewer service areas in the greater Racine area and provisions to abandon the existing sewage treatment plant operated by the Town of Yorkville Utility District No. 1, with the area served by that plant being connected to the City of Racine system for treatment plant purposes. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1992 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

### Reassessment of the Future Levels of Nonpoint Source Controls in the Entire Root River Watershed

The nonpoint source priority watershed program implementation period has now been completed for the Root River watershed. Following completion of detailed water quality and biological condition monitoring in the Root River watershed under the DNR ongoing monitoring program, it is recommended that the need for further nonpoint source controls be assessed based upon the current level of plan implementation and water quality and biological conditions data.

### Milwaukee Metropolitan Sewerage District Facility Plan Update

A future amendment to the regional plan for the Root River watershed may potentially be developed under the facility plan update initiated by the Milwaukee Metropolitan Sewerage District in 1995. That plan update is anticipated to constitute an amendment to the regional plan once it is adopted by all of the agencies involved.

## Stream Reclassification Evaluation

Hoods Creek and Tess Corners Creek are currently included under the limited forage fish classifications in Chapter NR 104 of the Wisconsin Administrative Code. However, it is recommended that the objectives for these streams be upgraded to provide for forage fish classification. It is recommended that the Wisconsin Department of Natural Resources include further stream appraisals for Hoods Creek and Tess Corners Creek as part of the monitoring program during the next period when the Department is conducting monitoring efforts in the Root River watershed as is envisioned within the next five to seven years.

Chapter XIV

# SAUK CREEK WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

## INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update.

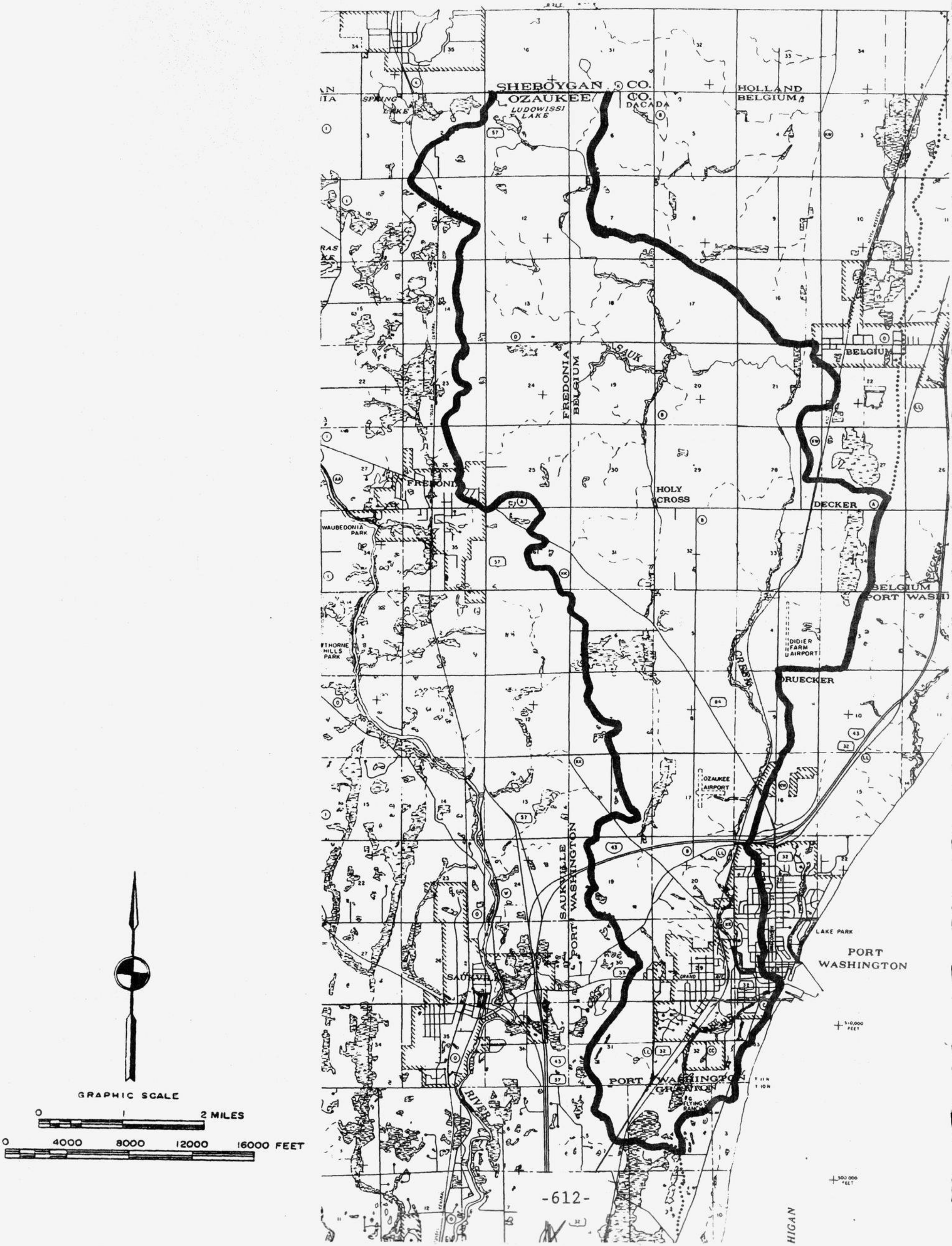
In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Sauk Creek watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Sauk Creek watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited to the Sauk Creek watershed as there are no major lakes located on the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Sauk Creek watershed is located in the northeast portion of the Region and all but 0.9 square mile of the approximately 34 square mile area of the watershed lies within the Region. The main stem of the Sauk Creek rises in Ozaukee County, and flows southeasterly for approximately 18.8 miles and discharges into Lake Michigan in the City of Port Washington in Ozaukee County. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Sauk Creek and its principal tributaries, are shown on Map XIV-1. The Sauk Creek watershed contains no lakes with a surface area of 50 acres or more.

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Sauk Creek watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit

# Map XIV-1
## SAUK CREEK WATERSHED



consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban lake uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharged to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table XIV-1 summarizes the existing land uses in the Sauk Creek watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. The watershed contains a limited amount of urbanized areas, 90 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 81 percent of the total area of the watershed in agricultural and related rural uses, about 2 percent in woodlands, about 5 percent in surface water and wetlands, and about 2 percent in other open lands. The remaining 10 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XIV-2.

Within the Sauk Creek watershed, urban development has occurred in the Village of Fredonia and in and around the City of Port Washington.

As shown in Table XIV-1, from 1975 to 1990, urban land uses in the watershed increased from 1,934 acres, or about 3.0 square miles, to 2,195 acres, or about 3.4 square miles, or by about 14 percent. As shown in Table XIV-1, residential land use has increased within the watershed, from 665 acres or about 1.0 square miles in 1975 to 798 acres, or about 1.3 square miles in 1990, a 20 percent increase. Commercial and industrial lands increased from 113 acres to 140 acres, or about 0.2 square miles, an increase of about 24 percent.

The 2,195 acres, or about 3.4 square miles of urban land uses in the watershed as of 1990 can be compared to the staged 1990 planned level of about 2,365 acres envisioned in the adopted year 2000 land use plan. The current status of development in the Sauk Creek watershed and in adjacent portions of Ozaukee County was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XIV-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Sauk Creek watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban uses are expected to increase in and adjacent to the City of Port Washington, north and east of the Village of Fredonia, and south and west of the Village of Belgium.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Sauk Creek watershed, as indicated in Table XIV-2, is projected to increase from the 1990 total of about 3.4 square miles, or about 10 percent of the total area of the watershed, to about 3.8 square miles, or about 11 percent of the total area of

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Table XIV-1

**LAND USE IN THE SAUK CREEK WATERSHED: 1975 and 1990[a]**

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 665 | 3.0 | 798 | 3.6 | 133 | 20.0 |
| Commercial | 31 | 0.1 | 46 | 0.2 | 15 | 48.4 |
| Industrial | 82 | 0.4 | 94 | 0.4 | 12 | 14.6 |
| Transportation, Communication, and Utilities[b] | 1,016 | 4.6 | 1,096 | 4.9 | 80 | 7.9 |
| Governmental and Institutional | 97 | 0.4 | 129 | 0.6 | 32 | 33.0 |
| Recreational | 43 | 0.2 | 32 | 0.1 | - 11 | - 25.6 |
| Subtotal | 1,934 | 8.7 | 2,195 | 9.8 | 261 | 13.5 |
| Rural | | | | | | |
| Agricultural and Related | 18,252 | 82.4 | 18,004 | 81.3 | - 248 | - 1.4 |
| Lakes, Rivers, Streams and Wetlands | 1,088 | 4.9 | 1,061 | 4.8 | - 27 | - 8.4 |
| Woodlands[c] | 393 | 1.8 | 409 | 1.9 | 16 | 4.1 |
| Open Lands, Landfills, Dumps, and Extractive | 477 | 2.2 | 475 | 2.2 | - 2 | - 0.4 |
| Subtotal | 20,210 | 91.3 | 19,949 | 90.2 | - 261 | - 1.3 |
| Total | 22,144 | 100.0 | 22,144 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

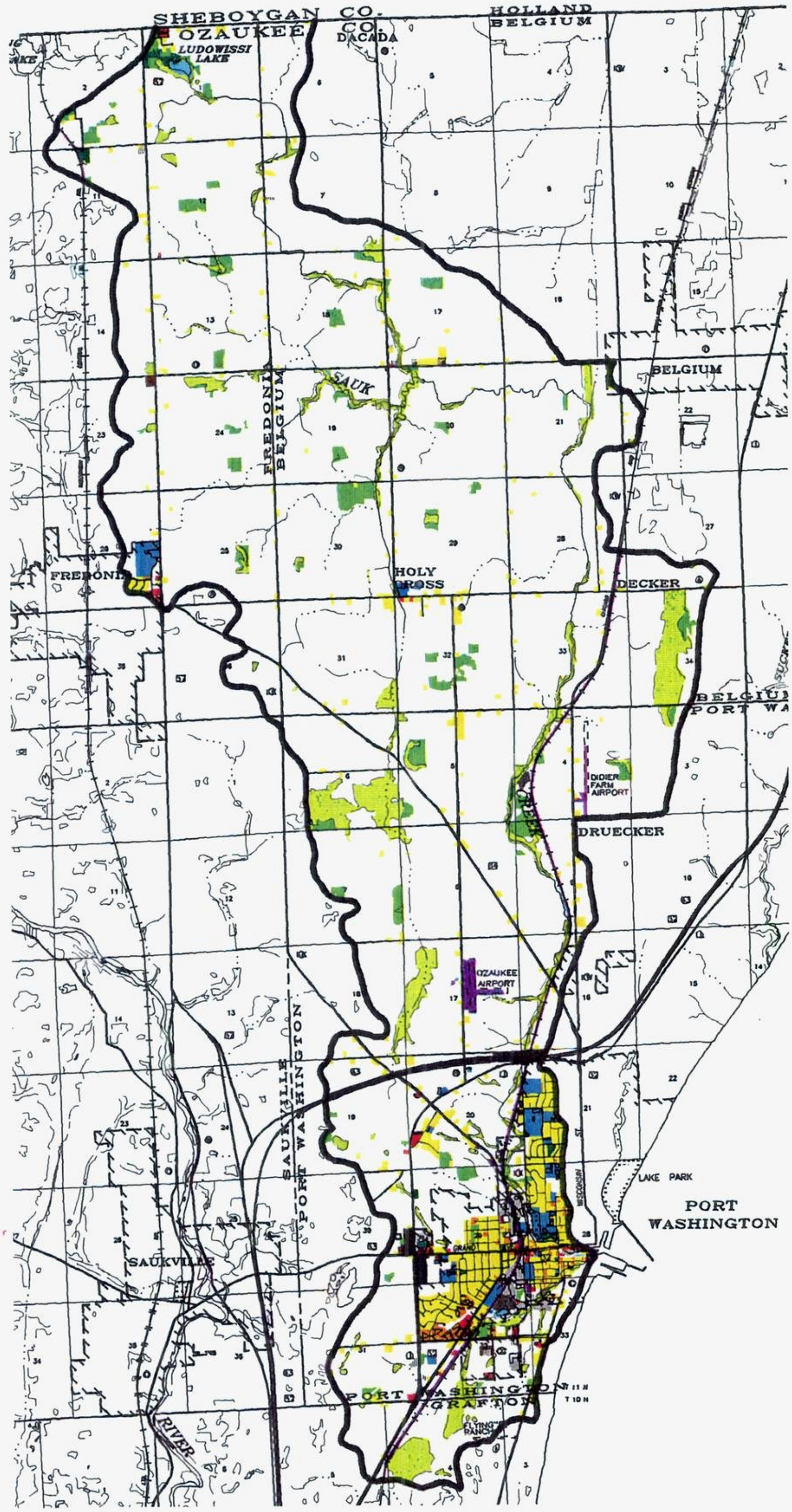
[b] Includes all off-street parking.

[c] Includes both rural and urban lands.

Source: SEWRPC.

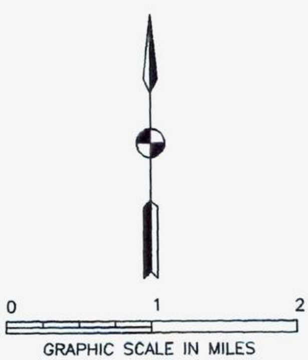
# MAP XIV-2

# LAND USES IN THE SAUK CREEK WATERSHED: 1990




-LEGEND-

- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREET AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS




The Sauk Creek watershed is about 35 square miles in areal extent, or about 1 percent of the total Region. In 1990, about 3 square miles, or about 10 percent of the watershed, was in urban land uses.

Source: SEWRPC.

Table XIV-2

**EXISTING AND PLANNED LAND USE IN THE SAUK CREEK WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]**

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1990-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 798 | 3.6 | 971 | 4.4 | 173 | 21.7 | 1,562 | 7.1 | 764 | 95.7 |
| Commercial | 46 | 0.2 | 40 | 0.2 | 6 | 13.0 | 46 | 0.2 | 0 | 0.0 |
| Industrial | 94 | 0.4 | 160 | 0.7 | 66 | 70.0 | 205 | 0.9 | 111 | 118.1 |
| Transportation, Communication, and Utilities[b] | 1,096 | 4.9 | 1,120 | 5.1 | 24 | 2.2 | 1,338 | 6.1 | 242 | 22.1 |
| Governmental and Institutional | 129 | 0.6 | 109 | 0.5 | 20 | 15.5 | 129 | 0.6 | 0 | 0.0 |
| Recreational | 32 | 0.1 | 54 | 0.2 | 22 | 68.8 | 97 | 0.4 | 65 | 203.1 |
| Subtotal | 2,195 | 9.8 | 2,454 | 11.1 | 359 | 11.8 | 3,377 | 15.3 | 1,182 | 53.8 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 11,004 | 81.3 | 17,830 | 80.5 | - 174 | - 1.0 | 16,955 | 76.6 | - 1,049 | - 5.8 |
| Lakes, Rivers, Streams, and Wetlands | 1,061 | 4.8 | 1,042 | 4.7 | - 19 | - 1.8 | 1,042 | 4.7 | - 19 | - 1.8 |
| Woodlands | 409 | 1.9 | 386 | 1.7 | - 23 | - 5.6 | 386 | 1.7 | - 23 | - 4.9 |
| Open Lands[c] | 475 | 2.2 | 432 | 2.0 | - 43 | - 9.1 | 384 | 1.7 | - 91 | - 19.2 |
| Subtotal | 19,949 | 90.2 | 19,690 | 88.9 | - 259 | - 1.3 | 18,767 | 84.7 | - 1,182 | - 5.9 |
| Total | 22,144 | 100.0 | 22,144 | 100.0 | 0 | - - | 22,144 | 100.0 | 0 | - - |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both urban and rural open lands.

Source: SEWRPC.

the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 5.3 square miles, or about 15 percent of the total watershed by year 2010. It is important to note that the 85 to 89 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and as recommended in the year 2010 regional land use plan, and is proposed to be preserved, largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 31.2 square miles in 1990 to about 30.7 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 29.3 square miles under the high growth-decentralized land use plan, decreases of about 2 and 6 percent between 1990 and 2010 for the two year 2010 plans considered.

## POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the current initial regional water quality management plan, as well as current plan recommendations for the abatement of water pollution from point sources of pollution in the Sauk Creek watershed--including consideration of private sewage treatment plants, points of public sewage collection system overflows, and industrial wastewater treatment systems and discharges. This section also includes a status report on the public sanitary service areas located in the watershed.

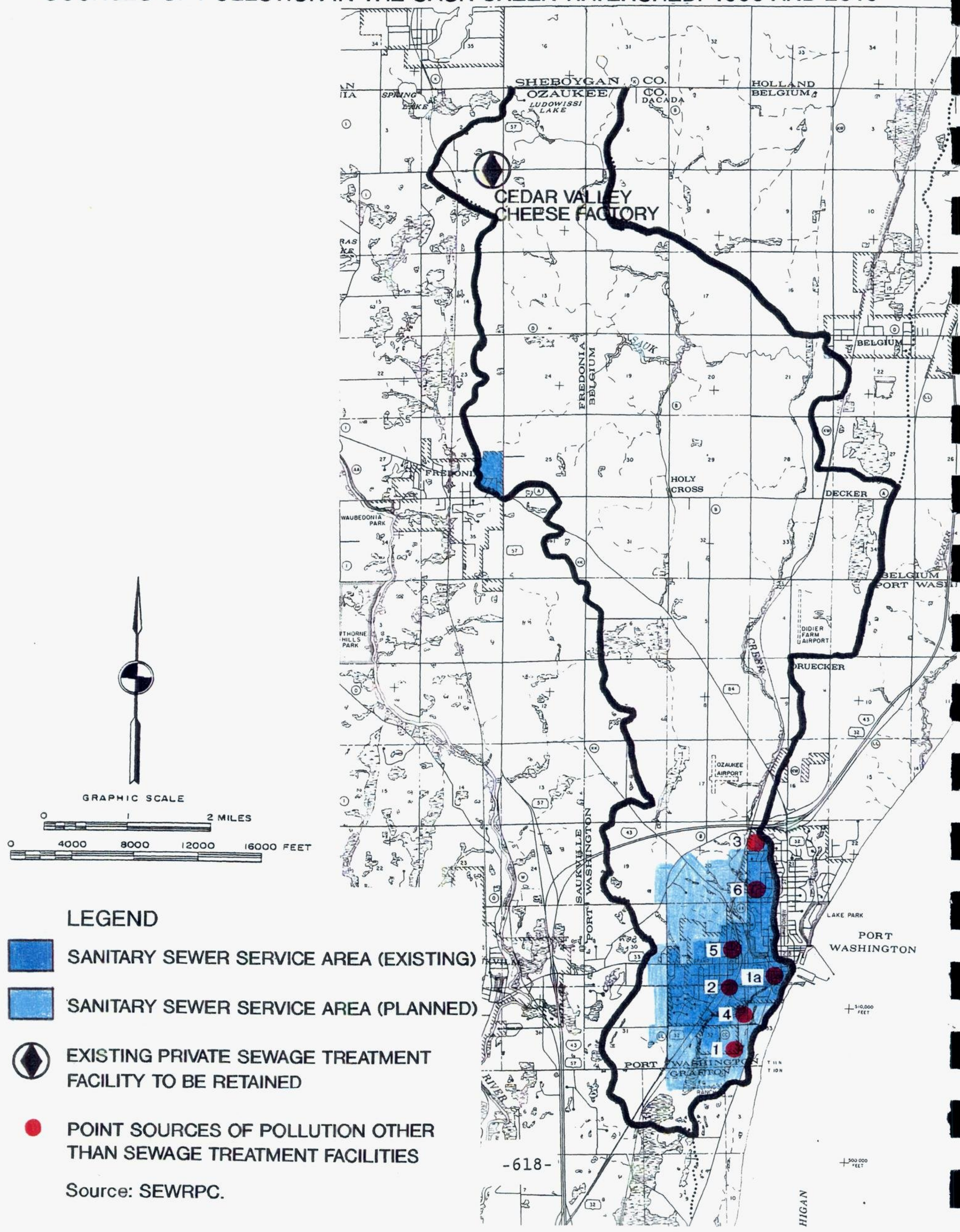
### Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were no public sewage treatment facilities located in the Sauk Creek watershed. One private sewage treatment plant serving the Cedar Valley Cheese Factory in the Town of Fredonia was in operation in 1975, as shown on Map XIV-3. The status of implementation in regard to the private sewage treatment plant in the Sauk Creek watershed, as recommended in the initial regional water quality management plan, is shown in Table XIV-3. As indicated in Table XIV-3, the private plant serving the Cedar Valley Cheese Factory was recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES).

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were two sewer service areas identified within, or partially within, the Sauk Creek watershed, Port Washington, and Fredonia. Currently, these areas have undergone refinements as recommended. The boundaries of the sewer service areas, as currently refined, are shown on Map XIV-3. Table XIV-4 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer

# Map XIV-3

## SEWER SERVICE AREAS, SEWAGE TREATMENT PLANTS AND OTHER POINT SOURCES OF POLLUTION IN THE SAUK CREEK WATERSHED: 1990 AND 2010




## LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.

Table XIV-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS
IN THE SAUK CREEK WATERSHED: 1990

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| -- | -- | -- | -- |
| **Private Sewage Treatment Plants** | **Disposal of Effluent** | **Plan Recommendation** | **Implementation Status** |
| Cedar Valley Cheese Factory | Soil absorption | Maintain and upgrade as needed | Plant maintained |

Source: SEWRPC.

Table XIV-4

PLANNED SANITARY SEWER SERVICE AREAS IN
THE SAUK CREEK WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sanitary Sewer Service Area (sq. miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Port Washington | 3.9 | Port Washington | December 1, 1983 | SEWRPC CAPR. No. 95, Sanitary Sewer Service Area for the City of Port Washington, Ozaukee County, Wisconsin |
| Fredonia Waubeka | 0.1 | Fredonia Waubeka | September 13, 1984 | SEWRPC CAPR. No 96, Sanitary Sewer Service Area for the Village of Fredonia, Ozaukee County, Wisconsin |
| Total | 4.0 | | | |

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

service area for the Sauk Creek watershed, as refined through 1993, totals about four miles, or about 11 percent of the total watershed area, as shown in Table XIV-4.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation and maintenance of the private sewage treatment plant serving the Cedar Valley Cheese Factory.

The current planned sanitary sewer service areas in the Sauk Creek watershed are shown on Map XIV-3. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. In the Sauk Creek watershed, these sewer service areas include Fredonia and Port Washington. Together, these sewer service areas total about four miles, or about 11 percent of the Sauk Creek watershed.

As noted above, each of these service areas in the watershed has been refined as part of the ongoing regional water quality management plan updating process. Thus, no specific additional refinements are envisioned to be needed. It is recommended that the sanitary sewer service areas and attendant planned population levels be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

There is currently one private sewage treatment plant in operation within the Sauk Creek watershed. This facility serves the Cedar Valley Cheese facility which is located beyond the current limits of the planned public sanitary sewer service area. It is recommended that this plant be maintained and upgraded as needed as part of the Wisconsin Pollution Discharge Elimination System permitting process.

Sewer Flow Relief Devices

Current Conditions and Status of Plan Implementation: In 1975, there were two known separate sewer flow relief devices located in the Sauk Creek watershed, both draining to Sauk Creek from the City of Port Washington. During the period of 1988 through 1993, the only flow relief devices which existed in the sanitary sewer systems were selected bypasses which physically remained in the sewerage system but which function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table XIV-5, two points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Sauk Creek watershed. Both of these flow relief points are located in the City of Port Washington. These flow relief points have been in operation infrequently, with the average discharge occurrence frequency over this five-year period, being about once per five years per flow relief location. This equates to an average of about one isolated overflow occurrence every two to three years considering all reported bypassing.

Current Plan Recommendations: It is recommended that the City of Port Washington continue to monitor the sewerage system operations to ensure that the use the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is

Table XIV-5

KNOWN SEWAGE FLOW RELIEF DEVICES
IN THE SAUK CREEK WATERSHED: 1988-1993

| Sewerage System | Sewage Treatment Plant Flow Relief Device | Sewage Flow Relief Devices in the Sewer System | | | | | Comments |
|---|---|---|---|---|---|---|---|
| | | Crossovers | Pumping Station Bypasses | Other Bypasses | Portable Pumping Systems | Total | |
| City of Port Washington | -- | -- | -- | 2 | -- | 2 | Used only in case of extreme wet weather |

Source: SEWRPC.

recommended that planning for all sewerage system expansion and upgrading be conducted with the assumption that there will be no planned bypasses of untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only by passes remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan contained no intercommunity trunk sewers recommended for construction within the Sauk Creek watershed.

Current Plan Recommendations: No new intercommunity trunk sewers are recommended for construction in the Sauk Creek watershed under the current plan.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Current Conditions and Status of Plan Implementation: In 1975, there was a total of two known point sources of pollution identified in the Sauk Creek watershed other than public and private sewage treatment plants. These sources discharged industrial cooling and process waters to the surface water system. Of these, one was identified as discharging only cooling water and the other discharged a process wastewater. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were seven such point sources of wastewater discharging to Sauk Creek or the groundwater system of the Sauk Creek watershed. Table XIV-6 summarizes selected characteristics of these other point sources and Map XIV-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were seven known, permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface or groundwaters in the Sauk Creek watershed. These point sources of wastewater discharge, primarily industrial cooling process, rinse, and wash water, discharge directly or following treatment to the groundwater or the surface waters of the Sauk Creek watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were no enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, no new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map XIV-3.

Table XIV-6

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
WATER POLLUTION IN THE SAUK CREEK WATERSHED: 1990[a]

| Facility Name | County | Map ID#[b] | Permit Type | Permit # | Expiration Date | Standard Industrial Classification Code | Industrial Activity | Receiving Water | Treatment System[c] |
|---|---|---|---|---|---|---|---|---|---|
| Sauk Creek Watershed | | | | | | | | | |
| Kickhaefer Mfg. Co. | Ozaukee | 1 | General | 0044938-3 | 09/30/95 | 3469/3496 | Metal stampings, misc. wire prod. | Sauk Creek | -- |
| Modern Equipment Co. | Ozaukee | 2 | General | 0044938-3 | 09/03/95 | 3559 | Special industry machinery | Sauk Creek via storm sewer | -- |
| Port Washington Park and Rec. Dept. | Ozaukee | 3 | General | 0046523-2 | 09/03/95 | 9199 | General government | Sauk Creek | -- |
| Schmitz Ready Mix - Port Washington | Ozaukee | 4 | General | 0046507-2 | 09/03/95 | 3273 | Ready-mix concrete | Groundwater discharge | -- |
| Simplicity Manufacturing | Ozaukee | 5 | General | SPEC PERM | -- | 3524 | Lawn & garden equipment | Sauk Creek | -- |
| Swietlik Residence | Ozaukee | 6 | General | HEAT PUMP | -- | 8811 | Private household | Sauk Creek via storm sewer | -- |
| WI Electric Power Co. - Port Wash. | Ozaukee | 1A | Specific | 0000922 | 12-31-93 | 4911 | Electric services | Lake Michigan via Sauk Creek | 3, 2, 5, 6 |

[a]Table XIV-6 includes seven known, permitted point sources of wastewater discharging to Sauk Creek or to the groundwater system in the Sauk Creek watershed. As of 1993, there were seven known, permitted point sources of water pollution.

[b]See Map XIV-3, Sewer Service Areas, Sewage Treatment Plants and Point Sources of Pollution in the Sauk Creek Watershed: 1990 and 2010.

[c]The number code refers to the following treatment systems:

1. Aerated lagoon
2. Coagulation flocculation
3. Gravity sedimentation
4. Holding pond
6. Secondary clarification
7. Spray Irrigation

5. pH control
6. Secondary clarification
7. Spray irrigation

Source: Wisconsin Department of Natural Resources and SEWRPC.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Sauk Creek watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources. In some cases, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can potentially be transmitted to the surface waters.

There are currently six known abandoned landfills located in the Sauk Creek watershed. There is no indication that any of these landfills are negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Sauk Creek watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U. S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were no known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters or ground water in the Sauk Creek Watershed. As of 1993, there were 19 leaking underground storage tank sites in the Sauk Creek watershed. None of these sites involved discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters. As of 1990, there were no permitted sites discharging to surface or ground waters in the Sauk Creek watershed.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the adopted regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning onsite sewage disposal systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Sauk Creek watershed, the plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, streambank erosion control, and onsite sewage system disposal management. Implementation of the recommended nonpoint source control practices has been achieved on a very limited basis in the Sauk Creek watershed through a variety of State and local regulations and programs. These programs include the regulation of onsite sewage disposal systems under the program currently administered by Ozaukee County. This program provides for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified. In addition, significant progress has also been made in the area of construction site erosion control. As of January 1993, the Village of Fredonia had adopted a construction erosion control ordinance which is based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities, while the City of Port Washington had an existing ordinance that pre-dated the model.

With regard to rural nonpoint source control, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program and other programs, such as the Conservation Reserve Program administered by the U. S. Department of Agriculture, Soil Conservation Service, and the wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances to T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U. S Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade, and Consumer Protection as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Ozaukee County. Thus, such a plan has been prepared for all areas of the Sauk Creek watershed. That plan identifies priority areas for cropland soil erosion control within Ozaukee County, and, additionally, recommends farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While these local programs described above have likely resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. To date, the Sauk Creek watershed has not been selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program.

Current Plan Recommendations

Nonpoint source pollution control practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings, plus construction site erosion control, onsite sewage system management, and streambank erosion control are recommended to be carried out throughout the Sauk Creek watershed. The types of practice recommended to be considered for this level of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, the watershed should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make State cost-sharing funds and related programs available for nonpoint source pollution control measures. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[1] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Sauk Creek watershed in the high category, indicating that inclusion in the program will be possible when existing planning projects are completed and staff becomes available within the Department of Natural Resources.

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[1]See SEWRPC Memorandum entitled "Assessment and Ranking of Watershed for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous section, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program. As of 1993, no water quality monitoring has been conducted in the Sauk Creek watershed.

### Current Plan Recommendations

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at Stations Sk-1 and Sk-2, the locations of which are shown on Map XIV-4. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five to seven year intervals. These recommendations can be coordinated with, and are consistent with, the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each basin in the Region in an approximate five to seven year rotating cycle.

## LAKE MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological condition monitoring programs to be established.

As noted above, there are no major lakes in the Sauk Creek watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the region are considered applicable for management purposes.

## WATER QUALITY AND BIOLOGICAL CONDITIONS

### Streams

Streamwater quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark streamwater quality study, the 1965 through 1975 Commission streamwater quality monitoring effort, and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Sauk Creek watershed included

# Map XIV-4

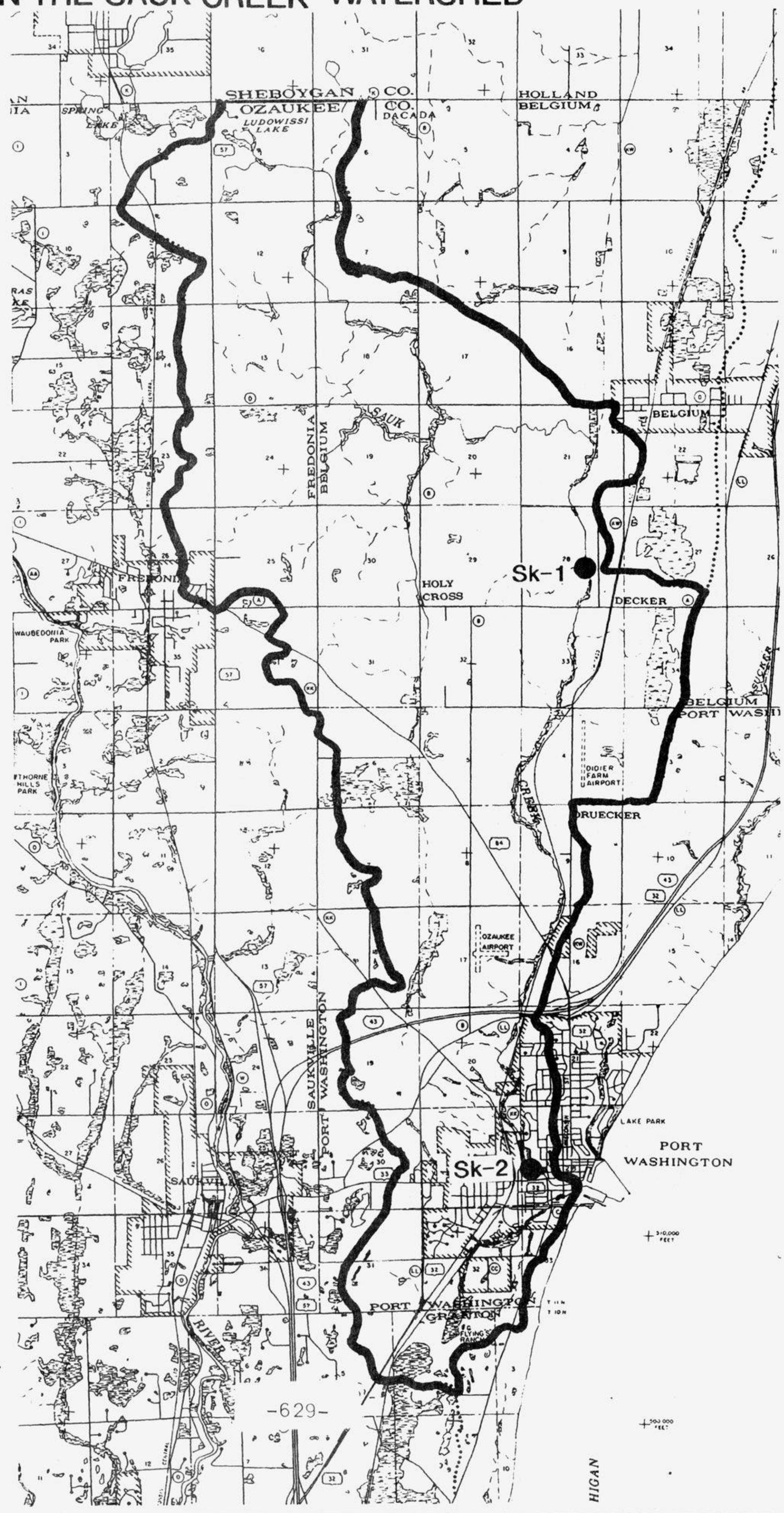
## LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE SAUK CREEK WATERSHED

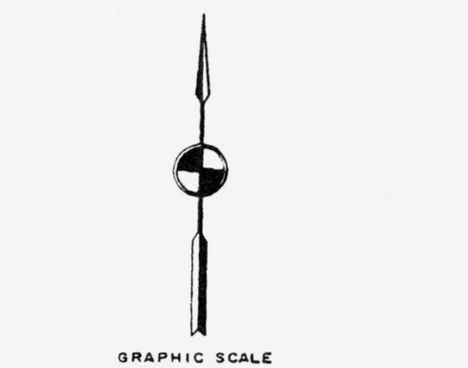
### LEGEND

Sampling stations used in preparation of initial plan

● SEWRPC

Source: SEWRPC.



samplings at two Commission stations on the Sauk Creek main stem. The sampling station locations are shown on Map XIV-4.

No known post-1976 water quality data were available from the Sauk Creek watershed. The assessment of current conditions relied upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. Review of this data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Sauk Creek watershed.

Toxic and Hazardous Substances: No known stream water or bottom sediment sampling for toxic and hazardous materials in the form of heavy metals, polychlorinated biphenyls (PCB's), or pesticides have been conducted within the Sauk Creek watershed.

Since the completion of the initial regional water quality management plan, five spills of toxic substances into streams within the Sauk Creek watershed have been documented by the Wisconsin Department of Natural Resources. All of these spills have occurred in the main stem of Sauk Creek in the City of Port Washington. The majority of the substances that were spilled into the creek were oil.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of Sauk Creek were assessed with the results set forth in Table XIV-7. Fish population and diversity is fair. Problems with levels of fecal coliform are estimated to exceed standards in Sauk Creek. Dissolved oxygen, phosphorus, and un-ionzed ammonia nitrogen levels are estimated to meet the standards. No recent data were available on toxic pollutants or on the biotic index ratings, which are biological indicators of water quality within a stream system. High levels of streambed sedimentation were noted throughout the watershed.

Table XIV-8 sets forth water quality index classifications[2] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table XIV-8, no recent comparative data were available.

A summary of potential pollution sources in the Sauk Creek watershed by stream reach is shown in Table XIV-9. Review of the data indicate that a limited number of spills of toxic substances have occurred in the watershed, and six industrial discharges have been permitted to discharge to Sauk Creek. It should be noted that all of the spills and discharges have discharged to the portion of Sauk Creek located within the City of Port Washington. Data on nonpoint source pollution is also included in Table XIV-8.

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[2]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table XIV-7

CHARACTERISTICS OF STREAMS WITHIN THE SAUK CREEK WATERSHED

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating | Streambed Sedimentation | Physical Modifications to Channel[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| Sauk Creek . . . | 18.8 | Fair | No | No | No | No | Yes | -- | -- | High (clay, gravel, silt) | Moderate |

[a]Based upon professional judgment of area fish managers.

[b]Simulation modeling analyses data developed in the initial plan were used to estimate current water quality for Sauk Creek based upon year 2000 land use conditions and current level of pollution control.

[c]Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources, and SEWRPC.

Table XIV-8

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE SAUK CREEK WATERSHED 1964, 1974-1975, AND 1990-91

| Water Quality Sampling Stations[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Main Stem Stations | | | |
| Sk-1 | Poor | Poor | -- |
| Sk-2 | Good | Fair | -- |
| Watershed Average | Fair | Fair | -- |

[a]See Map XIV-4 for sampling station locations.

Source: SEWRPC.

Table XIV-9

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE SAUK CREEK WATERSHED: 1990

| Stream Reach[a] | Extent of Conversion of Lands from Rural to Urban[b] | | Documented Toxic Spills 1976-1990 | Remaining Potential Surface Water Pollution Sources | | | | | | | Ongoing Pollution Abatement Efforts[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Historical 1976-1990 | Expected 1990-2010 | | Urban Nonpoint Source Pollution | Rural Nonpoint Source Pollution | Public Sewage Treatment Plants | Private Sewage Treatment Plants | Number of Permitted Industrial Discharges | Other Known Potential Impacts to Surface Water Quality | Comments | |
| Sauk Creek | Insignificant | Insignificant | 1988 - oil<br>1989 - hydraulic oil<br>brown foam<br>hydraulic oil<br>hydraulic oil | X | X | -- | -- | 6 | | | X[c] |

[a]Includes the tributary drainage area of each stream reach.

[b]Extent of urban land conversions were determined as a percentage of the watershed as follows:

| | |
|---|---|
| major | > 20% |
| moderate | 10 - 20% |
| significant | 5 - 10% |
| insignificant | 0 - 5% |

[c]Construction Erosion Control Ordinances in place

Source: Wisconsin Department of Natural Resources and SEWRPC.

Compliance with Water Use Objectives

As indicated in Chapter II, Sauk Creek is recommended for warmwater sport fish and full recreational use. These water use objectives and the associated water quality standards are discussed in Chapter II. Based upon the available data for sampling stations in the watershed, the main stem of Sauk Creek did not fully meet water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. No current water quality sampling data are available to assess the current compliance with the water quality standards for the Sauk Creek watershed. Simulation modeling developed in the initial plan indicates that it is likely that the standards associated with the recommended water use objectives are largely being met with the exception of the fecal coliform levels. Thus, the water use objective is being partially met.

## WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of pollution abatement planning and land use decisions, there are no major water quality issues remaining to be addressed specific to the Sauk Creek watershed.

Chapter XV

# SHEBOYGAN RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

## INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Sheboygan River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Sheboygan River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited for the Sheboygan River watershed as there are no major lakes located in the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

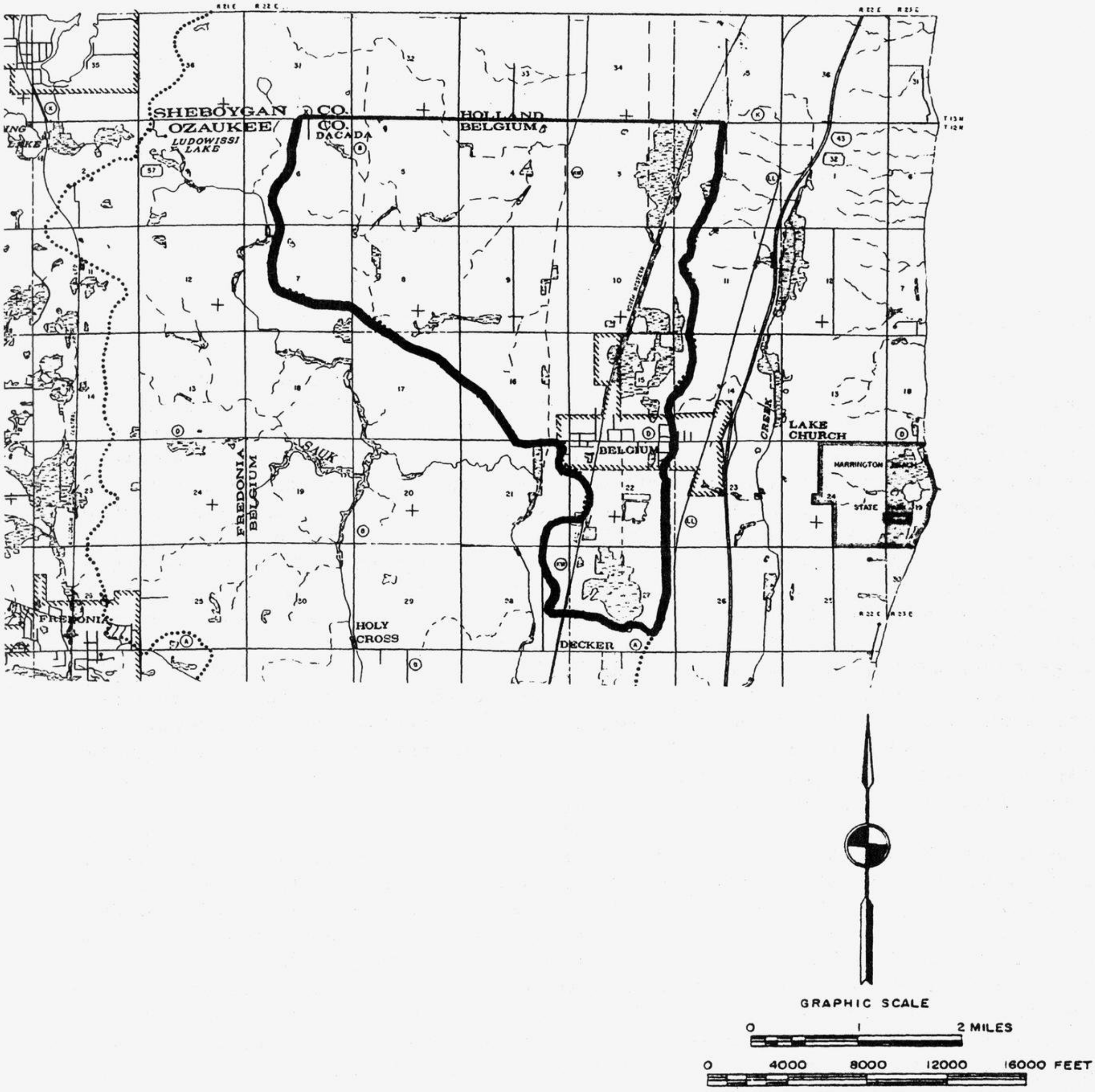
The Sheboygan River watershed is located in the northern portion of the Region. That part of the watershed contained within the Region--about 10.8 square miles--is only a small part of a much larger watershed. Both the East Branch and West Branch of Belgium Creek rise and are tributary to the southern portion of the watershed in Ozaukee County, and flow northward into Sheboygan County, where the Onion River discharges into the Sheboygan River. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the Sheboygan River basin, together with the location of Belgium Creek, are shown on Map XV-1. The Sheboygan River watershed contains no lakes with a surface area of 50 acres or more.

## LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Sheboygan River watershed

# Map XV-1

## SHEBOYGAN RIVER WATERSHED



since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants, such as metals and chlorides, can also be expected to increase with urbanization.

Table XV-1 summarizes the existing land uses in the Sheboygan River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains a limited amount of urbanized areas, 93 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 82 percent of the total area of the watershed in agricultural and related rural uses, about 1 percent in woodlands, about 9 percent in surface water and wetlands, and about 1 percent in other open lands. The remaining 7 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XV-2.

Within the Sheboygan River watershed, limited urban development has occurred within the Village of Belgium. As shown in Table XV-1, from 1975 to 1990, urban land uses in the watershed increased from about 432 acres to about 459 acres, or by about 7 percent. As shown in Table XV-1, residential land use within the watershed remained relatively constant, from 132 acres in 1975 to 139 acres in 1990, about a 5 percent increase. Commercial and industrial lands increased from 25 acres to 30 acres, an increase of about 17 percent.

The 459 acres of urban land uses in the watershed as of 1990 exceeded the staged 1990 planned level of about 431 acres envisioned in the adopted year 2000 land use plan. The current status of development in the Sheboygan River watershed and in adjacent portions of Ozaukee County was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XV-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Sheboygan River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban land uses are expected to increase in Ozaukee County within and around the Village of Belgium.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Sheboygan River watershed, as indicated in Table XV-2, is projected to increase from the 1990 total of about 459 acres, or about 7 percent of the total area of the watershed, to about 599 acres, or about 9 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the

Table XV-1

**LAND USE IN THE SHEBOYGAN RIVER WATERSHED: 1975 and 1990[a]**

| Land Use Category | 1975 | | 1990 | | Change 1975-1990 | |
|---|---|---|---|---|---|---|
| | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | |
| Residential | 132 | 1.9 | 139 | 2.0 | 7 | 5.3 |
| Commercial | 4 | 0.1 | 5 | 0.1 | 1 | 25.0 |
| Industrial | 21 | 0.3 | 25 | 0.4 | 4 | 19.0 |
| Transportation, Communication, and Utilities[b] | 253 | 3.6 | 266 | 3.8 | 13 | 5.1 |
| Governmental and Institutional | 16 | 0.2 | 18 | 0.2 | 2 | 12.5 |
| Recreational | 6 | 0.1 | 6 | 0.1 | 0 | 0.0 |
| Subtotal | 432 | 6.2 | 459 | 6.6 | 27 | 6.3 |
| Rural | | | | | | |
| Agricultural and Related | 5,721 | 82.5 | 5,724 | 82.5 | 3 | 0.1 |
| Lakes, Rivers, Streams and Wetlands | 666 | 9.6 | 629 | 9.1 | - 37 | - 5.6 |
| Woodlands | 79 | 1.1 | 75 | 1.1 | - 4 | - 5.1 |
| Open Lands, Landfills, Dumps, and Extractive[c] | 41 | 0.6 | 52 | 0.7 | 11 | 26.8 |
| Subtotal | 6,507 | 93.8 | 6,480 | 93.4 | - 27 | - 0.4 |
| Total | 6,939 | 100.0 | 6,939 | 100.0 | 0 | -- |

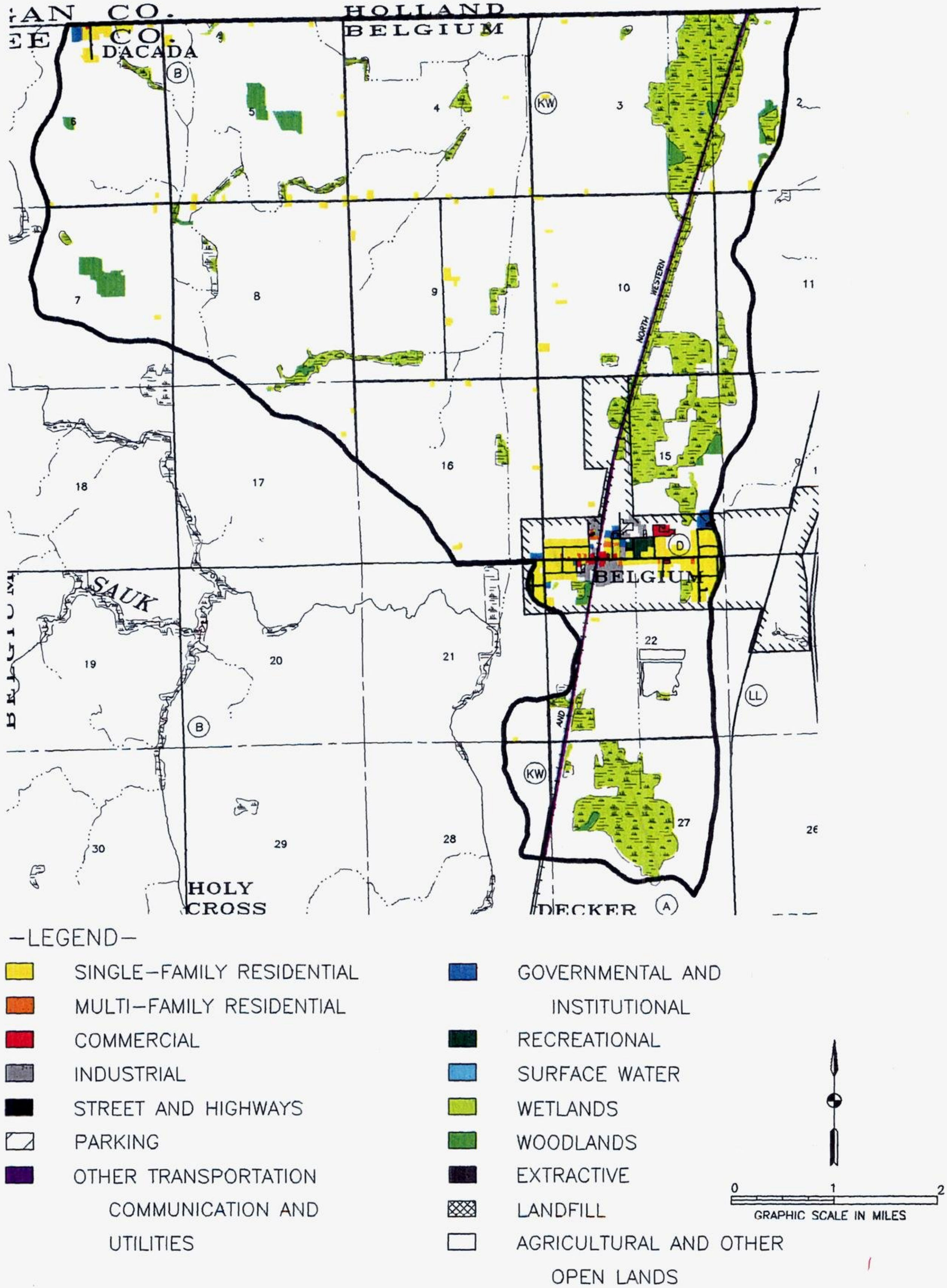
[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

# MAP XV-2
## LAND USES IN THE SHEBOYGAN RIVER WATERSHED: 1990




The Sheboygan River watershed is about 11 square miles in areal extent, or less than 1 percent of the total Region.

In 1990, about 0.7 square miles, or about 7 percent of the watershed, was in urban land uses.



Source: SEWRPC

Table XV-2

**EXISTING AND PLANNED LAND USE IN THE SHEBOYGAN RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]**

| Land Use Category | Existing 1990 | | Year 2010 Intermediate Growth - Centralized Land Use | | | | Year 2010 High Growth - Decentralized Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | | Change 1985-2010 | | 2010 | | Change 1990-2010 | |
| | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent | Acres | Percent |
| Urban | | | | | | | | | | |
| Residential | 139 | 2.0 | 228 | 3.3 | 89 | 64.0 | 277 | 4.0 | 138 | 99.3 |
| Commercial | 5 | 0.1 | 5 | 0.1 | 0 | 0.0 | 5 | 0.1 | 0 | 0.0 |
| Industrial | 25 | 0.4 | 38 | 0.6 | 13 | 52.0 | 59 | 0.8 | 34 | 136.0 |
| Transportation, Communication, and Utilities[b] | 266 | 3.8 | 300 | 4.3 | 34 | 12.8 | 321 | 4.6 | 55 | 20.7 |
| Governmental and Institutional | 18 | 0.2 | 19 | 0.3 | 1 | 5.6 | 21 | 0.3 | 3 | 16.7 |
| Recreational | 6 | 0.1 | 9 | 0.1 | 3 | 50.0 | 11 | 0.2 | 5 | 83.3 |
| Subtotal | 459 | 6.6 | 599 | 8.7 | 140 | 30.5 | 694 | 10.0 | 235 | 51.2 |
| Rural | | | | | | | | | | |
| Agricultural and Related | 5,724 | 82.5 | 5,601 | 80.7 | - 123 | - 2.1 | 5,518 | 79.5 | - 206 | - 3.6 |
| Lakes, Rivers, Streams, and Wetlands | 629 | 9.1 | 633 | 9.1 | 4 | 0.6 | 633 | 9.1 | 4 | 0.6 |
| Woodlands | 75 | 1.1 | 76 | 1.1 | 1 | 1.3 | 76 | 1.1 | 1 | 1.3 |
| Open Lands, Landfills, Dumps, and Extractive[c] | 52 | 0.7 | 30 | 0.4 | - 22 | - 42.3 | 18 | 0.3 | - 34 | - 65.4 |
| Subtotal | 6,480 | 93.4 | 6,340 | 91.3 | - 140 | - 2.2 | 6,245 | 90.0 | - 235 | - 3.6 |
| Total | 6,939 | 100.0 | 6,939 | 100.0 | 0 | -- | 6,939 | 100.0 | 0 | -- |

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

land devoted to urban uses is projected to increase to about 694 acres, or about 10 percent of the total watershed by year 2010. It is important to note that the 90 to 91 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and, as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space use through joint zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 10.1 square miles in 1990 to about 9.9 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 9.7 square miles under the high growth-decentralized land use plan, decreases of about 2 and 4 percent between 1990 and 2010 for the two-year 2010 plans considered.

POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the portion of the Sheboygan River watershed within the Southeastern Wisconsin Region--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary sewer service area located in the watershed.

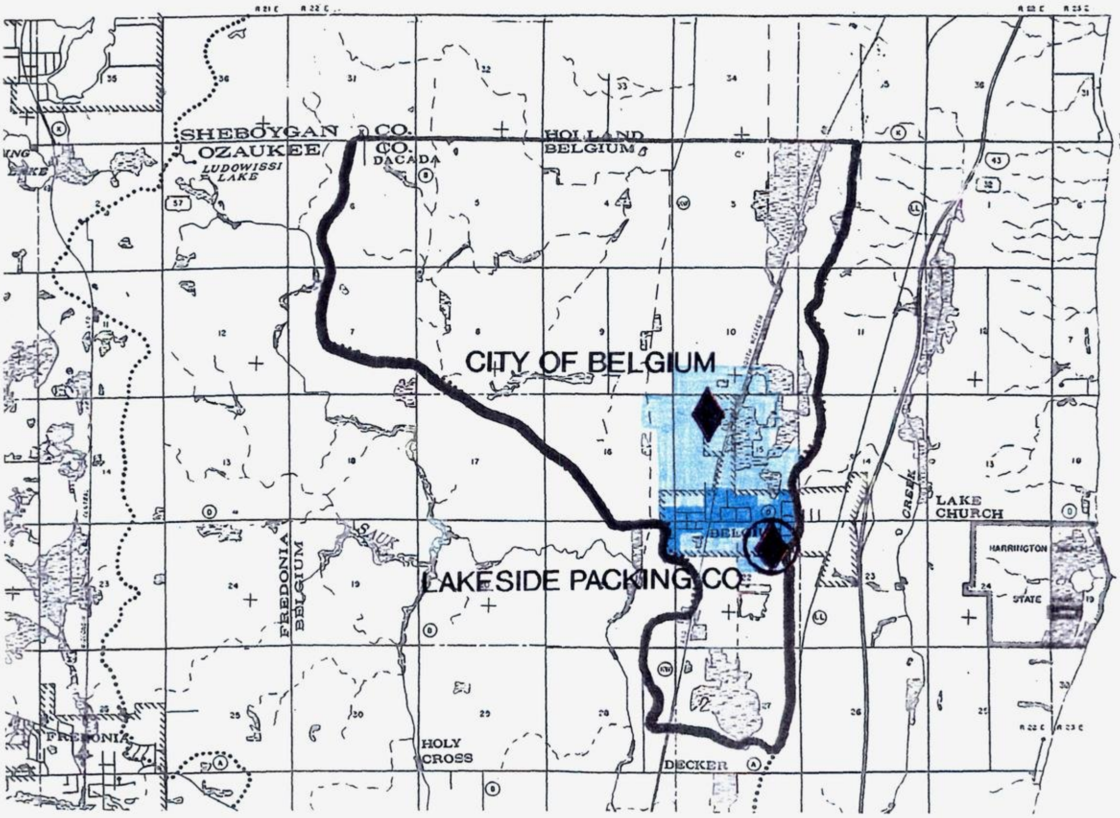
Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there was one public sewage treatment facility located in the Sheboygan River watershed, as shown on Map XV-3. The Village of Belgium sewage treatment plant discharged directly to the East Branch of Belgium Creek. The status of implementation with regard to the upgrading, expansion, and relocation of the public and private sewage treatment plants in the Sheboygan River watershed, as recommended in the initial regional water quality management plan, is summarized in Table XV-3.

As can be seen by review of Table XV-3, full implementation of the initial plan would provide for the expansion and relocation of the public sewage treatment plant operated by the Village of Belgium. Implementation of this recommendation has been completed. The Village of Belgium plant has not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluents to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site specific phosphorus limitations on all public sewage

## Map XV-3

## SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE SHEBOYGAN RIVER WATERSHED: 1990 AND 2010




LEGEND

SANITARY SEWER SERVICE AREA (EXISTING)

SANITARY SEWER SERVICE AREA (PLANNED)

EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED

EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

Source: SEWRPC.

**Table XV-3**

**IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS IN THE SHEBOYGAN RIVER WATERSHED: 1990**

| Public Sewage Treatment Plants | Disposal of Effluent | Plan Recommendation | Implementation Status |
|---|---|---|---|
| Village of Belgium | East Branch of Belgium Creek | Expand | Completed--plant relocated (1984) |
| **Private Sewage Treatment Plants** | **Disposal of Effluent** | **Plan Recommendation** | **Implementation Status** |
| Lakeside Packing Co.[a] | Soil absorption and East Branch of Belgium Creek | Maintain and upgrade as needed | Plant maintained |

[a] Formerly Krier Preserving Company

Source: SEWRPC.

treatment plants, and in 1993, by the adoption of rules to allow for placement of such limitations. Thus, as specific sewage treatment plant permits are issued, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. Selected characteristics of the public sewage treatment plant currently existing in the watershed are given in Table XV-4.

In addition to the publicly-owned sewage treatment facilities, one private sewage treatment plant was in existence in 1975 in the Sheboygan River watershed. This plant served the Krier Preserving Company (currently the Lakeside Packing Company). As indicated in Table XV-3, this plant was recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES).

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Sheboygan River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. Belgium is the only sewer service area identified in the portion of the Sheboygan River watershed within the Region. This area was refined as recommended in the initial plan. The boundaries of the sewer service area, through 1993, are shown on Map XV-3. Table XV-5 lists the plan amendment prepared for the refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The planned sewer service area in the Sheboygan River watershed, as refined through 1993, totals about 0.8 square miles, or about 7 percent of the total watershed area, as shown in Table XV-5.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, for the Village of Belgium sewage treatment plant and for the continued operation and maintenance of the private plant serving the Lakeside Packing Corporation facility. Estimated approximate dates for beginning facility

Table XV-4

**SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS IN THE SHEBOYGAN RIVER WATERSHED: 1990**

| Name of Public Sewage Treatment Plant | 1990 Estimated Total Area Served (square mile) | 1990 Estimated Total Population Served | Date of Construction and Major Modification | Major Sewage Treatment Unit Processes[a] | Name of Receiving Water to which Effluent is Disposed | WPDES Permit Expiration Date |
|---|---|---|---|---|---|---|
| Village of Belgium | 0.5 | 900 | 1949, 1970, 1984 | Aerated lagoon, sand filtration, chlorination, post aeration | East Branch of Belgium Creek | 3/31/90 |

| Name of Public Sewage Treatment Plant | Hydraulic Loading[b] (mgd) | | | | $BOD_5$ Loading[b] (pounds per day) | | | | Suspended Solids Loading[b] (pounds per day) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | | Design Average Flow | Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity | Existing | | Design Average Flow | Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity | Existing | | Design Average Flow | Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity |
| | Average Annual | Maximum Monthly Average | | | Average Annual | Maximum Monthly Average | | | Average Annual | Maximum Monthly Average | | |
| Village of Belgium | 0.13 | 0.19 | 0.19 | 0 | 109 | 176 | 300 | 0 | 108 | 160 | 300 | 0 |

[a] In addition, plants typically include headworks and miscellaneous processes such as pumping, flow metering and sampling, screening and grit removal, as well as sludge handling and disposal facilities.

[b] Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XV-5

PLANNED SANITARY SEWER SERVICE AREAS IN THE SHEBOYGAN RIVER WATERSHED: 1993

| Name of Initially Defined Sanitary Sewer Service Area(s) | Planned Sanitary Sewer Service Area (square miles) | Name of Refined and Detailed Sanitary Sewer Service Area(s) | Date of SEWRPC Adoption of Plan Amendment | Plan Amendment Document |
|---|---|---|---|---|
| Belgium | 0.8 | Belgium | September 15, 1993 | SEWRPC CAPR No. 97, 3rd Edition, Sanitary Sewer Service Area for the Village of Belgium, Ozaukee County, Wisconsin |

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

planning for public sewage treatment plant expansion and upgrading are indicated in Table XV-6. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map XV-3. Table XV-6 presents selected design data for the Village of Belgium public treatment plant recommended to be maintained in the Sheboygan River watershed. It is important to note that the plant has not currently recorded monthly average flow which has equalled or exceeded the average design capacity of the plant, as shown in Table XV-4.

Table XV-6 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the public sewage treatment plant in the Sheboygan River watershed. Under the intermediate scenario, the plant is not anticipated to have a loading rate equal to or higher than the average annual design capacity. It appears that facility planning should be between the years 2000 and 2005 for the Village of Belgium sewage treatment plant, as indicated in Table XV-6. Under the high growth scenario, a plant expansion would be required late in the planning period.

The current planned sanitary sewer service area in the Sheboygan River watershed is shown on Map XV-3. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. A portion of the Belgium sewer service area is located in the Sheboygan River watershed. The planned service area within the portion of the watershed within the Region totals about 0.7 square mile, or about 6 percent of the Sheboygan River watershed.

As noted above, the Belgium sewer service area has been refined as part of the ongoing regional water quality management plan updating process. No additional refinements are envisioned to be needed. It is recommended that the sanitary sewer service area and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension design. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plant, there was one private sewage treatment plant in operation within the Sheboygan River watershed in 1990. The facility serves the Lakeside Packing Company facility, located near the current limits of the planned sanitary public sewer service area of the Village of Belgium. Because of the special character and the associated treatment needs of the wastewater generated at the facility, it is recommended that the private plant continue to be operated. The need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there was one known separate sewer flow relief devices in the Sheboygan River watershed; a bypass located at the Village of Belgium wastewater treatment facility

Table XV-6

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE SHEBOYGAN RIVER WATERSHED: 1990 AND 2010

| Name of Public Sewage Treatment Plant | Sewer Service Area | Design Capacity-Average Annual Hydraulic (mgd) | Existing 1990 | | | Planned Year 2010 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Intermediate Growth Centralized Land Use Plan | | | High Growth Decentralized Land Use Plan | | |
| | | | Average Hydraulic Loading (mgd) | Total Area Served (square mile) | Resident Population Served | Planned Sewer Service Area (square mile) | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] | Resident Population Served | Average Hydraulic Loading (mgd) | Approximate Facility Planning Year[a] |
| Village of Belgium | Belgium Lake Church | 0.19 | 0.13 | 0.5 | 900 | 3.2 | 1,500 | 0.21 | 2004 | 3,900 | 0.51 | 2000 |

[a] Approximate year in which facility planning for plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average design flows compared to average annual and maximum monthly flows and age of facilities based upon date of last major construction. -49-

Source: SEWRPC

discharging to the East Branch of Belgium Creek. This bypass has been eliminated as the plant was upgraded, as recommended in the initial regional water quality management plan. As of 1993, there were no known points of sanitary sewer flow relief in the Sheboygan River watershed.

Current Plan Recommendations: As noted above, there are currently no known points of sewage flow relief in the sanitary sewerage systems in the Sheboygan River watershed.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of one intercommunity trunk sewer in the Sheboygan River watershed. This trunk sewer would connect the Lake Church sewer service area to the Village of Belgium sewerage system. As of 1993, the implementation of the public sewer system in the Lake Church area has not yet been implemented and the trunk sewer connection has not been made.

Current Plan Recommendations: The current regional water quality management plan includes a recommendation to extend public sanitary sewer services to the Lake Church area. Thus, the plan continues to recommend the construction of the trunk sewer to connect that area to the Village of Belgium sewerage systems. This trunk sewer is discussed in Chapter IX and is shown on Map IX-4, since it is located within the drainage area tributary to Lake Michigan immediately east of the Sheboygan River watershed.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975 and in 1990, there were no known point sources of pollution identified in the Sheboygan River watershed other than public and private sewage treatment plants. The initial regional plan recommends that such industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

Current Plan Recommendations: As of 1993, there were five known, permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface or groundwater systems in the portion of the Sheboygan River watershed contained within the Region. These point sources of wastewater discharge industrial cooling process, rinse, and wash water directly, or following treatment, to the groundwater or the surface waters of the Sheboygan River watershed. It is recommended that such sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were no enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service areas. As of 1990, no new enclaves of unsewered urban development have been created beyond the proposed 2010 sewer service area.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Sheboygan River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources. In some cases, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can potentially be transmitted to the surface waters.

There are currently no active landfills and one known, abandoned landfill located in the portion of the Sheboygan River watershed located within the Region. There is no indication that this landfill is negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Sheboygan River watershed have the potential to affect water quality through the release of substances into the surrounding soils and ground water. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the clean up of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing clean up efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground waters. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were four known leaking underground storage tanks in the portion of the Sheboygan River watershed contained within the Region. None of these involved the discharging of remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters. As of 1993, there were no such permitted sites discharging to surface or ground waters in the Sheboygan River watershed.

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning on site sewage disposal systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Sheboygan River watershed, the initial plan generally recommended urban and rural nonpoint source pollution control practices designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, onsite systems management, and streambank erosion. Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Sheboygan River watershed through a variety of local and State regulations and programs. These programs include the regulation of onsite sewage disposal systems under programs currently administered by Ozaukee County in the unincorporated areas. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified.

With regard to rural nonpoint source controls, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program has been used in a few selected cases in the Sheboygan River watershed. Other programs, such as the Conservation Reserve Program administered by the U. S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others, are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade, and Consumer Protection as priority counties for soil erosion control. The Commission has prepared an agricultural soil erosion control plan for Ozaukee County, and thus for all areas of the Sheboygan River watershed contained within Southeastern Wisconsin. This plan identifies priority areas for cropland soil erosion control within the County and the watershed, and, additionally, recommends farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While the local programs described above have probably resulted in some modest reduction in pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources.

Onion River Priority Watershed Project: The Onion River priority watershed project was designated a "priority watershed" in 1981. Planning for the Onion River priority watershed project was completed in 1981[1], and implementation of practices occurred from 1981 through 1989.[2] The planning was conducted for the entire 101.5-square-mile Onion River watershed, which is tributary to the Sheboygan River. About 91 square miles, or about 90 percent of the watershed is located in Sheboygan County. The Onion River priority watershed program established pollutant reduction goals which provided for a reduction of about 40 percent, as well as reduction in bacterial counts and improved fish population and habitat. These reductions were considered to be consistent with the initial water quality management plan.

To achieve these pollutant reduction goals, the Onion River priority watershed project included recommendations and funding eligibility for barnyard runoff and manure storage systems, streambank protection programs, and the construction of grassed waterways and other cropland management practices. Participation in the priority watershed program as measured by the actual installation of practice compared to the practice recommended was generally about 25 percent or less. The Department of Natural Resources final report[3] on the project suggests that the Onion River water quality and biological conditions has improved between 1981 and 1990 although the level of such improvement remains to be relatively low.

Current Plan Recommendations

Given the partial implementation of the nonpoint source priority watershed plan recommendations, it is recommended that the need for further nonpoint source

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[1] Wisconsin Department of Natural Resources Publication, The Onion River Priority Watershed Plan, May 1981.

[2] Wisconsin Department of Natural Resources Publication No. WR-277-91, An Evaluation of Water Quality in the Onion River Priority Watershed and the Effects of Best Management Practice Implementation: Final Report, January 1991.

[3] Wisconsin Department of Natural Resources Publication No. WR-268-91. Onion River Priority Watershed Project: Final Report: Nonpoint Source Water Pollution Abatement Program, May 1992.

reductions in the Sheboygan River watershed be reviewed and reevaluated. It is also recommended that construction site erosion control onsite sewage system management and streambank erosion control be carried out in the watershed. The reevaluation of the levels of nonpoint source pollution control needed should be based upon additional monitoring which would be conducted as described in the next section.

## WATER QUALITY MONITORING PLAN ELEMENT

### Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program. As of 1993, no long-term monitoring has been carried out in the Sheboygan River watershed within the Region on a sustained basis.

### Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that an intensive water quality and detailed biological condition monitoring program be conducted by the Wisconsin Department of Natural Resources over a one-year period at one station on the West Branch of Belgium Creek and at one station on the East Branch of Belgium Creek, both near the Ozaukee County-Sheboygan County line. It is recommended that this program be conducted within the next five to seven years and be repeated at approximately five to seven year intervals. These recommendations can be coordinated, and are consistent, with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five to seven year rotating cycle.

## LAKE MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality monitoring programs to be established.

As noted above, there are no major lakes in the Sheboygan River watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

WATER QUALITY AND BIOLOGICAL CONDITIONS

Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Sheboygan River watershed included samplings at one Commission station on the West Branch of Belgium Creek. The sampling station location is shown on Map XV-4.

No post-1976 known water quality data have been collected in the watershed. The assessment of current conditions relied upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Sheboygan River watershed.

Toxic and Hazardous Substances: No known stream or bottom sediment sampling for toxic and hazardous materials had been available for use in preparing the initial regional water quality management plan or in preparing the current plan.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Onion River subwatershed was assessed with the results set forth in Table XV-7. Fish population and diversity was classified as being poor in the West Branch of Belgium Creek. Standards are estimated to be exceeded for fecal coliform levels in the West Branch of Belgium Creek. Dissolved oxygen, ammonia nitrogen, and total phosphorus levels are estimated to meet the standards.
No recent data were available on biotic index ratings, which are biological indicators of water quality within a stream system. High levels of streambed sedimentation were noted in the West Branch of Belgium Creek.

Table XV-8 sets forth the water quality index classification[4] used in the initial plan for 1964, 1974-75, and for 1990-1991 conditions for the sampling station in the watershed. The use of the index is discussed in Chapter II. The limited data indicate that water quality conditions remained "fair" from 1964 through 1974 and 1975. As indicated in Table XV-8, no recent data were available to assess the water quality conditions on a similar basis in 1990 or 1991 within the watershed. However, the aforementioned project evaluating report of the Onion River nonpoint source priority watershed program indicates that there was a very small improvement in water quality conditions between 1980 and 1990. The

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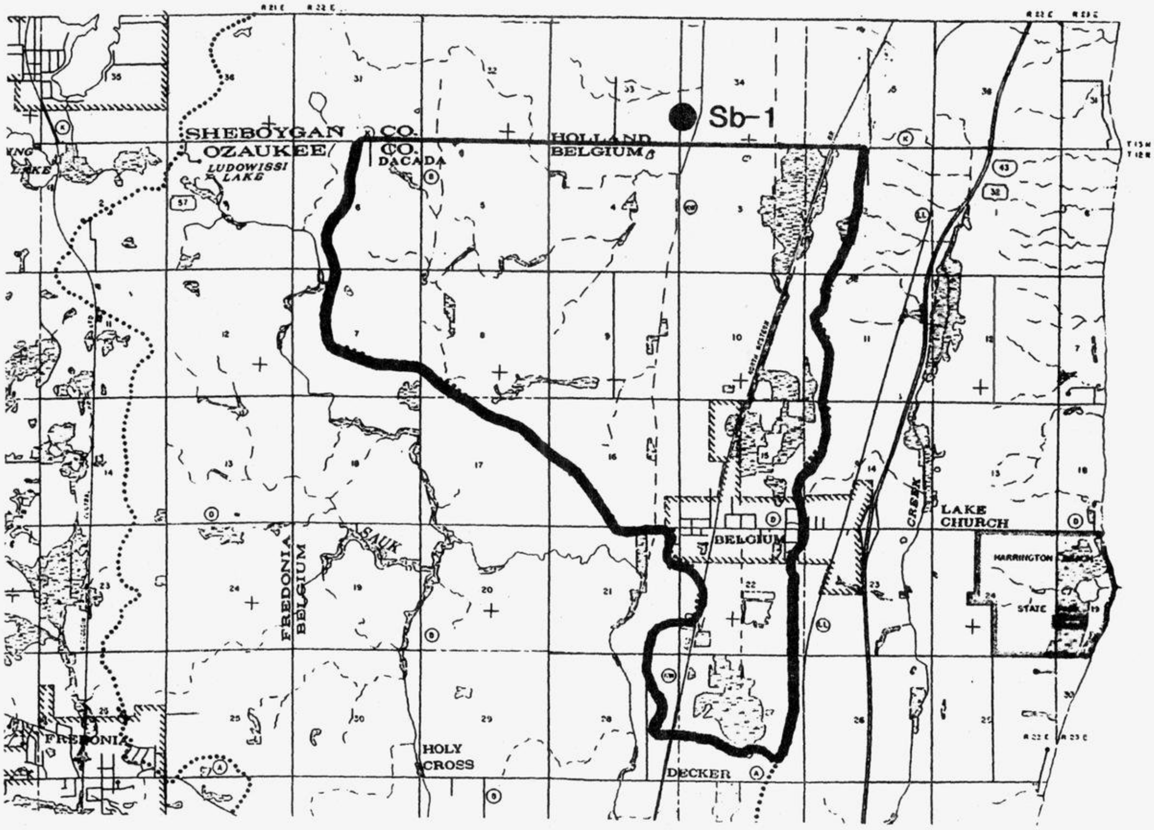
[4]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

# Map XV-4

## LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE SHEBOYGAN RIVER WATERSHED




LEGEND

Sampling stations used in preparation of initial plan

● SEWRPC

Source: SEWRPC.

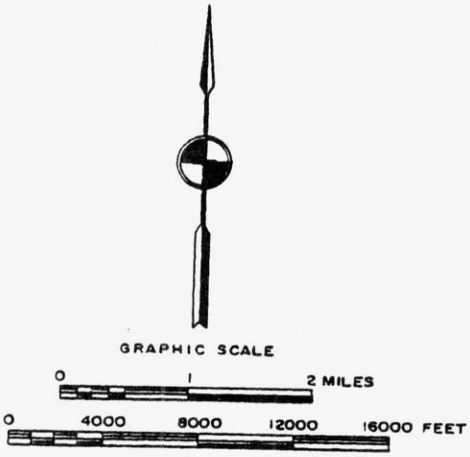


Table XV-7

CHARACTERISTICS OF STREAMS REACHES IN THE SHEBOYGAN RIVER WATERSHED

| Stream Reach | Stream Length (miles) | Fish Population and Diversity[a] | Recorded Fish Kills | Water Quality Problems[b] | | | | | Biotic Index Rating | Streambed Sedimentation | Physical Modifications to Channel[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | DO | $NH_3$ | Total P | Fecal Coliform | Toxics | | | |
| West Branch Belgium Creek Upstream Sheboygan County Line | 3.0 | Poor | No | No | No | No | Yes | - - | -- | High (muck) | Major |
| East Branch Belgium Creek | 4.2 | - - | No | - - | - - | - - | - - | - - | - - | - - | Major |

[a] Based upon stream appraisal documentation set forth in the May 1981 Onion River Priority Watershed Plan and professional judgement of area fish managers.

[b] Simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for the Sheboygan River watershed based upon year 2000 land use conditions and current level of pollutant control.

[c] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XV-8

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATION IN THE SHEBOYGAN RIVER WATERSHED 1964, 1974-1975, AND 1990-91

| Water Quality Sampling Station[a] | July, August, September, and October of 1964 | August of the Years 1974-1975 | July, August, 1990 and 1991 |
|---|---|---|---|
| Sb-1 | Fair | Fair | - - |
| Watershed Average | Fair | Fair | - - |

[a] See Map XV-4 for sampling station locations.

Source: SEWRPC.

conclusion was based upon a comparison of biotic indices taken in the headwaters of the Onion River, which are upstream of the confluence with the Belgium Creek.

A summary of potential pollution sources in the portion of the Sheboygan River watershed contained within the Region is shown in tabular summary in Table XV-9. Review of the data indicate that an insignificant amount of land within the watershed has been converted from rural to urban uses. Data on nonpoint source pollution, public and private sewage treatment plans discharging to surface waters are included in Table XV-9.

Compliance with Water Use Objectives

As indicated in Chapter II, both the East and West Branches of Belgium Creek are recommended for warmwater sport fish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II.

Based upon the available data for the sampling station in the watershed, the West Branch of Belgium Creek partially meets the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. As part of the Onion Creek priority watershed planning program, the DNR staff conducted field inspections and limited sampling in order to assess the water quality and biological conditions in 1981 and 1990 of the streams in the Onion River watershed. Review of the data collected in those investigations and a review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is estimated that violations of fecal coliform standards occur throughout the watershed, and thus, the water use objectives are being partially met.

It should be noted that the water use objectives set forth herein for both the East and West Branches of Belgium Creek are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. Chapter NR 104 classifies the East and West Branches of Belgium Creek as capable of supporting only a limited aquatic life community, while the objectives set for herein recommend a warmwater sport fish objective. It is recommended that a stream appraisal to further assess the potential for a higher use objective be conducted for the East and West Branches of Belgium Creek as part of the next one-year monitoring period envisioned to be carried out in the Sheboygan River watershed by the Wisconsin Department of Natural Resources.

WATER QUALITY MANAGEMENT ISSUES
REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, current land use planning and local nonpoint source pollution abatement and sewerage system planning, there are two major issues which remain to be addressed in the Sheboygan River watershed. One issue related to the degree of nonpoint source pollution abatement still required in the watershed. In addition, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological conditions survey on the East and West Branches of Belgium Creek to re-assess the water use objectives currently set forth in the Wisconsin Administrative Code.

Table XV-9

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY
MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS
IN THE SHEBOYGAN RIVER WATERSHED: 1990

| Intercommunity Trunk Sewer | Status of Implementation |
| --- | --- |
| Lake Church - Belgium | No action |

Source: SEWRPC.

Reassessment of the Future Levels of Nonpoint Source Controls In the Onion River Watershed

The nonpoint source priority watershed program implementation period has now been completed for the Onion River watershed. Following completion of detailed water quality and biological condition monitoring in the Onion River watershed under the Wisconsin Department of Natural Resources ongoing monitoring program, it is recommended that the need for further nonpoint source controls be assessed based upon the current level of plan implementation and water quality and biological conditions data.

Stream Reclassification Evaluation

The East Branch of Belgium Creek is currently included under the limited classifications in Chapter NR 104 of the Wisconsin Administrative Code. However, it is recommended that the objective for this stream be upgraded to provide for water sport fish classifications. It is recommended that the Wisconsin Department of Natural Resources include further stream appraisals for Belgium Creek as part of the monitoring program during the next period when the Department is conducting monitoring efforts in the Sheboygan River watershed as is envisioned within the next five to seven years.

Chapter XVI

# STATUS OF GROUNDWATER MANAGEMENT PLAN ELEMENT

## INTRODUCTION AND BACKGROUND

Groundwater resources constitute an extremely valuable element of the natural resource base of Southeastern Wisconsin. The groundwater reservoir not only sustains lake levels and provides the base flow of the streams in the Region, but comprises a major source of water supply for domestic, municipal, industrial, and agricultural water users. Like surface water, groundwater is susceptible to depletion in quantity and to deterioration in quality. An important consideration in regional water quality planning, therefore, is the protection of the quantity and quality of this valuable resource.

A groundwater management plan element of the regional water quality management plan is currently under preparation in a cooperative program being carried out by the University of Wisconsin-Extension, Wisconsin Geologic and Natural History Survey, and the Regional Planning Commission. This chapter describes the groundwater resources in Southeastern Wisconsin; presents the purpose and objectives, as well as scope of the groundwater management plan being prepared; and sets forth the current status and the timetable for completion of the plan element.

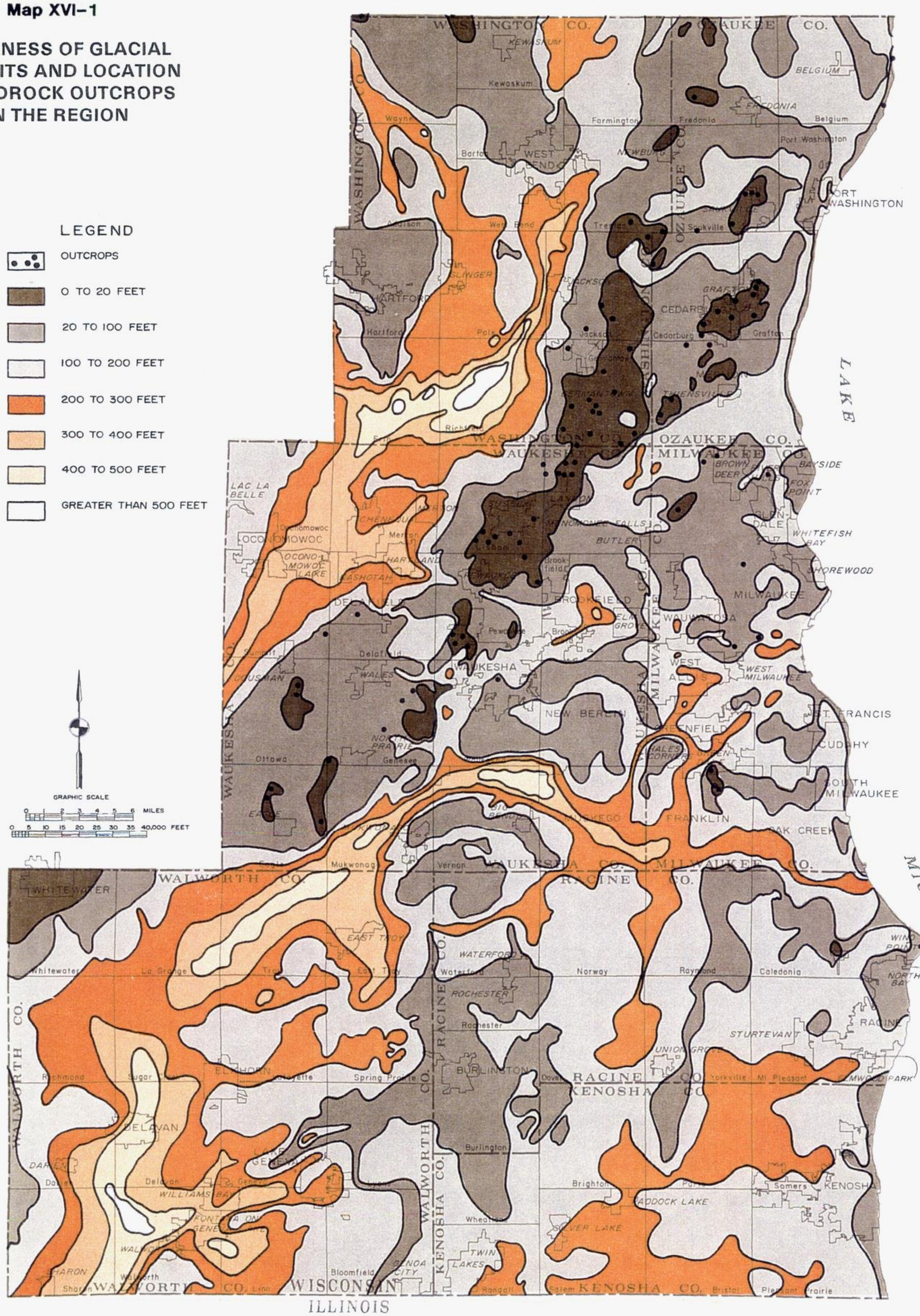
## GROUNDWATER RESOURCES DESCRIPTION

Three major aquifers exist within the seven-county Region. From land's surface downward, they are: 1) the sand and gravel deposits in the glacial drift; 2) the shallow dolomite strata in the underlying bedrock; and 3) the deeper sandstone, dolomite, siltstone, and shale strata. Because of their relative proximity to the land's surface, and because of the hydraulic interconnection, the first two aquifers are commonly referred to collectively as the "shallow aquifer," while the latter is referred to as the "deep aquifer." Wells tapping these aquifers are referred to as shallow or deep wells, respectively. Except in the western portions of Walworth and Waukesha Counties, the shallow and deep aquifers are separated by the Maquoketa shale, which forms a relatively impermeable barrier between the two aquifers. The spatial distribution of the unconsolidated surficial material and the thickness and orientation of the bedrock strata are depicted on Map XVI-1 and Figure XVI-1; lithologic descriptions of the surficial deposits and the bedrock are provided in Table XVI-1.

Some water is recharged to the deep sandstone aquifer underlying the Region by vertical movement through wells open to both the shallow and deep aquifers and by slight vertical movement downward through the Maquoketa shale. The principal source of recharge to the deep aquifer, however, is precipitation percolating

**Map XVI-1**

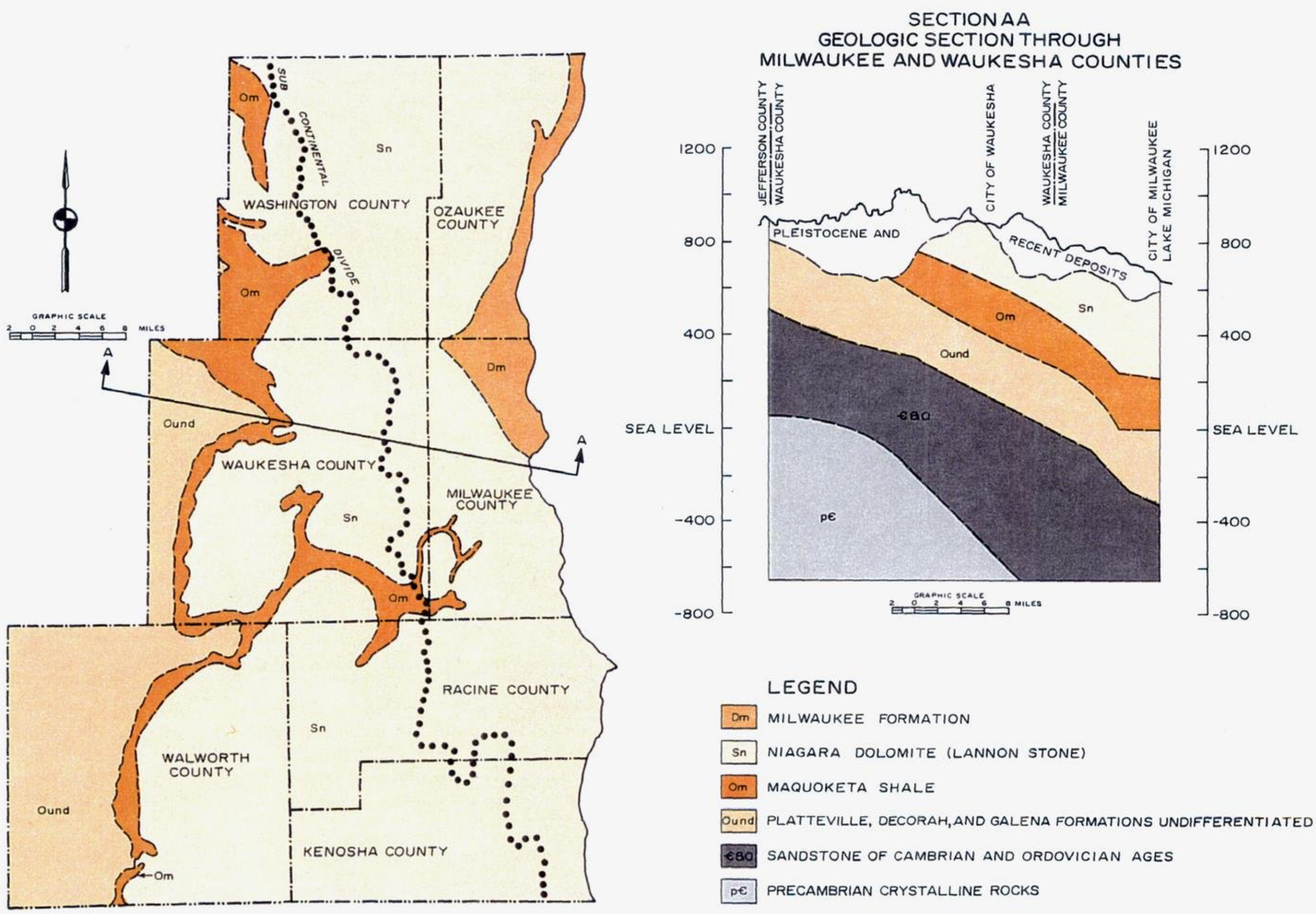
**THICKNESS OF GLACIAL DEPOSITS AND LOCATION OF BEDROCK OUTCROPS IN THE REGION**




Source: T. O. Friz, Man and the Materials of Construction, How They Interrelate in the Seven Counties of Southeastern Wisconsin, Ph.D. Dissertation, University of Wisconsin, Madison, 1969.

Figure XVI-1

## MAP AND CROSS-SECTION OF BEDROCK GEOLOGY IN THE REGION




*Source: SEWRPC.*

Table XVI-I

STRATIGRAPHIC COLUMN OF BEDROCK AND GLACIAL DEPOSITS IN THE REGION

| System | Series | Formation | Lithologic Description |
|---|---|---|---|
| Quaternary | | Recent deposits | Soils, muck, peat, alluvium, beach sand and gravel. Zero to five feet thick |
| | | Pleistocene deposits | Till and outwash sand and gravel. Zero to 430 feet thick. |
| | | Kenwood | Shale, black, carbonaceous. Fossiliferous. No outcrops. Found in City of Milwaukee intake tunnel--Lake Michigan. Approximately 55 feet thick. |
| Devonian | Middle Erian | Milwaukee | Shale, shaly limestone; lower one-third dolomite. Fossiliferous. Approximately 130 feet thick. |
| | | Thiensville | Dolomite, thick- to thin-bedded. Some fossils. Small amounts of bitumen. Approximately 65 feet thick. |
| | | Lake Church | Dolomite, thick- to thin-bedded. Fossiliferous. Pyritic in places. Approximately 27 feet thick. |
| Silurian | Cayugan | Waubakee | Dolomite, thin-bedded, hard and brittle. Fossils scarce. Approximately 30 feet thick. |
| | Niagaran | Racine | Dolomite, fine to coarsely crystaline. Thick- to thin-bedded. Barren to fossiliferous. Approximately 100 feet thick. |
| | | Manistique | Dolomite--lower part thin-bedded. Fossils. Upper--fairly thin-bedded, cherty. Many corals. Approximately 150 feet thick. |
| | | Burnt Bluff | Dolomite, thick-bedded or thin-bedded. Lower part, a few fossils. Upper part, semilithographic. No fossils. Approximately 110 feet thick. |
| | Alexandrian | Mayville | Dolomite, thick-bedded, compact to coarsely crystalline. Brecciated in places, cherty, many reef structures. Approximately 175 feet thick. |
| Ordovician | Cincinnatian | Meda | Red-brown oolitic iron ore and nonoolitic ore. Missing in Racine, Milwaukee, Ozaukee, Door, and Dodge Counties. In lenses up to approximately 55 feet thick. |
| | | Maquoketa | Shale, dolomitic, and beds of dolomite. Fossiliferous. Ninety to 225 feet thick. |
| | Champlainian | Salena | Dolomite, thick- to thin-bedded, fine to coarsely crystalline. Cherty. Shaly and sandy in places; some fossils. Approximately 227 feet thick. |

Source: SEWRPC.

downward through glacial deposits into the deep aquifer which is exposed beneath the glacial deposits within the Region only in the western one-half of Walworth County and the western one-quarter of Waukesha County. The deep aquifer recharge area within Southeastern Wisconsin is a long narrow zone oriented in a generally north-south direction. It is bounded on the east by the Maquoketa shale and on the west by a groundwater divide, the separation between eastward and westward groundwater movements, located along the western edge of Waukesha and Walworth Counties. Groundwater in the deep aquifer beneath the Region moves in a generally easterly direction from the primary western recharge areas toward Lake Michigan. Thus, most of the water withdrawn from the deep sandstone aquifer by communities and industries in the seven-county Region originally entered the aquifer via the Waukesha and Walworth county recharge areas.

Pumping from the confined sandstone aquifer has altered the potentiometric surface[1] of that aquifer over the past century. Prior to intensive pumpage from the aquifer, the movement of groundwater in the aquifer was generally from west to east, with the potentiometric surface being located just below the ground surface and in some instances actually above the ground surface as evidenced by reports of flowing or artesian wells. Since 1880, the original potentiometric surface of the sandstone aquifer has been markedly altered, primarily as a result of pumpage in the major urban areas in the Region, as well a heavy groundwater use south of the Region in Northeastern Illinois. Drawdowns of up to 350 feet have occurred in the Milwaukee-Waukesha area, while drawdowns in excess of 275 feet have occurred at the Wisconsin-Illinois line.

Whereas the primary source of recharge for the deep sandstone aquifer is located partly outside of Southeastern Wisconsin, the shallow aquifer, composed of the glacial draft and interconnected dolomitic bedrock, is recharged locally by downward percolation of precipitation and surface water. In contrast to the deep aquifer, the direction of water movement in the shallow aquifer is much more variable and complex. Movement occurs from local recharge areas toward multiple points of discharge, such as streams, lakes, marshes, and wells. Compared to the deep aquifer, the shallow aquifer is more susceptible to pollution by wastewater because it is nearer, both in terms of distance and time, to potential pollution sources, thus minimizing the potential for dilution, filtration, and other natural processes that tend to reduce the potential detrimental effects of pollutants.

The current quality of groundwater in both the shallow and deep aquifers throughout the Region is generally good, although localized water quality problems affect some areas. Groundwater throughout the Region may be characterized as hard, containing high concentrations of calcium, magnesium, sulfates, and other dissolved solids; therefore, softening is required for almost all water uses. Localized water quality problems include hardness, expressed as calcium carbonate, in excess of 500 mg/l in the deep sandstone aquifer along much of the

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[1]The potentiometric surface represents the static head of water in an aquifer as defined by the levels to which water will rise in wells penetrating the aquifer.

eastern edge of the Region. Some wells in the Village of River Hills in Milwaukee County, for example, have measured hardnesses exceeding 1,500 mg/l and total dissolved solids concentrations in excess of 6,000 mg/l.

Groundwater quality conditions can be impacted by sources of pollution, such as landfills, agricultural fertilizer or manure storage and application sites, pesticide application sites, chemical spills, leaking surface or underground storage tanks, and nonpoint sources of pollution, including onsite sewage disposal systems. In addition, concerns exist in isolated cases in Southeastern Wisconsin with regard to naturally occurring substances. Within Southeastern Wisconsin, isolated groundwater problems have been encountered relating to several types of groundwater quality problems an issues.

The first groundwater quality concern relates to radium concentrations. Certain formations within the Cambrian sandstones in Southeastern Wisconsin are known to produce relatively high concentrations of naturally occurring radium. This naturally occurring radium has been found to exceed the State standard for radium in a number of municipal wells using the sandstone aquifer as a source. Evaluations are being undertaken to consider alternative means of reducing the radium level in these wells. In addition, the U. S. Environmental Protection Agency and the Wisconsin Department of Natural Resources are continuing to evaluate the standard for radium in order to assess the suitability of the current standards.

Another groundwater quality problem found in Southeastern Wisconsin is the presence at certain locations of volatile organic materials. These volatile organic materials enter the groundwater system primarily through commercial, industrial, and municipal waste disposal systems or spills. Most of these organic materials are industrial solvents or household products, such as spot and stain removers, paints and thinners, drain cleaners, and air fresheners. Other sources of volatile organics are leaking underground storage tanks for gasoline and other petroleum products. The Wisconsin Department of Natural Resources has tested all municipal water supplies in the State and a large number of private wells for volatile organic materials. An isolated number of municipal wells in Southeastern Wisconsin have been found to contain detectable levels of volatile organic materials. The areas where these materials have been encountered are relatively limited; in most cases remedial actions have been carried out or are underway to resolve the problems. In addition, the increased awareness and monitoring activity is expected to resolve these isolated problems over time.

Isolated cases of bacterial and nitrogen contamination have also been identified in Southeastern Wisconsin. Such cases have occurred most often in areas where the limestone formations are near the surfaces, including portions of northeastern Waukesha County. These problems can often be traced to nonpoint pollution sources and septic system discharges. Public awareness of these problems is increasing and improved monitoring is underway. The continued installation of public centralized sewerage systems will help to resolve many of these isolated problems over time.

REGIONAL GROUNDWATER MANAGEMENT PLANNING PROGRAM

Purpose and Objectives

The purpose of the groundwater management plan element is to complete a comprehensive groundwater resource data inventory and analysis, including a series of groundwater resource maps of the Region and a technical report describing the findings of the inventory and analysis; to complete a groundwater pollution source inventory and supporting mapping; and to develop groundwater protection and management recommendations for the Region.

The primary objectives relating to the Southeastern Wisconsin Region are:

1. To interpret soil survey information and determine and map the pollutant attenuation capacity of soils.

2. To map the geology of the Region, concentrating on the Pleistocene geology and depth to bedrock and to compile bedrock geology data from existing information.

3. To revise and refine existing water-table maps and identify groundwater divides and regional groundwater flow directions.

4. To evaluate hydrogeology of the soils, unconsolidated materials, and the underlying bedrock, and evaluate the susceptibility of groundwater to contamination.

5. To identify and evaluate the potential contamination sources of groundwater.

6. To develop groundwater management protection recommendations for the Region based upon the inventories and analyses.

The planning program is intended to form the basis for a groundwater management element of the regional water quality management plan. In addition, the planning program will provide, on a regional basis, valuable hydrogeologic information for use in parallel and subsequent groundwater planning programs, such as well head protection planning.

Scope of Work

The project elements include inventory and analyses of existing data; field and laboratory work; mapping; and report preparation. The initial inventory work will include:

1. Review of existing information on the Region's groundwater and other related resources.

2. Gathering data on soils, geology, groundwater, precipitation, streamflow, and water levels.

3. Inventory of existing well logs and observation stations for measuring precipitation, streamflow, and groundwater levels.

4. Inventory of major potential contamination sources, such as solid and liquid waste disposal sites.

The mapping and field and laboratory work is envisioned to include the following work elements:

1. The preparation of maps illustrating the soil pollutant attenuation potential. Maps will be prepared at a scale of one inch equals 8,000 feet for the following parts of the Region: Washington and Ozaukee Counties, Waukesha and Milwaukee Counties, Racine and Kenosha Counties, and Walworth County. In addition, a regional map at a scale of one inch equals 8,000 feet will be prepared.

2. The preparation of Pleistocene hydrogeologic maps at a scale of one inch equals 8,000 feet, with cross sections, for Washington and Ozaukee Counties, Racine and Kenosha Counties, Milwaukee County, Walworth County, and Waukesha County. In addition, a regional Pleistocene hydro-stratigraphic map at a scale of one inch equals 8,000 feet will be prepared.

3. The preparation of depth to bedrock maps at a scale of one inch equals 8,000 feet will be prepared for Ozaukee and Washington Counties, Kenosha and Racine Counties, Waukesha and Milwaukee Counties, and Walworth County.

4. The bedrock geology in the Region will be evaluated to the extent necessary for the evaluation of hydrogeology and of the groundwater susceptibility to contamination. Bedrock hydrogeologic units will be defined. Adequate data will be collected and mapping developed to refine the limits of the Maquoketa shale where it covers the suspected recharge area of the deep sandstone aquifer in the Region. This mapping update will be limited to the boundary of the Maquoketa shale with the sandstone aquifer recharge area.

5. The preparation of refined and updated water-table maps at a scale of one inch equals 8,000 feet for the shallow aquifer for Ozaukee and Washington Counties, Kenosha and Racine Counties, Waukesha and Milwaukee Counties, and Walworth County. These maps will be constructed using well constructor's reports and other available information. The water-table maps will show hydrogeologic boundaries and general direction of groundwater flow, in addition to contour lines of the water-table surface.

6. The preparation of a regional groundwater pollution vulnerability map will be prepared at a scale of one inch equals 8,000 feet and will be prepared based upon the relative vulnerability of aquifers to contamination from surface and near-surface contamination sources and activities, utilizing all of the inventory information gathered for the project. Mapping system and criteria will be described.

7. The preparation of a map at a scale of one inch equals 8,000 feet showing public supply wells, other high-capacity wells, potential

flowing wells, observation wells, precipitation stations, and surface water gaging stations, known waste disposal sites, known and potential groundwater pollution sources, and other relevant potential groundwater pollution sources.

8. The preparation of a map at a scale of one inch equals 8,000 feet showing land uses.

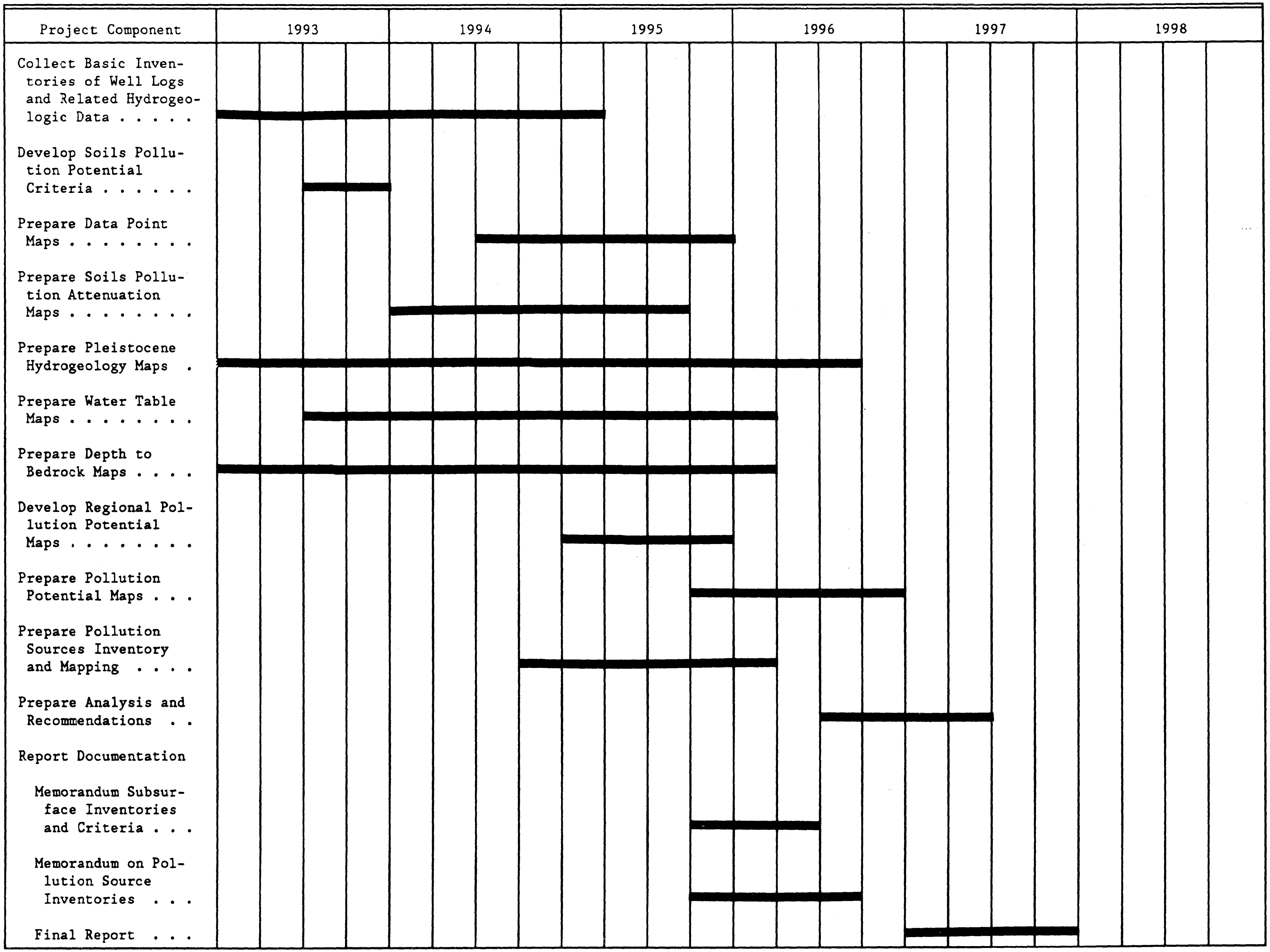
A final report will be prepared summarizing the findings of the inventories and analyses conducted characterizing the groundwater resources of the Region and susceptibility of those resources to contamination; describing the existing and potential sources of pollution; and describing recommended means of protecting the groundwater resources which can be determined by the inventories and analyses conducted.

Current Status and Schedule for Completion

The ongoing water quality management planning program is being conducted over a multi-year period 1993 through 1997. The current status and schedule for completion of the program is summarized in Figure XVI-2. As can be seen by review of Figure XVI-2, as of March 1995, work has been completed on collecting and collating the basic subsurface inventory data needed, including well logs and related subsurface data. The mapping of soils pollution attenuation maps for all seven counties has been completed in draft form with final maps expected to be completed by mid-1995. Mapping of depth to bedrock, water table, and pleistocene geology, pollution sources and inventory are currently under preparation and are expected to be completed by mid-1996. Regional pollution potential criteria and the final mapping of the pollution potential for the Region are expected to be completed by the end of 1996. Recommendations and final report preparation is to be completed in 1997.

Figure XVI-2

SCHEDULE FOR COMPLETION OF GROUNDWATER MANAGEMENT PLANNING PROGRAM




Source: SEWRPC.

## Chapter XVII

# DESIGNATED MANAGEMENT AGENCIES--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

## INTRODUCTION

Section 208 of the Federal Clean Water Act as amended sets forth a detailed planning process to be adopted by States pursuant to the goal of the Act--the attainment of surface waters, wherever attainable, to "fishable and swimmable" conditions. Importantly, this planning process includes the designation of areawide planning agencies and plan implementation management agencies. Within the seven-county Southeastern Wisconsin Region, the Southeastern Wisconsin Regional Planning Commission has been designated as the areawide water quality management planning agency by the Governor of Wisconsin under Section 208(a)(5). The Wisconsin Department of Natural Resources is the agency responsible for regulatory oversight of water quality management within the Region and throughout the State. The current regional water quality management plan has been described in Chapters IV through XVI on a watershed basis and is summarized in Chapter XVIII.

Implementation of the areawide water quality management plan, in terms of the process set forth in Section 208(b)(2)(D) of the Federal Clean Water Act as amended and Chapter NR 121 of the Wisconsin Administrative Code, requires that management agencies be designated and responsibilities defined for the major components of the plan. Accordingly, this chapter presents recommendations for such management agency designations and sets forth the various actions that must be undertaken in order for the plan to be carried out as it has now been described in its current form. As was done in the initial plan, the plan implementation recommendations regarding management agency designations, are to the maximum extent possible related to the existing governmental institutional structure and programs, and to existing enabling legislation.

As noted in Chapter III of this report, the most fundamental and basic element of the areawide water quality management plan is the land use element. The various recommended means of implementing the regional land use plan have been discussed in detail in Chapter XII of SEWRPC Planning Report No. 40, <u>A Regional Land Use Plan and a Regional Transportation Plan for Southeastern Wisconsin: 2010</u>, Volume Two, <u>Alternatives and Recommended Plans</u>. These various methods of land use plan implementation are not to be repeated here, but rather are hereby directly incorporated by reference into the plan implementation component for the regional water quality management plan. The local governmental management agencies designated for each of the other plan elements of the recommended regional water quality management plan--point source pollution abatement, nonpoint source pollution abatement, and water quality monitoring and lakes management plan elements--are set forth in this Chapter.

POINT SOURCE POLLUTION ABATEMENT AND
SLUDGE MANAGEMENT PLAN ELEMENT IMPLEMENTATION

The local governmental management agencies for the point source pollution abatement and sludge management elements of the recommended areawide water quality management plan are identified in Table XVII-1. As previously noted, sludge management planning is generally carried out as part of the detailed sewage treatment plant planning, design, and construction and, since 1977, has been a requirement of the Wisconsin Pollutant Discharge Elimination System permitting process. Consequently, recommendations regarding the management of sewage sludges are included herein as an integral component of the point source pollution abatement plan element. The designated point source management agencies are comprised of all of the units and agencies of government that currently provide centralized sanitary sewer service in the Region, and which operate or would operate a sewage treatment facility under the plan, together with proposed new agencies where such are deemed necessary to carry out the plan recommendations.

In Kenosha County, a total of 16 management agencies have been designated, all except one of which are existing agencies. Eleven of the 15 existing management units are special purpose units of government. One new agency is proposed to be formed, that being a new utility or sanitary district to provide for public sanitary sewer service to the urban development around Powers, Benedict, and Tombeau Lakes, which is currently unsewered, but is recommended to be provided with a public sanitary sewer system. Of the 15 existing management agencies, 11 are special purpose units of government. A subregional sewer and water supply system plan prepared for the Greater Kenosha Area[1] recommended the creation of an areawide sewer and water authority as the best approach to implementing the recommended sewerage and water supply system plans. Such an authority would own and operate all of the major, that is, areawide sewerage and water supply facilities in the planning area. It is envisioned that the regional water quality management plan will be amended to reflect the findings of this subregional plan at such time as there is general agreement on the recommendations of the plan. This would add a new management agency, an areawide sewer and water authority. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1991 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In Milwaukee County, a total of 20 agencies have been designated. All 20 of these agencies, which consist of the 19 local units of government in the County and the Milwaukee Metropolitan Sewerage District, already provide centralized sanitary sewer service.

In Ozaukee County, a total of 10 agencies have been designated. Nine of the agencies currently exist. One of the existing management agencies is a special purpose unit of government. One new agency is proposed to be formed, that being a sanitary or utility district in the Town of Belgium to provide centralized sanitary sewer service to the Lake Church and Harrington Beach area of the Town.

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[1]Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991.

Table XVII-1

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES FOR THE POINT SOURCE POLLUTION ABATEMENT ELEMENT OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN

| Point Source Management Agency | Refine and Detail Sewer Service Area | Construct, Maintain, and Operate Sewage Treatment Plant | Abandon Sewage Treatment Plant | Construct and Maintain Inter-community Trunk Sewer | Construct and Maintain Local Sewer System | Abate Combined Sewer Overflow | Eliminate Discharges from All Points of Sewage Flow Relief |
|---|---|---|---|---|---|---|---|
| KENOSHA COUNTY | | | | | | | |
| City of Kenosha . . . . . . . . . . . . | -- | X | -- | -- | X | -- | -- |
| Village of Paddock Lake . . . . . . . | -- | X | -- | -- | X | -- | -- |
| Village of Silver Lake . . . . . . . | -- | X | -- | -- | X | -- | -- |
| Village of Twin Lakes . . . . . . . . | -- | X | -- | -- | X | -- | X |
| Village of Pleasant Prairie | | | | | | | |
| Sewer Utility District No. 1 . . . . | -- | -- | -- | -- | X | -- | -- |
| Sewer Utility District D . . . . . . | -- | X | -- | -- | X | -- | -- |
| Sewer Utility District F . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Sanitary District No. 73-1 . . . . . | -- | X | -- | -- | X | -- | -- |
| Town of Bristol | | | | | | | |
| Utility District No. 1 . . . . . . . | -- | X | -- | -- | X | -- | -- |
| Utility District No. 3 . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Utility District No. 4 . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Salem | | | | | | | |
| Sewer Utility District No. 1 . . . . | -- | -- | X | X | X | -- | -- |
| Sewer Utility District No. 2 . . . . | -- | X | -- | X | X | -- | -- |
| Town of Somers | | | | | | | |
| Sanitary District No. 1 . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Utility District No. 1 . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Towns of Randall and Wheatland | | | | | | | |
| New District--Powers, Benedict, | | | | | | | |
| Tombeau Lakes District . . . . . . | X | X | -- | X | X | -- | -- |
| MILWAUKEE COUNTY | | | | | | | |
| Milwaukee Metropolitan | | | | | | | |
| Sewerage District . . . . . . . . . . | X | X | -- | X | -- | X | X |
| City of Cudahy . . . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| City of Franklin . . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| City of Glendale . . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| City of Greenfield . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| City of Milwaukee . . . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| City of Oak Creek . . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| City of St. Francis . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| City of South Milwaukee . . . . . . . | X | X | -- | -- | X | -- | X |
| City of Wauwatosa . . . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| City of West Allis . . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of Bayside . . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of Brown Deer . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of Fox Point . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Village of Greendale . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Village of Hales Corners . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of River Hills . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of Shorewood . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of West Milwaukee . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Village of Whitefish Bay . . . . . . | -- | -- | -- | -- | X | -- | X |
| OZAUKEE COUNTY | | | | | | | |
| City of Cedarburg . . . . . . . . . . | -- | X | -- | -- | X | -- | X |
| City of Mequon . . . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| City of Port Washington . . . . . . . | -- | X | -- | -- | X | -- | X |
| Village of Belgium . . . . . . . . . | -- | X | -- | -- | X | -- | -- |
| Village of Fredonia . . . . . . . . . | -- | X | -- | -- | X | -- | X |
| Village of Grafton . . . . . . . . . | -- | X | -- | -- | X | -- | X |
| Village of Saukville . . . . . . . . | -- | X | -- | -- | X | -- | X |
| Village of Thiensville . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Belgium | | | | | | | |
| New District--Lake Church . . . . . | X | -- | -- | X | X | -- | -- |
| Town of Fredonia | | | | | | | |
| Waubeka Area Sanitary District . . . | -- | -- | -- | X | X | -- | -- |

| Point Source Management Agency | Refine and Detail Sewer Service Area | Construct, Maintain, and Operate Sewage Treatment Plant | Abandon Sewage Treat-ment Plant | Construct and Maintain Inter-community Trunk Sewer | Construct and Maintain Local Sewer System | Abate Combined Sewer Overflow | Eliminate Discharges from All Points of Sewage Flow Relief |
|---|---|---|---|---|---|---|---|
| RACINE COUNTY | | | | | | | |
| Wisconsin Department of | | | | | | | |
| Health and Social Services . . . . . | -- | -- | X | X | X | -- | -- |
| Western Racine County | | | | | | | |
| Sewerage District . . . . . . . . . | -- | X | -- | X | -- | -- | -- |
| City of Burlington . . . . . . . . . | -- | X | -- | -- | X | -- | -- |
| City of Racine . . . . . . . . . . | -- | X | -- | -- | X | -- | X |
| Village of Elmwood Park . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Village of North Bay . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of Rochester . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Village of Sturtevant . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Village of Union Grove . . . . . . . | -- | X | -- | X | X | -- | X |
| Village of Waterford . . . . . . . . | -- | -- | -- | -- | X | -- | X |
| Town of Burlington | | | | | | | |
| Bohner Lake Sanitary District . . . | -- | -- | -- | X | X | -- | -- |
| Browns Lake Sanitary District . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Caledonia | | | | | | | |
| Sewer Utility District No. 1 . . . . | -- | -- | -- | -- | X | -- | X |
| Caddy Vista Sanitary District . . . | -- | -- | -- | -- | X | -- | -- |
| Crestview Sanitary District . . . . | -- | -- | -- | -- | X | -- | X |
| North Park Sanitary District[a] . . . | -- | -- | -- | -- | X | -- | X |
| Town of Dover | | | | | | | |
| Eagle Lake Sewer Utility District . | -- | X | -- | -- | X | -- | -- |
| Town of Mt. Pleasant | | | | | | | |
| Sewer Utility District No. 1 . . . . | -- | -- | -- | -- | X | -- | X |
| Town of Norway | | | | | | | |
| Sanitary District No. 1 . . . . . . | X | X | -- | -- | X | -- | X |
| Town of Rochester | | | | | | | |
| Sewer Utility District No. 1 . . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Waterford | | | | | | | |
| Sanitary District No. 1 . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Yorkville | | | | | | | |
| Sanitary District No. 1 . . . . . . | X | X | -- | -- | X | -- | -- |
| WALWORTH COUNTY | | | | | | | |
| Walworth County . . . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Walworth County Metropolitan | | | | | | | |
| Sewerage District . . . . . . . . | -- | X | -- | X | -- | -- | X |
| Fontana-Walworth Water Pollution | | | | | | | |
| Control Commission . . . . . . . . . | -- | X | -- | -- | -- | -- | X |
| City of Delavan . . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| City of Elkhorn . . . . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| City of Lake Geneva . . . . . . . . | -- | X | -- | X | X | -- | -- |
| City of Whitewater . . . . . . . . . | -- | X | -- | -- | X | -- | X |
| Village of Darien . . . . . . . . . | -- | -- | X | X | X | -- | -- |
| Village of East Troy . . . . . . . . | -- | X | -- | -- | X | -- | -- |
| Village of Fontana . . . . . . . . . | X | -- | -- | X | X | -- | -- |
| Village of Genoa City . . . . . . . | -- | X | -- | -- | X | -- | -- |
| Village of Sharon . . . . . . . . . | X | X | -- | -- | X | -- | -- |
| Village of Walworth . . . . . . . . | X | -- | -- | -- | X | -- | -- |
| Village of Williams Bay . . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Bloomfield | | | | | | | |
| Pell Lake Sanitary District . . . . | X | -- | -- | X | X | -- | -- |
| Town of Delavan | | | | | | | |
| Delavan Lake Sanitary District[b] . . | -- | -- | -- | -- | X | -- | -- |
| Geneva National Sanitary District . | -- | -- | -- | -- | X | -- | -- |
| Town of East Troy | | | | | | | |
| Sanitary District No. 2 . . . . . . | -- | -- | -- | -- | X | -- | -- |
| New District--Army Lake . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Geneva | | | | | | | |
| New District--Como Lake . . . . . . | -- | -- | -- | X | X | -- | -- |
| Town of Linn | | | | | | | |
| Sanitary District . . . . . . . . . | X | -- | -- | X | X | -- | -- |
| Town of Lyons | | | | | | | |
| Sanitary District No. 2 . . . . . . | -- | X | -- | -- | X | -- | -- |
| Town of Troy | | | | | | | |
| New District--Booth Lake . . . . . . | -- | -- | -- | -- | X | -- | -- |
| Town of Walworth | | | | | | | |
| Utility District No. 1 . . . . . . . | -- | -- | -- | -- | X | -- | -- |

Table XVII-1 (continued)

| Point Source Management Agency | Refine and Detail Sewer Service Area | Construct, Maintain, and Operate Sewage Treatment Plant | Abandon Sewage Treatment Plant | Construct and Maintain Intercommunity Trunk Sewer | Construct and Maintain Local Sewer System | Abate Combined Sewer Overflow | Eliminate Discharges from All Points of Sewage Flow Relief |
|---|---|---|---|---|---|---|---|
| WASHINGTON COUNTY | | | | | | | |
| City of Hartford | -- | X | -- | -- | X | -- | X |
| City of West Bend | -- | X | -- | -- | X | -- | X |
| Village of Germantown | -- | -- | -- | -- | X | -- | X |
| Village of Jackson | -- | X | -- | -- | X | -- | X |
| Village of Kewaskum | -- | X | -- | -- | X | -- | X |
| Village of Newburg | -- | X | -- | -- | X | -- | X |
| Village of Slinger | -- | X | -- | -- | X | -- | -- |
| Town of Addison | | | | | | | |
| Allenton Sanitary District | -- | X | -- | -- | X | -- | -- |
| Town of Hartford | | | | | | | |
| Pike Lake Sanitary District | -- | -- | -- | -- | X | -- | -- |
| Town of Trenton | | | | | | | |
| Wallace Lake Sanitary District[c] | -- | -- | -- | -- | X | -- | -- |
| Town of West Bend | | | | | | | |
| Silver Lake District | -- | -- | -- | -- | X | -- | -- |
| WAUKESHA COUNTY | | | | | | | |
| Waukesha County | -- | -- | -- | X | X | -- | -- |
| Delafield-Hartland Water Pollution Control Commission | -- | X | -- | X | -- | -- | -- |
| City of Brookfield | -- | X | -- | -- | X | -- | X |
| City of Delafield | -- | -- | -- | -- | X | -- | -- |
| City of Muskego | -- | -- | -- | -- | X | -- | X |
| City of New Berlin | -- | -- | -- | -- | X | -- | -- |
| City of Oconomowoc | -- | X | -- | X | X | -- | -- |
| City of Waukesha | -- | X | -- | -- | X | -- | X |
| Village of Butler | -- | -- | -- | -- | X | -- | -- |
| Village of Chenequa | X | -- | -- | X | X | -- | -- |
| Village of Dousman | -- | X | -- | -- | X | -- | X |
| Village of Elm Grove | -- | -- | -- | -- | X | -- | X |
| Village of Hartland | -- | -- | -- | -- | X | -- | -- |
| Village of Lac La Belle | -- | -- | -- | -- | X | -- | -- |
| Village of Lannon | -- | -- | -- | X | X | -- | -- |
| Village of Menomonee Falls | -- | -- | -- | -- | X | -- | X |
| Village of Mukwonago | -- | X | -- | X | X | -- | -- |
| Village of Nashotah | -- | -- | -- | -- | X | -- | -- |
| Village of North Prairie | X | X | -- | -- | X | -- | -- |
| Village of Oconomowoc Lake | X | -- | -- | X | X | -- | -- |
| Village of Pewaukee | -- | -- | -- | -- | X | -- | X |
| Village of Sussex | -- | X | -- | -- | X | -- | X |
| Village of Wales | X | X | -- | -- | X | -- | -- |
| Town of Brookfield | -- | -- | -- | -- | X | -- | -- |
| Town of Eagle | | | | | | | |
| Eagle Spring Lake Rehabilitation and Protection District | -- | -- | -- | X | X | -- | -- |
| Town of Lisbon Sanitary District No. 1 | -- | -- | -- | -- | X | -- | -- |
| Town of Merton | | | | | | | |
| New District-North Lake | X | -- | -- | X | X | -- | -- |
| New District-Beaver Lake | X | -- | -- | X | X | -- | -- |
| New District-Moose Lake | -- | -- | -- | -- | X | -- | -- |
| Town of Oconomowoc | | | | | | | |
| Blackhawk Drive Sanitary District | -- | -- | -- | -- | X | -- | -- |
| Mary Lane Sanitary District | -- | -- | -- | -- | X | -- | -- |
| New District-Okauchee Lake[d] | X | -- | -- | X | X | -- | -- |
| Town of Pewaukee | | | | | | | |
| Sanitary District No. 3 | -- | -- | -- | -- | X | -- | -- |
| Pewaukee Lake Sanitary District[e] | -- | -- | -- | -- | X | -- | -- |
| Town of Summit | | | | | | | |
| New District-Nashotah-Nemahbin Lakes | -- | -- | -- | X | X | -- | -- |
| New District-Silver Lake | -- | -- | -- | -- | X | -- | -- |

[a]The North Park Sanitary District also serves the Village of Wind Point.
[b]The Delavan Lake Sanitary District also serves part of the Town of Walworth.
[c]The Wallace Lake Sanitary District also serves part of the Town of Barton.
[d]This new District would also serve part of the Town of Merton.
[e]The Pewaukee Lake Sanitary District also serves part of the Town of Delafield.

Source: SEWRPC.

Of the nine existing management agencies, eight currently provide centralized sanitary sewer service. One agency, the Waubeka Area Sanitary District in the Town of Fredonia, has been created and is anticipated to construct a local sewer system and trunk sewer in the Waubeka area of the Town of Fredonia, with treatment to be provided at the Village of Fredonia sewage treatment plant, at a future date.

In Racine County, a total of 22 management agencies have been designated, all of which currently exist. Thirteen of these management units are special purpose units of government. One agency, the Bohners Lake Sanitary District in the Town of Burlington, has been created and is anticipated to construct a local sewer system and trunk sewer to serve the Bohners Lake area, with treatment to be provided by the City of Burlington sewage treatment plant. A subregional sewer and water supply system plan prepared for the Greater Racine Area[2] recommended the creation of an areawide sewer and water authority as the best approach to implementing the recommended sewerage and water supply system plans. Such an authority would own and operate all of the major, that is, areawide sewerage and water supply facilities in the planning area. It is envisioned that the regional water quality management plan will be amended to reflect the findings of this subregional plan at such time as there is general agreement on the recommendations of the plan. This would add a new management agency, that being an areawide sewer and water authority. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1992 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In Walworth County, a total of 24 management agencies have been designated, 21 of which currently exist. Three new agencies are proposed to be formed, one being a sanitary or utility district in the Town of Geneva to provide centralized sanitary sewer service to the Como Lake area of the Town and to construct a trunk sewer to the Walworth County Metropolitan Sewerage District sewerage system; one being a sanitary or utility district in the Town of East Troy to provide centralized sanitary sewer service to the Army Lake area; and one being a sanitary or utility district in the Town of Troy to provide centralized sewer service to portions of the Booth Lake area. Nine of the 21 agencies are special purpose units of government, one of which--Pell Lake Sanitary District--is not yet providing centralized sanitary sewer service.

In Washington County, a total of 11 agencies have been designated, all of which currently exist. Four of these management units are special purpose units of government.

In Waukesha County, a total of 36 management agencies have been designated. Of this total, 30 agencies currently exist. Seven of the 30 management agencies are special purpose units of government. Six new agencies are proposed to be created, consisting of sanitary or utility districts in the North Lake, Moose Lake, and Beaver Lake portions of the Town of Merton, the Okauchee Lake portion of the Town of Oconomowoc, and the Nashotah-Nemahbin and Silver Lake Portions of

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[2]Alvord, Burdick, and Howson, and Applied Technologies, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area, September 1992.

the Town of Summit. Of the 30 existing management agencies in Waukesha County, 25 currently provide centralized sanitary sewer service. Four existing agencies which do not yet provide such service, but which are recommended to provide service in the plan consist of the Village of Chenequa, the Village of North Prairie, the Village of Wales, and Waukesha County. Waukesha County is recommended to provide service to Mukwonago County Park. One agency, the Village of Lannon, is anticipated to construct a local sewer system and trunk sewer in the Village of Lannon, with treatment to be provided by the Village of Sussex sewage treatment plant, at a future date.

For the Region as a whole, then, a total of 139 management agencies have been designated for point source pollution abatement and sludge management purposes. Of this total, all but 11 agencies currently exist. Forty-six of the existing management agencies are special purpose units of government. Eleven new agencies are proposed to be created, consisting of sanitary or utility districts created to provide centralized sewerage service to urban development in various towns throughout the Region. Of the 128 existing management agencies, 120 already provide centralized sanitary sewer service.

In addition to the foregoing local government management designations for point source pollution abatement and sludge management purposes, the Wisconsin Department of Natural Resources is designated as the management agency with primary responsibility for ensuring full implementation of the entire point source pollution abatement and sludge management plan element. It is envisioned that the primary mechanism to be used by the Wisconsin Department of Natural Resources to ensure plan implementation would be the waste discharge permit process established under the Wisconsin Pollutant Discharge Elimination System (WPDES). Certain other important tasks, however, would be attendant to the role of the Wisconsin Department of Natural Resources in implementation of the plan. The development of detailed sewerage facilities plans will require effluent limitation (waste load allocation) studies by the Department to refine and detail the allowable effluent limits for specific sewage treatment plants so that recommended water use objectives and supporting standards in the plan are met. The Wisconsin Department of Natural Resources may need to review its administrative rules and procedures with regard to the application of the recommended phosphorus standard to lakes and streams of the Region, and to attainment of that standard through the regulation of the design of facilities to abate point sources of pollution.

The major responsibilities of the designated management agencies in carrying out the areawide water quality management plan are also identified in Table XVII-1. As shown in the table, these management agency responsibilities include the refinement and detailing of sanitary sewer service areas; the construction, maintenance, and operation of sewage treatment plants; the abandonment of sewage treatment plants; the construction and maintenance of intercommunity trunk sewers; the construction and maintenance of local sewer collection systems; the abatement of combined sewer overflows; and the elimination of discharges from the remaining overflows of sanitary sewage.

Under the recommended water quality management plan for the Region, eight of the 27 existing private sewage treatment facilities are proposed to be abandoned over the plan design period. It is recommended that the Wisconsin Department of Natural Resources, in administering the Wisconsin Pollutant Discharge Elimination

System, schedule the abandonment of these eight identified private sewage treatment facilities recommended to be abandoned, with the precise scheduling to be determined by the Department as public centralized sanitary sewerage systems are constructed and extended.

It is recognized that the Department may receive during the plan implementation period requests to approve additional private sewage treatment facilities to serve new enclaves of isolated land use development. It is recommended that the Wisconsin Department of Natural Resources, with the assistance of the Southeastern Wisconsin Regional Planning Commission, evaluate each such proposal as it arises. Such evaluation should be made in light of the objectives sought to be achieved in both the adopted regional land use plan and the recommended areawide water quality management plan.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT IMPLEMENTATION

The local governmental management agencies designated to implement the nonpoint source pollution abatement element of the recommended areawide water quality management plan are identified in Table XVII-2. In urban areas, these designated agencies are comprised of all of the incorporated units of government in the Region, together with selected unincorporated towns that have large urban populations and selected utility, sanitary, and lake protection and rehabilitation districts within unincorporated towns. In rural areas, these designated agencies are comprised of each of the seven-county Land Conservation Committees in the Region, together with selected utility, sanitary, and lake protection and rehabilitation districts within unincorporated towns. New agencies are proposed in some instances, particularly in lake areas, where such action is deemed necessary to carry out the plan recommendations.

In Kenosha County, a total of 23 nonpoint source management agencies have been designated. Of this total, 19 are existing agencies, 11 of which are special purpose units of government. The four new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Benedict Lake and Benet/Shangrila Lake in the Towns of Randall and Bristol, respectively; Dyer Lake in the Town of Wheatland; and the unnamed quarry lake in the Town of Pleasant Prairie.

In Milwaukee County, a total of 20 nonpoint source management agencies have been designated, all of which currently exist.

In Ozaukee County, a total of 12 nonpoint source management agencies have been designated, nine of which currently exist. The three new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Lac du Cours in the City of Mequon, Mud Lake in the town of Saukville, and Spring Lake in the Town of Fredonia.

In Racine County, a total of 23 nonpoint source management agencies have been designated. Of the 23 agencies, 20 are existing agencies and three would be new agencies. The three new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Bueno Lake in the Town of Waterford, and Echo Lake and

Table XVII-2

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES
FOR THE NONPOINT SOURCE POLLUTION ABATEMENT ELEMENT OF THE RECOMMENDED
REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| KENOSHA COUNTY | | | | | | | |
| Kenosha County | X | X | X | X | X | X | X |
| City of Kenosha | -- | X | X | -- | -- | X | -- |
| Village of Paddock Lake | -- | X | X | -- | -- | X | -- |
| Village of Pleasant Prairie | -- | -- | X | -- | -- | X | -- |
| New District--Unnamed Quarry Lake | -- | -- | -- | -- | X | X | -- |
| Village of Silver Lake | -- | X | X | -- | -- | X | -- |
| Village of Twin Lakes | -- | X | X | -- | -- | X | -- |
| Town of Brighton | | | | | | | |
| Department of Natural Resources (East Lake Flowage) | X | -- | -- | -- | X | o | -- |
| Town of Bristol | | | | | | | |
| Utility District No. 1 | -- | -- | X | -- | -- | X | -- |
| George Lake Protection and Rehabilitation District | -- | -- | X | -- | X | X | -- |
| New District--Benet/Shangrila Lake | -- | X | X | -- | X | X | -- |
| Town of Randall | | | | | | | |
| Powers Lake Management District[a] | X | -- | X | -- | X | X | -- |
| Twin Lakes Protection and Rehabilitation District | -- | -- | X | -- | -- | X | -- |
| New District--Benedict Lake | X | -- | X | -- | X | X | -- |
| Town of Salem | | | | | | | |
| Sewer Utility District No. 1 | -- | -- | X | -- | -- | X | -- |
| Sewer Utility District No. 2 | -- | -- | X | -- | -- | X | -- |
| Paddock Lake Inland Lake Protection and Rehabilitation District | -- | -- | X | -- | -- | X | -- |
| Hooker Lake Management District | -- | -- | X | -- | -- | X | -- |
| Voltz Lake Management District | -- | -- | X | -- | -- | X | -- |
| Camp and Center Lake Rehabilitation District | -- | -- | X | -- | X | X | -- |
| Town of Somers | -- | -- | X | -- | -- | X | -- |
| Town of Wheatland | | | | | | | |
| Lilly Lake Protection and Rehabilitation District | -- | -- | X | -- | -- | X | -- |
| New District--Dyer Lake | X | X | -- | X | X | X | -- |

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| MILWAUKEE COUNTY | | | | | | | |
| Milwaukee County | -- | X | X | -- | -- | X | X |
| City of Cudahy | -- | X | X | -- | -- | X | -- |
| City of Franklin | X | X | X | -- | -- | X | -- |
| City of Glendale | -- | X | X | -- | -- | X | -- |
| City of Greenfield | -- | X | X | -- | -- | X | -- |
| City of Milwaukee | -- | X | X | -- | -- | X | -- |
| City of Oak Creek | X | X | X | -- | -- | X | -- |
| City of St. Francis | -- | X | X | -- | -- | X | -- |
| City of South Milwaukee | -- | X | X | -- | -- | X | -- |
| City of Wauwatosa | -- | X | X | -- | -- | X | -- |
| City of West Allis | -- | X | X | -- | -- | X | -- |
| Village of Bayside | -- | X | X | -- | -- | X | -- |
| Village of Brown Deer | -- | X | X | -- | -- | X | -- |
| Village of Fox Point | -- | X | X | -- | -- | X | -- |
| Village of Greendale | -- | X | X | -- | -- | X | -- |
| Village of Hales Corners | -- | X | X | -- | -- | X | -- |
| Village of River Hills | -- | X | X | -- | -- | X | -- |
| Village of Shorewood | -- | X | X | -- | -- | X | -- |
| Village of West Milwaukee | -- | X | X | -- | -- | X | -- |
| Village of Whitefish Bay | -- | X | X | -- | -- | X | -- |
| OZAUKEE COUNTY | | | | | | | |
| Ozaukee County | X | X | -- | X | -- | X | -- |
| City of Cedarburg | -- | X | X | -- | -- | X | -- |
| City of Mequon | X | X | X | -- | -- | X | -- |
| New District--Lac du Cours | -- | -- | o | -- | o | X | -- |
| City of Port Washington | -- | X | X | -- | -- | X | -- |
| Village of Belgium | -- | X | X | -- | -- | X | -- |
| Village of Fredonia | -- | X | X | -- | -- | X | -- |
| Village of Grafton | -- | X | X | -- | -- | X | -- |
| Village of Saukville | -- | X | X | -- | -- | X | -- |
| Village of Thiensville | -- | X | X | -- | -- | X | -- |
| Town of Saukville | | | | | | | |
| New District--Mud Lake | -- | -- | -- | X | o | X | -- |
| Town of Fredonia | | | | | | | |
| New District--Spring Lake | X | o | o | -- | o | X | -- |

Table XVII-2 (continued)

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| RACINE COUNTY | | | | | | | |
| Racine County | X | X | X | X | X | X | X |
| City of Burlington | -- | X | X | -- | -- | X | -- |
| City of Racine | -- | X | X | -- | -- | X | -- |
| Village of Elmwood Park | -- | X | X | -- | -- | X | -- |
| Village of North Bay | -- | X | X | -- | -- | X | -- |
| Village of Rochester | -- | X | X | -- | -- | X | -- |
| Village of Sturtevant | -- | X | X | -- | -- | X | -- |
| Village of Union Grove | -- | X | X | -- | -- | X | -- |
| Village of Waterford | -- | X | X | -- | -- | X | -- |
| Village of Wind Point | -- | X | X | -- | -- | X | -- |
| Town of Burlington | | | | | | | |
| Browns Lake Sanitary District | -- | -- | X | -- | X | X | -- |
| Bohner Lake Sanitary District | X | -- | X | -- | -- | X | -- |
| New District--Long Lake[b] | X | -- | X | -- | X | X | -- |
| New District--Echo Lake | -- | X | X | X | -- | X | -- |
| Town of Caledonia | -- | -- | X | -- | -- | X | -- |
| Town of Dover | | | | | | | |
| Eagle Lake Sewer Utility District | -- | -- | X | -- | X | X | -- |
| Town of Mt. Pleasant | -- | -- | X | -- | -- | X | -- |
| Town of Norway | | | | | | | |
| Sanitary District No. 1 | -- | -- | X | -- | X | X | -- |
| Wind Lake Management District | -- | X | X | -- | -- | X | -- |
| Town of Rochester | | | | | | | |
| Sewer Utility District No. 1 | -- | -- | X | -- | -- | X | -- |
| Town of Waterford | | | | | | | |
| Sanitary District No. 1 | -- | -- | X | -- | X | X | -- |
| New District--Buena Lake | -- | X | X | X | X | X | -- |
| Town of Yorkville | | | | | | | |
| Sanitary District No. 1 | -- | -- | X | -- | -- | X | -- |

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| WALWORTH COUNTY | | | | | | | |
| Walworth County | -- | -- | X | X | X | X | -- |
| Geneva Lake Environmental Agency | -- | X | -- | -- | -- | X | X |
| City of Delavan | -- | X | X | -- | -- | X | X |
| City of Elkhorn | -- | X | X | -- | -- | X | -- |
| City of Lake Geneva | -- | X | X | -- | -- | X | -- |
| City of Whitewater | X | o | X | -- | -- | X | -- |
| New District--Tripp Lake | -- | X | X | -- | X | X | -- |
| Village of Darien | -- | X | X | -- | -- | X | -- |
| Village of East Troy | -- | X | X | -- | -- | X | -- |
| Village of Fontana | -- | X | X | -- | -- | X | -- |
| Village of Genoa City | -- | X | X | -- | -- | X | -- |
| Village of Sharon | -- | X | X | -- | -- | X | -- |
| Village of Walworth | -- | X | X | -- | -- | X | -- |
| Village of Williams Bay | -- | X | X | -- | -- | X | -- |
| Town of Bloomfield | | | | | | | |
| Pell Lake Sanitary District | X | -- | X | X | X | X | -- |
| Powers Lake Management District | -- | -- | X | X | X | X | -- |
| Town of Delavan | | | | | | | |
| Delavan Lake Sanitary District[c] | -- | -- | X | -- | X | X | -- |
| Comus Lake Protection and Rehabilitation District | -- | -- | X | -- | X | X | -- |
| Town of East Troy | | | | | | | |
| Beulah Lake Sanitary District No. 1 | X | -- | X | -- | X | X | -- |
| Sanitary District No. 1 | -- | -- | X | -- | -- | X | -- |
| Sanitary District No. 2 | X | -- | X | -- | -- | X | -- |
| Potters Lake Protection and Rehabilitation District | -- | -- | X | -- | X | X | -- |
| New District--LaGrange Lake | X | -- | X | -- | X | X | -- |
| Town of Geneva | | | | | | | |
| Como Lake District | -- | -- | X | -- | X | X | -- |
| Town of LaGrange | | | | | | | |
| Lauderdale Lake Management District | X | -- | X | -- | X | X | -- |
| Pleasant Lake Protection and Rehabilitation District | X | -- | X | -- | X | X | -- |
| New District--Army Lake | -- | -- | X | -- | X | X | -- |
| Town of Linn | | | | | | | |
| Sanitary District No. 1 | X | -- | X | -- | -- | X | -- |
| Town of Richmond | | | | | | | |
| New District--Lake Loraine | X | -- | X | X | X | X | -- |
| New District--Turtle Lake | X | -- | o | X | o | X | -- |

Table XVII-2 (continued)

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| WALWORTH COUNTY (continued) | | | | | | | |
| Town of Spring Prairie | | | | | | | |
| Honey Lake Protection and Rehabilitation District . . . . . . . . . . . . . . . . . . . . . . | -- | -- | X | -- | X | X | -- |
| Town of Sugar Creek | | | | | | | |
| New District--North Lake . . . . . . . . . . . . | X | -- | X | X | X | X | -- |
| New District--Silver Lake . . . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| New District--Wandawega Lake . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| Town of Troy | | | | | | | |
| New District--Booth Lake . . . . . . . . . . . . | X | -- | X | X | X | X | -- |
| New District--Lulu Lake . . . . . . . . . . . . . | -- | -- | o | X | o | o | -- |
| New District--Peters Lake . . . . . . . . . . . . | -- | -- | X | X | X | X | -- |
| Town of Whitewater | | | | | | | |
| Whitewater-Rice Lakes District . . . . . . . . . | X | -- | X | -- | X | X | -- |
| New District--Cravath Lake . . . . . . . . . . . | -- | o | X | -- | X | X | -- |

Table XVII-2 (continued)

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| WASHINGTON COUNTY | | | | | | | |
| Washington County . . . . . . . . . . . . . . . . . . . | X | X | X | X | X | X | X |
| City of Hartford . . . . . . . . . . . . . . . . . . . | -- | X | X | -- | -- | -- | -- |
| City of West Bend . . . . . . . . . . . . . . . . . . . | -- | X | X | -- | -- | X | -- |
| New District--Barton Pond . . . . . . . . . . . . . | -- | o | o | -- | o | X | -- |
| Village of Germantown . . . . . . . . . . . . . . . . | X | X | X | -- | -- | X | -- |
| Village of Jackson . . . . . . . . . . . . . . . . . . | -- | X | X | -- | -- | X | -- |
| Village of Kewaskum . . . . . . . . . . . . . . . . . | -- | X | X | -- | -- | X | -- |
| Village of Newburg . . . . . . . . . . . . . . . . . . | -- | X | X | -- | -- | X | -- |
| Village of Slinger . . . . . . . . . . . . . . . . . . | -- | X | X | -- | -- | X | -- |
| Town of Addison | | | | | | | |
| Allenton Sanitary District . . . . . . . . . . . . | -- | -- | X | -- | -- | X | -- |
| Town of Barton | | | | | | | |
| New District--Smith Lake . . . . . . . . . . . . . | X | -- | o | X | o | X | -- |
| Town of Erin | | | | | | | |
| Druid Lake Inland Protection and Rehabilitation District . . . . . . . . . . . . | -- | -- | -- | -- | X | X | -- |
| Town of Farmington | | | | | | | |
| New District--Green Lake . . . . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| New District--Lake Twelve . . . . . . . . . . . . . | X | o | o | -- | o | X | -- |
| Town of Hartford | | | | | | | |
| New District--Pike Lake . . . . . . . . . . . . . . | -- | -- | X | -- | X | X | -- |
| Town of Richfield | | | | | | | |
| Richfield Sanitary District . . . . . . . . . . . . | X | -- | X | X | X | X | -- |
| New District--Bark Lake . . . . . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| New District--Freiss Lake . . . . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| New District--Lake Five . . . . . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| Town of Trenton | | | | | | | |
| Wallace Lake Sanitary District . . . . . . . . . | -- | -- | X | -- | X | X | -- |
| Town of West Bend | | | | | | | |
| Big Cedar Lake District . . . . . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| Little Cedar Lake Protection and Rehabilitation District . . . . . . . . . . . . | X | -- | X | -- | X | X | -- |
| Silver Lake Rehabilitation District . . . . . . . | -- | -- | X | -- | X | X | -- |
| New District--Lucas Lake . . . . . . . . . . . . . | X | o | o | -- | o | X | -- |

Table XVII-2 (continued)

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| WAUKESHA COUNTY | | | | | | | |
| Waukesha County | X | X | X | X | X | X | X |
| City of Brookfield | -- | X | X | -- | -- | X | -- |
| City of Delafield | -- | X | X | -- | -- | X | -- |
| City of Muskego | -- | X | X | -- | -- | X | -- |
| Big Muskego Lake-Bass Bay Protection and Rehabilitation District | -- | X | X | -- | -- | X | -- |
| Little Muskego Lake Protection and Rehabilitation District | -- | X | X | -- | -- | X | -- |
| City of New Berlin | -- | X | X | -- | -- | X | -- |
| City of Oconomowoc | -- | X | X | -- | -- | X | -- |
| Fowler Lake Management District | -- | X | X | -- | -- | X | -- |
| City of Waukesha | -- | X | X | -- | -- | X | -- |
| Village of Big Bend | -- | X | X | -- | -- | X | -- |
| Village of Butler | -- | X | X | -- | -- | X | -- |
| Village of Chenequa | X | X | X | -- | -- | X | -- |
| Village of Dousman | -- | X | X | -- | -- | X | -- |
| Village of Eagle | -- | X | X | -- | -- | X | -- |
| Village of Elm Grove | -- | X | X | -- | -- | X | -- |
| Village of Hartland | -- | X | X | -- | -- | X | -- |
| Village of Lac La Belle | -- | X | X | -- | -- | X | -- |
| Village of Lannon | -- | X | X | -- | -- | X | -- |
| Village of Menomonee Falls | -- | X | X | -- | -- | X | -- |
| Village of Merton | -- | X | X | -- | -- | X | -- |
| Village of Mukwonago | -- | X | X | -- | -- | X | -- |
| Village of Nashotah | -- | X | X | -- | -- | X | -- |
| Village of North Prairie | -- | X | X | -- | -- | X | -- |
| Village of Oconomowoc Lake | -- | X | X | -- | -- | X | -- |
| Village of Pewaukee | -- | X | X | -- | -- | X | -- |
| Village of Sussex | -- | X | X | -- | -- | X | -- |
| Village of Wales | -- | X | X | -- | -- | X | -- |
| Town of Brookfield | -- | -- | X | -- | -- | X | -- |
| Town of Delafield | -- | -- | X | -- | -- | X | -- |
| Town of Eagle | | | | | | | |
| Eagle Spring Lake Protection and Rehabilitation District | X | -- | X | -- | X | X | -- |
| Town of Genesee | -- | -- | X | -- | -- | X | -- |
| Town of Lisbon | -- | -- | X | -- | -- | X | -- |

| Urban Nonpoint Source Management Agency | Undertake Septic Tank System Management Program | Undertake Construction Erosion Control Program | Develop and Implement Detailed Plan for Application of Urban Land Practices | Undertake Livestock Waste Control Project | Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices | Conduct Educational and Informational Programs | Provide Technical Assistance |
|---|---|---|---|---|---|---|---|
| WAUKESHA COUNTY (continued) | | | | | | | |
| Town of Merton | | | | | | | |
| North Lake Management District | X | -- | X | -- | X | X | -- |
| New District--Beaver Lake | + | + | X | -- | X | X | -- |
| New District--Moose Lake | X | X | X | -- | X | X | -- |
| Lake Keesus Management District | X | -- | X | -- | X | X | -- |
| Town of Mukwonago | | | | | | | |
| Phantom Lakes Protection and Rehabilitation District | X | -- | X | -- | X | X | -- |
| New District--Spring Lake | -- | -- | X | -- | X | X | -- |
| Town of Oconomowoc | | | | | | | |
| Lac La Belle Management District | -- | -- | X | -- | X | X | -- |
| New District--Oconomowoc Lake | + | + | X | -- | X | X | -- |
| Okauchee Lake Protection and Rehabilitation District | X | -- | X | -- | X | X | -- |
| Ashippun Lake Protection and Rehabilitation District | X | -- | X | -- | X | X | -- |
| Town of Ottawa | | | | | | | |
| Pretty Lake Protection and Rehabilitation District | X | -- | X | -- | X | X | -- |
| School Section Lake Protection and Rehabilitation District | X | -- | X | -- | X | X | -- |
| Town of Pewaukee | | | | | | | |
| Pewaukee Lake Sanitary District | -- | -- | X | -- | -- | X | -- |
| Town of Summit | | | | | | | |
| Middle Genesee Lake Management District | -- | -- | X | -- | -- | X | -- |
| Upper Nemahbin Lake Management District | -- | -- | X | -- | -- | X | -- |
| New District--Crooked Lake | X | -- | + | -- | + | X | -- |
| New District--Upper Nashotah Lake | X | X | X | X | X | X | -- |
| New District--Waterville Pond | X | -- | X | -- | X | X | -- |
| Town of Vernon | -- | -- | X | -- | -- | X | -- |
| Town of Waukesha | -- | -- | X | -- | -- | X | -- |

[a] This District also serves a portion of Walworth County.

[b] This new District would also serve a portion of the Town of Rochester.

[c] The Delavan Lake Sanitary District also serves part of the town of Walworth.

Source: SEWRPC.

Long Lake, in the Town of Burlington. The existing agencies designated in Racine County include eight special purpose units of government.

In Walworth County, a total of 39 nonpoint source management agencies have been designated. Of these 39 agencies, 27 are existing agencies and 12 would be new agencies. The 12 new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Lake Lorraine and Turtle Lake in the Town of Richmond; North Lake, Silver Lake and Wandawega Lake in the Town of Sugar Creek; Booth Lake, Lulu Lake, and Peters Lake in the Town of Troy; Army Lake in the Town of East Troy; LaGrange Lake in the Town of LaGrange; Cravath Lake in the Town of Whitewater; and Tripp Lake in the City of Whitewater. Of the 27 existing agencies, 15 are special purpose units of government.

In Washington County, a total of 24 nonpoint source management agencies have been designated. Of these 24 agencies, 15 are existing agencies and nine would be new agencies. The nine new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Smith Lake in the Town of Barton; Green Lake and Lake Twelve in the Town of Farmington; Pike Lake in the Town of Hartford; Bark Lake, Friess Lake, and Lake Five in the Town of Richfield; Lucas Lake in the town of West Bend; and Barton Pond in the City of West Bend. Of the 15 existing agencies, seven are special purpose units of government.

In Waukesha County, a total of 53 nonpoint source management agencies have been designated. Of this total, 46 are existing agencies and seven would be new agencies. The seven new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Beaver Lake and Moose Lake in the Town of Merton; Spring Lake in the Town of Mukwonago; Oconomowoc Lake in the Town of Oconomowoc; and Crooked Lake, Upper Nashotah Lake, and the Waterville Pond in the Town of Summit. Of the 46 existing management agencies in Waukesha County, 15 are special purpose units of government.

For the Region as a whole, then, a total of 194 management agencies have been designated for nonpoint source pollution abatement purposes. Of this total, all but 38 agencies currently exist. The 38 new agencies would be sanitary, utility and/or lake protection and rehabilitation districts created to provide an institutional framework for the development and implementation of detailed local plans for the application of urban and rural nonpoint source pollution abatement practices. Of the 194 designated nonpoint source pollution abatement management agencies, 104 have been previously designated for point source pollution abatement purposes.

The major responsibilities of the designated management agencies in carrying out the areawide water quality management plan are also identified in Table XVII-2. As shown in the table, these management agency responsibilities include the refinement and detailing of local nonpoint source pollution control practices; educational programs to encourage reductions in urban and rural nonpoint source loading to surface waters; and the minimization of all nonpoint source pollutants, especially those arising from onsite wastewater treatment practices, construction activities, and livestock operations. Not all agencies will be assigned all of these responsibilities.

LAKES MANAGEMENT PLAN ELEMENT IMPLEMENTATION

The local governmental management agencies designated to implement the lakes management element of the recommended areawide water quality management plan are identified in Table XVII-3. These designated agencies are comprised of all lake protection and rehabilitation districts created under Chapter 33 of the Wisconsin Statutes in the Region, together with selected utility and/or sanitary districts within unincorporated towns, and qualified lake associations, incorporated under Chapter 181 of the Wisconsin Statutes, as described in Chapters NR 119 and NR 191 of the Wisconsin Administrative Code.[3] New agencies are proposed in some instances where such action is deemed necessary to carry out the plan recommendations.

In Kenosha County, a total of 13 governmental lake management agencies have been designated; two of which--Camp and Center Lake rehabilitation District and Twin Lakes Protection and Rehabilitation District--serve both Camp and Center Lakes and Elizabeth and Mary Lakes, respectively. A further three nongovernmental agencies also exist. Of the 13 governmental agencies, nine lake management agencies are existing agencies. The four new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Benedict Lake in the Town of Randall; Benet/Shangrila Lake in the Town of Bristol; Dyer Lake in the Town of Wheatland; and the unnamed quarry lake in the Town of Pleasant Prairie. Of the nine existing agencies, the Wisconsin Department of Natural Resources is the designated management agency for East Lake Flowage which is totally contained within the boundaries of the Bong Recreational Area.

In Milwaukee County, there are no major lakes. Consequently, no lake management agencies have been designated.

In Ozaukee County, three lake management agencies have been designated. All three would be new agencies that would be created to encompass urban and rural development tributary to: Lac du Cours in the City of Mequon; Spring Lake in the Town of Fredonia; and Mud Lake in the Town of Saukville.

In Racine County, a total of six governmental lake management agencies have been designated. A further four nongovernmental agencies also exist; one of which--Tri-Lakes Conservancy, Inc.--serves KeeNongGoMong, Waubeesee, and Wind Lakes. Of the six governmental agencies, three are existing agencies and three would be

[3] Section 208 of the Federal Clean Water Act requires that local governmental units and agencies be identified as designated management agencies for areawide water quality management plan implementation. Cities, villages, towns, sanitary districts and public inland lake protection and rehabilitation districts are the principal local governmental management units having responsibility for plan implementation in the Region. In addition, however, Chapters NR 119 and 191 of the Wisconsin Administrative Code recognize certain nongovernmental agencies, qualified lake associations, as able to undertake lake management planning and protection activities. Although such agencies cannot be designated management agencies pursuant to Section 208, these agencies are shown in Table XVII-3 for completeness.

Table XVII-3

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES FOR THE LAKE MANAGEMENT PLAN ELEMENT OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| KENOSHA COUNTY | | | | | | | |
| Des Plaines River | | | | | | | |
| New District--Benet/Shangrila[c] . | O | + | + | + | + | + | + |
| East Lake Flowage--Wisconsin Department of Natural Resources | + | -- | O | O | -- | O | + |
| George Lake | | | | | | | |
| George Lake Protection and Rehabilitation District . . . | O | O | + | X | + | O | O |
| Hooker Lake | | | | | | | |
| Hooker Lake Management District | O | + | + | X | + | + | O |
| Paddock Lake | | | | | | | |
| Paddock Lake Inland Lake Protection and Rehabilitation District . . . . . . . . . . . | O | X | X | X | X | + | O |
| Unnamed Quarry Lake--New District . . . . . . . . . . . | X | -- | X | X | -- | X | X |
| Fox River | | | | | | | |
| Benedict Lake--New District . . . | O | + | + | + | + | + | + |
| Camp Lake | | | | | | | |
| Camp & Center Lake Rehabilitation District . . . . . . . . | O | + | + | X | X | + | O |
| Center Lake | | | | | | | |
| Camp & Center Lake Rehabilitation District . . . . . . . . | O | + | + | X | X | + | O |
| Cross Lake | | | | | | | |
| Cross Lake Improvement Association . . . . . . . . . | O | + | + | + | + | + | O |
| Dyer Lake--New District . . . . . | + | + | + | + | + | + | + |
| Elizabeth Lake | | | | | | | |
| Twin Lakes Protection and Rehabilitation District . . . | O | X | + | X | X | + | X |
| Lilly Lake | | | | | | | |
| Lilly Lake Rehabilitation District . . . . . . . . . . . | O | X | + | X | + | + | O |
| Marie Lake | | | | | | | |
| Twin Lakes Protection and Rehabilitation District . . . | O | X | + | X | + | + | X |
| Powers Lake | | | | | | | |
| Powers Lake Management District | O | + | + | O | X | + | X |
| Silver Lake | | | | | | | |
| Silver Lake Protection Association . . . . . . . . . | + | + | X | X | + | + | + |
| Silver Lake Sportsmans Club . . | X | X | + | X | X | + | X |
| Voltz Lake | | | | | | | |
| Voltz Lake Management District | O | + | + | + | + | + | O |

Table XVII-3 (continued)

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| OZAUKEE COUNTY | | | | | | | |
| Milwaukee River | | | | | | | |
| Lac du Cours--New District . . . | + | -- | + | + | X | + | + |
| Mud Lake--New District . . . . . | + | -- | -- | + | X | + | + |
| Spring Lake--New District . . . . | + | -- | + | + | X | + | + |
| RACINE COUNTY | | | | | | | |
| Fox River | | | | | | | |
| Bohner Lake Sanitary District . . | O | O | + | + | + | + | O |
| Bohner Lake Improvement Association . . . . . . . . . . | O | + | + | X | X | + | + |
| Browns Lake | | | | | | | |
| Browns Lake Sanitary District . . | O | X | X | X | + | + | O |
| Eagle Lake | | | | | | | |
| Eagle Lake Property Owners Improvement Association . . . . | O | O | X | X | + | + | O |
| Echo Lake--New District . . . . . . | + | -- | + | + | + | + | + |
| Kee Nong Go Mong Lake | | | | | | | |
| Tri-Lakes Conservancy, Inc. . . . | O | + | + | X | + | + | O |
| Long Lake | | | | | | | |
| New District--Long Lake . . . . . | + | + | + | + | + | + | + |
| Waterford Impoundment | | | | | | | |
| Buena Lake--New District . . . . | + | -- | + | + | + | + | + |
| Tichigan Lake | | | | | | | |
| Tichigan Advancement Association | O | -- | + | X | + | + | + |
| Waubeesee Lake | | | | | | | |
| Tri-Lakes Conservancy, Inc. . . . | O | + | + | X | + | + | O |
| Wind Lake | | | | | | | |
| Wind Lake Management District . . | O | + | X | X | X | + | X |
| Tri-Lakes Conservancy, Inc. . . . | X | X | X | X | + | O | X |

Table XVII-3 (continued)

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| WALWORTH COUNTY | | | | | | | |
| Fox River | | | | | | | |
| Army Lake--New District . . . . . | + | -- | + | + | + | + | + |
| Booth Lake | | | | | | | |
| New District--Booth Lake . . . | -- | + | + | + | + | + | + |
| Booth Lake Property Owners Association . . . . . . . . . | O | O | + | + | + | + | + |
| Lake Beulah | | | | | | | |
| Beulah Lake Sanitary District . | X | + | X | X | X | + | X |
| Beulah Lake Protection and Improvement Association . . . | O | X | + | X | + | + | + |
| Lake Como | | | | | | | |
| Como Lake District . . . . . . | O | O | + | + | + | + | + |
| Lake Geneva | | | | | | | |
| Geneva Lake Environmental Agency . . . . . . . . . . . . | O | + | X | X | X | + | X |
| Geneva Lake Conservancy, Inc. . | X | X | X | X | + | O | X |
| Geneva Lake Association . . . . | X | X | X | X | X | + | X |
| Lauderdale Lake | | | | | | | |
| Lauderdale Lake Management District . . . . . . . . . . . | O | + | + | X | + | + | O |
| Lulu Lake--New District . . . . . | + | + | + | X | + | O | O |
| North Lake | | | | | | | |
| New District--North Lake . . . | + | + | + | + | + | + | + |
| Pell Lake | | | | | | | |
| Pell Lake Sanitary District . . | + | -- | + | + | + | + | + |
| Pell Lake Property Owners Association . . . . . . . . . | + | X | + | + | + | + | + |
| Peters Lake--New District . . . . | + | + | + | + | + | + | + |
| Pleasant Lake | | | | | | | |
| Pleasant Lake Protection and Rehabilitation District . . . | O | + | X | + | + | + | + |
| Pleasant Lake Association . . . | X | X | X | X | X | + | X |
| Potters Lake | | | | | | | |
| Potters Lake Protection and Rehabilitation District . . . | O | + | + | + | + | + | O |
| Silver Lake | | | | | | | |
| New District--Silver Lake . . . | + | -- | + | + | + | + | + |
| Wandawega Lake | | | | | | | |
| New District--Wandawega Lake . | + | + | + | + | + | + | + |
| Rock River | | | | | | | |
| Comus Lake | | | | | | | |
| Comus Lake Protection and Rehabilitation District . . . | + | + | + | + | X | + | + |
| Cravath Lake--New District . . . | + | + | + | + | + | + | + |
| Delavan Lake | | | | | | | |
| Delavan Lake Sanitary District | X | X | X | X | X | + | X |
| Town of Delavan . . . . . . . . | O | X | X | X | X | O | + |

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| WALWORTH County--continued | | | | | | | |
| Rock River--continued | | | | | | | |
| La Grange Lake--New District | + | -- | + | + | + | + | + |
| Lake Lorraine | | | | | | | |
| New District--Lake Lorraine | + | + | + | + | + | + | + |
| Lorraine Lake Property Owners Association | + | + | + | + | + | + | + |
| Rice Lake | | | | | | | |
| Whitewater-Rice Lakes Management District | O | O | + | X | + | O | O |
| Tripp Lake--New District | + | + | + | + | + | + | + |
| Turtle Lake | | | | | | | |
| New District--Turtle Lake | + | + | + | + | X | + | + |
| Turtle Lake Improvement and Protection Association | + | + | + | + | + | + | + |
| Whitewater Lake | | | | | | | |
| Whitewater-Rice Lakes Management District | O | + | X | X | + | O | O |
| WASHINGTON COUNTY | | | | | | | |
| Milwaukee River | | | | | | | |
| Barton Pond--New District | + | -- | + | + | X | + | + |
| Big Cedar Lake | | | | | | | |
| Big Cedar Lake District | O | X | X | X | X | + | + |
| Big Cedar Lake Sanitary District | X | X | X | X | X | + | + |
| Big Cedar Lake Property Owners Association | X | X | X | X | X | + | + |
| Green Lake | | | | | | | |
| New District--Green Lake | O | -- | + | + | X | + | + |
| Green Lake Property Owners Association of Washington County | O | + | + | X | + | + | + |
| Lake Twelve | | | | | | | |
| New District--Lake Twelve | + | -- | + | + | X | + | + |
| Emerald Valley Property Owners Association | + | + | + | + | + | + | + |
| Little Cedar Lake | | | | | | | |
| Little Cedar Lake Protection and Rehabilitation District | O | X | + | X | X | + | + |
| Little Cedar Lake Advancement Association | X | X | X | X | X | + | X |
| Lucas Lake--New District | + | + | + | + | X | + | + |
| Silver Lake | | | | | | | |
| Silver Lake Sanitary District | O | + | + | X | + | + | + |
| Silver Lake Protection Association | X | X | X | X | X | + | X |
| Smith Lake--New District | + | + | + | + | X | + | + |

Table XVII-3 (continued)

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| WASHINGTON COUNTY--continued | | | | | | | |
| Milwaukee River--continued | | | | | | | |
| Wallace Lake Sanitary District . | O | + | + | X | X | + | + |
| Rock River | | | | | | | |
| Bark Lake | | | | | | | |
| New District--Bark Lake . . . . | -- | -- | -- | -- | -- | -- | -- |
| Richfield Sanitary District . . | + | + | + | + | + | + | + |
| Druid Lake | | | | | | | |
| Druid Lake Inland Protection and Rehabilitation District . . . | O | + | + | X | X | + | O |
| Friess Lake | | | | | | | |
| New District--Friess Lake . . . | -- | -- | -- | -- | -- | -- | -- |
| Friess Lake Action Group . . . | O | + | + | + | X | + | X |
| Lake Five | | | | | | | |
| New District--Lake Five . . . . | -- | -- | -- | -- | -- | -- | -- |
| Lake Five Advancement Association . . . . . . . . . | O | + | + | + | + | + | + |
| Pike Lake | | | | | | | |
| New District--Pike Lake . . . . | O | + | + | X | + | + | + |
| Pike Lake Advancement Association, Inc. . . . . . . | -- | -- | -- | -- | -- | + | -- |

Table XVII-3 (continued)

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| WAUKESHA COUNTY | | | | | | | |
| Rock River | | | | | | | |
| Ashippun Lake | | | | | | | |
| Ashippun Lake Protection and Rehabilitation District . . . | 0 | + | + | X | + | + | 0 |
| Beaver Lake | | | | | | | |
| New District--Beaver Lake . . . | + | + | + | + | + | + | + |
| Beaver Lake Environmental Protection Association . . . . | + | + | + | X | + | + | + |
| Beaver Lake Yacht Club . . . . | X | X | X | X | X | + | X |
| Crooked Lake--New District . . . | + | + | + | + | + | + | + |
| Fowler Lake | | | | | | | |
| Fowler Lake Management District | 0 | X | + | X | X | + | X |
| Golden Lake | | | | | | | |
| Golden Lake Association . . . . | 0 | + | + | X | + | + | + |
| Hunters Lake | | | | | | | |
| Hunters Lake Association . . . | + | + | + | + | + | + | + |
| Lac La Belle | | | | | | | |
| Lac La Belle Management District . . . . . . . . . . . | 0 | 0 | X | X | X | 0 | X |
| Lake Keesus | | | | | | | |
| Lake Keesus Management District | 0 | X | + | + | X | + | + |
| Lake Keesus Advancement Association . . . . . . . . . | X | X | X | X | X | + | X |
| Lower Genesee Lake | | | | | | | |
| Genesee Lakes Association . . . | 0 | + | + | + | + | + | + |
| Lower Nashotah Lake | | | | | | | |
| Lower Nashotah Lake Association | + | + | + | + | + | + | + |
| Lower Nemahbin Lake | | | | | | | |
| Lower Nemahbin Lake Association | 0 | + | + | + | + | + | + |
| Middle Genesee Lake | | | | | | | |
| Middle Genesee Lake District . | + | + | + | + | X | + | + |
| Genesee Lakes Association . . . | 0 | X | X | X | + | + | X |
| Moose Lake | | | | | | | |
| New District--Moose Lake . . . | + | + | + | + | 0 | + | + |
| Moose Lake Advancement Association . . . . . . . . . | X | X | X | + | + | + | + |
| Moose Lake Association . . . . | + | + | + | X | X | + | + |
| Nagawicka Lake | | | | | | | |
| Nagawicka Lake Improvements Association . . . . . . . . . | 0 | X | X | X | + | + | + |
| Nagawicka-Kettle Lake Preservation Society . . . . . . . . . | X | X | X | X | X | + | X |
| North Lake | | | | | | | |
| North Lake Management District | 0 | + | + | + | + | + | X |
| North Lake Voluntary Association . . . . . . . . . | X | X | X | X | X | + | X |

Table XVII-3 (continued)

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| WAUKESHA COUNTY--continued | | | | | | | |
| Rock River--continued | | | | | | | |
| Oconomowoc Lake--New District . . | O | O | + | + | O | + | O |
| Okauchee Lake | | | | | | | |
| Okauchee Lake Management District . . . . . . . . . . . | O | X | X | X | X | + | X |
| Pine Lake | | | | | | | |
| Pine Lake Association . . . . | + | + | + | X | X | + | + |
| Pretty Lake | | | | | | | |
| Pretty Lake Protection and Rehabilitation District . . . | O | + | X | + | + | + | O |
| School Section Lake | | | | | | | |
| School Section Lake Management District . . . . . . . . . . . | O | X | + | + | + | + | O |
| Silver Lake | | | | | | | |
| Silver Lake Environmental Association . . . . . . . . . | O | X | + | + | X | + | O |
| Upper Nashotah Lake--New District | + | + | + | + | + | + | + |
| Upper Nemahbin Lake | | | | | | | |
| Upper Nemahbin Lake Management District . . . . . . . . . . . | O | + | + | X | + | + | O |
| Waterville Pond | | | | | | | |
| New District--Waterville Pond . | + | + | + | + | + | + | + |
| Fox River | | | | | | | |
| Big Muskego Lake | | | | | | | |
| Big Muskego-Bass Bay Protection and Rehabilitation District . . | O | + | X | X | X | O | O |
| Eagle Spring Lake | | | | | | | |
| Eagle Spring Lake Protection and Rehabilitation District . . . . | O | O | X | + | + | + | O |
| Lake Denoon | | | | | | | |
| Lake Denoon Advancement Association . . . . . . . . . | O | + | + | + | + | + | + |
| Little Muskego Lake | | | | | | | |
| Little Muskego Lake Protection and Rehabilitation District . | O | + | + | X | X | + | + |
| Little Muskego Lake Association | X | X | X | X | X | O | X |
| Lower Phantom Lake | | | | | | | |
| Phantom Lakes Management District . . . . . . . . . . . | + | X | + | X | + | O | + |
| Pewaukee Lake | | | | | | | |
| Pewaukee Lake Sanitary District | O | + | X | + | + | O | X |
| Pewaukee Lake Improvement Association . . . . . . . . . | X | X | + | X | X | + | X |
| Pewaukee Lake Sportsmans Club . | X | X | X | X | X | + | X |
| Spring Lake | | | | | | | |
| New District--Spring Lake . . . | O | -- | + | + | + | + | + |

Table XVII-3 (continued)

| County/Watershed Lake Management Agency[a] | Monitor Water Quality | Conduct Aquatic Plant Management Program | Conduct Fishing Management Program | Undertake Public Access and Recreation Program | Undertake Watershed Management[b] Program | Conduct Public Educational and Information Programs | Prepare Comprehensive Plan |
|---|---|---|---|---|---|---|---|
| WAUKESHA COUNTY--continued | | | | | | | |
| Fox River--continued | | | | | | | |
| Upper Phantom Lake | | | | | | | |
| Phantom Lakes Management District . . . . . . . . . . . | 0 | X | + | X | + | 0 | + |

KEY:

0 = Ongoing water quality monitoring, management activities, or information programming.
\+ = Water quality monitoring recommended; development of detailed plan element recommended.
X = No action necessary at this time; detailed plan element completed--update and refine as necessary.
-- = Not applicable at this time; no action necessary.

[a] Section 208 of the Federal Clean Water Act requires that local governmental units and agencies be identified as designated management agencies for areawide water quality management plan implementation. Cities, villages, towns, sanitary districts, utility districts, and public inland lake protection and rehabilitation districts are the principal local governmental management units having responsibility for plan implementation in the Region. In addition, however, Chapters NR 119 and 191 of the Wisconsin Administrative Code recognize certain nongovernmental agencies, qualified lake associations, as able to undertake lake management planning and protection activities. Although such agencies cannot be designated management agencies pursuant to Section 208, these agencies are shown in this Table for completeness.

[b] The designated management agency should participate in the priority watershed or priority lakes projects affecting the lake--Table XII-2; in addition, the designated management agency may undertake additional activities aimed at reducing and controlling nonpoint source pollution in the lake watershed outside of participation in formal State programs.

[c] Creation of a new management agency is recommended; this agency may be a sanitary, utility, or lake protection and rehabilitation district, or appropriate non-governmental organization. Management actions may also be undertaken by the responsible local governmental agencies.

Source: SEWRPC.

new agencies. The three new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Echo Lake and Long Lake, both in the Town of Burlington, and Buena Lake in the Town of Waterford.

In Walworth County, a total of 22 governmental lake management agencies have been designated; one of which--Whitewater-Rice Lake Management District--serves both Whitewater and Rice Lakes. A further eight nongovernmental agencies also exist. Of these 22 governmental agencies, 10 are existing agencies and 12 would be new agencies. The 12 new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Tripp Lake in the City of Whitewater; Lake Lorraine and Turtle Lake in the Town of Richmond; North Lake, Silver Lake, and Wandawega Lake in the Town of Sugar Creek; Cravath Lake in the Town of Whitewater; Army Lake in the Town of East Troy; LaGrange Lake in the Town of LaGrange; and Booth Lake, Lulu Lake, and Peters Lake in the Town of Troy. Of the existing governmental agencies, one--the Geneva Lake Environmental Agency--is a Section 66.30 intergovernmental agency created by the communities riparian to Lake Geneva to coordinate water quality management activities, and one--the Town of Delavan--is a local municipality which has constituted the Town of Delavan Lake Committee to coordinate and oversee lake protection and rehabilitation activities at Delavan Lake.

In Washington County, a total of 16 governmental lake management agencies have been designated. A further eight nongovernmental agencies also exist. Of these 16 agencies, seven are existing agencies and nine would be new agencies. The nine new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Barton Pond in the City of West Bend; Smith Lake in the Town of Barton; Green Lake and Lake Twelve in the Town of Farmington; Pike Lake in the Town of Hartford; Lucas Lake in the Town of West Bend; and Bark Lake, Friess Lake, and Lake Five in the Town of Richfield.

In Waukesha County, a total of 22 lake management agencies have been designated; one of which--Phantom Lakes Management District--serves both Upper and Lower Phantom Lakes. A further 19 nongovernmental agencies also exist. Of these 22 governmental agencies, 15 are existing agencies and seven would be new agencies. The seven new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Beaver Lake in the Town of Merton; Waterville Pond, Upper Nashotah Lake, and Crooked Lake in the Town of Summit; Spring Lake in the Town of Mukwonago; Moose Lake in the Town Merton; and Oconomowoc Lake in the Town of Oconomowoc.

For the Region as a whole, then, a total of 124 management agencies have been designated for lake management purposes. Of this total, 82 agencies are sanitary, utility, or lake protection and rehabilitation districts, and similar agencies, including the Town of Delavan Lake Committee and the Geneva Lake Environmental Agency, created to encompass urban and rural development tributary to major lakes in the Southeastern Wisconsin Region. A further 42 agencies are nongovernmental agencies which may be qualified lake associations as defined in Chapters NR 119 and NR 191 of the Wisconsin Administrative Code. Of the 82 governmental agencies, all but 38 agencies currently exist. The 38 new agencies would be sanitary, utility, or lake protection and rehabilitation districts created to provide an institutional framework for the development and implementation of detailed local plans for the application of lake management practices. Of the 124 designated governmental lake management agencies, 81 have been previously designated for point and nonpoint source pollution abatement purposes.

The major responsibilities of the designated management agencies in carrying out the areawide water quality management plan are also identified in Table XVII-3. As shown in the Table, these management agency responsibilities include the carrying out of water quality monitoring; educational programs to encourage reductions in urban and rural impacts on lake waters; and the development of specific and comprehensive lake management plans and plan elements. Not all agencies will be assigned all of these responsibilities.

In addition to these designated management agencies, general purpose governmental units riparian to lakes within the Southeastern Wisconsin Region retain responsibilities for lakes management within their jurisdictional boundaries. In particular, the seven counties and all cities and villages within the Region have specific responsibilities regarding establishment and administration of shoreland and floodplain zoning and stormwater management as set forth in the preceding sections of this chapter. These local units of government, together with Towns within the Region, also have specific powers relative to the establishment of lake protection and rehabilitation districts in terms of Chapter 33, Stats., and, where such new districts have been identified in Table XVII-3, these local governmental management agencies should give due consideration to the establishment of public inland lake protection and rehabilitation districts in the urban and rural areas tributary to the major lakes where such action is deemed necessary to carry out the plan recommendations. Local authorities and the designated management agencies set forth in Table XVII-3 insofar as their jurisdictions encompass urban and rural lands tributary to the numerous "minor" lakes and ponds in the Region having surface areas of less than 50 acres should recognize the aesthetic, recreational, and ecological value of these water bodies and likewise undertake management actions as may be necessary to prevent water quality degradation of these systems, including formation and technical support of lake organizations formed for the protection and rehabilitation of these lakes and ponds, preparation and implementation of management plans, and inclusion of such water bodies in watershed protection projects.

## WATER QUALITY AND BIOLOGICAL CONDITION MONITORING PLAN ELEMENT IMPLEMENTATION

The recommended areawide water quality management plan calls for a comprehensive long-term water quality monitoring program within the Region that can serve both the needs of the Commission as an areawide water quality management planning agency and the needs of the Wisconsin Department of Natural Resources as a regulatory agency. The Wisconsin Department of Natural Resources is designated as the lead agency to carry out that mandatory program. The Department currently has in place a program to conduct intensive monitoring on a watershed-by-watershed basis on a rotating five-to-ten-year cycle.[4] It is recognized that the regional water quality will also conclude cooperative monitoring programs

[4]See Wisconsin Department of Natural Resources Publication No. Wr-299-92, Surface Water Monitoring Strategy, 1992.

being carried out by other units of government and agencies, including the U.S. Geological Survey, the U.S. Environmental Protection Agency, the Milwaukee Metropolitan Sewerage District, local public sewage treatment plant operators, and local inland lake management organizations.

It is recommended that the Wisconsin Department of Natural Resources and each sanitary, utility, and/or lake protection and rehabilitation district formed in the Region for each of the 101 major lakes conduct such lake water quality surveys as may be necessary to prepare detailed, local lake use and management plans. In addition, long-term water quality sampling efforts should be undertaken on lakes to monitor the effects of plan implementation actions and of continuing lake management efforts.

SUMMARY

This chapter has presented the recommended means for implementing the areawide water quality management plan for the seven-county Southeastern Wisconsin Region. The chapter includes the designation of management agencies and assignment of plan implementation responsibilities for point source pollution abatement and sludge management, nonpoint source pollution abatement, and water quality monitoring. A summary of local governmental management agencies designated to implement the recommended plan is set forth in Tables XVII-1 through XVII-3. A total of 228 management agencies have been designated for plan implementation purposes. Of this total, all but 44 currently exist. The 44 new agencies would be sanitary, utility, and/or lake protection and rehabilitation districts required to carry out a variety of plan implementation responsibilities in direct drainage areas to lakes or, in a few instances, to isolated enclaves of urban development within unincorporated towns. A total of 139 management agencies have been designated for point source pollution abatement purposes, 194 management agencies for nonpoint source pollution abatement purposes, and 124 management agencies for lake management purposes.

## Chapter XVIII

## SUMMARY AND RECOMMENDATIONS--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

### INTRODUCTION AND BACKGROUND

Water resources constitute one of the most important elements of the natural resource base of Southeastern Wisconsin. A meaningful comprehensive regional planning effort must, therefore, recognize the central role of water resources as an important element of regional planning. This is particularly true in the highly urbanized seven-county Southeastern Wisconsin Region, a Region richly endowed with water resources. Properly husbanded, these water resources can constitute a valuable natural resource for the Region. Misused and mismanaged, however, these resources can become the focus of serious and costly developmental and environmental problems, and can be a severe constraint on the sound social, economic, and physical development of the Region. Water pollution is one manifestation of the misuse of water resources, and the public has become increasingly aware of, and concerned over, pollution which has seriously interfered with desired water uses.

In 1979, the Commission completed and adopted a regional water quality management plan[1] designed in part to meet the Congressional mandate that the waters of the United States be made to the extent practicable "fishable and swimmable." The plan provides recommendations for the control of water pollution from such point sources as sewage treatment plants, separate and combined sewer overflows, and industrial waste outfalls; and from such nonpoint sources as urban and rural stormwater runoff. The plan was subsequently endorsed by the Wisconsin Natural Resources Board and approved by the U. S. Environmental Protection Agency.

Since adoption of the plan in 1979, the Commission has carried on a continuing regional water quality management planning program. That program is intended, to the extent that available fiscal resources permit, to meet the planning requirements set forth in Chapter NR 121 of the Wisconsin Administrative Code. Those rules envision periodic amendment, revision, and updating of the original plan as may be found necessary and desirable. The systems level regional water quality management plan has been refined, detailed, and, as necessary, amended since 1979, as a result of various types of subregional planning and plan implementation efforts, including: sewer service area plans; detailed sewerage

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[1]SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, Volume One, Inventory Findings, September 1978; Volume Two, Alternative Plans, February 1979; and Volume Three, Recommended Plan, June 1979.

facilities plans; detailed nonpoint source pollution abatement plans; comprehensive lake management plans; and certain special studies. Many of these plan refinement and detailing efforts have led to formal amendments of that original plan by the Regional Planning Commission and the Wisconsin Department of Natural Resources. Those plan amendments, which were adopted only after public hearings and designated management agency approval, are documented in Chapter I.

In addition to these subregional planning efforts which are intended to refine and detail and, as necessary, amend the regional water quality management plan, the Commission carries on an important related regional land use planning program, which results from time-to-time in an updated and revised regional land use plan. The original regional water quality management plan directly incorporated the second generation design year 2000 regional land use plan that had been adopted by the Commission in 1978. Under the continuing regional planning program, the Commission prepared and adopted, in 1991, a third generation design year 2010 regional land use plan.[2] That plan also stands as an amendment to the systems level regional water quality management plan, and is being incorporated into detailed sanitary sewer area plans as those plans are prepared initially and revised from time-to-time.

This report is intended to provide a restatement of the areawide water quality management plan for Southeastern Wisconsin as updated over time through the amendment and revision process. The report documents the extent to which the plan, as amended, has been implemented since its adoption, by identifying--to the extent that available data permit--progress toward meeting the water use objectives and supporting water quality standards set forth in the plan. The report also identifies those issues which need to be addressed in the continuing planning process which may lead to further amendments, revisions, and updates of the plan. The updated regional water quality management plan for Southeastern Wisconsin consists of five major elements: a land use plan element, a point source pollution abatement plan element, a nonpoint source pollution abatement plan element, a water quality monitoring plan element, and a lake management plan element. Chapters IV through XV provide, for each of the twelve major watersheds in the Southeastern Wisconsin Region, a description of the various elements of the initial plan and the extent to which these elements have been implemented; to the extent available data permit, a description of current water quality conditions; a description of the plan elements as amended and updated based upon the status of implementation and the results of the ongoing continuing planning program; and a description of substantive water quality management issues that remain to be addressed. This chapter presents a summary of the findings of the inventory of existing water quality conditions, and a restatement of the design year 2010 plan, reflecting the amendments and extensions adopted since the completion of the original plan in 1979.

## WATER QUALITY INVENTORY AND ANALYSIS

Water quality data available for use in preparing the initial regional water quality management plan were collected in the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream

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[2]SEWRPC Planning Report No. 40, A Regional Land Use Plan for Southeastern Wisconsin: 2010, January 1992.

water quality monitoring effort; the 1976 Commission sampling program; and the 1973 and 1976 Wisconsin Department of Natural Resources sampling programs. In addition, the results of the hydrologic-hydraulic water quality simulation modeling developed under the initial planning effort were also used to characterize existing conditions by considering model simulation which approximate current land use and levels of pollutant control.

Water quality data available for use in the plan review consisted of water quality, sediment quality, and biological condition data collected since the completion of the initial regional plan under monitoring programs operated by the Commission and by other agencies and local units of government, including the Wisconsin Department of Natural Resources, the Milwaukee Metropolitan Sewerage District, the U.S. Geological Survey, the U.S. Environmental Protection Agency, and local inland lake management organizations. In many cases, these data were collected for local or subregional planning and engineering purposes and thus do not represent a uniform data base comparable to that which was available for use in the initial regional plan preparation effort.

In addition to the aforereferenced data sources, the assessment of surface water quality conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort and expanded upon under the Milwaukee Harbor estuary study.[3] Simulation modeling conducted under various levels of point source and nonpoint source pollution control, and under both the then current land use conditions and under planned year 2000 land use conditions, during these earlier planning programs, in many cases, was considered to remain valid. While the resulting data cannot be used to precisely quantify current water quality conditions, a review of these data together with knowledge of the current status of the pollution control recommendations contained in the original plan, provides insight into the current water quality conditions and the potential for achieving the adopted water use objectives and supporting water quality standards under current conditions.

Streams

To the extent possible, water quality data collected during the period 1976 through 1993 were utilized by the Commission to evaluate stream water quality conditions and trends in those conditions within the Region. The data concerned are presented by watershed in Chapters IV through XV, and as already noted, include water quality, sediment quality, and biological condition data. Water quality monitoring data were used to compare the instream water quality conditions to the instream water quality standards set forth in the adopted plan, as described in Chapter II. This comparison was then used to assess the extent to which the water use objectives were being achieved. The biological monitoring data were used to calculate biotic index values which were numerically grouped to indicate a relative measure of stream water quality as described in Chapter II. Sediment sampling data were used to compare to sediment quality criteria and standards to assess the level of contamination and relative quality of sediments.

As indicated on Map XVIII-1, comprehensive long-term water quality monitoring data collected following the preparation of the initial plan were available for

[3]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, December 1987.

## Map XVIII-1

## AVAILABILITY OF STREAM AND LAKE WATER QUALITY MONITORING DATA IN SOUTHEASTERN WISCONSIN: 1976-1993

LEGEND

STREAMS

- STREAM REACHES FOR WHICH COMPREHENSIVE POST-1976 LONG-TERM WATER QUALITY MONITORING DATA ARE AVAILABLE (105 MILES)
- STREAM REACHES FOR WHICH POST-1976 SHORT-TERM WATER QUALITY MONITORING DATA ARE AVAILABLE (219 MILES)
- STREAM REACHES FOR WHICH NO KNOWN USEABLE POST-1976 WATER QUALITY MONITORING DATA WERE AVAILABLE (899 MILES)

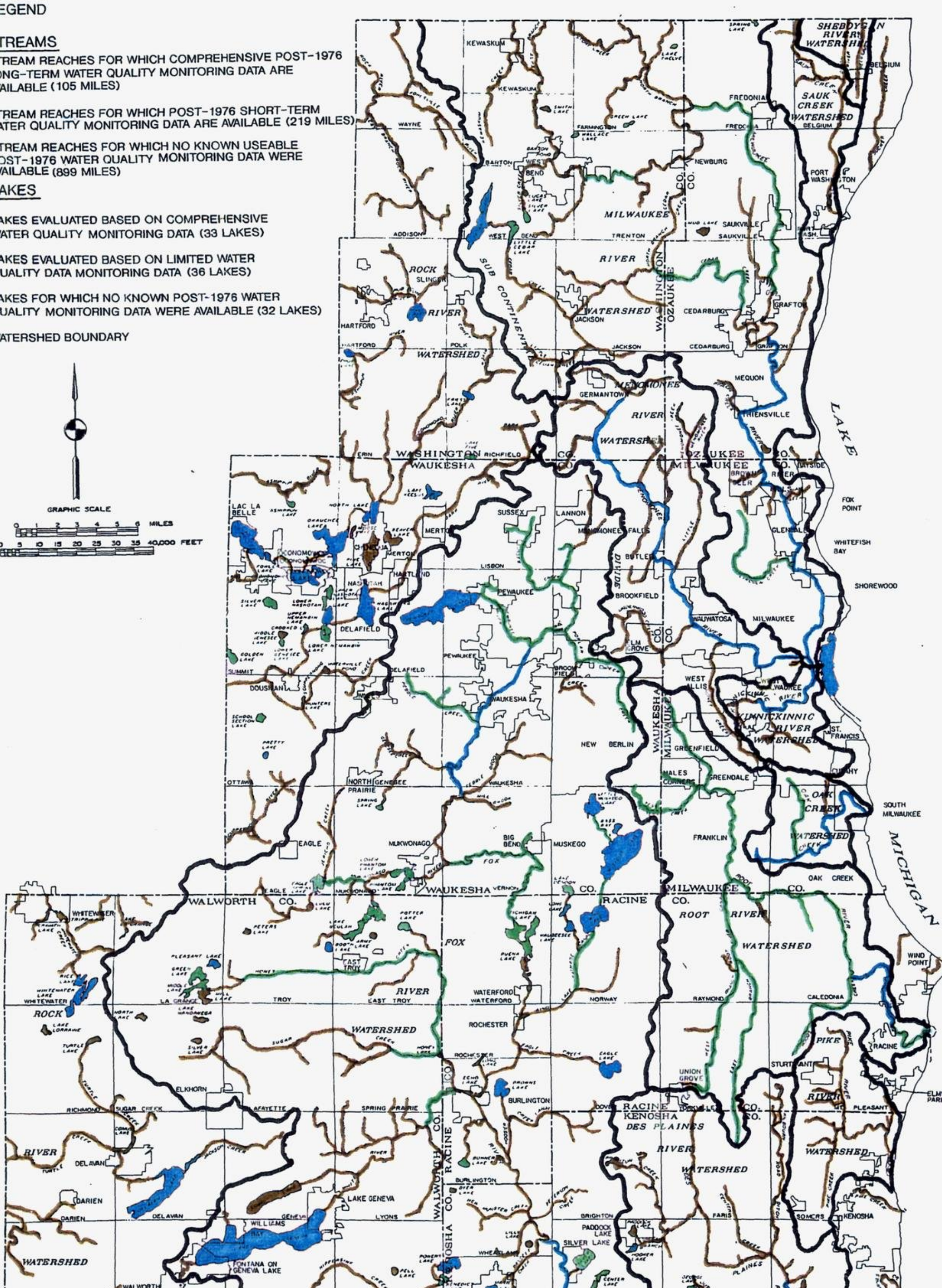
LAKES

- LAKES EVALUATED BASED ON COMPREHENSIVE WATER QUALITY MONITORING DATA (33 LAKES)
- LAKES EVALUATED BASED ON LIMITED WATER QUALITY DATA MONITORING DATA (36 LAKES)
- LAKES FOR WHICH NO KNOWN POST-1976 WATER QUALITY MONITORING DATA WERE AVAILABLE (32 LAKES)
- WATERSHED BOUNDARY

GRAPHIC SCALE

0 1 2 3 4 5 6 MILES

0 5 10 15 20 25 30 35 40,000 FEET




Source: SEWRPC.

approximately 105 miles of stream, or about 9 percent, of the 1,223 stream miles within the Southeastern Wisconsin Region addressed in the planning effort. Short-term water quality monitoring data were available for an additional approximately 219 miles of stream, or about 18 percent of the total, as shown on Map XVIII-1. These latter data, while not adequate for use in definitively assessing trends in water quality, were used to supplement long-term monitoring data and provide information on existing conditions. No water quality data suitable for evaluating trends or existing conditions were available for the remaining approximately 899 stream miles, or about 73 percent of the total stream miles. It should be noted that while post-1976 data were available for only a relatively small percentage of the stream mileage within the Region, the streams for which data did exist included the main stem reaches of the major rivers which traverse the most highly urbanized areas of the Region and thus are the most susceptible to water pollution from urban sources, and for which a knowledge of current conditions and trends within the Region is most important.

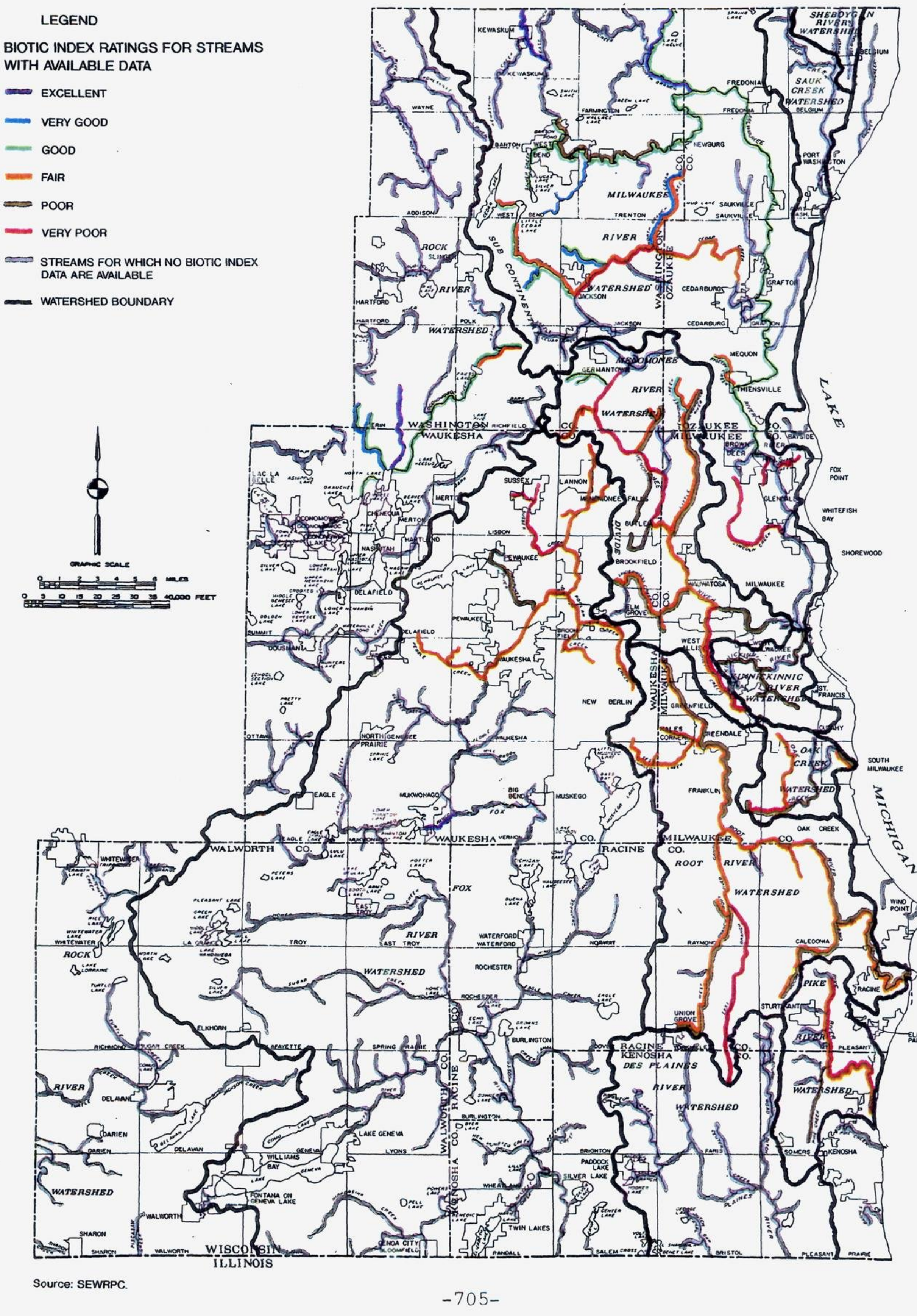
Recent biological condition data collected for streams within the Region were also available for use in characterizing water quality conditions, as indicated on Map XVIII-2. These data were collected for about 425 stream miles in the Region, or about 35 percent of the total stream miles within the Region addressed in the planning effort. These data provide a basis for the assessment of conditions in a manner different than that provided by water quality data. Thus, the data are not directly comparable with the earlier data to indicate trends. However, the biological monitoring data do serve as a measure of current conditions and can be used in the future to indicate trends as additional similar data are collected. The availability of water quality, biological conditions, and sediment condition data is summarized in Table XVIII-1. In total, some types of water quality and/or biological monitoring data were available for approximately 521 stream miles, or about 43 percent of the total stream miles concerned.

Sediment sampling data collected since the completion of the initial plan were also available for use in characterizing water quality conditions within the Region, as indicated on Map XVIII-3. Data were collected in the Milwaukee harbor estuary and in those stream reaches immediately upstream of the inner harbor; in Cedar Creek in the City of Cedarburg; and at 47 additional sampling sites within the Region. The majority of the data were collected for specific studies relating to harbor maintenance, dam removal evaluations, and special sediment contamination studies. These data were generally not adequate for use in definitively assessing trends in water quality, but were used as a measure of the current level of contaminants present in the sediments of the stream systems.

Instream Water Quality Conditions and Trends: An analysis of relative changes in surface water quality conditions based on long-term monitoring data over the period of 1976 through 1993 is summarized on Map XVIII-4. As already noted, adequate monitoring data to assess long-term trends in water quality were available for only about 105 miles, or about 9 percent of the stream miles within the Region addressed in the planning effort. The available data indicate that water quality conditions have improved for selected stream reaches in the Region, specifically portions of the Milwaukee, Menomonee, Fox, and Root River main stems, totaling 60 stream miles, or about 57 percent of those streams for which long-term, post-1976 water quality sampling data were available. The data also indicate that water quality conditions have deteriorated in short reaches of Oak Creek and the Kinnickinnic River, totaling about four miles, or about 4 percent

Map XVIII-2

SUMMARY OF BIOLOGICAL INDEX DATA FOR STREAMS IN SOUTHEASTERN WISCONSIN: 1976-1993




Source: SEWRPC.

Table XVIII-1

**AVAILABLE POST-1976 DATA FOR STREAMS IN SOUTHEASTERN WISCONSIN**

| **WATERSHED** <u>**Subwatershed**</u> Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data: Long-Term Monitoring | Water Quality Data: Short-Term Monitoring | Water Quality Data: Modeling | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| **DES PLAINES RIVER WATERSHED** | | | | | | | | | |
| Brighton Creek and Salem Branch | 17.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Dutch Gap Canal | 5.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Kilbourn Road Ditch | 14.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Des Plaines River u/s STH 50 | 8.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Des Plaines River d/s STH 50 | 13.5 | Warmwater Sport Fish Community and Full Recreational Use | 3.4 miles | -- | x | -- | -- | 3.4 miles = NC | P |
| Pleasant Prairie Tributary | 0.8 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Jerome Creek | 1.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Center Creek | 5.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | -- |
| **FOX RIVER WATERSHED** | | | | | | | | | |
| <u>**Upper Fox River Subwatershed**</u> | | | | | | | | | |
| Fox River u/s Mill Road | 5.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | f | -- | -- | P |
| Fox River d/s Mill Road to Sussex Creek inflow | 4.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | 1.3 miles | x | f | -- | -- | P |
| Sussex Creek | 7.7 | Warmwater Forage Fish Community and Full Recreational Use | -- | x | x | vp | -- | -- | P |
| Fox River d/s Sussex Creek to Watertown Road | 6.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f | x | -- | P |
| Fox River d/s Watertown Road to Prairie Avenue (Waukesha) | 4.4 | Warmwater Sport Fish Community and Full Recreational Use | 3.1 miles | 1.3 miles | x | f | x | 3.1 miles = I | P |
| Fox River d/s Prairie Avenue to Pebble Creek inflow | 2.7 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | f | x | I | P |
| Deer Creek | 7.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f | x | -- | N |
| Pebble Creek and Brandy Brook | 6.8 | Coldwater Community and Full Recreational Use | -- | x | x | f | -- | -- | P |
| Poplar Creek | 7.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | f | x | -- | N |
| Pewaukee River | 7.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | p | -- | -- | P |

Table XVIII-1 (cont'd)

| WATERSHED<br>Subwatershed<br>Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data: Long-Term Monitoring | Water Quality Data: Short-Term Monitoring | Water Quality Data: Modeling | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| **Middle Fox River Subwatershed** | | | | | | | | | |
| Fox River d/s Pebble Creek inflow | 13.3 | Warmwater Sport Fish Community and Full Recreational Use | 7.0 miles | -- | x | -- | -- | 7.0 miles = I | P |
| Fox River d/s I-43 to Waterford Impoundment | 13.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | -- | x | -- | P |
| Fox River d/s Waterford Impoundment to Echo Lake inflow | 10.6 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Fox River d/s Echo Lake inflow to Spring Brook Creek inflow | 1.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Muskego Canal | 2.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | -- | -- | -- | P |
| Wind Lake Drainage Canal | 12.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | 4.7 miles | x | -- | -- | -- | F |
| Genesee Creek u/s Spring Creek | 4.5 | Coldwater Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Genesee Creek d/s Spring Creek | 3.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Spring Creek | 3.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Eagle Creek | 5.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Pebble Brook, Mill Brook, and Mill Creek | 13.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| **Lower Fox River Subwatershed** | | | | | | | | | |
| Fox River d/s Spring Brook Creek inflow to CTH JB | 4.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Spring Brook Creek | 3.9 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | 7.5 miles = NC | P |
| tributary stream | 1.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Fox River d/s CTH JB to State Line | 11.8 | Warmwater Sport Fish Community and Full Recreational Use | 7.5 miles | -- | x | -- | -- | -- | P |
| tributary stream | 2.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Hoosier, Palmer, and Peterson Creeks | 21.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Bassett Creek | 5.1 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| New Munster Creek | 4.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| **Mukwonago River Subwatershed** | | | | | | | | | |
| Mukwonago River u/s Eagle Spring Lake | 6.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Mukwonago River d/s Eagle Spring Lake to Phantom Lakes | 9.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | 3.0 miles | x | -- | -- | -- | F |
| Mukwonago River d/s Phantom Lakes | 2.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | e | -- | -- | F |
| Jericho Creek | 6.9 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |

Table XVIII-1 (cont'd)

| **WATERSHED**<br>Subwatershed<br>Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **Honey/Sugar Creeks Subwatershed** | | | | | | | | | |
| Honey Creek | 26.1 | Warmwater Sport Fish Community and Full Recreational Use | -- | 24.0 miles | x | -- | -- | -- | P |
| Spring Creek | 4.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| tributary streams | 4.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Sugar Creek | 23.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | 3.2 miles | x | -- | -- | -- | P |
| Spring Brook Creek | 5.5 | Coldwater Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| tributary streams | 5.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| **White River/Nippersink Creek Subwatershed** | | | | | | | | | |
| White River | 22.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | 3.5 miles | x | -- | -- | -- | P |
| Como Creek | 3.6 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Ore Creek | 11.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Lake Ivanhoe Outlet | 8.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Nippersink Creek | 21.6 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Potawatomi, Van Slyke, and Southwick Creeks | 3.1 | Coldwater Community and Full Recreational Use | -- | -- | x | -- | -- | -- | -- |
| **KINNICKINNIC RIVER WATERSHED** | | | | | | | | | |
| Kinnickinnic River u/s 27th Street | 3.9 | Limited Aquatic Life and Limited Recreational Use | 1.6 miles | -- | x | p | -- | 1.6 miles = NC | P |
| Kinnickinnic River 27th Street to 5th Street | 2.2 | Limited Aquatic Life and Limited Recreational Use | x | -- | x | -- | -- | 1.0 miles = D<br>1.2 miles = NC | P |
| Kinnickinnic River 5th Street to 1st Street | 1.3 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | p | x | 0.3 miles = D<br>1.0 miles = NC | P |
| Kinnickinnic River d/s 1st Street | 1.4 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | p | x | NC | P |
| Lyons Creek | 1.4 | Limited Aquatic Life and Limited Recreational Use | -- | -- | x | -- | -- | -- | P |
| Wilson Park Creek | 3.7 | Limited Aquatic Life and Limited Recreational Use | -- | -- | x | p | -- | -- | P |
| tributary stream | 1.4 | Limited Aquatic Life and Limited Recreational Use | -- | -- | x | -- | -- | -- | P |

Table XVIII-1 (cont'd)

| **WATERSHED** <br> **Subwatershed** <br> Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **MENOMONEE RIVER WATERSHED** | | | | | | | | | |
| North Branch of Menomonee River u/s STH 145 | 10.0 | Warmwater Sport Fish Community and Limited Recreational Use | -- | -- | x | -- | -- | -- | N |
| Menomonee River West Branch | 2.1 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | g | -- | -- | P |
| northern tributary | 2.1 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | g | -- | -- | P |
| Menomonee River d/s STH 145 to CTH Q | 3.8 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | f | x | I | P |
| Menomonee River d/s CTH Q to Lilly Road | 3.8 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | f | -- | I | P |
| Menomonee River d/s Lilly Road to Good Hope Rd | 2.4 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | f | -- | I | P |
| Dretzka Park tributary | 4.7 | Warmwater Sport Fish Community and Limited Recreational Use | -- | -- | x | -- | -- | -- | N |
| Menomonee River d/s Good Hope Road to Silver Spring Drive | 2.7 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | f | -- | I | P |
| Menomonee River d/s Silver Spring Drive to Hampton Avenue | 2.1 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | p | x | I | P |
| Menomonee River d/s Hampton Avenue to Capitol Drive | 1.3 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | p | -- | NC | P |
| Menomonee River d/s Capitol Drive to North Avenue | 2.7 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | p | x | NC | P |
| Menomonee River d/s North Avenue to 70th Street | 2.4 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | p | x | NC | P |
| Menomonee River d/s 70th Street to USH 41 | 1.5 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | vp | -- | NC | P |
| Menomonee River d/s USH 41 to Falk Corp dam | 2.4 | Warmwater Forage Fish Community and Limited Recreational Use | x | -- | x | vp | -- | NC | P |
| Menomonee River d/s Falk Corp dam to 25th Street | 0.5 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | vp | -- | NC | P |
| Menomonee River d/s 25th Street to Milwaukee River | 1.7 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | -- | x | NC | N |
| S. Menomonee and Burnham Canals | 1.5 | Warmwater Sport Fish Community and Limited Recreational Use | -- | -- | x | -- | x | -- | P |
| Honey Creek u/s Wisconsin Avenue | 7.5 | Limited Aquatic Life and Limited Recreational Use | -- | -- | x | f to vp | -- | -- | P |
| Honey Creek d/s Wisconsin Avenue | 0.9 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | f to vp | -- | -- | P |
| Underwood Creek u/s Watertown Plank Road | 6.3 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | f to p | -- | -- | P |
| South Branch Underwood Creek | 1.1 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | f to p | -- | -- | P |
| Underwood Creek d/s Watertown Plank Road | 1.5 | Limited Aquatic Life and Limited Recreational Use | -- | -- | x | f to p | -- | -- | P |
| Little Menomonee Creek | 2.3 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | g to f | x | -- | P |
| Little Menomonee River | 9.7 | Warmwater Sport Fish Community and Limited Recreational Use | -- | -- | x | f to p | x | -- | N |

Table XVIII-1 (cont'd)

| WATERSHED<br>Subwatershed<br>Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **MENOMONEE RIVER WATERSHED (cont'd)** | | | | | | | | | |
| Butler Ditch | 2.4 | Limited Forage Fish Community and Limited Recreational Use | -- | -- | x | p | -- | -- | P |
| Dousman Ditch | 2.5 | Limited Forage Fish Community and Limited Recreational Use | -- | -- | x | -- | -- | -- | P |
| Lilly Creek | 3.4 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | p | x | -- | P |
| Nor-X-Way Channel u/s Donges Bay Road | 2.1 | Limited Forage Fish Community and Limited Recreational Use | -- | -- | x | f to p | -- | -- | P |
| Nor-X-Way Channel d/s Donges Bay Road to Warren Street | 1.9 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | f to p | -- | -- | P |
| Nor-X-Way Channel d/s Warren Street to Brown Deer Road | 0.5 | Limited Forage Fish Community and Limited Recreational Use | -- | -- | x | f to p | -- | -- | P |
| Willow Creek | 3.2 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | f | -- | -- | P |
| **MILWAUKEE RIVER WATERSHED** | | | | | | | | | |
| **Cedar Creek Subwatershed** | | | | | | | | | |
| Cedar Creek u/s Little Cedar Creek inflow | 8.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | g to f | -- | -- | P |
| Little Cedar Creek | 7.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Cedar Creek d/s Little Cedar Creek inflow to CTH M | 9.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | 6.2 miles = f to vp | -- | -- | P |
| Cedar Creek d/s CTH M to STH 60 | 9.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f | -- | -- | P |
| Cedar Creek d/s STH 60 | 6.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | 0.7 miles | x | -- | x | -- | P |
| North Branch Cedar Creek | 7.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | vg to f | -- | -- | -- |
| Friedens Creek | 3.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | vg to g | -- | -- | -- |
| Lehner Creek | 1.8 | Coldwater Community and Full Recreational Use | -- | -- | -- | vg to g | -- | -- | -- |
| **Milwaukee River East and West Branches Subwatershed** | | | | | | | | | |
| Milwaukee River d/s north Washington County Line to CTH H | 5.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | e | -- | -- | F |
| Milwaukee River d/s CTH H to Woodford Drive | 4.9 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Milwaukee River d/s Woodford Drive to STH 33 | 13.6 | Warmwater Sport Fish Community and Full Recreational Use | -- | 4.8 miles | x | 10.8 miles = g to p | -- | -- | P |
| Milwaukee River d/s STH 33 | 9.9 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | g | -- | -- | P |
| Kewaskum Creek | 6.4 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Silver Creek | 4.0 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | g | -- | -- | P |

Table XVIII-1 (cont'd)

| **WATERSHED**<br>**Subwatershed**<br>Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data: Long-Term Monitoring | Water Quality Data: Short-Term Monitoring | Water Quality Data: Modeling | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| **Milwaukee River East and West Branches Subwatershed (cont'd)** | | | | | | | | | |
| Quaas Creek u/s CTH G | 2.7 | Coldwater Community and Full Recreational Use | -- | -- | -- | vg to f | -- | -- | -- |
| Quaas Creek d/s CTH G | 2.2 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | vg to f | -- | -- | -- |
| East Branch Milwaukee River d/s north Washington County Line | 5.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **Milwaukee River North Branch Subwatershed** | | | | | | | | | |
| North Branch Milwaukee River | 8.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | e to g | -- | -- | P |
| Stony Creek u/s STH 144 | 8.6 | Coldwater Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Stony Creek d/s STH 144 | 1.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Wallace Creek u/s CTH A | 1.2 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Wallace Creek u/s CTH A | 7.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **Milwaukee River South Branch Subwatershed** | | | | | | | | | |
| Milwaukee River u/s STH 33 | 11.1 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | g | x | -- | P |
| Milwaukee River d/s STH 33 to STH 57 | 6.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | g | x | -- | P |
| Mole Creek | 7.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | x | -- | P |
| Milwaukee River d/s STH 57 to CTH C | 4.5 | Warmwater Sport Fish Community and Full Recreational Use | 1.2 miles | -- | x | g | x | 1.2 miles = I | P |
| Milwaukee River d/s CTH C to Mequon Road | 7.5 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | g | x | I | P |
| Lakefield tributary | 5.9 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Milwaukee River d/s Mequon Road to Brown Deer Road | 3.8 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | g | -- | I | P |
| Beaver Creek tributary | 2.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Milwaukee River d/s Brown Deer Road to Port Washington Road | 8.1 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | -- | x | I | P |
| South Branch Creek | 2.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Milwaukee River d/s Port Washington Road to North Avenue | 3.8 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | -- | x | I | P |
| Milwaukee River d/s North Avenue to Walnut Street | 0.9 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | -- | x | I | P |
| Milwaukee River d/s Walnut Street to Wells Street | 0.8 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | -- | x | NC | P |
| Milwaukee River d/s Wells Street to Water Street | 0.6 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | -- | x | NC | P |

Table XVIII-1 (cont'd)

| **WATERSHED**<br>Subwatershed<br>Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **Milwaukee River South Branch Subwatershed (cont'd)** | | | | | | | | | |
| Milwaukee River d/s Water Street | 0.8 | Warmwater Sport Fish Community and Limited Recreational Use | x | -- | x | -- | x | NC | P |
| Lincoln Creek u/s Silver Spring Drive | 2.7 | Limited Forage Fish Community and Limited Recreational Use | -- | x | x | vp | -- | -- | N |
| Lincoln Creek d/s Silver Spring Drive to Hampton Avenue | 1.3 | Limited Aquatic Life and Limited Recreational Use | -- | x | x | vp | -- | -- | P |
| Lincoln Creek d/s Hampton Avenue to 32nd Street | 2.5 | Limited Forage Fish Community and Limited Recreational Use | -- | x | x | vp | -- | -- | N |
| Lincoln Creek d/s 32nd Street to Teutonia Avenue | 0.6 | Limited Aquatic Life and Limited Recreational Use | -- | x | x | vp | -- | -- | P |
| Lincoln Creek d/s Teutonia Avenue | 1.3 | Warmwater Sport Fish Community and Limited Recreational Use | -- | x | x | vp | -- | -- | N |
| Indian Creek u/s I-43 | 0.6 | Limited Aquatic Life and Limited Recreational Use | -- | -- | x | vp | x | -- | F |
| Indian Creek d/s I-43 | 1.3 | Warmwater Sport Fish Community and Limited Recreational Use | -- | -- | x | vp | -- | -- | N |
| Brown Deer Creek | 1.9 | Limited Forage Fish Community and Limited Recreational Use | -- | -- | -- | vp | -- | -- | -- |
| Pigeon Creek | 2.4 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | g to f | -- | -- | N |
| **WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN** | | | | | | | | | |
| Fish Creek | 3.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| unnamed stream in T4N R23E sections 21 and 22 | 0.9 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| unnamed stream in T4N R23E sections 17 and 20 | 1.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **Barnes Creek Subwatershed** | | | | | | | | | |
| Barnes Creek | 3.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| **Pike Creek Subwatershed** | | | | | | | | | |
| Pike Creek (Kenosha) | 3.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| **Sucker Creek Subwatershed** | | | | | | | | | |
| Sucker Creek | 18.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |

Table XVIII-1 (cont'd)

| **WATERSHED** <br> **Subwatershed** <br> Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **OAK CREEK WATERSHED** | | | | | | | | | |
| Oak Creek u/s STH 100 | 2.8 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | p to vp | -- | NC | P |
| Oak Creek d/s STH 100 to Drexel Avenue | 4.5 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | p | -- | NC | P |
| Oak Creek d/s Drexel Avenue to Pennsylvania Avenue | 0.9 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | -- | -- | NC | P |
| Oak Creek d/s Pennsylvania Avenue to 15th Avenue | 1.9 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | -- | -- | NC | P |
| Oak Creek d/s 15th Avenue | 2.8 | Warmwater Sport Fish Community and Full Recreational Use | x | -- | x | f to p | -- | D | P |
| Mitchell Field Ditch | 2.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| North Branch Oak Creek | 5.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f | -- | -- | P |
| **PIKE RIVER WATERSHED** | | | | | | | | | |
| Pike River u/s STH 20 to Bartlett Branch | 1.0 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | f to vp | -- | -- | P |
| Bartlett Branch | 1.5 | Limited Forage Fish Community and Limited Recreational Use | -- | -- | x | -- | -- | -- | F |
| Pike River d/s STH 20 to Pike Creek | 11.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | 5.3 miles = f to vp | -- | -- | P |
| Pike River d/s Pike Creek | 13.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | 9.6 miles = f to vp | -- | -- | P |
| Pike Creek d/s STH 142 | 9.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | 4.8 miles = p | -- | -- | P |
| Pike Creek u/s STH 142 | 0.7 | Warmwater Forage Fish Community and Limited Recreational Use | -- | -- | x | p | -- | -- | P |
| **ROCK RIVER WATERSHED** | | | | | | | | | |
| **Ashippun River Subwatershed** | | | | | | | | | |
| Ashippun River u/s Druid Lake | 4.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Ashippun River d/s Druid Lake to Washington County Line | 5.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Ashippun River d/s Waukesha County Line to Ashippun Lake inflow | 7.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Ashippun River d/s Ashippun Lake inflow | 4.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |

Table XVIII-1 (cont'd)

| WATERSHED<br>Subwatershed<br>Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data: Long-Term Monitoring | Water Quality Data: Short-Term Monitoring | Water Quality Data: Modeling | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| **Bark River Subwatershed** | | | | | | | | | |
| Bark River u/s Nagawicka Lake | 19.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Bark River d/s Nagawicka Lake | 12.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Scuppernong Creek u/s Waterville Pond | 4.9 | Coldwater Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Scuppernong Creek d/s Waterville Pond | 7.6 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| **Oconomowoc River Subwatershed** | | | | | | | | | |
| Coney River | 6.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Oconomowoc River u/s Friess Lake | 2.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | g to f | -- | -- | -- |
| Oconomowoc River d/s Friess Lake to North Lake | 15.2 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | 10.3 miles = g | -- | -- | -- |
| Oconomowoc River d/s North Lake to Okauchee Lake | 1.8 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | g | -- | -- | -- |
| Oconomowoc River d/s Okauchee Lake to Oconomowoc Lake | 0.4 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Oconomowoc River d/s USH 16 to Fowler Lake | 1.7 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Oconomowoc River d/s Lac La Belle to Waukesha County Line | 5.0 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Little Oconomowoc River | 5.7 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | e | -- | -- | -- |
| Mason Creek | 6.5 | Coldwater Community and Full Recreational Use | -- | -- | -- | vg to g | -- | -- | -- |
| **Piscasaw Creek Subwatershed** | | | | | | | | | |
| Piscasaw Creek | 2.5 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **Rock River East Branch Subwatershed** | | | | | | | | | |
| East Branch Rock River d/s CTH D | 4.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Limestone Creek u/s CTH W | 4.0 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| tributary stream | 0.9 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Limestone Creek d/s CTH W | 0.9 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| East Branch Rock River u/s CTH D | 14.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Allenton Creek | 3.4 | Coldwater Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |

Table XVIII-1 (cont'd)

| **WATERSHED** <br> **Subwatershed** <br> Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **Rock River East Branch Subwatershed (cont'd)** | | | | | | | | | |
| Kohlsville River | 7.9 | Coldwater Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| West Branch Kohlsville River | 2.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Wayne Creek | 6.5 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **Rubicon River Subwatershed** | | | | | | | | | |
| Rubicon River u/s Hilldale Road | 1.4 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Rubicon River d/s Hilldale Road to Pike Lake | 1.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Rubicon River d/s Pike Lake | 9.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| **Scuppernong River Subwatershed** | | | | | | | | | |
| Scuppernong River | 14.9 | Coldwater Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Steel Brook Creek | 7.1 | Coldwater Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **Turtle Creek Subwatershed** | | | | | | | | | |
| Jackson Creek | 5.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Swan Creek | 4.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Turtle Creek u/s Comus Lake | 10.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Turtle Creek d/s Comus Lake to STH 11 | 3.3 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Turtle Creek d/s STH 11 to Walworth County Line | 7.1 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | F |
| Little Turtle Creek | 7.5 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Ladd Creek | 1.1 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Darien Creek | 8.8 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Sharon Creek | 2.1 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |

Table XVIII-1 (cont'd)

| **WATERSHED**<br>**Subwatershed**<br>Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **Whitewater Creek Subwatershed** | | | | | | | | | |
| Whitewater Creek u/s Bluff Creek inflow to Rice Lake | 1.6 | Coldwater Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| western tributary stream | 2.5 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Whitewater Creek d/s Bluff Creek inflow | 3.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Spring Brook | 2.9 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | x | -- | -- | -- | P |
| Bluff Creek | 1.9 | Coldwater Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| Galloway Creek | 1.4 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **ROOT RIVER WATERSHED** | | | | | | | | | |
| Root River u/s Grange Avenue | 4.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f to p | -- | -- | P |
| Root River d/s Grange Avenue to Ryan Road | 9.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f to p | -- | -- | P |
| Root River d/s Ryan Road to County Line Road | 3.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f | -- | -- | P |
| Root River d/s County Line Road to Nicholson Road | 5.7 | Warmwater Sport Fish Community and Full Recreational Use | -- | 3.8 miles | x | 3.8 miles = f to p | -- | -- | P |
| Root River d/s Nicholson Road to STH 38 | 12.5 | Warmwater Sport Fish Community and Full Recreational Use | 7.5 miles | 5.0 miles | x | f to p | -- | 7.5 miles = I | P |
| Root River d/s STH 38 | 6.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f to p | -- | -- | P |
| West Branch Root River Canal u/s CTH C | 3.6 | Limited Aquatic Life and Limited Recreational Use | -- | 3.0 miles | x | f to p | -- | -- | P |
| West Branch Root River Canal d/s CTH C | 9.9 | Limited Forage Fish Community and Limited Recreational Use | -- | 6.1 miles | x | 7.9 miles = f to p | -- | -- | P |
| Root River Canal | 4.9 | Limited Forage Fish Community and Limited Recreational Use | -- | x | x | f | -- | -- | P |
| East Branch Root River Canal u/s STH 20 | 6.6 | Limited Aquatic Life and Limited Recreational Use | -- | x | x | vp | -- | -- | P |
| East Branch Root River Canal d/s STH 20 | 5.0 | Limited Forage Fish Community and Limited Recreational Use | -- | x | x | vp | -- | -- | P |
| Tess Corners/Whitnall Park Creek | 9.9 | Warmwater Forage Fish Community and Full Recreational Use | -- | x | x | f | -- | -- | P |
| Husher Creek | 3.4 | Warmwater Sport Fish Community and Full Recreational Use | -- | x | x | f | -- | -- | P |
| Hoods Creek | 8.6 | Warmwater Forage Fish Community and Full Recreational Use | -- | x | x | f to p | -- | -- | P |

Table XVIII-1 (cont'd)

| **WATERSHED** <br> **Subwatershed** <br> Stream Reach | Stream Length (miles) | Recommended Water Use Objective | Water Quality Data | | | Biological Condition Data[a] | Sediment Condition Data | Water Quality Trends[b] | Compliance with Water Use Objective[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Long-Term Monitoring | Short-Term Monitoring | Modeling | | | | |
| **SAUK CREEK WATERSHED** | | | | | | | | | |
| Sauk Creek | 18.8 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | X | -- | -- | -- | P |
| **SHEBOYGAN RIVER WATERSHED** | | | | | | | | | |
| Belgium Creek - West Branch | 3.0 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | X | -- | -- | -- | P |
| Belgium Creek - East Branch | 4.2 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- | -- |
| **TOTAL** | 1223.2 | | 105.4 | 219.4 | 980.3 | -- | -- | -- | -- |

Note: u/s = upstream
d/s = downstream
x = data available
-- = adequate data not available

[a] Letter codes are as follows:
e = excellecnt
e to g = excellent to good
vg to g = very good to good
vg to f = very good to fair
g = good
g to f = good to fair
g to p = good to poor
f = fair
f to p = fair to poor
f to vp = fair to very poor
p = poor
p to vp = poor to very poor
vp = very poor

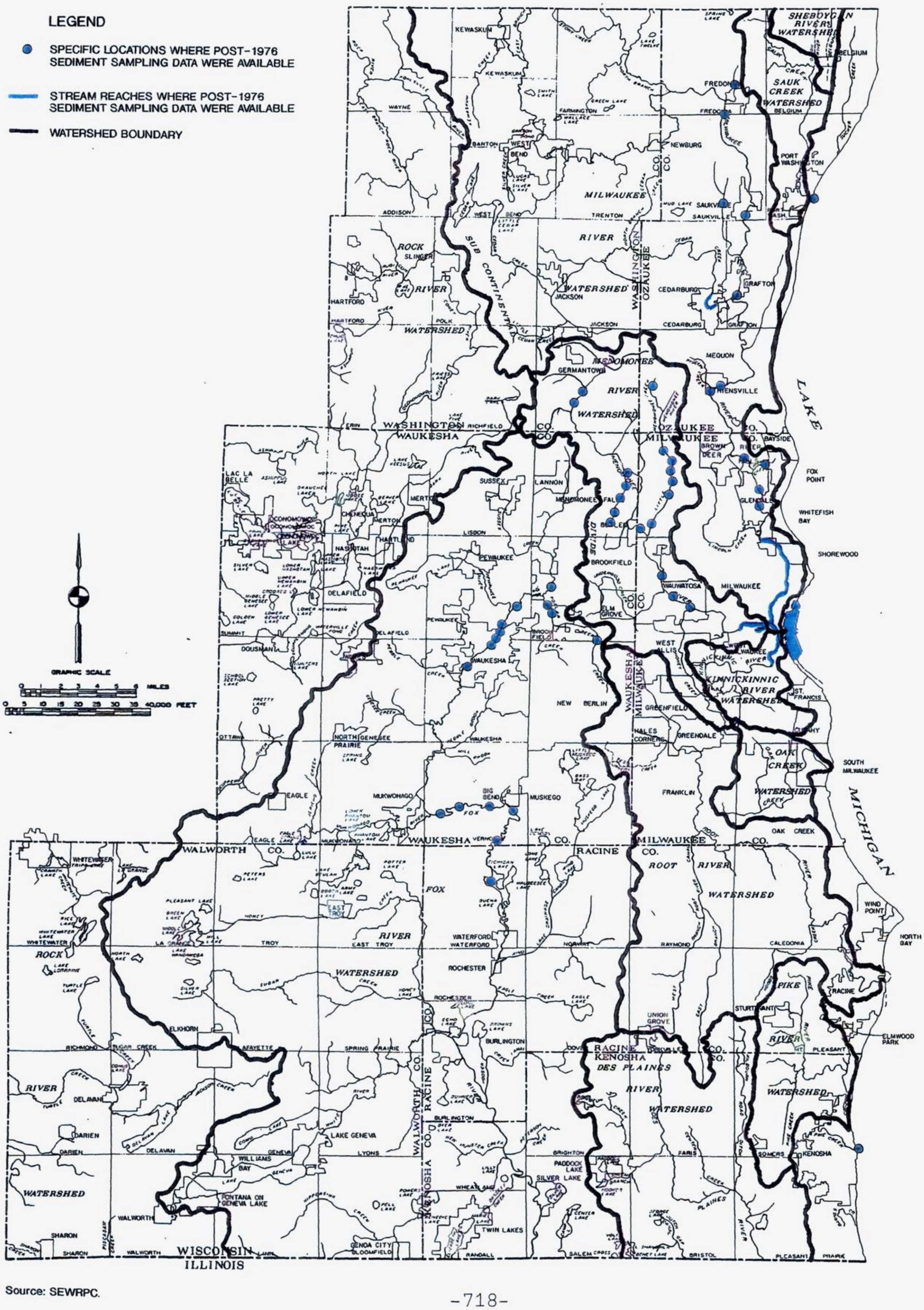
[b] I = improvement in water quality conditions based on long-term water quality monitoring data
D = decline in water quality conditions based on long-term water quality monitoring data
NC = no change in water quality conditions based on long-term water quality monitoring data

[c] F = fully meeting recommended water use objectives
P = partially meeting recommended water use objectives
N = not meeting recommended water use objectives

Source: Wisconsin Department of Natural Resources and SEWRPC.

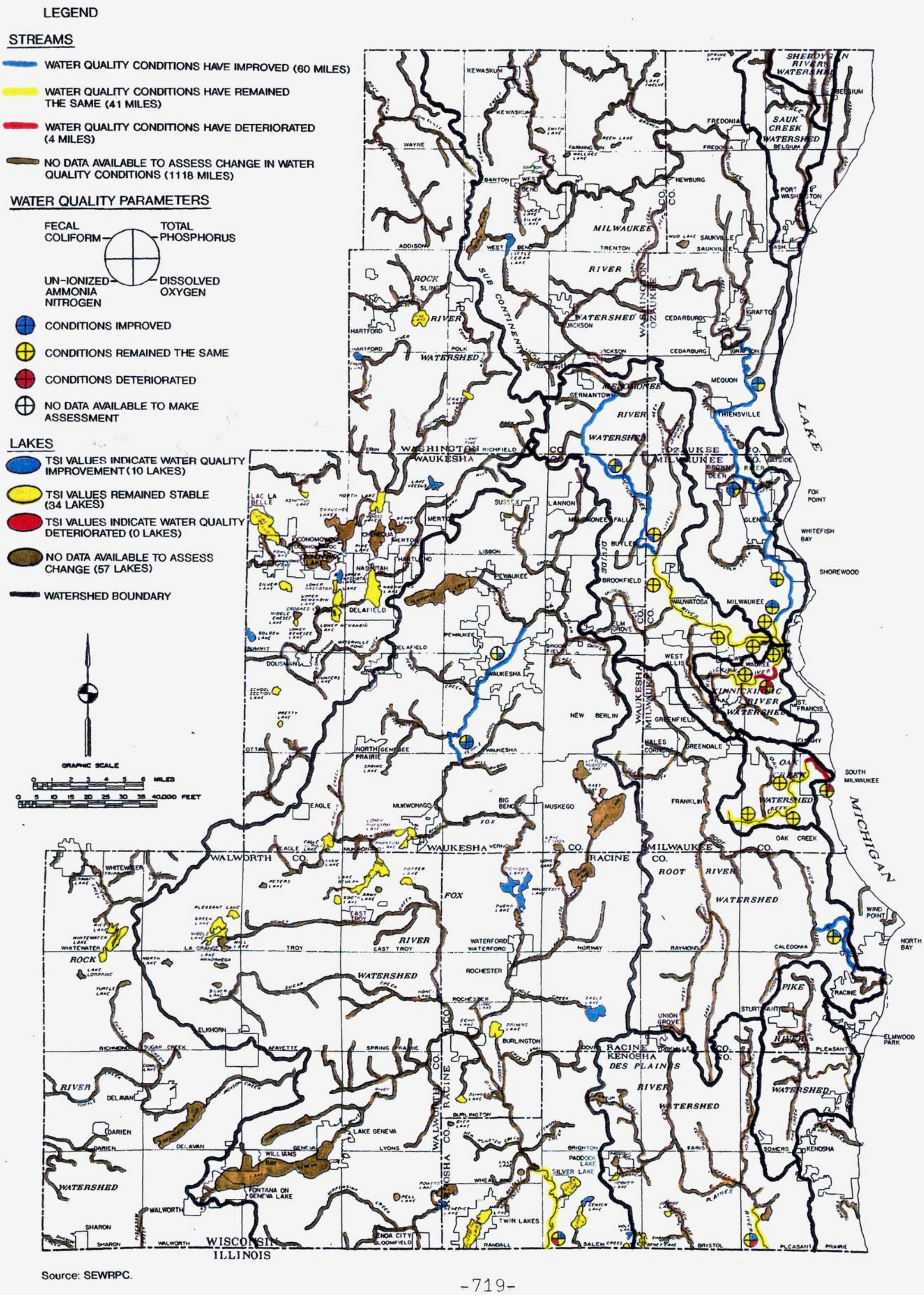
Map XVIII-3

AVAILABILITY OF SEDIMENT SAMPLING DATA IN SOUTHEASTERN WISCONSIN: 1976-1993




Source: SEWRPC.

## Map XVIII-4
## SUMMARY OF TRENDS IN SURFACE WATER QUALITY CONDITIONS IN SOUTHEASTERN WISCONSIN: 1976-1993




Source: SEWRPC.

of the stream miles for which long-term data were available. For the remaining 41 miles of stream, or 39 percent of the stream miles, for which data were available, the data indicate that no significant changes in water quality conditions have occurred. These stream reaches include portions of the Des Plaines, Fox, Kinnickinnic, Menomonee, and Milwaukee Rivers and a portion of Oak Creek.

As indicated on Map XVIII-4, water quality improvement was noted in the Fox River watershed along the Fox River from the confluence with the Pewaukee River upstream of the City of Waukesha to the confluence with Pebble Brook in the Vernon Marsh Wildlife Area in Waukesha County. The improvement, which was evidenced by improvements in dissolved oxygen, phosphorus, and un-ionized ammonia nitrogen levels, may be attributed to improvements in the City of Waukesha and City of Brookfield sewage treatment plants; the abandonment of the Village of Pewaukee and City of New Berlin Regal Manors sewage treatment plants; as well as to reductions in pollutant loadings from industrial point sources. Although an improvement was noted, levels of fecal coliform and total phosphorus continue to generally exceed the standards for this reach of the Fox River. Dissolved oxygen and un-ionized ammonia nitrogen levels generally met the water quality standards in this reach. Chronic toxicity standards for heavy metals, as set forth in Chapter II of this document, were also generally met.

In the Menomonee River watershed, water quality improvement was noted in the Menomonee River upstream of the confluence with the Little Menomonee River, as shown on Map XVIII-4. This improvement is indicated by reduced levels of phosphorus and un-ionized ammonia nitrogen concentrations and may be attributed to the abandonment of the Village of Germantown and the Village of Menomonee Falls Pilgrim Road and Lilly Road sewage treatment plants, a reduction in the bypassing of raw sanitary sewage through flow relief devices; and reductions in pollutant loading from industry sources. Levels of fecal coliform continue to exceed the water quality standards associated with the water use objectives for the Menomonee River. Dissolved oxygen levels and un-ionized ammonia nitrogen levels occasionally violated water quality standards. Lead and cadmium concentrations repeatedly exceeded the chronic toxicity standards prior to 1986, while levels of copper and zinc occasionally exceeded the standard during the period of record. The levels of lead and cadmium exceeded the standards only occasionally after 1986.

In the Milwaukee River watershed, the water quality data indicate an improvement on the Milwaukee River main stem from the confluence with Cedar Creek in Ozaukee County downstream to Walnut Street in Milwaukee County, as shown on Map XVIII-4. The improvement is indicated by reduced levels of phosphorus, un-ionized ammonia nitrogen, and fecal coliform levels. In addition, reduced levels of biochemical oxygen demand, volatile suspended solids, and chlorophyll-_a_ concentrations at some monitoring stations were demonstrated by the data. These improvements may be attributed to the improvements of the City of West Bend, the Village of Saukville, the Village of Grafton, and the City of Cedarburg sewage treatment plants; to the abandonment of the Village of Thiensville treatment plant; and to reductions in the frequency of sanitary sewer flow bypassing and in pollutant loadings from industrial point sources. In addition, limited implementation of nonpoint source pollution abatement programs within the watershed may have contributed to the improvements. The levels of phosphorus and fecal coliform generally exceeded the standards throughout the watershed. Levels of dissolved oxygen and un-ionized ammonia levels generally met but occasionally exceeded water quality standards in those stream reaches in the downstream, highly urbanized areas of the watershed. Concentrations of cadmium and lead frequently exceeded the chronic toxicity standards prior to 1986. Since 1986, the levels of these metals have only occasionally exceeded the standards, and lead levels generally met the standards after 1986. An increase in the concentrations of chloride in the Milwaukee River was also noted. This increase may be the result of new urban development which has occurred in the watershed in Ozaukee and northern Milwaukee Counties and the associated increased use of salt in winter road maintenance. Chloride levels were still within acceptable limits as defined in Chapter II.

Within the Root River watershed, the water quality monitoring data indicate an improvement in the Root River main stem from the confluence with Hoods Creek in the Town of Caledonia to the Horlick dam in the City of Racine, as shown on Map XVIII-4. This improvement is indicated by a reduced level of phosphorus concentrations and reduced levels of un-ionized ammonia and fecal coliform. This improvement may be attributed to the abandonment of the four public and six private sewage treatment plants all located upstream of the reach for which long-term sampling data were available. Levels of phosphorus and fecal coliform continue to exceed the standards in the watershed. Dissolved oxygen levels and un-ionized ammonia levels generally meet the standard.

As indicated on Map XVIII-4, only four miles, or about 4 percent of the total of 105 miles of stream for which data were available indicated a decline in water quality conditions. This decline was noted in the Oak Creek downstream of Rawson Avenue and in the Kinnickinnic River from W. Cleveland Avenue to S. Chase Avenue, and may be attributed to possible changes in pollutant loadings attendant to increased urban nonpoint source loadings associated with development or redevelopment activities. The decline in water quality conditions was indicated by increases in total phosphorus levels in both streams. In Oak Creek, concentrations of total phosphorus and fecal coliform frequently violated water quality standards. Levels of dissolved oxygen did not violate the water quality standards. Levels of lead and cadmium frequently violated the chronic toxicity standards prior to 1986. After 1986 lead levels generally met the standards. In the Kinnickinnic River, fecal coliform concentrations exceeded the water quality standards. Exceedances of the chronic toxicity standards for cadmium and lead also occurred in the Kinnickinnic River main stem, with occasional exceedances of the chronic toxicity standards for copper and zinc.

The remaining approximately 41 miles, or about 39 percent, of stream reaches analyzed did not indicate any significant change in water quality conditions from 1976 through 1993. As shown on Map XVIII-4, these stream reaches include most of the main stem of Oak Creek; portions of the Kinnickinnic River; all of the Menomonee River main stem downstream of the confluence with the Little Menomonee River; and the lower reaches of the Des Plaines, Fox, and Milwaukee Rivers. For these stream reaches, phosphorus and fecal coliform levels generally exceeded the water quality standards. Dissolved oxygen levels generally met the standards with only infrequent periods where the standard was not achieved. Levels of toxic metals were noted to exceed the standard chronic toxicity standard during the analysis period, with the metals levels generally improving over time--particularly the lead levels which generally met the standards after 1986.

In the Des Plaines River downstream of Jerome Creek, levels of total phosphorus and fecal coliform frequently violated water quality standards. Levels of dissolved oxygen, cadmium, and lead only occasionally violated water quality standards.

Data collected on the Fox River downstream of Bassett Creek in Kenosha County exhibited an increase in un-ionized ammonia nitrogen levels and a slight improvement in dissolved oxygen levels. Violations of the fecal coliform and total phosphorus standards frequently occurred, while no violations of levels of un-ionized ammonia nitrogen or dissolved oxygen were noted. Violations of the chronic toxicity standards for lead, copper, cadmium, and zinc were also observed in this stream reach. It is of interest to note that chloride levels have increased in the Fox River in Kenosha County. This increase may be the result of new urban development which has occurred in the watershed and the impacts of increased winter road maintenance activities associated with urban development. Chloride levels were still within the acceptable limits as defined in Chapter II.

In the Kinnickinnic River portion of the inner harbor, levels of dissolved oxygen and fecal coliform frequently did not meet the water quality standards. In the Kinnickinnic River upstream of Cleveland Avenue, violations of the water quality standards for fecal coliform levels frequently occurred.

In the Menomonee River downstream of the Little Menomonee River inflow, concentrations of dissolved oxygen and fecal coliform frequently did not meet the water quality standards. Levels of lead and cadmium frequently violated the chronic toxicity standards prior to 1986. After 1986, lead levels generally met the standards. Occasional exceedances of chronic toxicity standards for copper and zinc also occurred in the lower reaches of the Menomonee River.

In the Milwaukee River downstream of Walnut Street, water quality standards were frequently exceeded for fecal coliform levels and occasionally for dissolved oxygen levels. Cadmium and lead levels frequently violated chronic toxicity standards before 1986. After 1986, lead levels generally met the standards.

In Oak Creek upstream of Rawson Avenue, fecal coliform levels frequently violated standards. Levels of dissolved oxygen and total phosphorus occasionally did not meet water quality standards. Lead and cadmium levels frequently violated chronic toxicity standards, with lower levels of lead noted after 1986.

It should be noted that the water quality data analyzed was collected prior to the completion of the Milwaukee Metropolitan Sewerage District inline deep tunnel storage system which went on line in 1994. Operation of that system over a period of time is expected to result in significant improvements in water quality conditions in the Kinnickinnic and the lower reaches of the Menomonee River and Milwaukee River. Such improvements will only be able to be quantified after a period of implementation coupled with water quality monitoring. The monitoring program currently being carried out by the Milwaukee Metropolitan Sewerage District should be adequate to demonstrate such changes in water quality.

Biological Conditions: As already noted, biological condition data were also collected for selected streams within the Region,as indicated on Map VIII-2. These data were collected for about 400 stream miles in the Region, or about 33 percent of the total stream miles considered under the planning effort. Most of these data were collected after 1988 as part of the nonpoint source priority watershed projects undertaken within the Region. For the majority of the streams, data obtained from benthic macroinvertebrate sampling were used to calculate biotic index ratings based upon the Hilsenhoff Biotic Index (HBI)[4]. Fish community sampling was also used to calculate biotic index ratings based upon the Index of Biotic Integrity (IBI)[5], as indicated in Chapter II.

As indicated on Map XVIII-2, of the approximately 425 stream miles for which biotic index values were calculated, approximately 135 miles, or about 32 percent of the stream miles for which data were available, received a rating of good or higher. The majority of these streams were located in the Ozaukee County portion of the Milwaukee River watershed, in the upper tributary reaches of the Menomonee River watershed, and in the Oconomowoc River subwatershed. Water quality ratings of very poor were calculated for about 69 stream miles, or about 16 percent of the stream miles for which data were available, including Lincoln Creek, Indian Creek, Brown Deer Creek, Sussex Creek, Honey Creek, the East Branch Root River Canal, the Pike River mainstem, and portions of Cedar Creek and Oak Creek. Biotic index ratings of fair to poor were calculated for about 221 stream miles, or about 52 percent of the stream miles for which data were available, including portions of the Fox River and its major tributaries; most of the Root River and its major tributaries; the Kinnickinnic River and its major tributaries; most of Oak Creek and its major tributaries; Pike Creek, the Little Menomonee River, Butler Ditch, Lilly Creek, Underwood Creek, the Nor-X-Way Channel, Willow Creek, and a portion of Cedar Creek.

<u>Sediment Conditions:</u> Sediment data were collected for selected stream reaches in the Fox, Kinnickinnic, Milwaukee and Menomonee River watersheds, as well as in the Milwaukee, Port Washington, and Kenosha Harbors, as shown on Map XVIII-3. Specific concentrations of substances found to be present are set forth by watershed in Chapters IV through XV.

In the Fox River watershed, data collected in the Fox River in the City of Waukesha indicated levels of Polychlorinated Biphenyls (PCBs) which exceeded the lowest effect level (LEL) guidelines set forth in the draft screening criteria proposed by the Wisconsin Department of Natural Resources[6] as described in Chapter II. Sediment concentrations of copper, lead, mercury, and zinc exceeded the LEL guidelines in both the Waterford and Barstow impoundments. Severe effect level (SEL) guidelines were exceeded in the Waterford Impoundment for concentrations of chromium, copper, lead and nickel.

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[4]William L. Hilsenhoff, "Using a Biotic Index to Evaluate Water Quality in Streams," Wisconsin Department of Natural Resources Technical Bulletin No. 132, 1982.

[5]John Lyons, "Using the Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams of Wisconsin," U. S. Department of Agriculture, Forest Service, General Technical Report NC-149, April 1992.

[6]Wisconsin Department of Natural Resources, (Draft) <u>Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System</u>, June 1994.

In the Kinnickinnic River upstream to Chase Avenue, levels of Polycyclic Aromatic Hydrocarbons (PAHs) exceeded the LEL concentrations at the majority of sampling sites.

In the Menomonee River watershed, the available data indicated levels of PAHs which exceeded the LEL guidelines in the Lower Menomonee River and in the Menomonee River Canals. At those sampling sites in the Menomonee River main stem, in the Little Menomonee River, and in Lilly Creek, concentrations of heavy metals, PAHs, and other toxic substances exceeded the LEL guidelines for the majority of sites. In the Menomonee River portion of the Milwaukee Harbor estuary, sediment concentrations of ammonia, lead, zinc, and cadmium exceeded the proposed SEL guidelines at most of the sites sampled.

In the Milwaukee River watershed, sediment data collected from sampling stations located on the Milwaukee River and on certain major tributaries indicated PAH and heavy metal concentrations which generally exceeded LEL guidelines. Levels of PAHs and PCBs also exceeded LEL guidelines in sediments sampled in the Milwaukee River downstream of Lincoln Creek, including those sediments sampled as part of the North Avenue Dam feasibility study. Sediments sampled in Cedar Creek in the City of Cedarburg immediately upstream of each of four dams also indicated high levels of contamination of the sediments by PCBs. Data collected from above these dams indicated PCB levels which were higher than the SEL guidelines for three of the four dams.

In the three harbors for which sediment samples were collected, levels of heavy metals exceeded the LEL guidelines for both the City of Port Washington and City of Kenosha harbors, and PAH levels exceeded LEL concentrations at the majority of the offshore stations in the Milwaukee Harbor estuary.

Water Use Objectives: The recommended water use objectives for streams in the Region are described in Chapter II and set forth by watershed in Chapters IV through XV. Based upon a review and analysis of available water quality monitoring data; in-stream field inventories and appraisals; the results of simulation modeling; and information on the current uses of certain streams, an assessment of the ability of current stream conditions to meet the recommended water use objectives was conducted, with the findings summarized in Table XVIII-1 and on Map XVIII-5. Streams for which the available water quality data indicated that all of the critical water quality standards were achieved, or for which field observation indicated the stream actually supported the intended water uses, were noted as "fully meeting" the water use objectives. Streams where water quality conditions indicated one or more, but not all of the critical water quality standards were being achieved, were noted to be "partially meeting" the water use objectives. Those streams for which field observation indicated the stream actually supported the intended water use objectives some of the time were also noted as partially meeting the objectives. Streams where actual or estimated water quality conditions indicated that none of the critical water quality standards were met, or where field inspection indicated the intended uses were generally not being met, were noted to be "not meeting" the water use objectives.

As shown in Table XVIII-1 and on Map XVIII-5, of the 1,223 stream miles assessed under this planning effort, 148 miles, or 12 percent, are estimated to fully meet the recommended water use objectives. The majority of the streams--773 miles, or 63 percent--are estimated to be partially meeting the recommended water use

Map XVIII-5

ESTIMATED CURRENT LEVEL OF ACHIEVEMENT FOR SURFACE WATER USE OBJECTIVES IN SOUTHEASTERN WISCONSIN: 1993

LEGEND

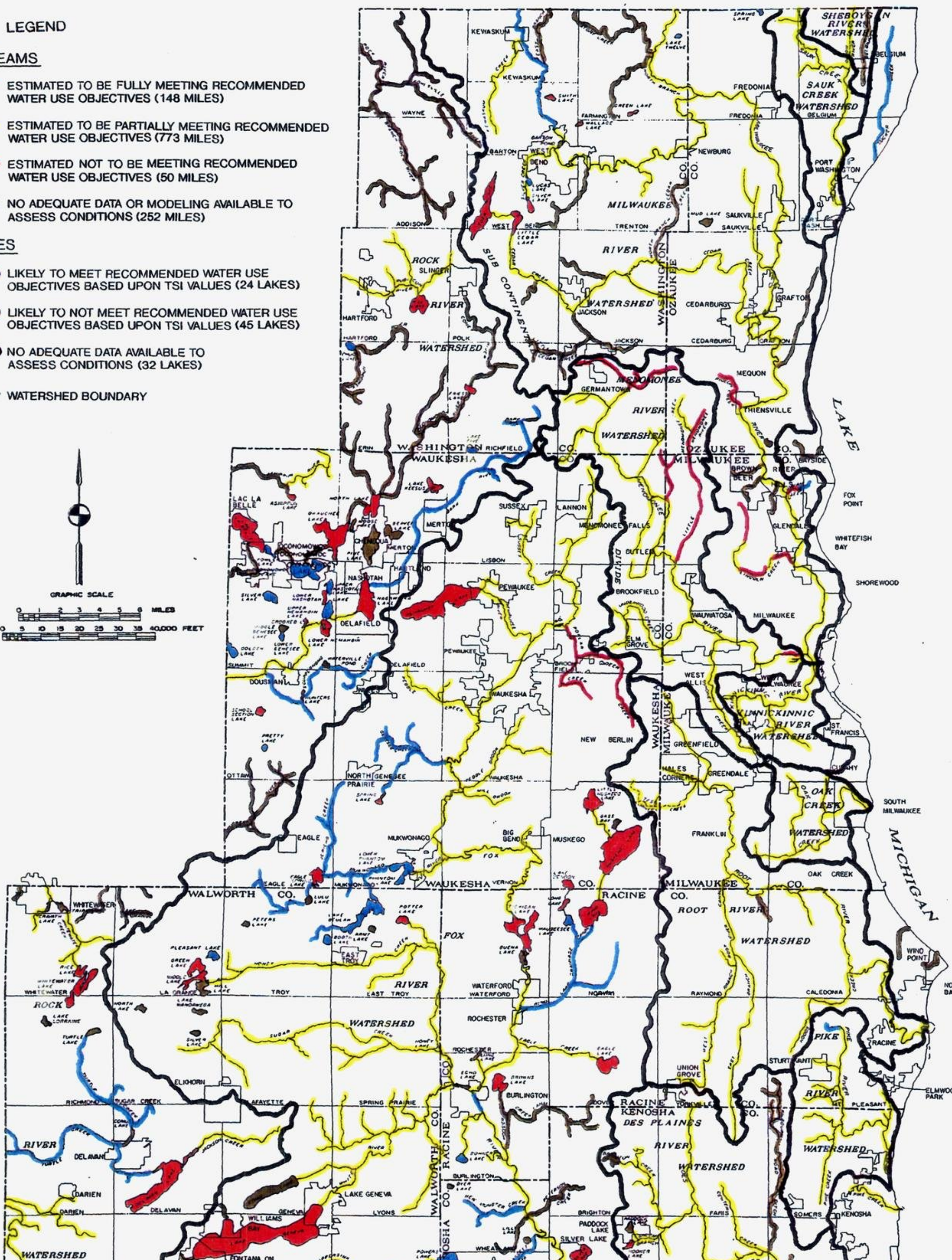
STREAMS

- ESTIMATED TO BE FULLY MEETING RECOMMENDED WATER USE OBJECTIVES (148 MILES)
- ESTIMATED TO BE PARTIALLY MEETING RECOMMENDED WATER USE OBJECTIVES (773 MILES)
- ESTIMATED NOT TO BE MEETING RECOMMENDED WATER USE OBJECTIVES (50 MILES)
- NO ADEQUATE DATA OR MODELING AVAILABLE TO ASSESS CONDITIONS (252 MILES)

LAKES

- LIKELY TO MEET RECOMMENDED WATER USE OBJECTIVES BASED UPON TSI VALUES (24 LAKES)
- LIKELY TO NOT MEET RECOMMENDED WATER USE OBJECTIVES BASED UPON TSI VALUES (45 LAKES)
- NO ADEQUATE DATA AVAILABLE TO ASSESS CONDITIONS (32 LAKES)

- WATERSHED BOUNDARY




Source: SEWRPC.

objectives. About 50 stream miles, or 4 percent, are estimated not to be meeting the water use objectives. For 252 stream miles, or 21 percent of the total stream miles, no data were available to assess the potential level of achievement of the water use objectives.

Lakes

Available lake water quality data collected since the completion of the initial water quality management plan were utilized by the Commission to evaluate to the extent possible changes in lake water quality for the 101 major lakes within the Region. As indicated in Table XVIII-2 and on Map XVIII-1, water quality monitoring data collected since the completion of the initial plan were available for 69 of the major lakes in the Region. It is important to note that comprehensive water quality monitoring data collected as part of the Wisconsin Department of Natural Resources Long-Term Trends Lake Monitoring Program, U.S. Geological Survey monitoring programs, and other comprehensive monitoring programs, were available for 33 of these 69 lakes. Data on the other 36 lakes consisted primarily of Secchi disc data collected under the Wisconsin Department of Natural Resources Self-Help Monitoring Program.

Water Quality: Current available lake water chemistry data were compared with available lake monitoring data collected prior to 1981 to assess any potential changes in lake water quality over time, using the procedure set forth in Chapter II. Results are set forth in graphic summary in Map XVIII-4. Based upon the Trophic State Index (TSI) values, as described in Chapter II, 10 of the 44 lakes for which comparative data were available exhibited an improvement in lake water quality since the completion of the initial plan. These apparent improvements may be attributed, in part, to the construction of public sanitary sewerage systems at a number of the lakes, as well as to the recent implementation of programs of improved onsite sewage disposal system inspection and maintenance for areas served by private onsite sewage treatment systems. In addition, increased riparian awareness regarding water quality impacts and the subsequent implementation of better housekeeping practices by landowners may also have had positive impacts on lake water quality.

It should be noted that for those lakes with comparative water chemistry data available, none of the lakes exhibited a decline in water quality based upon Trophic State Index values. For the remaining 34 lakes where comparative water chemistry data were available, water quality conditions appeared to be unchanged from 1976 to 1993, even though a number of these lakes in the Region have experienced increased developmental pressures during this period.

Water Use Objectives: Based upon available Trophic State Index values, an assessment of the compliance of current lake water quality conditions to the recommended water use objectives was conducted, with results set forth in Table XVIII-2 and on Map XVIII-5. The data used in this assessment included data collected for 69 lakes since the preparation of the initial plan. Those lakes with a Trophic State Index value in excess of approximately 47, indicated to be eutrophic or very eutrophic, were assumed to be exceeding the total phosphorus standard associated with full recreational uses. As indicated in Map XVIII-5, 45, or about 65 percent, of the 69 lakes for which trophic state index data were available have an estimated water quality which indicates that the recommended water use objectives are unlikely to be fully met. The data indicate that the water use objectives are fully met for 24 lakes. It should be noted that those

Table XVIII-2

AVAILABLE POST-1976 DATA FOR LAKES IN SOUTHEASTERN WISCONSIN

| WATERSHED / Subwatershed / Lake | Lake Area (acres) | Recommended Water Use Objective | Water Quality Data: Pre-1981 Monitoring | Water Quality Data: Post-1987 Comprehensive Monitoring | Water Quality Data: Post-1981 Limited Monitoring | Trophic State Index[a] | Water Quality Trends | Compliance with Water Use Objective |
|---|---|---|---|---|---|---|---|---|
| **DES PLAINES RIVER WATERSHED** | | | | | | | | |
| Benet/Shangrila Lake . . . . . . . | 188 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 67 | NC | N |
| East Lake Flowage . . . . . . . . . | 123 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| George Lake . . . . . . . . . . . . | 59 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 64 | NC | N |
| Hooker Lake . . . . . . . . . . . . | 87 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 54 | NC | N |
| Paddock Lake . . . . . . . . . . . | 112 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Unnamed Quarry Lake . . . . . . . . | 100 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| **FOX RIVER WATERSHED** | | | | | | | | |
| Upper Fox River Subwatershed | | | | | | | | |
| Pewaukee Lake . . . . . . . . . . . | 2493 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 59 | -- | N |
| Middle Fox River Subwatershed | | | | | | | | |
| Big Muskego Lake . . . . . . . . . | 2177 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 70 | -- | N |
| Denoon Lake . . . . . . . . . . . . | 162 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 49 | -- | N |
| Eagle Lake . . . . . . . . . . . . | 520 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 52 | I | N |
| Kee Nong Go Mong Lake . . . . . . . | 88 | Warmwater Forage Fish Community and Full Recreational Use | -- | + | -- | 55 | -- | N |
| Little Muskego Lake . . . . . . . . | 506 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 62 | -- | N |
| Long Lake (Racine County) . . . . . | 102 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Spring Lake (Waukesha County) . . . | 105 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 51 | -- | N |
| Waterford Impoundment | | | | | | | | |
| Buena Lake . . . . . . . . . . . . | 241 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Tichigan Lake . . . . . . . . . . | 892 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 54 | I | N |
| Waubeesee Lake . . . . . . . . . . | 129 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 46 | -- | F |
| Wind Lake . . . . . . . . . . . . . | 936 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 69 | -- | N |

Table XVIII-2 (continued)

| **WATERSHED**<br>**Subwatershed**<br>Lake | Lake Area (acres) | Recommended Water Use Objective | Water Quality Data: Pre-1981 Monitoring | Water Quality Data: Post-1987 Comprehensive Monitoring | Water Quality Data: Post-1981 Limited Monitoring | Trophic State Index[a] | Water Quality Trends | Compliance with Water Use Objective |
|---|---|---|---|---|---|---|---|---|
| **Lower Fox River Subwatershed** | | | | | | | | |
| Bohner Lake . . . . . . . . . . . . . | 135 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 45 | NC | F |
| Browns Lake . . . . . . . . . . . . . | 396 | Warmwater Sport Fish Community and Full Recreational Use | + | + | -- | 51 | NC | N |
| Camp Lake . . . . . . . . . . . . . . | 461 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 54 | NC | N |
| Center Lake . . . . . . . . . . . . . | 129 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 35 | I | F |
| Cross Lake . . . . . . . . . . . . . | 87 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 52 | NC | N |
| Dyer Lake . . . . . . . . . . . . . . | 56 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Lilly Lake . . . . . . . . . . . . . | 88 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Silver Lake (Kenosha County) . . . | 464 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 50 | NC | N |
| Voltz Lake . . . . . . . . . . . . . | 52 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 57 | I | N |
| **Mukwonago River Subwatershed** | | | | | | | | |
| Army Lake . . . . . . . . . . . . . . | 78 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Beulah Lake . . . . . . . . . . . . . | 834 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 46 | NC | F |
| Booth Lake . . . . . . . . . . . . . | 113 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 45 | NC | F |
| Eagle Spring Lake . . . . . . . . . | 311 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 49 | NC | N |
| Lower Phantom Lake . . . . . . . . | 433 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 43 | NC | F |
| Lulu Lake . . . . . . . . . . . . . . | 84 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Peters Lake . . . . . . . . . . . . . | 64 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Upper Phantom Lake . . . . . . . . | 107 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 44 | NC | F |

Table XVIII-2 (continued)

| WATERSHED Subwatershed Lake | Lake Area (acres) | Recommended Water Use Objective | Water Quality Data: Pre-1981 Monitoring | Water Quality Data: Post-1987 Comprehensive Monitoring | Water Quality Data: Post-1981 Limited Monitoring | Trophic State Index[a] | Water Quality Trends | Compliance with Water Use Objective |
|---|---|---|---|---|---|---|---|---|
| **Honey/Sugar Creeks Subwatershed** | | | | | | | | |
| Lauderdale Lakes | | | | | | | | |
| Green Lake . . . . . . . . . . . . | 311 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 49 | NC | N |
| Middle Lake . . . . . . . . . . . | 259 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 51 | NC | N |
| Mill Lake . . . . . . . . . . . . | 271 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| North Lake (Walworth County) . . . | 191 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Pleasant Lake . . . . . . . . . . . | 155 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 45 | NC | F |
| Potters Lake . . . . . . . . . . . | 162 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 78 | NC | N |
| Silver Lake (Walworth County) . . . | 85 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Wandawega Lake . . . . . . . . . . | 119 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| **White River/Nippersink Creek Subwatershed** | | | | | | | | |
| Benedict Lake . . . . . . . . . . . | 78 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 44 | I | F |
| Como Lake . . . . . . . . . . . . . | 946 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Echo Lake . . . . . . . . . . . . . | 71 | Warmwater Forage Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Elizabeth Lake . . . . . . . . . . | 865 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 52 | NC | N |
| Geneva Lake . . . . . . . . . . . . | 5262 | Coldwater Community and Full Recreational Use | -- | + | + | 48 | -- | N |
| Mary Lake . . . . . . . . . . . . . | 315 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 47 | NC | F |
| Pell Lake . . . . . . . . . . . . . | 86 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | -- | 60 | -- | N |
| Powers Lake . . . . . . . . . . . . | 459 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 45 | -- | F |
| **MILWAUKEE RIVER WATERSHED** | | | | | | | | |
| **Cedar Creek Subwatershed** | | | | | | | | |
| Big Cedar Lake . . . . . . . . . . | 932 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 59 | -- | N |
| Little Cedar Lake . . . . . . . . . | 246 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 59 | I | N |
| Mud Lake (Ozaukee County) . . . . . | 245 | Warmwater Sport Fish Community and Full Recreational Use | + | --[b] | -- | -- | -- | -- |

Table XVIII-2 (continued)

| WATERSHED Subwatershed Lake | Lake Area (acres) | Recommended Water Use Objective | Water Quality Data: Pre-1981 Monitoring | Water Quality Data: Post-1987 Comprehensive Monitoring | Water Quality Data: Post-1981 Limited Monitoring | Trophic State Index[a] | Water Quality Trends | Compliance with Water Use Objective |
|---|---|---|---|---|---|---|---|---|
| **Milwaukee River East-West Branch Subwatershed** | | | | | | | | |
| Barton Pond . . . . . . . . . . . | 67 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Lucas Lake . . . . . . . . . . . . | 78 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 43 | -- | F |
| Silver Lake (Washington Co.) . . . | 118 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 50 | -- | N |
| Smith Lake . . . . . . . . . . . . | 86 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 49 | -- | N |
| **Milwaukee River North Branch Subwatershed** | | | | | | | | |
| Green Lake (Washington County) . . | 71 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 50 | -- | N |
| Spring Lake (Ozaukee County) . . . | 66 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 43 | -- | F |
| Lake Twelve . . . . . . . . . . . | 53 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 45 | -- | F |
| Wallace Lake . . . . . . . . . . | 52 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 59 | -- | N |
| **Milwaukee River South Branch Subwatershed** | | | | | | | | |
| Lac du Cours . . . . . . . . . . . | 57 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| **ROCK RIVER WATERSHED** | | | | | | | | |
| **Ashippun River Subwatershed** | | | | | | | | |
| Ashippun Lake . . . . . . . . . . . | 84 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 49 | NC | N |
| Druid Lake . . . . . . . . . . . . | 124 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 47 | I | F |
| **Bark River Subwatershed** | | | | | | | | |
| Bark Lake . . . . . . . . . . . . . | 65 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Crooked Lake . . . . . . . . . . . | 58 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 51 | -- | N |
| Golden Lake . . . . . . . . . . . . | 250 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 42 | I | F |
| Hunters Lake . . . . . . . . . . . | 65 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Lower Nashotah Lake . . . . . . . . | 90 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 51 | NC | N |
| Lower Nemahbin Lake . . . . . . . . | 271 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 54 | NC | N |
| Nagawicka Lake . . . . . . . . . . | 957 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 60 | NC | N |

Table XVIII-2 (continued)

| WATERSHED Subwatershed Lake | Lake Area (acres) | Recommended Water Use Objective | Water Quality Data | | | Trophic State Index[a] | Water Quality Trends | Compliance with Water Use Objective |
|---|---|---|---|---|---|---|---|---|
| | | | Pre-1981 Monitoring | Post-1987 Comprehensive Monitoring | Post-1981 Limited Monitoring | | | |
| **Bark River Subwatershed (cont'd)** | | | | | | | | |
| Pretty Lake . . . . . . . . . . . . | 64 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 42 | NC | F |
| School Section Lake . . . . . . . . | 125 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 53 | NC | N |
| Upper Nashotah Lake . . . . . . . . | 133 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 45 | I | F |
| Upper Nemahbin Lake . . . . . . . . | 283 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 45 | NC | F |
| Waterville Pond . . . . . . . . . . | 68 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| **Oconomowoc River Subwatershed** | | | | | | | | |
| Beaver Lake . . . . . . . . . . . . | 316 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Lake Five . . . . . . . . . . . . . | 102 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | + | 47 | -- | F |
| Fowler Lake . . . . . . . . . . . . | 99 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 43 | -- | F |
| Friess Lake . . . . . . . . . . . . | 119 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 59 | NC | N |
| Lake Keesus . . . . . . . . . . . . | 237 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 50 | I | N |
| Lac La Belle . . . . . . . . . . . | 1117 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 54 | NC | N |
| Lower Genesee . . . . . . . . . . . | 66 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 41 | NC | F |
| Middle Genesee . . . . . . . . . . | 102 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Moose Lake . . . . . . . . . . . . | 81 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| North Lake . . . . . . . . . . . . | 437 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 54 | NC | N |
| Oconomowoc Lake . . . . . . . . . . | 767 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 44 | -- | F |
| Okauchee Lake . . . . . . . . . . . | 1187 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | -- | 58 | -- | N |
| Pine Lake . . . . . . . . . . . . . | 703 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Silver Lake (Waukesha County) . . . | 222 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | + | 43 | NC | F |
| **Rubicon River Subwatershed** | | | | | | | | |
| Pike Lake . . . . . . . . . . . . . | 522 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 52 | NC | N |
| **Scuppernong River Subwatershed** | | | | | | | | |
| LaGrange Lake . . . . . . . . . . . | 55 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |

Table XVIII-2 (continued)

| WATERSHED<br>Subwatershed<br>Lake | Lake Area (acres) | Recommended Water Use Objective | Water Quality Data: Pre-1981 Monitoring | Water Quality Data: Post-1987 Comprehensive Monitoring | Water Quality Data: Post-1981 Limited Monitoring | Trophic State Index[a] | Water Quality Trends | Compliance with Water Use Objective |
|---|---|---|---|---|---|---|---|---|
| **Turtle Creek Subwatershed** | | | | | | | | |
| Comus Lake . . . . . . . . . . . . | 117 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Delavan Lake . . . . . . . . . . . | 2072 | Warmwater Sport Fish Community and Full Recreational Use | -- | + | + | 64 | -- | N |
| Turtle Lake . . . . . . . . . . . . | 140 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| **Whitewater Creek Subwatershed** | | | | | | | | |
| Cravath Lake . . . . . . . . . . . | 65 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Lake Lorraine . . . . . . . . . . . | 133 | Warmwater Sport Fish Community and Full Recreational Use | -- | -- | -- | -- | -- | -- |
| Rice Lake . . . . . . . . . . . . . | 137 | Warmwater Forage Fish Community and Full Recreational Use | + | + | + | 60 | NC | N |
| Tripp Lake . . . . . . . . . . . . | 115 | Warmwater Sport Fish Community and Full Recreational Use | + | -- | -- | -- | -- | -- |
| Whitewater Lake . . . . . . . . . . | 640 | Warmwater Sport Fish Community and Full Recreational Use | + | + | + | 61 | NC | N |

[a]Carslon Trophic State Index (TSI) classification based upon water chemistry data collected between 1981 and 1994.

[b]Fisheries survey conducted during priority watershed appraisal process.

Note: + = data available
-- = no data available
I = improvement in water quality conditions based on long-term water quality monitoring data
D = decline in water quality conditions based on long-term water quality monitoring data
NC = no change in water quality conditions based on long-term water quality monitoring data
F = likely to meet recommended water use objectives based on a TSI < or equal to 47
N = not likely to meet recommended water use objectives based on a TSI < or equal to 47

Source: Wisconsin Department of Natural Resources and SEWRPC.

lakes for which the data indicate the objectives are not fully met do in most cases provide for sport fishing and for positive recreation uses which are considered limited to various extents due to algae and aquatic plant problems.

## LAND USE PLAN ELEMENT

The most fundamental and basic element of the regional water quality management plan is the land use element. The type, intensity, and distribution of urban and rural land uses within the Region will determine to a large degree the character, magnitude, and distribution of point and nonpoint sources of pollution; the location and size of wastewater treatment facilities and attendant collection and conveyance facilities; the kind and level of wastewater treatment required; the need for, and practicality of, various land management practices for nonpoint source pollution abatement; and ultimately, the quality of the surface waters of the Region.

The land use plan element of the initial regional water quality management plan consisted of the recommended regional land use plan for the design year 2000, adopted by the Regional Planning Commission on December 19, 1977.[7] The year 2000 land use plan emphasized a compact, centralized regional settlement pattern. The plan recommended that intensive urban development be encouraged to occur only in those areas of the Region covered by soils suitable for such development, that are not subject to special hazards, such as flooding or shoreline erosion, and that can be readily served by such essential urban services as sanitary sewer, public water supply, and mass transit; that all remaining primary environmental corridors be preserved in essentially natural, open uses; and that all remaining prime agricultural lands be retained in essentially agricultural uses. Between 1970 and 1985, major commercial, industrial, and recreational land use development proceeded in substantial conformance with the year 2000 regional land use plan recommendations. Residential development, however, occurred at a rate somewhat higher than envisioned under the plan; and approximately 30 percent of all housing units were developed at lower densities than recommended in the plan. Between 1970 and 1985, significant progress was made in the protection of primary environmental corridor lands, through the increase in both public land use regulation and in public ownership of the corridor lands. With regard to prime agricultural lands, substantial progress was made toward the preservation of these lands through the application of exclusive agricultural zoning. The land use plan recognized the loss of certain agricultural lands to accommodate continued urban growth and development within the Region. However, approximately 80 percent of the prime agricultural land lost to urban development was located in outlying rural areas generally recommended to remain in agriculture and related uses under the year 2000 land use plan.

The land use plan element of the current regional water quality management plan consists of the recommended regional land use plan[8] for the design year 2010 adopted by the Commission on September 23, 1992. This plan, as shown on Map

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[7]SEWRPC Planning Report No. 25, A Regional Land Use Plan and a Regional Transportation Plan for Southeastern Wisconsin: 2000, May 1978.

[8]SEWRPC Planning Report No. 40, A Regional Land Use Plan for Southeastern Wisconsin-2010, January 1992.

XVIII-6, seeks to centralize land use development to the greatest degree practicable; to encourage new urban development to occur at densities consistent with the provision of public centralized sanitary sewer, water supply, and mass transit facilities and services; to encourage new urban development to occur only in areas covered by soils well suited to urban use and not subject to special hazards, such as flooding; and to encourage new urban development and redevelopment to occur in areas in which essential urban facilities and services are available--particularly the existing urban centers of the Region--or into which such facilities and services can be readily and economically extended.

The new design year 2010 regional land use plan incorporated the use of an alternative futures approach in order to deal with uncertainties as to whether or not historic trends will continue. Under this approach, the development and evaluation of alternative land use plans was based not upon a single most probable forecast of future socio-economic conditions, but rather upon a number of alternative futures chosen to represent a range of conditions which may occur over the plan design period. Consideration of these alternative future conditions is particularly important in local plan implementation activities associated with the regional water quality management plan. To this end, design year 2010 data under the recommended plan and under the high growth future scenario are provided herein in order to present a reasonable range of conditions for use in local plan facility planning.

Under the alternative futures approach, the resident population of the Region may be expected to increase from 1,765,000 persons in 1980 to about 1,911,000 persons by 2010 under the intermediate-growth scenario, and to about 2,316,000 persons under the high-growth scenario. These population levels represent a range of from 8 to 32 percent in population increase over the planning period. The number of households in the Region may be expected to increase from 676,000 households in 1990 to 774,000 households by 2010 under the intermediate-growth scenario; and to about 856,000 households under the high-growth scenario. These household levels represnt a range of from 24 to 42 percent increases over the planning period. Similarly, total regional employment may be expected to increase from 884,000 jobs in 1980 to about 1,095,000 jobs by 2010 under the intermediate-growth scenario;, and to about 1,252,000 jobs under the high-growth scenario. These employment levels represent an increase of about 24 and 42 percent, respectively, over the planning period.

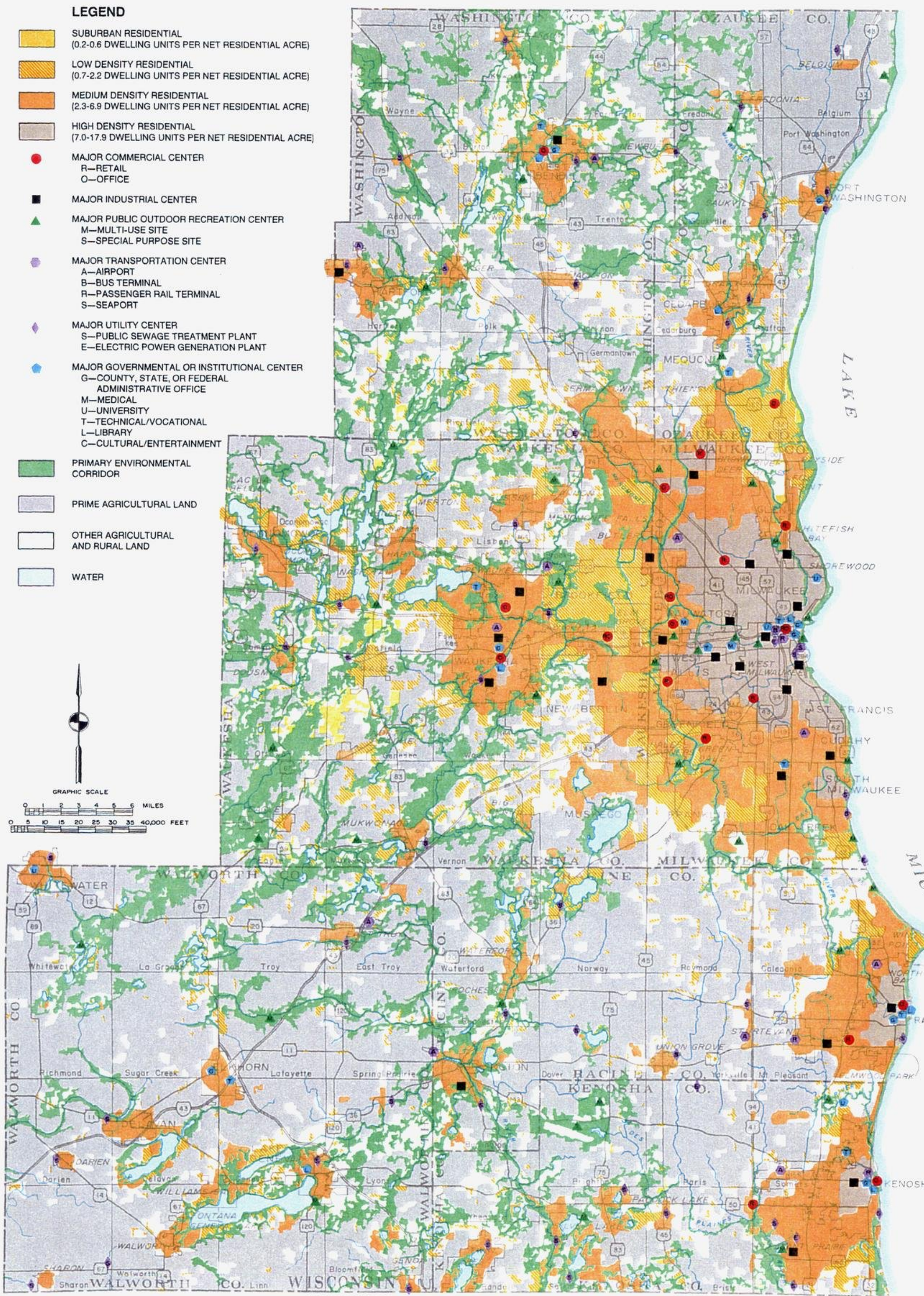
Urban Development and Density

In order to accommodate the anticipated increases in population, household and employment levels, the land use plan element envisions converting about 69 square miles of land from rural to urban use over the period 1990 through 2010, increasing the total stock of urban land to 691 square miles, or to about 26 percent of the total area of the Region.

The land use plan envisions that most new urban development would occur in planned neighborhood development units at medium density, with a typical single-family lot size of one-quarter acre and a typical multi-family development averaging about 10 dwelling units per net acre. Urban development would be provided with basic urban services and facilities, including, importantly, public sanitary sewer and water supply services. The plan envisions that by the year 2010 about 85 percent of all urban land and about 91 percent of the total

## Map XVIII-6

# RECOMMENDED LAND USE PLAN FOR THE SOUTHEASTERN WISCONSIN REGION: 2010




Source: SEWRPC.

population of the Region would be served with public sanitary sewer and water supply services.

The year 2010 land use plan seeks to discourage scattered, "leap frog" urban development--urban sprawl--in outlying areas of the Region, both through encouragement of higher density development in those areas of the Region that can be most readily served by essential urban services, and through the maintenance of rural development densities in the rural, outlying areas, that is, average lot sizes of at least five acres per dwelling unit.

Under the recommended plan, the population density within the developed area of the Region would decline from a 1985 level of about 3,600 persons per square mile to a year 2010 level of about 2,800 persons per square mile, continuing the trend toward declining densities evident in the Region since 1920. The rate of decline would be significantly reduced, however, by implementation of plan proposals to develop the majority of new urban land within the Region at medium, rather than low, densities and to provide such development with public sanitary sewer and water supply services.

Major Regional Commercial and Industrial Centers

As described in Chapter III, the recommended land use plan proposes retaining all 14 existing major commercial centers through the year 2010 and also proposes the expansion of certain of these centers. In addition to the proposed expansion of the centers, the plan recommends the development of five new major commercial centers in the Region.

The recommended regional land use plan proposes to retain all 22 of the existing major industrial centers and further proposes to add three new major industrial centers by the year 2010.

Park and Outdoor Recreation Areas

Under the recommended year 2010 land use plan, about 4,100 acres of land for intensive, public recreational land use would be added to the existing 26,000 acres currently designated as recreational lands. The additional recreational areas called for under the plan are based in part on neighborhood development standards, which seek to provide adequate neighborhood park land in developing areas. The year 2010 regional land use plan proposes a system of 31 major parks of regional size and significance to serve the needs of the Region through the year 2010. Such parks have an area of at least 250 acres and provide opportunities for a variety of resource-oriented outdoor recreational activities.

Environmentally Sensitive Lands

Environmental corridors are defined as linear areas in the landscape containing concentrations of natural resource and natural resource-related amenities. These corridors generally lie along the major stream valleys, around major lakes, and in the Kettle Moraine area of southeastern Wisconsin. Almost all of the remaining high-value wetlands, woodlands, wildlife habitat areas, major bodies of surface water, and delineated floodlands and shorelands are contained within these corridors. In addition, significant groundwater recharge and discharge areas, many of the most important recreational and scenic areas, and the best remaining potential park sites are located within the environmental corridors. Such environmental corridors are, in effect, a composite of the most important individual elements of the natural resource base in Southeastern Wisconsin and have immeasurable environmental, ecological, and recreational value.

As described in Chapter III, the environmentally sensitive areas in Southeastern Wisconsin have been categorized into primary environmental corridors, secondary environmental corridors, and isolated natural areas. The primary environmental corridors encompass about 467 square miles, or about 17 percent of the Region. It is recommended that lands identified as primary environmental corridors not be developed for intensive urban use. Accordingly, the plan further recommends that sanitary sewers not be extended into such corridors for the purpose of accommodating urban development in the corridors. It was, however, recognized in the plan that it would be necessary in some cases to construct sanitary sewers across and through primary environmental corridors, and that certain land uses requiring sanitary sewer service could be properly located in the corridors, including park and outdoor recreation facilities and certain institutional uses. In some cases very low density single-family residential development on five-acre lots, compatible with the preservation of the corridors in essentially natural open uses, may also be permitted to occupy corridor lands and it may be desirable to extend sewers into the corridors to serve such uses. Basically, however, the plan element seeks to ensure that the primary environmental corridor lands are not destroyed through conversion to intensive urban uses.

Secondary environmental corridors are also identified in the year 2010 regional land use plan. The secondary environmental corridors, while not as significant as the primary environmental corridors in terms of the overall resource values, should be considered for preservation as the process of urban development proceeds because such corridors often provide economical drainageways, as well as needed "green space," through developing residential neighborhoods. Isolated natural areas are also identified in the year 2010 regional land use plan. Isolated natural areas generally consist of those natural resource base elements that have "inherent natural" value such as wetlands, woodlands, wildlife habitat areas, and surface water areas, but that are separated physically from the primary and secondary environmental corridors by intensive urban and agricultural land uses.

The updated regional water quality management plan recommends that county and local governments take appropriate actions to preserve and protect the resources found in secondary environmental corridors and isolated natural resource areas, as well as in the primary environmental corridors. In so doing, the resources concerned may be incorporated into drainageways, parks and parkways, and commonly held open space areas, depending upon the exercise of local planning judgements as local plans are prepared and development projects reviewed.

The regional plan recognizes, however, that the potential exists for at least some portions of the secondary environmental corridors and isolated natural resource areas to be converted to urban land uses and provided with sanitary sewer service. As the county and local governments concerned appropriately exercise their local planning authority attendant to secondary environmental corridors and isolated natural resource areas, it will be important to recognize that Federal, State, and even local regulations--and particularly State regulations set forth in Chapter NR 103 of the Wisconsin Administrative Code--may effectively preclude development of such areas with or without public sanitary sewer service. Of particular significance in this respect are those Federal and

State natural resource protection regulations dealing with wetlands, floodlands, shorelands, stormwater management, and erosion control. All or portions of secondary environmental corridors and isolated natural resource areas may also be found unsuitable for development to be served by sanitary sewer extensions because of physical or environmental constraints within the meaning of Section NR 121.05(1)(g)2c of the Wisconsin Administrative Code. Accordingly, it is important that the local units of government concerned, and landowners and developers determine the need for Federal, State, and local permits prior to undertaking any disturbances of lands classified as secondary environmental corridors and isolated natural resource areas.

As sanitary sewer service area plans are developed for the individual sewer service areas in the Region, as recommended in the updated plan, the primary environmental corridors, secondary environmental corridors, and isolated natural areas must be further delineated, quantified, and mapped in order to assist the designated management agencies in the protection of the primary environmental corridors and in considering protection of the secondary corridors and other environmentally sensitive lands.

### Prime Agricultural Lands

The recommended land use plan recognizes that general agricultural lands are subject to conversion to urban lands. However, the plan seeks to minimize the development of new urban uses on lands which have been designated as prime agricultural lands. Those areas totaled just over 1,047 square miles, or 39 percent of the Region. The recommended year 2010 land use plan proposes to convert to urban use only those prime agricultural lands which were already committed to urban development due to proximity to existing and expanding concentrations of urban uses and the prior commitment of heavy capital investment in utility extensions.

The preservation of prime agricultural lands has important implications for water quality management planning. Prime agricultural land preservation will assist in the implementation of sound soil and water conservation practices and nonpoint source water pollution abatement measures.

## POINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

Point sources of water pollution include sewage treatment plant outfalls, industrial wastewater outfalls, and combined sanitary and stormwater drainage and separate sanitary sewerage system flow relief devices. Because pollutants associated with urban stormwater runoff have discharge characteristics related to the tributary land uses and associated land management practices, urban storm sewer system discharges were considered nonpoint, or diffuse, sources of water pollution and are addressed under the plan element relating to the abatement of pollution from such sources.

This section describes the recommended point source pollution abatement plan element. This element includes recommendations concerning the location and extent of sanitary sewer service areas; the location and capacity of sewage treatment facilities; the location, configuration, and size of trunk sewers; the abatement of pollution from separate and combined sewer overflows; the abatement of pollution from miscellaneous point source discharges; and the management of sewage treatment plant solids. The point source plan element represents an update and refinement of the point source pollution abatement recommendations set forth in the initial plan, as modified by completed implementation actions, and all of the amendments made to the original plan. These amendments are based upon the findings of local and subregional facilities planning studies; changes in future resident population and employment levels; and attendant land use development patterns set forth in the new design year 2010 regional land use plan upon which the regional water quality management plan is based.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on the preparation of a new sewerage facility plan[9] for the entire Milwaukee metropolitan service area. The new plan will have a design year 2010, updating the current facility plan. The resultant sewerage facilities plan is intended, upon its adoption by all of the agencies concerned, to constitute an amendment to the regional water quality management plan as herein presented.

Sewer Service Areas

The initial regional water quality management plan adopted in 1979 originally identified 85 sanitary sewer service areas. The initial regional water quality management plan recommended the refinement of the 85 sewer service areas identified in that plan within the Region. Subsequent to adoption of the original plan, the Commission has conducted a continuing effort to refine and detail the planned sewer service areas of the Region through local-level planning efforts resulting in amendments to the regional water quality management plan. As a result of this ongoing refinement and detailing process, by 1994, a total of 70 of the 85 initially identified sanitary sewer service areas had been refined and detailed. Because the refinement and detailing process sometimes involves the redefinition and combination of previously defined areas, these 70 originally defined areas have been combined into a total of 57 currently defined areas. In addition, the refinement and detailing process has resulted in the creation of new sanitary sewer service areas which were not envisioned in the initial plan. As of 1994, 13 such areas have been delineated by amendments to the regional water quality management plan. These 13 new areas are: the City of Franklin and City of Oak Creek portions of the Milwaukee Metropolitan Sewerage District in Milwaukee County; Powers Lake in Kenosha County; Bohner Lake in Racine County; Alpine Valley, Army Lake, the Country Estates Sanitary District, Griedanus Landfill and Pell Lake, all located in Walworth County; the Eagle Spring Lake Sanitary District, the Village of Lannon portion of the Lannon-Menomonee Falls areas, and the Mukwonago County Park area in Waukesha County; and Rainbow Springs, lying in both Waukesha and Walworth Counties. The current planned sanitary sewer service areas are shown on Map XVIII-7 and listed in Table XVIII-3.

As of 1994, refinements to the planned sewer service areas had been prepared cooperatively by the Commission and the local units of government involved for 70 of the current 85 sewer service areas. The 85 service areas include the 57 redefined areas, the 15 original areas which are unrefined, and the 13 newly identified areas.

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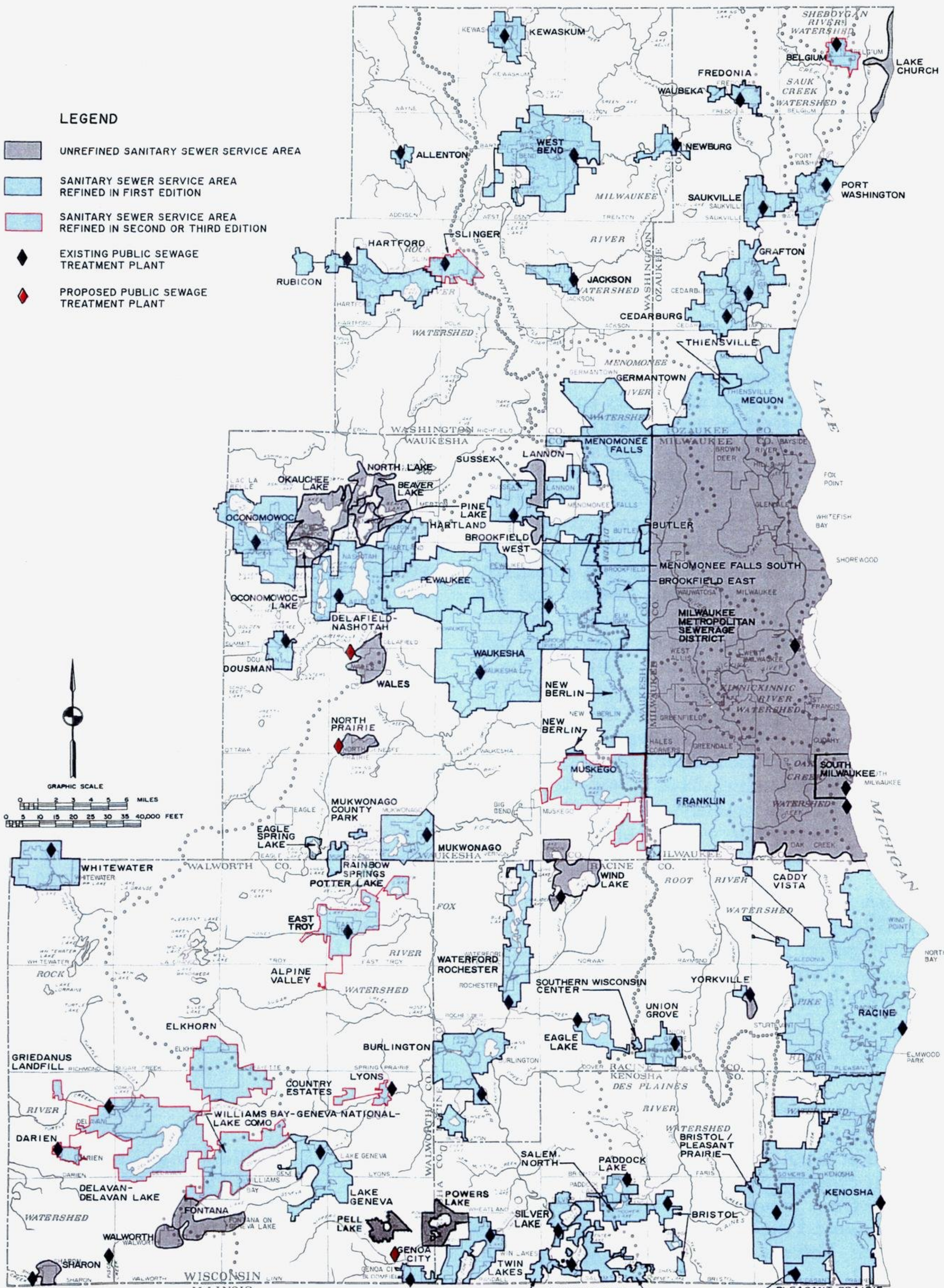
[9]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1980.

Map XVIII-7

## RECOMMENDED SANITARY SEWER SERVICE AREAS IN THE REGION: 2010




Source: SEWRPC.

Table XVIII-3

PLANNED SANITARY SEWER SERVICE AREAS IN THE REGION

| County | Name of Sanitary Sewer Service Area(s) | Area of Planned Sewer Service Area (square miles) | Sewer Service Area Population[a] | | |
|---|---|---|---|---|---|
| | | | | Planned Year 2010 | |
| | | | Existing[b] | Intermediate Growth Centralized Plan | High Growth Decentralized Plan |
| Kenosha | Bristol[c] | 2.3 | 1,200 | 2,500 | 2,700 |
| | Bristol/Pleasant Prairie | 6.7 | 1,600 | 5,500 | 6,500 |
| | Salem South[d]<br>Salem North[e] | 10.7 | 4,700 | 9,300 | 10,200 |
| | Kenosha | 53.2 | 85,800 | 100,900 | 118,400 |
| | Paddock Lake | 2.1 | 2,250 | 4,000 | 4,300 |
| | Pleasant Prairie South | 3.4 | 300 | 2,200 | 3,100 |
| | Powers Lake | 2.7 | 1,430 | --[f] | 1,750 |
| | Silver Lake | 1.9 | 1,600 | 2,900 | 3,200 |
| | Twin Lakes | 7.8 | 4,000 | 7,000 | 7,400 |
| Milwaukee | Franklin | 26.7 | 17,600 | 27,900 | 32,100 |
| | Oak Creek | 28.4 | 19,400 | 33,700 | 51,800 |
| | Milwaukee Metropolitan Sewerage District | 174.6 | 897,000 | 851,000 | 844,000 |
| | South Milwaukee | 4.8 | 20,500 | 19,840 | 20,280 |
| Ozaukee | Belgium | 2.1 | 950 | 1,000 | 2,700 |
| | Lake Church | 1.1 | --[g] | 500 | 1,200 |
| | Cedarburg | 7.4 | 9,600 | 12,400 | 27,800 |
| | Grafton | 6.9 | 9,400 | 11,500 | 24,100 |
| | Fredonia | 1.6 | 1,600 | 1,800 | 4,900 |
| | Waubeka | 0.7 | 300 | 500 | 1,600 |
| | Mequon<br>Thiensville | 28.2 | 16,600 | 24,500 | 50,500 |
| | Port Washington | 5.7 | 8,900 | 9,900 | 19,000 |
| | Saukville | 4.3 | 3,500 | 4,300 | 8,600 |
| Racine | Bohner Lake | 1.5 | --[g] | --[f] | 1,700 |
| | Burlington[h] | 10.3 | 10,550 | 13,500 | 17,100 |
| | Eagle Lake | 2.2 | 1,100 | 1,200 | 1,800 |
| | Racine | 60.4 | 122,100 | 133,400 | 167,800 |
| | Caddy Vista | 0.8 | 900 | 900 | 1,000 |
| | Union Grove<br>Southern Wisconsin Center | 3.9 | 3,800 | 5,900 | 8,100 |
| | Waterford/Rochester[i] | 9.3 | 3,400 | 8,700 | 10,600 |
| | Wind Lake | 5.3 | 3,200 | 4,800 | 5,300 |
| | Yorkville | 1.1 | 100 | 100 | 200 |
| Walworth | Alpine Valley | 0.1 | -- | -- | -- |
| | Darien | 1.2 | 1,100 | 1,500 | 2,500 |

Table XVIII-3 (continued)

| County | Name of Sanitary Sewer Service Area(s) | Area of Planned Sewer Service Area (square miles) | Sewer Service Area Population[a] | | |
|---|---|---|---|---|---|
| | | | | Planned Year 2010 | |
| | | | Existing[b] | Intermediate Growth Centralized Plan | High Growth Decentralized Plan |
| Walworth (continued) | Delavan-Delavan Lake<br>Elkhorn<br>Williams Bay-Geneva National-Lake Como | 42.6 | 8,500<br>5,200<br>1,800[j] | 11,800<br>7,600<br>3,300 | 21,900<br>14,400<br>7,600 |
| | East Troy<br>Potter Lake<br>Army Lake | 8.1 | 3,700 | 5,500 | 9,200 |
| | Fontana | 4.5 | 1,700 | 2,300 | 3,600 |
| | Genoa City | 1.6 | 1,200 | 1,800 | 3,000 |
| | Lake Geneva | 8.3 | 5,600 | 9,200 | 16,800 |
| | Lyons<br>Country Estates Sanitary District | 1.5 | 600 | 1,500 | 2,400 |
| | Pell Lake | 2.2 | 2,000 | --[f] | 2,800 |
| | Sharon | 1.2 | 1,300 | 1,800 | 2,900 |
| | Walworth | 1.8 | 1,700 | 2,300 | 3,800 |
| | Whitewater | 8.3 | 11,500 | 10,600 | 19,200 |
| Washington | Allenton | 0.8 | 900 | 1,200 | 2,400 |
| | Germantown | 8.0 | 7,480 | 18,270 | 35,280 |
| | Hartford[k] | 10.5 | 7,700 | 12,400 | 24,000 |
| | Jackson | 2.7 | 1,800 | 3,500 | 7,800 |
| | Kewaskum | 3.8 | 2,400 | 2,900 | 7,100 |
| | Newburg | 2.2 | 900 | 1,100 | 2,000 |
| | Slinger | 3.6 | 1,600 | 2,700 | 4,400 |
| | West Bend[l] | 21.2 | 22,900 | 32,500 | 53,800 |
| Waukesha | Beaver Lake | 2.5 | --[g] | --[f] | 2,100 |
| | Brookfield East | 15.4 | 16,100 | 16,600 | 19,400 |
| | Brookfield West | 20.6 | 18,800 | 27,400 | 33,500 |
| | Butler | 0.8 | 2,000 | 1,900 | 2,000 |
| | Delafield-Nashotah[m] | 13.8 | 3,700 | 8,000 | 14,400 |
| | Denoon Lake | 1.4 | 800 | 1,100 | 1,500 |
| | Dousman | 2.4 | 1,800 | 3,100 | 5,600 |
| | Eagle Spring Lake | 0.9 | --[g] | --[f] | 1,200 |
| | Hartland | 5.3 | 6,500 | 10,200 | 14,100 |
| | Menomonee Falls<br>Lannon | 24.7 | 29,100 | 35,800 | 51,600 |
| | Mukwonago | 7.8 | 4,300 | 7,500 | 18,000 |
| | Mukwonago County Park | 0.3 | -- | -- | -- |
| | Muskego | 15.7 | 12,800 | 17,400 | 26,900 |
| | New Berlin | 19.2 | 23,400 | 36,500 | 59,100 |
| | North Lake | 1.2 | --[g] | 700 | 1,400 |
| | North Prairie | 1.9 | 1,100 | --[f] | 3,640 |
| | Oconomowoc[n] | 16.7 | 10,600 | 17,300 | 28,300 |

Table XVIII-3 (continued)

| County | Name of Sanitary Sewer Service Area(s) | Area of Planned Sewer Service Area (square miles) | Sewer Service Area Population[a] | | |
|---|---|---|---|---|---|
| | | | | Planned Year 2010 | |
| | | | Existing[b] | Intermediate Growth Centralized Plan | High Growth Decentralized Plan |
| Waukesha (continued) | Oconomowoc Lake | 1.5 | --[g] | 500 | 900 |
| | Okauchee Lake | 4.8 | -- | 5,100 | 8,700 |
| | Pewaukee[o] | 26.5 | 10,300 | 23,300 | 41,100 |
| | Pine Lake | 1.2 | --[g] | --[f] | 600 |
| | Rainbow Springs | 1.4 | -- | -- | -- |
| | Sussex | 7.4 | 4,000 | 16,800 | 29,500 |
| | Wales | 2.8 | 2,200 | 3,600 | 7,900 |
| | Waukesha | 30.6 | 53,500 | 74,300 | 105,900 |
| | Total | 840.6 | 1,545,960 | 1,742,510 | 2,183,950 |

[a] The population levels for each sewer service area under the planned year 2010 growth scenarios include sewered population within the sewer service area in 1985, unsewered population within the sewer service area in 1985 which is envisioned to be provided with public sanitary sewer service by the year 2010, and incremental new population which is envisioned to occur wiathin the sewer service area between 1985 and 2010. Sewer service area populations indicate yuear-round, residential population. It should be noted that seasonal population may contribute to larger overall populations for some of the sewer service areas associated with the lake-oriented communities in the Region.

[b] 1985 population.

[c] Includes George Lake.

[d] Includes Camp Lake, Center Lake, Cross Lake, Rock Lake, and Wilmot.

[e] Includes Hooker Lake and Montgomery Lake.

[f] Planned year 2010 population levels assuming the provision of public sanitary sewer service were only developed under the high growth plan.

[g] Area currently not served by public sewer and having a significant seasonal population to be considered in addition to its resident population.

[h] Includes Browns Lake.

[i] Includes Tichigan Lake.

[j] Includes only Williams Bay.

[k] Includes Pike Lake.

[l] Includes Silver Lake.

[m] Includes Nashotah and Nemahbin Lakes.

[n] Includes Village of Lac La Belle and Silver Lake.

[o] Includes Pewaukee Lake, Town of Pewaukee, and Village of Pewaukee.

Source: SEWRPC.

In 1990, centralized sanitary sewer service in the Region was provided to a combined area of about 414 square miles, or 15 percent of the total area of the Region, and within this combined service area to approximately 1,560,000 persons, or about 86 percent of the total resident population of the Region. The planned year 2010 sewer service areas have a combined area of about 841 square miles, or about 31 percent of the total area of the Region. The designated sewer service areas represent general delineations designed to accommodate urban growth within the Region until the year 2010. The precise placement of future urban development in both time and space within the framework provided by sewer service areas delineated in the water quality management plan is properly the responsibility of local public officials. Accordingly, a certain amount of flexibility is intentionally provided within the boundaries of the designated sewer service areas to facilitate local planning and plan implementation. This flexibility derives from the need to provide for local preferences concerning such matters as population density, as well as to permit latitude in the placement within both time and space of envisioned urban development and redevelopment. Thus, the designated service areas are intended to accommodate, through local refinement, a broad range of housing types and styles, population densities, and commercial and industrial land use intensities, as well as, to the extent possible, the dictates of the urban land market, while meeting the agreed-upon areawide land use development and water quality management objectives.

The preparation of local sanitary sewer service area plans and sewerage facilities plans is intended to provide the means to adjust the recommended sewer service areas to meet local needs and objectives within the framework of the regional plans. It is recommended that the sewer service areas designated herein be utilized, along with subsequent additional duly prepared and adopted local refinements thereof, as the basis for the extension of public sanitary sewer service within the Region. Changes in those boundaries and the creation of new sewer service areas should be accommodated in the continuing planning process as it involves areawide systems planning and local facilities planning.

While the regional water quality management plan recommends the provision of centralized sanitary sewer service to much of the urban land use pattern identified in the newly adopted regional land use plan, some urban areas identified on that plan are not included within the recommended year 2010 sewer service areas. In most cases, these areas are relatively small, consisting of isolated enclaves of residential and commercial land uses located either along the shorelines of inland lakes or at rural highway intersections. Such areas were not included in a recommended sewer service area for a number of reasons, including the small size and isolated nature of some of this development; the presence of a significant number of seasonal homes; location in or adjacent to the Kettle Moraine State Forest and other environmentally sensitive areas where additional urban development should not be encouraged; or location on soils generally suited for the use of onsite soil absorption sewage disposal systems. It is recommended that detailed local studies be conducted of all such isolated enclaves of urban development as a step toward improved management of onsite sewage disposal facilities. Such detailed local studies may uncover serious existing or potential public health hazards, or ground and surface water pollution problems, and could result in recommendations for the provision of additional public centralized sanitary sewer service within the Region.

Public Sewage Treatment Facilities

The regional water quality management plan, as amended, envisions the maintenance and improvement of 48 existing public sewage treatment plants; the abandonment of 21 public sewage treatment facilities; and the construction of nine new public sewage treatment facilities within the Region. As of 1993, nine of the 21 public sewage treatment plants recommended for abandonment had been abandoned and their service areas connected to other sewerage systems for treatment purposes. In addition, facility planning for the abandonment of the Village of Darien sewage treatment plant was completed in 1994. Of the nine new public sewage treatment plants recommended, six had been constructed by 1993. The three plants proposed to serve the Village of North Prairie, the Village of Wales, and the Pell Lake and Powers-Benedict-Tombeau Lakes area had not yet been constructed.

Under the updated plan, sewage treatment would be provided at the 49 public facilities listed in Table XVIII-4 and shown on Map XVIII-8. These 49 plants include a new sewage treatment plant to be constructed in Walworth County to serve the Pell Lake sewer service area and the Powers-Benedict-Tombeau Lakes sewer service area. Two additional plants to serve the Villages of Wales and North Prairie are recommended to be constructed. However, the recommendations concerning these two plants may be affected by a comprehensive study of the best means for providing sewer service in Northwestern Waukesha County initiated by the Commission in cooperation with the County and local units of government concerned in 1995. Alternatives to be considered in that study include the connection of the Wales and North Prairie areas to an existing public sewerage system for treatment purposes, and continued reliance on onsite sewage disposal systems, as well as the construction of new sewage treatment facilities.

For each of the treatment plants recommended in the areawide water quality management plan, it is recommended that the levels of treatment set forth in the initial plan continue to be used, with final limits to be determined by site specific analyses and studies to be conducted during detailed sewerage system facility planning and as the issuance of new permits for the plants are considered under the Wisconsin Pollutant Discharge Elimination System. The findings of such studies would properly serve to refine the regional water quality management plan. Such studies should consider the water use objectives for the recovery stream; the existing water quality condition of the receiving stream; the potential water quality improvement associated with abatement of nonpoint source pollution; the presence of in-place pollutants; the slope, configuration, and biological characteristics of the receiving stream channel; the specific chemical composition of the wastewaters and receiving waters; and other localized factors which are typically beyond the scope of systems level planning.

Three plants--the Village of Pleasant Prairie Sanitary District No. 73-1, the Village of Pleasant Prairie Sewer Utility District "D", and the Town of Yorkville Sewer Utility District No. 1 treatment plants--have been proposed for abandonment in subregional system plans which have been prepared by the Commission in cooperation with the County and local units of government concerned for the

Table XVIII-4

RECOMMENDED PUBLIC SEWAGE TREATMENT PLANTS--REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

| Sewage Treatment Plant (by watershed) | Sewer Service Areas | Planned Sewer Service Area (square miles) | Existing 1990 | | | Planned Year 2010 | | | | Receiving Water to Which Effluent is Disposed |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Intermediate Growth | | High Growth | | |
| | | | Existing Design Capacity-Average Annual Hydraulic (mgd) | Population Served | Average Annual Hydraulic Loading (mgd) | Centralized Land Use Plan | Average Annual Hydraulic Loading (mgd) | Decentalized Land Use Plan | Average Annual Hydraulic Loading (mgd) | |
| Des Plaines River watershed | | | | | | | | | | |
| Town of Bristol Utility District No. 1 | Bristol | 2.3 | 0.48 | 1,200 | 0.34 | 2,500 | 0.49 | 2,700 | 0.52 | Bristol Creek tributary of Des Plaines River |
| Village of Paddock Lake | Paddock Lake | 2.1 | 0.49 | 2,300 | 0.47 | 4,000 | 0.63 | 4,300 | 0.67 | Brighton Creek |
| Village of Pleasant Prairie Sanitary District No. 73-1[a] | Pleasant Prairie South | 3.4 | 0.40 | 600 | 0.21 | 2,200 | 0.41 | 3,100 | 0.52 | Tributary of Des Plaines River |
| Village of Pleasant Prairie Sewer Utility District "D"[a] | Bristol/Pleasant Prairie | 6.7 | 0.50 | 1,700 | 0.50 | 5,500 | 0.98 | 6,500 | 1.10 | Tributary of Des Plaines River |
| Fox River Watershed | | | | | | | | | | |
| City of Brookfield | Brookfield West, Pewaukee, Menomonee Falls | 47.7 | 10.0 | 33,800 | 6.74 | 52,100 | 12.50[b] | 78,000 | 15.50 | Fox River |
| City of Burlington | Burlington, Bohner Lake | 11.8 | 3.5[c] | 10,400 | 2.15 | 13,500 | 2.54 | 18,800 | 3.20 | Fox River |
| Eagle Lake Sewer Utility District | Eagle Lake | 2.2 | 0.4 | 1,200 | 0.19 | 1,200 | 0.19 | 1,800 | 0.27 | Eagle Creek |
| Village of East Troy | East Troy, Potter Lake, Army Lake, Alpine Valley | 8.2 | 0.7 | 3,600 | 0.27 | 5,500 | 0.51 | 9,200 | 0.97 | Honey Creek |
| City of Lake Geneva | Lake Geneva | 8.3 | 1.74 | 6,400 | 1.24 | 9,200 | 1.59 | 16,800 | 2.54 | White River |
| Village of Genoa City | Genoa City | 1.6 | 0.22 | 1,200 | 0.10 | 1,800 | 0.18 | 3,000 | 3.2 | Nippersink Creek |
| Town of Lyons Sanitary District No. 2 | Lyons, Country Estates | 1.5 | 0.1 | 1,000 | 0.08 | 1,500 | 0.14 | 2,400 | 0.26 | White River |
| Village of Mukwonago | Mukwonago, Eagle Spring Lake, Mukwonago County Park, Rainbow Springs | 10.4 | 1.5 | 4,400 | 0.51 | 7,500 | 1.0 | 19,200 | 2.46 | Fox River |
| Town of Norway Sanitary District No. 1 | Wind Lake, Denoon Lake | 6.7 | 0.75 | 4,900 | 0.67 | 5,900 | 0.80 | 6,800 | 0.91 | Wind Lake Drainage Canal |
| Town of Salem Sewer Utility District No. 2 | Salem South, Salem North | 10.7 | 1.57 | 4,900 | 0.78 | 9,300 | 1.33 | 10,200 | 1.44 | Fox River |

Table XVIII-4 (cont'd)

| Sewage Treatment Plant (by watershed) | Sewer Service Areas | Planned Sewer Service Area (square miles) | Existing 1990 | | | Planned Year 2010 | | | | Receiving Water to Which Effluent is Disposed |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Intermediate Growth | | High Growth | | |
| | | | Existing Design Capacity-Average Annual Hydraulic (mgd) | Population Served | Average Annual Hydraulic Loading (mgd) | Centralized Land Use Plan | Average Annual Hydraulic Loading (mgd) | Decentalized Land Use Plan | Average Annual Hydraulic Loading (mgd) | |
| Fox River Watershed (continued) | | | | | | | | | | |
| Village of Silver Lake | Silver Lake | 1.9 | 0.36 | 1,800 | 0.22 | 2,900 | 0.36 | 3,200 | 0.40 | Fox River |
| Village of Sussex | Sussex, Lannon, Menomonee Falls | 13.7 | 3.2[d] | 4,400 | 0.98 | 19,800 | 2.91 | 33,100 | 4.57 | Sussex Creek |
| Village of Twin Lakes | Twin Lakes | 7.8 | 0.5 | 4,000 | 0.37 | 7,000 | 0.70 | 7,400 | 0.80 | Bassett Creek |
| City of Waukesha | Waukesha | 30.6 | 14.0[e] | 57,000 | 8.74 | 74,300 | 14.0 | 105,900 | 15.0 | Fox River |
| Western Racine County Sewerage District | Waterford, Rochester | 9.3 | 1.0 | 6,400 | 0.71 | 8,700 | 1.0 | 10,600 | 1.24 | Fox River |
| Proposed plant-Village of North Prairie[f] | North Prairie | 1.9 | -- | -- | -- | --[g] | -- | 3,600 | 0.45 | Groundwater system |
| Proposed plant-Powers Lake | Pell Lake, Powers Lake | 4.9 | -- | -- | -- | --[g] | -- | 7,000 | 0.87 | North Branch Nippersink Creek |
| Milwaukee River watershed | | | | | | | | | | |
| City of Cedarburg | Cedarburg | 7.4 | 2.75 | 10,100 | 1.58 | 12,400 | 1.87 | 27,800 | 3.80 | Cedar Creek |
| Village of Fredonia | Fredonia, Waubeka | 2.3 | 0.60 | 1,600 | 0.18 | 2,300 | 0.24 | 6,500 | 0.71 | Milwaukee River |
| Village of Grafton | Grafton | 6.9 | 2.2 | 9,300 | 1.35 | 11,500 | 1.60 | 24,100 | 3.16 | Milwaukee River |
| Village of Jackson | Jackson | 2.7 | 0.87 | 2,500 | 0.47 | 3,500 | 0.59 | 7,800 | 1.13 | Cedar Creek |
| Village of Kewaskum | Kewaskum | 3.8 | 0.50 | 2,500 | 0.36 | 2,900 | 0.42 | 7,100 | 0.94 | Milwaukee River |
| Village of Newburg | Newburg | 2.2 | 0.08 | 1,000 | 0.07 | 1,100 | 0.08 | 2,000 | 0.09 | Milwaukee River |
| Village of Saukville | Saukville | 4.3 | 1.0 | 3,700 | 0.56 | 4,300 | 0.63 | 8,600 | 1.17 | Milwaukee River |
| City of West Bend | West Bend | 21.2 | 9.0 | 23,900 | 3.45 | 32,500 | 4.53 | 53,800 | 7.18 | Milwaukee River |

Table XVIII-4 (cont'd)

| Sewage Treatment Plant (by watershed) | Sewer Service Areas | Planned Sewer Service Area (square miles) | Existing 1990: Existing Design Capacity-Average Annual Hydraulic (mgd) | Existing 1990: Population Served | Existing 1990: Average Annual Hydraulic Loading (mgd) | Planned Year 2010, Intermediate Growth: Centralized Land Use Plan | Planned Year 2010, Intermediate Growth: Average Annual Hydraulic Loading (mgd) | Planned Year 2010, High Growth: Decentalized Land Use Plan | Planned Year 2010, High Growth: Average Annual Hydraulic Loading (mgd) | Receiving Water to Which Effluent is Disposed |
|---|---|---|---|---|---|---|---|---|---|---|
| Watershed of Minor Streams and Direct Drainage Area Tributary to Lake Michigan | | | | | | | | | | |
| City of Kenosha | Kenosha | 53.2 | 28.6[h] | 88,000 | 23.0 | 100,900 | 25.0 | 118,400 | 27.3 | Lake Michigan |
| Milwaukee Metropolitan Sewerage District-Jones Island Plant | Milwaukee Metropolitan Sewerage District, Mequon, Thiensville, Germantown, Butler, Brookfield-East, New Berlin, Muskego, Caddy Vista, Franklin, Oak Creek, Menomonee Falls | 335.6 | 200.0 | 1,036,000 | 123.2 | 1,060,000 | 125.0 | 1,134,000 | 128.0 | Lake Michigan via Milwaukee Outer Harbor |
| Milwaukee Metropolitan Sewerage District-South Shore Plant | | | 120.0 | | 100.0 | | 105.0 | | 110.0 | Lake Michigan |
| City of Port Washington | Port Washington | 5.7 | 3.1 | 9,300 | 1.4 | 9,900 | 1.5 | 19,000 | 2.6 | Lake Michigan |
| City of Racine | Racine | 60.4 | 30.0 | 124,400 | 28.8 | 133,400 | 30.0 | 167,800 | 34.2 | Lake Michigan |
| City of South Milwaukee | South Milwaukee | 4.8 | 6.0 | 21,000 | 3.5 | 19,800 | 3.3 | 20,300 | 3.4 | Lake Michigan |
| Rock River watershed | | | | | | | | | | |
| Allenton Sanitary District No. 1 | Allenton | 0.8 | 0.36 | 800 | 0.15 | 1,200 | 0.20 | 2,400 | 0.36 | Rock River - East Branch |
| Delafield-Hartland Water Pollution Control Commission | Delafield, Nashotah, Hartland | 19.1 | 2.20 | 10,200 | 1.39 | 18,200 | 2.40 | 28,500 | 3.70 | Bark River |
| Village of Dousman | Dousman | 2.4 | 0.35 | 1,300 | 0.22 | 3,100 | 0.44 | 5,600 | 0.76 | Bark River |
| Fontana-Walworth Water Pollution Control Commission | Fontana, Walworth | 6.3 | 1.71 | 3,500 | 1.02 | 4,600 | 1.16 | 7,400 | 1.51 | Tributary of Piscasaw Creek |
| City of Hartford | Hartford | 10.5 | 2.0 | 8,200 | 1.46 | 12,400 | 2.00 | 24,000 | 3.44 | Rubicon River |
| City of Oconomowoc | Oconomowoc | 27.9[i] | 4.0 | 11,500 | 2.33 | 23,600[i] | 3.84[i] | 42,000[i] | 6.14[i] | Oconomowoc River |
| Village of Sharon | Sharon | 1.2 | 0.26 | 1,300 | 0.16 | 1,800 | 0.23 | 2,900 | 0.37 | Little Turtle Creek |
| Village of Slinger | Slinger | 3.6 | 0.76 | 2,300 | 0.33 | 2,700 | 0.38 | 4,400 | 0.60 | Rubicon River |
| Walworth County Metropolitan Sewerage District | Delavan, Delavan Lake, Elkhorn, Lake Como, Geneva National, Williams Bay, Darien | 43.8 | 5.6[j] | 19,100 | 2.92 | 24,200 | 3.53 | 46,400 | 6.33 | Turtle Creek |
| City of Whitewater | Whitewater | 8.3 | 3.65 | 12,600 | 1.43 | 13,100 | 1.50 | 21,600 | 2.56 | Whitewater Creek |
| Proposed plant-Village of Wales[f] | Wales | 1.5 | -- | -- | -- | 3,600 | 0.45 | 7,900 | 1.0 | Groundwater system[f] |

Table XVIII-4 (cont'd)

| | | | Existing 1990 | | | Planned Year 2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Intermediate Growth | | High Growth | | |
| Sewage Treatment Plant (by watershed) | Sewer Service Areas | Planned Sewer Service Area (square miles) | Existing Design Capacity-Average Annual Hydraulic (mgd) | Population Served | Average Annual Hydraulic Loading (mgd) | Centralized Land Use Plan | Average Annual Hydraulic Loading (mgd) | Decentalized Land Use Plan | Average Annual Hydraulic Loading (mgd) | Receiving Water to Which Effluent is Disposed |
| Root River watershed | | | | | | | | | | |
| Village of Union Grove | Union Grove | 3.9 | 0.88 | 3,700 | 0.67 | 5,900 | 0.94 | 8,100 | 1.22 | West Branch of Root River Canal |
| Town of Yorkville Sewer Utility District No. 1[k] | Yorkville | 1.1 | 0.15 | 100 | 0.05 | 100 | 0.33 | 200 | 0.67 | Hoods Creek |
| Sheboygan River watershed | | | | | | | | | | |
| Village of Belgium[l] | Belgium | 3.2 | 0.19 | 900 | 0.13 | 1,500[l] | 0.21[l] | 3,900[l] | 0.51[l] | Belgium Creek |

[a] Recommendations contained in a subregional system plan documented in the report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991, provide for the abandonment of these plants. As of January 1995, the findings of this subregional study have not been incorporated into the regional plan by amendment.

[b] Based upon design year 2014 capacity proposed in a May 1993 facility plan.

[c] Based upon new plant which was placed into service in 1992.

[d] Based upon plant expansion ongoing in 1994.

[e] Based upon plant expansion ongoing in 1994. A design flow of 18.5 mgd also developed based upon average wet weather period.

[f] Alternative of constructing a new plant and the alternatives of connection to an existing sewerage system and continued use of onsite sewage disposal systems are recommended to be evaluated in further subregional system planning.

[g] Planned year 2010 population levels assuming the provision of public sanitary sewer service only developed under the high-growth plan.

[h] Based upon a 1994 plant expansion.

[i] Includes Beaver Lake, North Lake, Oconomowoc Lake, Okauchee Lake, and Pine Lake sewer service areas.

[j] Based upon a plant expansion ongoing in 1994.

[k] Recommendations contained in a subregional system plan documented in the report prepared by Alvord, Burdick & Howson and Applied Technologies, Inc., entitled, A Coordinated Sanitary Sewerage and Water Supply System Plan, Greater Racine Area, September 1992, provide for abandonment of this plant. As of January 1995, the findings of this subregional study have not yet been incorporated into the regional plan by amendment.

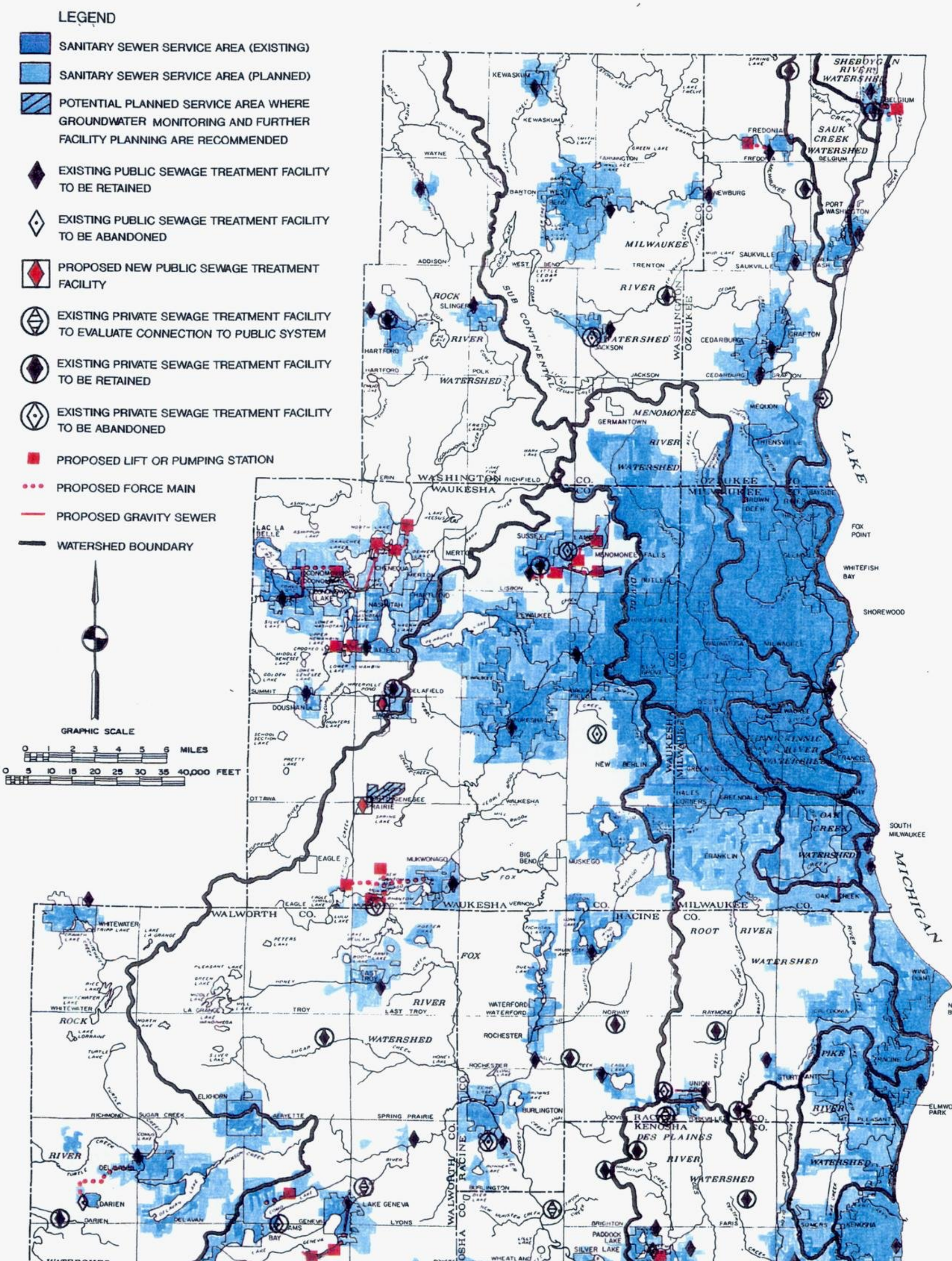
[l] Includes Lake Church sewer service area.

Source: SEWRPC.

Map XVIII-8

UPDATED REGIONAL WATER QUALITY MANAGEMENT

POINT SOURCE PLAN FOR SOUTHEASTERN WISCONSIN: 2010




Source: SEWRPC.

greater Kenosha and greater Racine urban areas.[10] Inclusion of these plan recommendations by amendment to the updated areawide water quality management plan is pending intergovernmental agreement on the recommendations of these subregional system plans.

It is noted that there remains in service one relatively small public sewage treatment plant--the City of South Milwaukee plant--which is located immediately adjacent to and surrounded by the Milwaukee Metropolitan Sewerage District service area. It is recommended that facility planning reexamine the cost effectiveness of retaining this plant, or of abandoning the plant and connecting its tributary source area to the Milwaukee metropolitan system, at such time as upgrading or replacement needs require significant capital investment in the plant. The resultant sewerage facilities plan update would then, upon its adoption by all of the agencies concerned, form the basis of any needed amendment to the regional water quality management plan herein presented.

Private Sewage Treatment Plants

The regional water quality management plan, as amended, recommended the maintenance of 25 existing private sewage treatment plants; the abandonment of 43 private sewage treatment facilities; and the construction of one new private sewage treatment facility. These private sewage treatment plants serve isolated enclaves of urban land uses within the Region, including public and private recreational facilities, institutional facilities, commercial service facilities, isolated residential areas such as mobile home parks, and industries. As of 1993, 35 of the 43 private sewage treatment plants recommended to be abandoned were abandoned and the new facility proposed to serve the Bong Recreation Area facilities had been constructed. In addition, there were seven private sewage treatment plants which were no longer in operation due to industries or institutions ceasing operation, or were reclassified as industrial process treatment facilities. In 1993 there were a total of 27 private sewage treatment facilities within the Region. Under the amended plan, eight of the 27 existing private sewage treatment facilities would be abandoned and the land uses served connected to public sanitary sewerage systems as set forth in Table XVIII-5 and shown on Map XVIII-8.

In addition, there were in 1993 four private sewage treatment plants which generate wastewater with the same characteristics as typically treated by public sewage treatment plants and which were located in relatively close proximity to an established public sanitary sewer service area, or are located within or in close proximity to an area where public sanitary sewer service may be expected to be provided in the future. These plants serve the Fonk Mobile Home Park No. 2 in the Town of Dover, Racine County; the Grand Geneva Resort and Spa in the Town of Lyons, Walworth County; the Rainbow Lake Manor Mobile Home Park in the

[10] Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, 1992, recommends abandonment of the two Village of Pleasant Prairie treatment plants, which service areas would subsequently be connected to the Kenosha Water Utility sewerage system for treatment purposes; Alvord, Burdick & Howson, A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area, 1992, recommends abandonment of the Town of Yorkville treatment plant, which service area would be connected to the Racine Water and Wastewater Utility sewerage system for treatment purposes.

Table XVIII-5

PRIVATE SEWAGE TREATMENT PLANTS RECOMMENDED TO BE ABANDONED UPON FULL IMPLEMENTATION OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

| Private Sewage Treatment Plant to be Abandoned (by watershed) | Type of Wastewater | Civil Division Location | Current Effluent Discharge | Public Sewage Treatment Facility to Provide Service Following Abandonment |
|---|---|---|---|---|
| Fox River watershed | | | | |
| Lake Geneva Interlaken Resort Village[a] | Sanitary | Town of Geneva | Soil Absorption | Walworth County Metropolitan Sewerage District |
| Willow Springs Mobile Home Park | Sanitary | Town of Lisbon | Soil Absorption | City of Brookfield |
| Rainbow Springs Resort | Sanitary | Town of Mukwonago | Tributary to Mukwonago River | Village of Mukwonago |
| New Berlin-West High School | Sanitary | City of New Berlin | Tributary to Poplar Creek | City of Brookfield |
| Packaging Corporation of America | Process and Sanitary | Town of Burlington | Tributary to Fox River | City of Burlington |
| Milwaukee River watershed | | | | |
| Seneca Food Company[b] | Process | Town of Jackson | Soil Absorption and Cedar Creek | Village of Jackson |
| Watershed of Minor Streams and Direct Drainage Area Tributary to Lake Michigan | | | | |
| Concordia University | Sanitary | City of Mequon | Lake Michigan | Milwaukee Metropolitan Sewerage District |
| Rock River watershed | | | | |
| National Farmers Organization-Slinger Transfer Station | Process | Town of Polk | Soil Absorption | Village of Slinger |
| Root River watershed | | | | |
| Southern Wisconsin Center for the Developmentally Disabled | Sanitary | Town of Dover | West Branch Root River Canal | Village of Union Grove |

[a] The Lake Geneva Interlaken Resort Village sewage treatment plant was abandoned in 1993 with the resort connected to the Walworth County Metropolitan Sewerage District.

[b] Seneca Food Company private plant is currently used as a supplementary facility to the Village of Jackson sewage treatment plant.

Source: SEWRPC.

Town of Bristol, and the Wheatland Mobile Home Park in the Town of Wheatland, both in Kenosha County. It is recommended that detailed facility planning be undertaken for these four plants at such time as upgrading or replacement needs require significant capital investment to determine the most cost-effective means of providing sewage treatment. Such facility planning would consider alternatives to maintaining the existing private plant, as well as abandonment with connection to a public sanitary sewerage system. These four plants and the 15 private sewage treatment facilities proposed to be retained under the updated areawide water quality management plan are listed in Table XVIII-6.

It is further recommended that the need for upgrading and the level of treatment required for the private treatment plants that are to remain in service be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process.

It is important to recognize that additional private sewage treatment facilities may be needed during the plan implementation period to serve new enclaves of isolated land use development. Generally such new facilities may be expected to lie beyond the planned year 2010 sewer service areas set forth on Map XVIII-8. Each proposal for a new private sewage treatment facility must accordingly be individually evaluated in light of the current areawide plan and the objectives which that plan is intended to achieve.

It must also be recognized in this respect, that certain types of urban land uses are properly and logically located in the more rural reaches of the Region and at times may require the provision of a sewage treatment facility, as opposed to septic tank systems. The types of urban land uses that must of necessity often be located in rural areas, where public centralized sanitary sewer service is not available, include highway-oriented commercial service facilities, such as motels, restaurants, and certain types of truck service stations and terminals; certain transportation facilities, such as airports; park and outdoor recreational facilities, both public and private; certain institutional facilities; and industrial facilities directly related to the agricultural land use base. It is not possible within the context of an areawide system planning effort to identify the need for, or to locate all such potential land uses in the rural areas. Accordingly, each proposal for such land uses must be evaluated as it arises. Those additional private sewage treatment facilities found to be essential to accommodate such isolated urban enclaves must provide a type and level of treatment that will achieve the recommended water use objectives. Such facilities should not, however, be used to accommodate new urban residential development or new urban commercial or industrial development that can more rationally and efficiently be accommodated within the recommended year 2010 sanitary sewer service areas--areas where substantial public capital investment has in many cases already been made to accommodate future development.

<u>Sewage Treatment Plant Sludge Management</u>

Specific sludge management measures are set forth in the detailed plans for each individual sewage treatment facility required to be prepared pursuant to the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process. The permitting process requires designated management agencies to develop and submit to the Wisconsin Department of Natural Resources a sludge management plan, which, upon approval by the Department, requires the designated management agency to maintain records of sludge application sites and quantities and to monitor such

Table XVIII-6

PRIVATE SEWAGE TREATMENT PLANTS RECOMMENDED TO BE RETAINED OR REQUIRING FURTHER EVALUATION UPON FULL IMPLEMENTATION OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

| Private Sewage Treatment Plant to be Retained (by watershed) | Type of Wastewater | Civil Division Location | Current Effluent Discharge |
|---|---|---|---|
| Des Plaines River watershed | | | |
| Brightondale County Park | Sanitary | Town of Brighton | Soil Absorption |
| Fonk's Mobile Home Park No. 2[a] | Sanitary | Town of Dover | Tributary to the Des Plaines River |
| Kenosha Beef International Company | Cooling, Process, and Sanitary | Town of Paris | Soil Absorption |
| Rainbow Lake Manor Mobile Home Park[a] | Sanitary | Town of Bristol | Soil Absorption |
| Fox River watershed | | | |
| Bong Recreational Area | Sanitary | Town of Brighton | Peterson Creek |
| Grand Geneva Resort and Spa[a] | Sanitary | Town of Lyons | White River |
| Downy Duck Company | Process | Town of Dover | Soil Absorption |
| East Troy Rest Area (IH 43) | Sanitary | Town of LaFayette | Tributary to Sugar Creek |
| Midwest Neurological Rehabilitation Center | Sanitary | Town of Dover | Tributary to Wind Lake Canal |
| Friday Canning Corporation-Mammoth Springs Division | Process | Town of Lisbon | Soil Absorption |
| Wheatland Estates Mobile Home Park[b] | Sanitary | Town of Wheatland | Minor Tributary to the Fox River |
| Milwaukee River watershed | | | |
| Level Valley Dairy | Process and Cooling | Town of Jackson | Cedar Creek |
| S&R Cheese Corporation | Process | Town of Saukville | Soil Absorption |
| Rock River watershed | | | |
| Ethan Allen School | Sanitary | Town of Delafield | Soil Absorption |
| Libby, McNeill, & Libby, Inc. (Walworth County) | Process | Town of Darien | Soil Absorption |
| Root River watershed | | | |
| C&D Foods Inc. | Process | Town of Yorkville | West Branch Root River Canal |
| Fonk's Mobile Home Park No. 1 | Sanitary | Town of Yorkville | East Branch Root River Canal |
| Sauk Creek watershed | | | |
| Cedar Valley Cheese Factory | Process and Cooling | Town of Fredonia | Soil Absorption |
| Sheboygan River watershed | | | |
| Lakeside Packing Co. | Process | Town of Belgium | Soil Absorption and East Branch Belgium Creek |

[a] Private sewage treatment plant to carry out facility planning to consider connection to a public sanitary sewer service area at such time as a major plant upgrading or modification is required.

[b] Private sewage treatment plant to be evaluated in the context of further subregional facility planning considering the best means of providing sanitary sewer service to the Town of Wheatland area.

Source: SEWRPC.

sites for adverse environmental, health, or social effects. At present, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the Region. It is recommended that this plant-specific permitting process be maintained and that the sewage treatment plant sludge management facilities for the facilities noted in Tables XVIII-4 and XVIII-6 be expanded and upgraded as needed under the established permitting process.

Abatement of Pollution from Sewer System Flow Relief Devices

In 1975, there were 493 sanitary sewerage system flow relief devices in the Region which discharged sanitary sewage from separate sanitary sewer systems to surface water bodies. The initial regional water quality management plan recommended that each unit or agency of government responsible for the construction, operation, and maintenance of separate sanitary sewerage systems within the Region conduct detailed studies of local sewerage systems to identify all points of sewage flow relief and to ultimately eliminate all flow relief points through sewerage facility construction and infiltration and inflow reduction programs.

During the period since 1975, infiltration and inflow sewer system evaluations have been carried out for most of the sanitary sewer systems in the Region and, in many cases, flow reduction programs have been undertaken. However, as of 1990, releases of raw sanitary sewage from sanitary sewer system flow relief devices continued to occur throughout the Region. While the sewerage system upgrading which has occurred since the preparation of the initial regional water quality management plan has reduced the occurrences and the extent of discharges of untreated wastewater from flow relief devices in the Region; as of 1993 there still remained in existence within the Region about 330 sanitary sewer flow relief devices. These included 36 bypasses, 42 relief pumping stations, 52 portable pumping stations, and 200 sanitary to storm sewer crossovers.

During 1994, the Milwaukee Metropolitan Sewerage District completed work on the construction of the inline storage system, a major component of its water pollution abatement program as documented in the District facility plan.[11] Given the conveyance capacity now available in the inline storage deep tunnel system, bypassing from other sanitary sewer flow relief devices may be expected to be further reduced as additional sewerage system improvement upgrading is accomplished by the Milwaukee Metropolitan Sewerage District and other local units of government operating sewer systems. Currently, there are plans underway to further reduce the number of flow relief devices on the Milwaukee Metropolitan area sanitary sewer system.[12]

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[11]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1980.

[12]During 1994, the City of Milwaukee developed preliminary plans to specifically eliminate 52 of the 106 crossovers in the City's sanitary sewer system. In most cases, the crossovers were connected to other locations in the Milwaukee sewer system where adequate capacity was available. These plans were being refined and reviewed with the Milwaukee Metropolitan Sewerage District staff at the end of 1994.

Substantial progress has been made with regard to the elimination of the discharge to surface water courses of raw sanitary sewage from sanitary sewage flow relief devices. It is nevertheless recommended that all future planning for sewerage system expansion and improvement be conducted on the assumption that there will be no planned bypasses of raw sewage and that all flow relief devices in the systems will ultimately be eliminated, with the exception of bypasses at pumping stations and sewage treatment plants required to protect the public health and the treatment facilities in cases of unforeseen equipment or power failure. In the interim, it is recommended that the designated management agencies set forth in Chapter XVII continue to monitor sewerage system operations to ensure that the uses of the existing sewerage system flow relief devices are limited to periods of power or equipment failure, or to cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design.

This recommendation is meant to preclude all bypassing which relies on the provisions of Section 110.05(2) of the Wisconsin Administrative Code relating to category 2 bypasses and overflows. These provisions presently permit bypassing and overflows resulting from a precipitation event having a recurrence interval of once in five years or less. The code presently presents such bypasses, as well as bypasses resulting from equipment damage and temporary power failure, and bypasses which are necessary to prevent the loss of life or severe property damage, without regard to the impact of extensions to the sewerage systems concerned.

In 1975, there were a total of 126 combined sewer overflow outfalls located within the Region. The initial plan recommended the eventual elimination of these combined sewer overflow outfalls through sewerage system construction and upgrading. Since the completion of the initial plan, those overflows which had existed in the Cities of Kenosha and Racine have since been eliminated through partial sewer separation programs. While overflows located in the Milwaukee metropolitan sewerage system continue to bypass raw sanitary sewage and storm water to surface waters during high flow events, the frequency of bypassing has been significantly reduced as a result of the completion of the inline storage deep tunnel system. Prior to the completion of the system, such bypassing occurred on an average of 52 times per year, discharging an estimated 3.0 to 4.0 billion gallons of mixed raw sewage and stormwater to surface waters. With the completion of the inline storage deep tunnel system, bypassing of raw sanitary sewage and storm water from the combined sewer overflows is expected to occur an average of about two times per year with the average duration of an overflow event being about 12 hours. The Milwaukee Harbor estuary study[13] documented that this level of reduction in combined sewer overflow discharges would be adequate to meet water quality standards in the estuary portion of the Milwaukee River, assuming other water quality improvement measures recommended were carried out.

Intercommunity Trunk Sewers

The regional water quality management plan, as amended, recommended the construction of 62 intercommunity trunk sewers in order to extend centralized sanitary sewer service throughout the proposed sewer service areas and to enable the

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[13]SEWRPC Planning Report No. 37, op. cit.

abandonment of selected public and private sewage treatment plants. As of 1993, 49 of these intercommunity trunk sewers have been constructed. One trunk sewer, the Darien-Delavan trunk sewer, which will provide for the abandonment of the Village of Darien sewage treatment plant, was added to the plan in a 1994 plan amendment. Two trunk sewers were added to the plan also in a 1994 amendment to connect the Powers-Benedict-Tombeau Lakes area to a new sewage treatment plant located between these two lake areas. One additional trunk sewer--the Oak Creek Southeast trunk sewer--was recommended in the originally adopted plan but was estimated to not be needed until after the planning period. This trunk sewer has been included in this plan update based upon demonstrated need.

Thus the current plan recommends the construction of 16 intercommunity trunk sewers and force mains. The general alignment of these trunk sewers are shown on Map XVIII-8 and the trunk sewers are listed in Table XVIII-7.

The trunk sewer recommendations summarized in Table XVIII-7 concern only those trunk sewers which are of an intercommunity nature. Also of importance to the attainment of the basic plan recommendation to provide centralized sanitary sewer service to the recommended future sewer service areas are local trunk sewer extensions, which generally involve only a single community and are not, therefore, of areawide significance. It should be understood that these locally proposed trunk sewers, while not shown on the recommended plan map, represent an important adjunct to the recommended regional water quality management plan and, as such, are required for full plan implementation.

### Other Point Source Discharges

In 1975, there were 277 known point sources of wastewater, other than public and private sewage treatment plants, discharging wastewater to groundwater or surface waters in the Region. The initial areawide water quality management plan recommended that these "other" point sources be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permitting process.

As of 1993, there were 662 known point sources of wastewater, other than public and private sewage treatment plants, discharging wastewater to the ground water or to surface waters in the Region. These "other" point sources of wastewater discharge consist primarily of industrial cooling, process, rinse, and wash waters which were discharged directly, sometimes following treatment, to the surface waters or groundwaters of the Region, or to storm sewers tributary to the surface or groundwater system. The locations of these point sources, including the level of treatment applied and the receiving water for discharge, are provided by watershed in Chapters IV through XV. It is recommended that wastewater discharge from these "other" sources continue to be controlled and regulated on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process.

### Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

In 1975 there were 106 enclaves of unsewered urban development located outside of the then planned year 2000 sewer service areas. Since 1975, 16 of these areas have been incorporated into the planned year 2010 sanitary sewer service areas and 72 new areas have been created beyond the planned sewer service areas.

Table XVIII-7

INTERCOMMUNITY TRUNK SEWERS RECOMMENDED TO BE CONSTRUCTED
UPON FULL IMPLEMENTATION OF THE RECOMMENDED
REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

| Intercommunity Trunk Sewer | Watershed Location |
|---|---|
| Salem[a] | Des Plaines River and Fox River watersheds |
| Lannon-Sussex | Fox River watershed |
| Eagle Spring-Mukwonago | Fox River watershed |
| Lake Geneva South | Fox River watershed |
| Como Lake North | Fox River watershed |
| Fontana-Linn | Fox River watershed |
| Pell Lake | Fox River watershed |
| Powers Lake | Fox River watershed |
| Northridge | Milwaukee River watershed |
| Waubeka-Fredonia | Milwaukee River watershed |
| Lake Church-Belgium | Watershed of Minor Streams and Direct Drainage Area Tributary to Lake Michigan |
| Oak Creek Southeast[b] | Oak Creek and Root River watersheds |
| Darien-Delavan | Rock River watershed |
| North Lake-Oconomowoc | Rock River watershed |
| Summit-Delafield | Rock River watershed |
| Center for the Developmentally Disabled-Union Grove | Root River watershed |

[a] Trunk sewer was completed in 1993.

[b] Trunk sewer included in initial plan as needed beyond the year 2000 and included in the plan update based upon demonstrated needs.

Source: SEWRPC.

As of 1990, there were 162 enclaves of unsewered urban development located outside of the planned year 2010 sewer service areas. The location of these service areas and the corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are provided in Chapters IV through XV. Four of these areas are served by private sewage treatment plants. Approximately one-half of the areas not served by private sewage treatment plants are covered by soils and have lot sizes which indicate a high probability of meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. The remaining areas have soils and lot sizes having a high probability of not meeting these criteria, and consideration should be given to alternative methods of wastewater disposal. Many of these latter areas are located adjacent to inland lakes where alternative forms of wastewater management should be investigated during the planning period. Generally, for all of the remaining enclaves located in areas where soils are not considered to meet current criteria for onsite sewage disposal systems, it is recommended that an inspection and maintenance program be instituted and that further site-specific planning to determine the best wastewater management practices be conducted at such times as significant problems are anticipated.

Miscellaneous Point Source-Related Recommendations

Miscellaneous point sources of pollution including landfills and underground storage tanks are discussed and located on maps in Chapters IV through XV by watershed. As of 1990, there were 28 landfills in the Region that may potentially be impacting surface or ground waters. Seven of these landfills were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean up of hazardous waste sites. Three of these landfills were identified for State clean-up actions. In addition, as of 1990, there were 14 leaking underground storage tanks and three other sites of groundwater contamination undergoing remediation in the Region which were discharging remediation wastewater to surface or ground waters under the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process. It is recommended that these miscellaneous point sources of wastewater, including operating and abandoned landfills, underground storage tanks, and other groundwater contamination sites continue to be monitored and appropriate remediation be carried out under the programs and regulations currently in place for that purpose.

## NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element includes recommendations relating to the control of diffuse sources of water pollution including urban sources--such as runoff from residential, commercial, industrial, transportation, and recreational land uses, construction activities, and private onsite sewage disposal systems--and from rural sources--such as runoff from cropland, pasture, and woodland, and livestock wastes and from streambank erosion sites. These nonpoint sources of pollutants discharge to surface waters by direct land drainage, by drainage through natural channels, by drainage through engineered storm water drainage systems, and by deep percolation into the ground and return flow to the surface waters. The water quality analyses developed in the initial plan demonstrated that a reduction in the transport of pollutants from nonpoint sources is essential, in combination with the point source pollutant abatement measures, to the achievement of the recommended water use objectives and supporting water quality standards set forth in this regional water quality management plan update.

For planning purposes, measures for nonpoint source water pollution control were grouped into categories. The first category was defined as basic practices, which were recommended to be generally applied throughout the Region and included construction site erosion control, onsite sewage disposal system management, and streambank erosion controls. The effectiveness of such practices in reducing nonpoint source pollutant loadings varied by subwatershed and by pollutant. For conventional pollutants, these practices generally are expected to provide for a 5 to 30 percent reduction in nonpoint source pollutant loadings. Additional practices were then considered in incremental steps which would provide 25 and 50 percent reductions in nonpoint source pollutants from urban lands and 25, 50, and 75 percent reductions in nonpoint source pollutants from rural lands. The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

In the initial plan, water quality simulation modeling was conducted to determine the level of nonpoint source pollution control needed to meet the water quality standards associated with recommended water use objectives for each subwatershed area considered. The resulting recommendations of that analysis are shown on Map XVIII-9. For nearly all of the Southeastern Wisconsin Region, land management practices designed to achieve about a 25 percent reduction in nonpoint source pollutants, in addition to construction site erosion control, onsite sewage disposal system management, and streambank erosion controls were recommended to be implemented throughout the entire urban and rural areas. For these areas, the level of control expected to be achieved when considering the effectiveness of the basic practices, plus the land management practices designed to achieve the 25 percent reduction, varied, depending upon the specific subwatershed considered, ranging for specific subwatersheds from a 30 to 55 percent reduction overall.

The one exception to this recommendation was that no specific additional nonpoint source controls were recommended for the 21-square-mile area tributary to the Milwaukee Metropolitan Sewerage District inline storage deep tunnel system where stormwater runoff from storms with up to a recurrence interval of about one or two times per year is to be conveyed to the tunnel system and be stored and then treated at the District treatment plants, thus providing a high level of nonpoint source pollution control. In the area tributary to the combined sewer system, the discharge of stormwater to the surface water system will be reduced from an average of 50 times per year to 1.4 times per year. Accordingly, a level of control of nonpoint source pollutants exceeding 90 percent is expected. This is particularly important in that the area served by the combined sewer system represents the most highly urbanized area of the Region. This area contains concentrations of industrial, commercial, institutional, and transportation land uses which are expected to generate high nonpoint source loadings and where controls of nonpoint source pollutants using land management practices would be difficult and costly. The control of nonpoint sources in the combined sewer service area as provided by the inline storage deep tunnel system exceeds that which could practically be provided by any other practicable means.

Additional urban nonpoint source controls designed to provide about a 50 percent reduction in pollutant runoff were also recommended to be applied to a total of

## Map XVIII-9

## RECOMMENDED NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT IN THE REGION: 2010

### LEGEND

**APPLICATION OF URBAN LAND MANAGEMENT PRACTICES**

- MINIMUM-ABOUT 25 PERCENT REDUCTION IN POLLUTANT RUNOFF
- MINIMUM PLUS ADDITIONAL-ABOUT 50 PERCENT REDUCTION IN POLLUTANT RUNOFF

**APPLICATION OF RURAL LAND MANAGEMENT PRACITICES**

- MINIMUM-ABOUT 25 PERCENT REDUCTION IN POLLUTANT RUNOFF
- MINIMUM PLUS ADDITIONAL-ABOUT 50 PERCENT REDUCTION IN POLLUTANT RUNOFF
- MINIMUM PLUS ADDITIONAL-ABOUT 75 PERCENT REDUCTION IN POLLUTANT RUNOFF

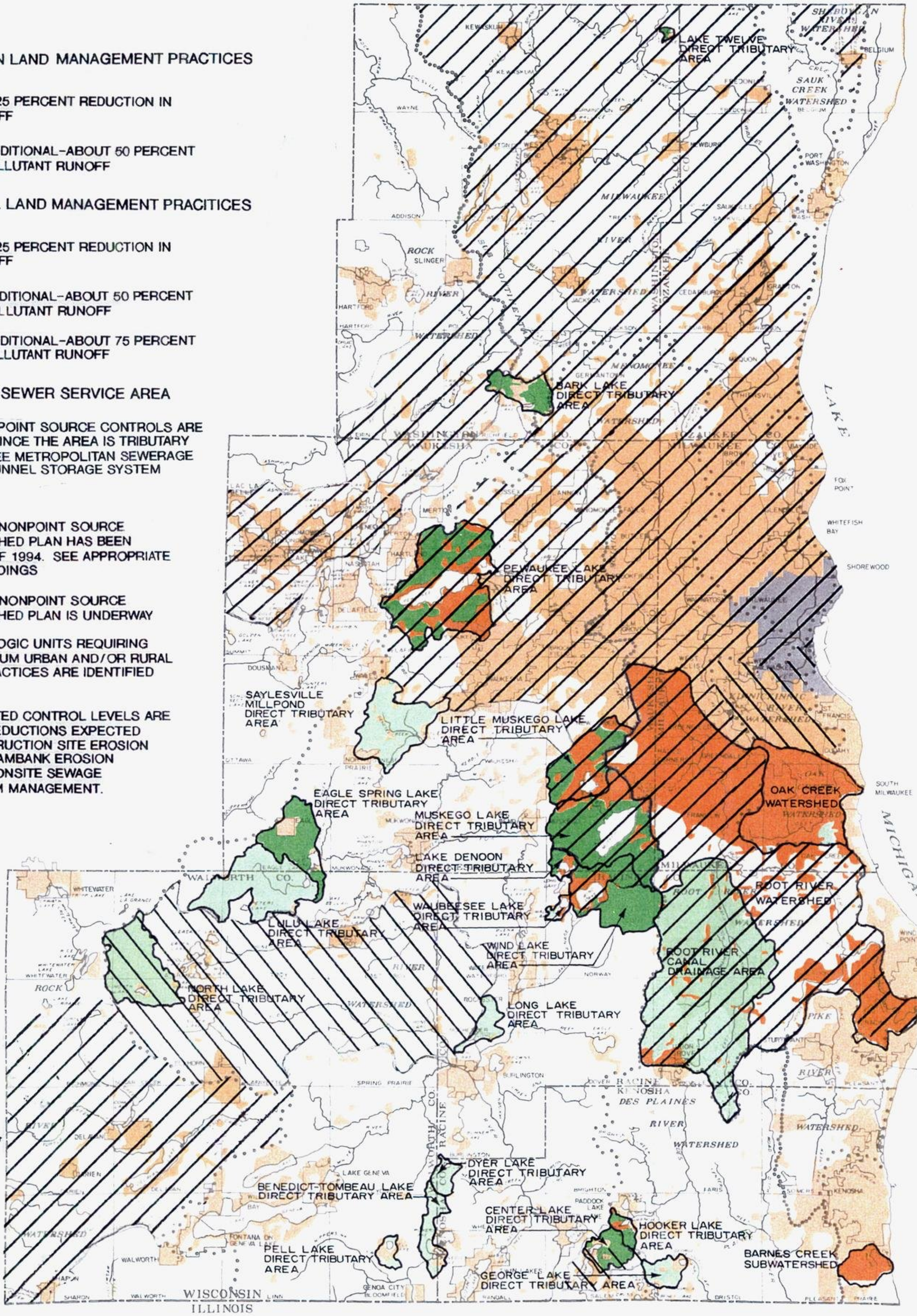
**MILWAUKEE COMBINED SEWER SERVICE AREA**

- NO SPECIFIC NONPOINT SOURCE CONTROLS ARE RECOMMENDED SINCE THE AREA IS TRIBUTARY TO THE MILWAUKEE METROPOLITAN SEWERAGE DISTRICT DEEP TUNNEL STORAGE SYSTEM

- AREA FOR WHICH NONPOINT SOURCE PRIORITY WATERSHED PLAN HAS BEEN COMPLETED AS OF 1994. SEE APPROPRIATE CHAPTER FOR FINDINGS
- AREA FOR WHICH NONPOINT SOURCE PRIORITY WATERSHED PLAN IS UNDERWAY

NOTES: 1. THOSE HYDROLOGIC UNITS REQUIRING MORE THAN MINIMUM URBAN AND/OR RURAL MANAGEMENT PRACTICES ARE IDENTIFIED BY NAME.

2. THE ABOVE-NOTED CONTROL LEVELS ARE IN ADDITION TO REDUCTIONS EXPECTED THROUGH CONSTRUCTION SITE EROSION CONTROLS, STREAMBANK EROSION CONTROLS, AND ONSITE SEWAGE DISPOSAL SYSTEM MANAGEMENT.




GRAPHIC SCALE

Source: SEWRPC.

109 square miles of urban area. These areas lie largely in the Oak Creek and Root River watersheds, in the Barnes Creek subwatershed portion of the drainage area directly tributary to Lake Michigan, and in the direct drainage areas tributary to Pewaukee Lake, Big and Little Muskego Lakes, Lake Denoon, Waubeesee Lake, Wind Lake, and Hooker Lake. Additional rural nonpoint source pollution abatement measures designed to achieve an approximate 50 percent reduction in pollutant runoff were recommended in the plan to be applied to about 118 square miles of rural land. These lands lie largely in the Oak Creek watershed, in Root River Canal drainage area, and in the direct drainage areas tributary to GeorgeLake, Benedict/Tombeau Lakes, Waubeesee Lake, Long Lake, Dyer Lake, Pell Lake, North Lake (Walworth County), and Lulu Lake. In addition, additional rural nonpoint source pollution abatement measures designed to achieve an approximate 75 percent reduction in pollutant runoff were recommended to be applied to about 58 square miles of rural lands in the direct drainage areas tributary to Lake Twelve, Bark Lake, Pewaukee Lake, Big and Little Muskego Lakes, Eagle Spring Lake, Lake Denoon, Center Lake, Wind Lake, and Hooker Lake.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans were to identify nonpoint source pollution control practices that should be applied to specific areas within the designated watersheds. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed by watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin State Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the DNR. Planning under the priority watershed program has been carried out, or is underway, for the Root River, Onion River, Turtle Creek, Oconomowoc River, Milwaukee River and Cedar Creek, Menomonee River, Upper Fox River, Kinnickinnic River, Honey and Sugar Creeks, Muskego-Wind Lakes, and Camp and Center Lakes watersheds and subwatersheds, as recommended in the initial areawide water quality management plan. The status of these projects are summarized in Table XVIII-8.

In those watersheds where nonpoint source pollution abatement priority watershed projects have been completed, the recommendations developed under the priority watershed projects now serve as the basis for nonpoint source project eligibility under the DNR priority watershed programs and must be taken into account along with the regional water quality management plan findings and recommendations in preparing subsequent detailed stormwater management plans, and for land management plans.

The nonpoint source priority watershed project implementation periods have now been completed for the Onion River, Oconomowoc River, Root River, and Turtle Creek watersheds. For each of these watersheds, it is recommended that the need for further nonpoint source controls be reevaluated based upon the level of plan implementation and additional water quality and biological monitoring data. This reevaluation should include adequate water quality and biological assessment and

Table XVIII-8

STATUS OF NONPOINT SOURCE POLLUTION ABATEMENT
PRIORITY WATERSHED PROJECTS: 1994

| Watershed | Counties | Date Selected | Date Plan Completed | Project Sign-Up End Date | Project Implementation End Date |
|---|---|---|---|---|---|
| Root River | Racine<br>Milwaukee<br>Waukesha<br>Kenosha | 1979 | 1980 | December 1984 | December 1989 |
| Onion River | Ozaukee<br>Sheboygan | 1980 | 1981 | June 1984 | June 1989 |
| Turtle Creek | Walworth<br>Rock | 1982 | 1984 | April 1987 | April 1992 |
| Oconomowoc River | Washington<br>Waukesha<br>Jefferson<br>Dodge | 1983 | 1986 | April 1989 | December 1994 |
| East and West Branches of the Milwaukee River | Washington<br>Ozaukee<br>Sheboygan<br>Dodge | 1984 | 1989 | December 1993[a] | June 1997 |
| North Branch of the Milwaukee River | Washington<br>Ozaukee<br>Sheboygan<br>Fond du Lac | 1984 | 1989 | December 1993[a] | July 1997 |
| Menomonee River | Washington<br>Waukesha<br>Milwaukee<br>Ozaukee | 1984 | 1991 | October 1994[a] | October 1999 |
| Milwaukee River South | Ozaukee<br>Milwaukee | 1984 | 1991 | October 1994[a] | October 1999 |
| Cedar Creek | Ozaukee<br>Washington | 1984 | 1992 | March 1995[a] | March 2000 |
| Upper Fox | Waukesha | 1990 | 1994 | May 1994 | May 1994 |
| Muskego-Wind Lakes | Waukesha<br>Racine | 1991 | 1993 | May 1994 | May 1997 |
| Kinnickinnic | Milwaukee | 1990 | 1994 | October 1994[a] | October 1997 |
| Honey Sugar Creek | Walworth | 1994 | -- | -- | -- |
| Camp-Center Lakes | Kenosha | 1994 | -- | -- | -- |

[a] Urban nonpoint source management practices can be signed up during the entire project implementation period.

Source: SEWRPC.

analyses to determine the current degree of achievement of the recommended water use objective for the stream reaches concerned. In some cases, this evaluation may indicate that the water use objective should be changed. For example, in the Root River watershed, the recommended point source pollution abatement measures have now been largely carried out, including the abandonment of seven public and seven private sewage treatment plants and the upgrading of the Village of Union Grove sewage treatment plant. Given that the nonpoint source priority watershed project implementation period has been completed and that the surface waters still do not fully meet the standards for the recommended water use objective,the achievability of the objective should be reevaluated along with the need for further nonpoint source controls.

For the Upper Fox River, Menomonee River, and Milwaukee River watersheds, the levels of control developed for the urban areas in the priority watershed plan are significantly higher than those developed in the initial regional water quality management plan. In this regard, it should be noted that the priority watershed plans included consideration of water quality implications of metals toxicity in stormwater. Such metal toxicity was not specifically considered in the development of the initial regional plan recommendations since metals toxicity standards were not available at the time of its preparation. However, levels of urban control developed under the priority watershed plans for these three areas are costly and full implementation will be difficult to achieve. Thus, it is recommended that the level of control for urban areas be refined based upon subsequent detailed stormwater management planning and based upon additional monitoring and quantitative analyses which are recommended to be conducted during the plan implementation period. These data and consideration of estimated costs and available funds for the urban practices are recommended to be evaluated to refine the recommended final level of control. Such refinement would include further consideration of toxics reduction requirements.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, those areas of the Region not yet included under the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program should be enrolled in the program in order to make State cost-sharing funds and related programs available for nonpoint source pollution control measures. In addition, detailed stormwater management plans in urban areas and farmland management plans in rural areas should be conducted to determine the practices to be installed in the most cost-effective manner. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[14] prepared by the Regional Planning Commission using DNR procedures. That ranking is summarized on Map XVIII-10 and Table XVIII-9, and includes the Bark River, Middle Fox River, Lower Fox River, Oak Creek, Pike River, Pike Creek, Sauk Creek-Sucker Creek, East Branch Rock River, and Rubicon River in the high category, indicating that inclusion in the program will be possible in the future when the existing planning projects are completed, or additional funds and staff become available with the Department of Natural Resources. The Commission is

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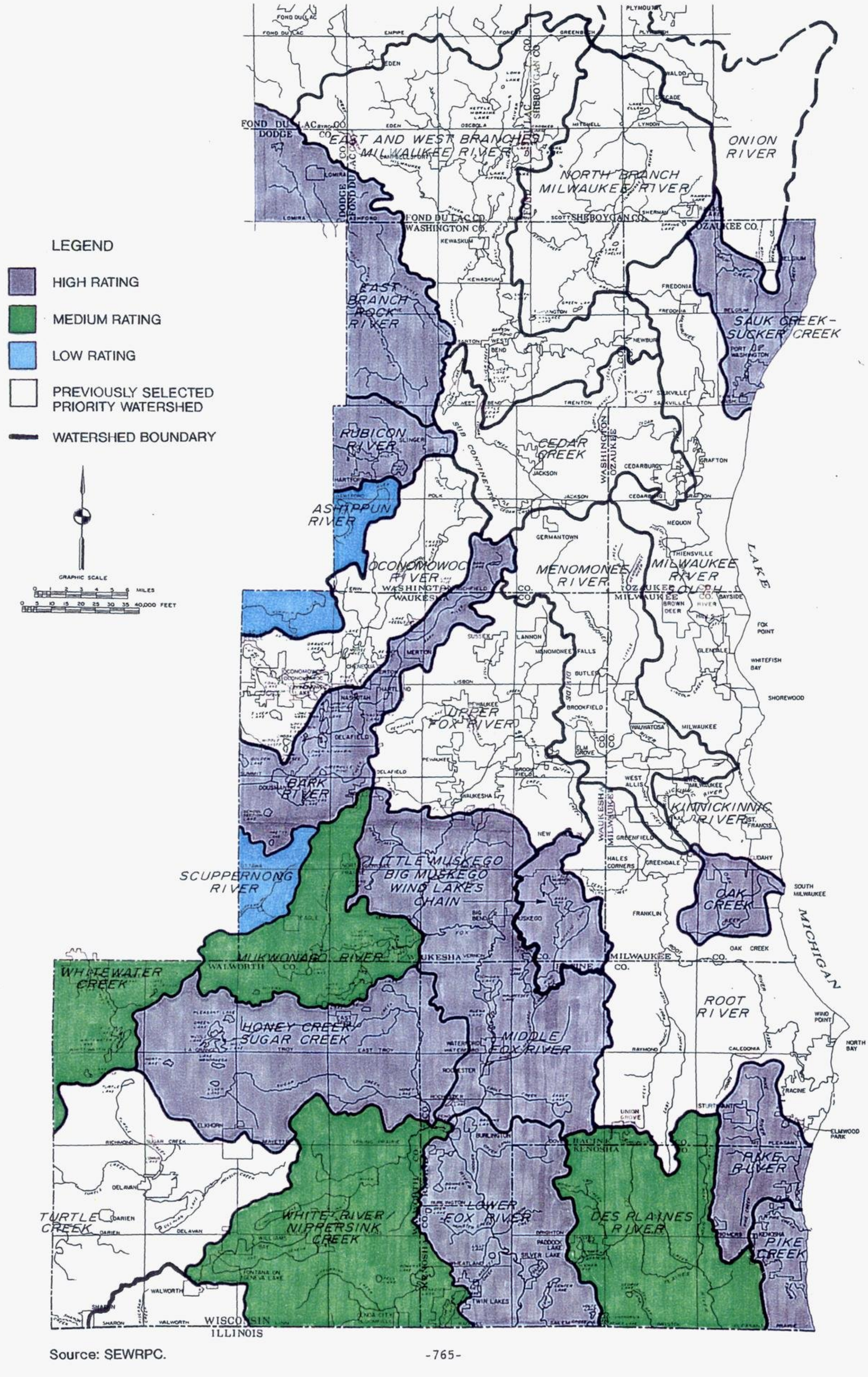
[14]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

Map XVIII-10

TOTAL NONPOINT SOURCE RATING ANALYSIS FOR CANDIDATE WATERSHEDS WITHIN SOUTHEASTERN WISCONSIN




Source: SEWRPC.

Table XVIII-9

SUMMARY OF CANDIDATE PRIORITY WATERSHED RATINGS
FOR SOUTHEASTERN WISCONSIN

| High Rating | Medium Rating | Low Rating |
|---|---|---|
| Bark River | Des Plaines River | Ashippun River |
| East Branch Rock River | Mukwonago River<br>White River/ | Scuppernong River |
| Honey/Sugar Creeks[a] | Nippersink Creek | |
| Lower Fox River | Whitewater Creek | |
| Middle Fox River | | |
| Oak Creek | | |
| Pike Creek | | |
| Pike River | | |
| Rubicon River | | |
| Sauk/Sucker Creeks | | |

[a] Since preparation of this priority watershed rating in 1993, the Honey/Sugar Creek watershed was selected in 1994 for inclusion in the Wisconsin Department of Natural Resources Nonpoint Source Pollution Abatement Priority Watershed Program.

Source: SEWRPC.

currently preparing a comprehensive watershed plan for the portion of the Des Plaines River watershed located in Southeastern Wisconsin.[15] That planning program will provide much of the information and data needed for the preparation of a nonpoint source priority watershed project. Because a comprehensive water resources planning program will be completed for the Des Plaines River watershed during 1995, the implementation of the nonpoint source pollution abatement in that watershed should be given special consideration since the comprehensive framework for the nonpoint source planning will be in place along with much of the inventory and analyses data needed to conduct priority watershed planning in a timely way. Thus, it is recommended that further consideration be given to including the Des Plaines River watershed under the State nonpoint source pollution abatement priority watershed program.

## WATER QUALITY MONITORING PLAN ELEMENT

The updated regional water quality management plan recommends that steps be taken to ensure the establishment of a sound program for continuing water quality monitoring within the Region to determine the extent to which the recommended water use objectives and supporting water quality standards are being met over time. In particular, the plan recommends that the water quality data collection programs be continued at selected stations established by the Department of Natural Resources, the U.S. Geological Survey, and the Milwaukee Metropolitan Sewerage District as set forth in Chapters IV through XV and shown on Map XVIII-11, on a continuing long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at selected additional locations as shown on Map XVIII-11, and that biological monitoring be conducted at selected continuing water quality monitoring stations during the same one-year period. The proper combination of water quality and biological monitoring should be determined during the development of monitoring programs for individual watersheds by the Department of Natural Resources in cooperation with the Regional Planning Commission. The data to be collected should be suitable for developing the necessary analyses, including modeling of future conditions, to reassess the levels of point and nonpoint source controls needed to achieve the recommended water use objectives, and to reexamine the practicality of achieving those objectives. It is recommended that this program be conducted within the next seven years and repeated at approximately five- to ten-year intervals. These recommendations are consistent with the Wisconsin Department of Natural Resources current conceptual surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five- to ten-year rotating cycle.

In addition, it is recommended that a lake water quality monitoring program be established on all lakes within the Region, consisting of, at a minimum, the enrollment of a citizen volunteer in the DNR Self-Help Monitoring Program. In addition, it is recommended that an intensive monitoring effort designed to establish baseline water quality conditions be undertaken on all major lakes within the Region, and on such smaller waterbodies as may be appropriate. For each lake, it is recommended that the monitoring program be such that current conditions be established during a two-year or more intensive monitoring program

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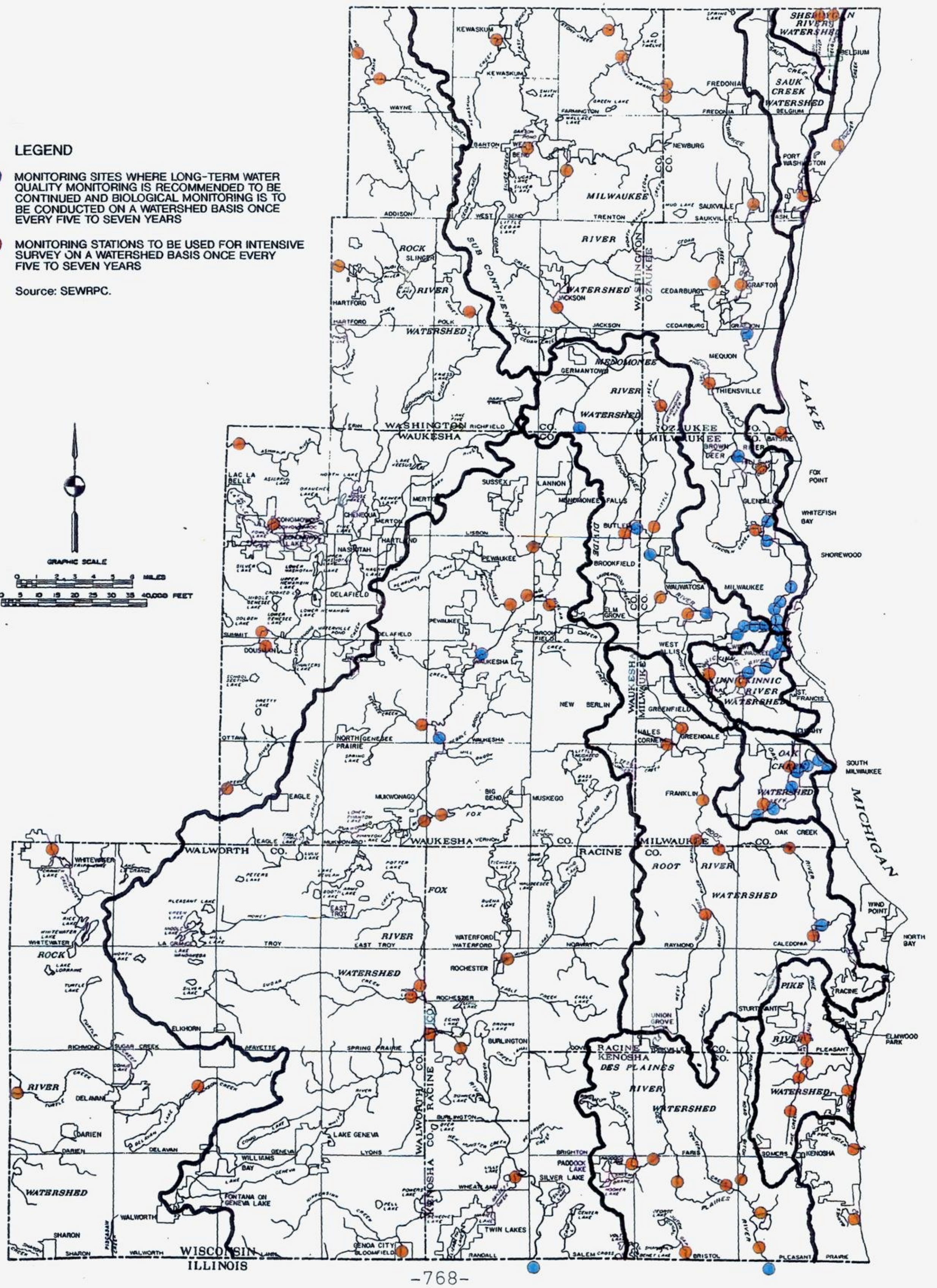
[15] Des Plaines River Watershed Planning Program Prospectus, September 1991.

## Map XVIII-11

## RECOMMENED WATER QUALITY AND BIOLOGICAL CONDITION MONITORING PROGRAM SITE LOCATIONS



**LEGEND**

- (blue) MONITORING SITES WHERE LONG-TERM WATER QUALITY MONITORING IS RECOMMENDED TO BE CONTINUED AND BIOLOGICAL MONITORING IS TO BE CONDUCTED ON A WATERSHED BASIS ONCE EVERY FIVE TO SEVEN YEARS
- (orange) MONITORING STATIONS TO BE USED FOR INTENSIVE SURVEY ON A WATERSHED BASIS ONCE EVERY FIVE TO SEVEN YEARS

Source: SEWRPC.

followed by continual long-term monitoring designed to detect changes in water quality conditions. In this regard, the monitoring program should be designed to provide data needed to prepare or update comprehensive lake management plans for the major lakes in each watershed and such smaller lakes as may be appropriate. The water quality sampling program should be carried out at spring turnover--usually in April--and during June, July, and August, during two subsequent years, with samples collected weekly.

## LAKE MANAGEMENT PLAN ELEMENT

Lake management measures recommended to be considered in more detail are set forth in Table XVIII-10 for the 101 major lakes in the Southeastern Wisconsin Region. It is recognized that the preparation of comprehensive lake management plans may need to be conducted in a staged manner in order to best utilize available resources. In this regard, water quality monitoring, aquatic plant management, and watershed protection measures planning and implementation are considered to be logical components, among others, of the comprehensive plans which can be conducted under separate planning programs, if designed to be integrated into a comprehensive lake management plan. In addition, it is recommended that water quality planning and supporting monitoring be conducted for those lakes and similar waterbodies of both greater and lesser than 50 acres in size, where such activities are deemed to be important for water quality protection. In cases where such planning and monitoring is conducted on waterbodies of less than 50 acres in size, management techniques similar to those recommended to be applicable for consideration on the major lakes can be considered for lake management purposes. Currently, such activities are underway on about half of the 101 major lakes in the Region, as shown in Table XVIII-10.

## MILWAUKEE HARBOR ESTUARY PLAN RECOMMENDATIONS

The water quality management recommendations developed in the Milwaukee Harbor estuary study[16] are incorporated into the regional water quality management plan update. In addition to those recommendations set forth above for the tributary area to the Milwaukee Harbor estuary, the plan recommends the continued operation of the existing flushing tunnels which discharge to the upstream end of the Milwaukee and Kinnickinnic River watersheds, and the installation and operation of an instream aeration system in the Menomonee River estuary. In addition, the updated plan incorporates the recommendations to implement measures to prevent contamination of surface water by stormwater runoff from scrap metal, salt, and other material storage sites located within the estuary direct drainage area and the development and continued operation of a water quality, sediment quality, and biological conditions monitoring program to document the extent to which desired water use objectives are being met over time.

## STATUS OF GROUNDWATER MANAGEMENT PLAN ELEMENT

A groundwater management plan element of the regional water quality management plan is currently under preparation under a cooperative program being carried out

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[16]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, Vol. One, Inventory Findings, Vol. Two, Alternative and Recommended Plans, December 1987.

Table XVIII-10

SUMMARY OF LAKE MANAGEMENT PLAN ELEMENT RECOMMENDATIONS

| **COUNTY** WATERSHED Lake | Area acres | TSI[a] | Form of Lake Organization | Provide Public Sanitary Sewerage | Manage Onsite Sewage Disposal | Monitor Water Quality | Manage Aquatic Plants | Manage Fish/ In-lake Habitat | Manage Access and Recreation | Manage Watershed NPS | Public Information | Comprehensive Plan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **KENOSHA COUNTY** | | | | | | | | | | | | |
| DES PLAINES RIVER | | | | | | | | | | | | |
| Benet/Shangrila | 186 | 67 | --[d] | o | - | o | x | x | x | x | x | o |
| East Lake Flowage | 123 | -- | State[b] | - | x | x | - | o | x | x | x | x |
| George Lake | 59 | 64 | District[c] | o | - | o | o | x | o | x | o | o |
| Hooker Lake | 87 | 54 | District[c] | o | - | o | x | x | o | x | x | o |
| Paddock Lake | 112 | -- | District[c] | o | - | o | x | x | o | x | x | o |
| Unnamed Quarry Lake | 100 | -- | --[d] | x | - | x | - | x | x | - | x | x |
| FOX RIVER | | | | | | | | | | | | |
| Benedict Lake | 78 | 44 | --[d] | x | x | o | x | x | x | x | x | x |
| Camp Lake | 461 | 54 | District[c] | o | - | o | x | x | o | o | x | o |
| Center Lake | 129 | 35 | District[c] | o | - | o | x | x | o | o | x | o |
| Cross Lake | 87 | 52 | Assn[e] | o | - | x | x | x | x | x | x | o |
| Dyer Lake | 56 | -- | --[d] | - | x | x | x | x | x | x | x | x |
| Elizabeth Lake | 865 | 52 | District[c] | o | - | o | - | x | o | x | x | o |
| Lilly Lake | 88 | -- | District[c] | x | x | o | - | x | o | x | x | o |
| Marie Lake | 315 | 47 | District[c] | o | - | o | - | x | o | x | x | o |
| Powers Lake | 459 | 45 | District[c] | x | x | o | x | x | o | x | x | o |
| Silver Lake | 464 | 50 | Assn[e] | o | - | x | x | x | o | x | x | o |
| Voltz Lake | 52 | 57 | District[c] | o | - | o | x | x | x | x | x | o |
| **OZAUKEE COUNTY** | | | | | | | | | | | | |
| MILWAUKEE RIVER | | | | | | | | | | | | |
| Lac du Cours | 56 | -- | --[d] | o | - | x | - | x | x | o | x | x |
| Mud Lake | 245 | -- | --[d] | - | - | x | - | - | x | o | x | x |
| Spring Lake | 66 | 43 | --[d] | - | x | x | - | x | x | o | x | x |
| **RACINE COUNTY** | | | | | | | | | | | | |
| FOX RIVER | | | | | | | | | | | | |
| Bohner Lake | 135 | 45 | Assn[e] | o | x | o | o | x | o | x | x | o |
| Browns Lake | 396 | 51 | District[c] | o | - | o | x | x | o | x | x | o |
| Buena Lake | 241 | -- | --[d] | o | - | x | - | x | x | x | x | x |
| Eagle Lake | 520 | 52 | Assn[e] | o | - | o | o | x | o | x | x | o |
| Echo Lake | 71 | -- | --[d] | o | - | x | - | x | x | x | x | x |
| KeeNongGoMong Lake | 88 | 55 | Assn[e] | o | - | o | x | x | o | x | x | o |
| Long Lake | 102 | -- | --[d] | - | x | x | x | x | x | x | x | x |
| Tichigan Lake | 892 | 54 | Assn[e] | o | - | o | - | x | o | x | x | x |
| Waubeesee Lake | 129 | 46 | Assn[e] | o | - | o | x | x | o | x | x | o |
| Wind Lake | 936 | 69 | District[c] | o | - | o | o | x | o | o | o | o |

Table XVIII-10 (cont'd.)

| **COUNTY**<br>WATERSHED<br>Lake | Area acres | TSI[a] | Form of Lake Organi-zation | Provide Public Sanitary Sewerage | Manage Onsite Sewage Disposal | Monitor Water Quality | Manage Aquatic Plants | Manage Fish/ In-lake Habitat | Manage Access and Recreation | Manage Watershed NPS | Public Infor-mation | Comprehen-sive Plan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WALWORTH COUNTY** | | | | | | | | | | | | |
| FOX RIVER | | | | | | | | | | | | |
| Army Lake | 78 | -- | --[d] | x | x | x | - | x | x | x | x | x |
| Booth Lake | 113 | 45 | Assn[e] | x | x | o | - | x | x | x | x | x |
| Lake Beulah | 834 | 46 | District[c] | - | x | o | o | x | o | x | x | x |
| Lake Como | 946 | -- | District[c] | o | - | o | o | x | x | x | x | x |
| Lake Geneva | 5,262 | 48 | Agency[f] | o | - | o | - | x | o | x | o | o |
| Lauderdale Lakes[g] | 841 | 50 | District[c] | - | x | o | x | x | o | x | x | o |
| Lulu Lake | 84 | -- | --[d] | - | - | x | x | x | o | x | x | o |
| North Lake | 191 | -- | --[d] | - | x | x | x | x | x | x | x | x |
| Pell Lake | 86 | 60 | Assn[e] | o | - | x | - | x | x | x | x | x |
| Peters Lake | 64 | -- | --[d] | - | - | x | x | x | x | x | x | x |
| Pleasant Lake | 155 | 45 | District[c] | - | x | o | x | x | o | x | x | x |
| Potters Lake | 162 | 78 | District[c] | o | - | o | x | x | x | x | x | o |
| Silver Lake | 85 | -- | --[d] | - | x | x | - | x | x | x | x | x |
| Wandawega Lake | 119 | -- | --[d] | - | x | x | x | x | x | x | x | x |
| ROCK RIVER | | | | | | | | | | | | |
| Comus Lake | 117 | -- | District[c] | o | - | x | x | x | x | o | x | x |
| Cravath Lake | 65 | -- | --[d] | o | - | x | x | x | x | x | x | x |
| Delavan Lake | 2,072 | 64 | District[c] | o | - | o | o | x | o | o | o | o |
| La Grange Lake | 55 | -- | --[d] | - | x | x | - | x | x | x | x | x |
| Lake Lorraine | 133 | -- | Assn[e] | - | x | x | x | x | x | x | x | x |
| Rice Lake | 137 | 60 | District[c] | - | x | o | o | x | x | x | o | o |
| Tripp Lake | 115 | -- | --[d] | o | x | x | x | x | x | x | x | x |
| Turtle Lake | 140 | -- | Assn[e] | - | x | x | x | x | x | o | x | x |
| Whitewater Lake | 640 | 61 | District[c] | - | x | o | o | x | o | x | o | x |
| **WASHINGTON COUNTY** | | | | | | | | | | | | |
| MILWAUKEE RIVER | | | | | | | | | | | | |
| Barton Pond | 67 | -- | --[d] | o | - | x | - | x | x | o | x | x |
| Big Cedar Lake | 932 | 59 | District[c] | - | x | o | o | x | o | o | x | x |
| Green Lake | 71 | 50 | Assn[e] | - | x | o | - | x | o | o | x | x |
| Lake Twelve | 53 | 45 | Assn[e] | - | x | x | - | x | x | o | x | x |
| Little Cedar Lake | 246 | 59 | District[c] | - | x | o | - | x | o | o | x | x |
| Lucas Lake | 78 | 43 | --[d] | - | x | x | x | x | x | o | x | x |
| Silver Lake | 118 | 50 | District[c] | o | - | o | o | x | o | o | x | x |
| Smith Lake | 86 | 49 | --[d] | - | x | x | x | x | x | o | x | x |
| Wallace Lake | 52 | 59 | District[c] | o | - | o | x | x | o | o | x | x |
| ROCK RIVER | | | | | | | | | | | | |
| Bark Lake | 65 | -- | District[c] | - | x | x | x | x | x | x | x | x |
| Druid Lake | 124 | 47 | District[c] | - | x | o | x | x | o | x | x | o |
| Friess Lake | 119 | 59 | Assn[e] | - | x | o | - | x | x | x | x | o |
| Lake Five | 102 | 47 | Assn[e] | - | x | o | x | x | x | x | x | x |
| Pike Lake | 522 | 52 | Assn[e] | - | x | o | - | x | o | x | x | x |

Table XVIII-10 (cont'd.)

| **COUNTY** WATERSHED Lake | Area acres | TSI[a] | Form of Lake Organi-zation | Provide Public Sanitary Sewerage | Manage Onsite Sewage Disposal | Monitor Water Quality | Manage Aquatic Plants | Manage Fish/ In-lake Habitat | Manage Access and Recreation | Manage Watershed NPS | Public Infor-mation | Comprehen-sive Plan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WAUKESHA COUNTY** | | | | | | | | | | | | |
| FOX RIVER | | | | | | | | | | | | |
| Big Muskego Lake | 2,177 | 70 | District[c] | o | - | o | - | o | o | o | o | o |
| Eagle Spring Lake | 311 | 49 | District[c] | x | x | o | o | x | x | x | x | o |
| Lake Denoon | 162 | 49 | Assn[e] | o | - | o | x | x | x | x | x | x |
| Little Muskego Lake | 506 | 62 | District[c] | o | - | o | o | x | o | o | o | o |
| Lower Phantom Lake | 433 | 43 | District[c] | x | x | x | o | x | o | x | o | x |
| Pewaukee Lake | 2,493 | 59 | District[c] | o | - | o | o | x | x | o | o | o |
| Spring Lake | 105 | 51 | --[d] | - | - | o | - | x | x | x | x | x |
| Upper Phantom Lake | 107 | 44 | District[c] | x | x | o | o | x | o | x | o | x |
| ROCK RIVER | | | | | | | | | | | | |
| Ashippun Lake | 84 | 49 | District[c] | - | x | o | x | x | o | x | x | o |
| Beaver Lake | 316 | -- | Assn[e] | x | x | x | x | x | o | o | x | x |
| Crooked Lake | 58 | 51 | --[d] | - | x | x | x | x | x | x | x | x |
| Fowler Lake | 78 | 43 | District[c] | o | - | o | o | x | o | o | x | - |
| Golden Lake | 250 | 42 | Assn[e] | - | x | o | x | x | o | x | x | x |
| Hunters Lake | 65 | -- | Assn[e] | - | x | x | x | x | x | x | x | x |
| Lac La Belle | 1,117 | 54 | District[c] | o | - | o | o | x | o | o | o | o |
| Lake Keesus | 237 | 50 | District[c] | - | x | o | o | x | o | o | x | o |
| Lower Genesee Lake | 66 | 41 | Assn[e] | - | x | o | x | x | x | x | x | x |
| Lower Nashotah Lake | 90 | 51 | Assn[e] | x | x | x | x | x | x | x | x | x |
| Lower Nemahbin Lake | 271 | 54 | Assn[e] | x | x | o | x | x | x | x | x | x |
| Middle Genesee Lake | 102 | -- | District[c] | - | x | o | x | x | o | x | x | x |
| Moose Lake | 81 | -- | Assn[e] | x | x | x | x | x | x | o | x | x |
| Nagawicka Lake | 957 | 60 | Assn[e] | o | - | o | o | x | x | x | x | x |
| North Lake | 437 | 54 | District[c] | x | x | o | o | x | x | o | x | o |
| Oconomowoc Lake | 767 | 44 | --[d] | x | x | o | o | x | x | o | x | o |
| Okauchee Lake | 1,187 | 58 | District[c] | x | x | o | o | x | o | o | x | o |
| Pine Lake | 703 | -- | Assn[d] | x | x | x | x | x | o | o | x | x |
| Pretty Lake | 64 | 42 | District[c] | - | x | o | x | x | x | x | x | o |
| School Section Lake | 125 | 53 | District[c] | - | x | o | o | x | x | x | x | o |
| Silver Lake | 222 | 43 | Assn[e] | x | x | o | x | x | x | o | x | o |
| Upper Nashotah Lake | 133 | 45 | --[d] | x | x | x | x | x | x | x | x | x |
| Upper Nemahbin Lake | 283 | 45 | District[c] | x | x | o | x | x | o | x | x | o |
| Waterville Pond | 68 | -- | --[d] | - | x | x | x | x | x | x | x | x |

[a] Carlson Trophic State Index (TSI) classification based on water chemistry data collected between 1981 and 1994.

[b] The East Lake Flowage is totally contained within the Bong State Recreational Area administered by the Wisconsin Department of Natural Resources.

[c] An inland lake protection and rehabilitation district, sanitary district or utility district is known to exist. These organizations may be eligible for State financial assistance in the preparation and implementation of lake management plans under Chapters NR 119 and NR 191 of the Wisconsin Administrative Code.

Footnotes continue.

Table XVIII-10 (cont'd.)

[d] No known lake organization exists. It is recommended that some type of local lake management organization be formed around each of the major lakes in the Region. These organizations may be eligible for State financial assistance in the preparation and implementation of lake management plans under Chapters NR 119 and NR 191 of the Wisconsin Administrative Code. Management actions may also be taken by the responsible local unit of government. Recognized lake management organizations include: cities, villages, towns, public inland lake protection and rehabilitation districts, and qualified lake associations, as well as sanitary districts and tribes under certain grant programs.

[e] A lake association, property owner's association, or similar organization is known to exist. Qualified lake associations, which are incorporated under Chapter 181 of the Wisconsin Statutes--and which meet other specified criteria--may be eligible for State financial assistance in the preparation and implementation of lake management plans under Chapters NR 119 and NR 191 of the Wisconsin Administrative Code.

[f] A Section 66.30, Stats., intergovernmental agreement exists between riparian municipalities and has created the Geneva Lake Environmental Agency to oversee planning and research into the water quality of Geneva Lake.

[g] Lauderdale Lake incorporates Green Lake, Middle Lake, and Mill Lake.

KEY:

o = Ongoing water quality monitoring, planning program or management activity.

x = Water quality monitoring recommended; development and implementation of detailed plan element recommended.

\- = No action necessary at this time; detailed plan element completed--implement, update and refine as necessary.

Source: Wisconsin Department of Natural Resources and SEWRPC.

by the Regional Planning Commission and the University of Wisconsin-Extension, Wisconsin Geologic and Natural History Survey.

The purpose of the groundwater management plan element is to complete a comprehensive groundwater resource data inventory and analysis, including a series of groundwater resource maps of the Region; to complete a groundwater pollution source inventory and supporting mapping; to development groundwater protection and management recommendations for the Region; and to document the inventory,analysis, and recommendations in a separate report expected to be completed in 1997. The planning program is intended to form the basis for a groundwater management element of the regional water quality management plan. In addition, the planning program will provide, on a regional basis, valuable hydrogeologic information for use in parallel and subsequent groundwater planning programs, such as well head protection planning.

A more detailed description and status of the work to be conducted and a schedule for its completed is set forth in Chapter XVI.

DESIGNATED MANAGEMENT AGENCIES

While the recommended plan described above is designed to achieve the water use objectives and the supporting water quality standards, the plan is not complete in a practical sense until the steps required to implement the plan--that is, to convert the plan into action policies and programs--are specified. In addition, Federal and State regulations require that specific designations be made of the water quality management agencies required to implement the plan and that the plan implementation responsibilities of such agencies be identified. Accordingly, the plan includes recommendations for management agency designations and sets forth the various actions that must be taken by these agencies in order for the recommended plan to be fully carried out by the plan design year 2010. The plan also includes a series of proposed implementation schedules, with particular regard to the point source pollution abatement element of the recommended plan, including proposed dates for sewage treatment plant upgrading and expansion.

In total, it is proposed that 228 management agencies be designated for plan implementation purposes as set forth in Chapter XVII. All but 44 of these agencies currently exist. The 44 new agencies would be sanitary, utility, and/or lake protection and rehabilitation districts required to carry out a variety of plan implementation responsibilities in direct drainage areas to lakes or, in a few instances, to isolated enclaves of urban development within unincorporated towns. A total of 139 management agencies are proposed to be designated for point source pollution abatement purposes, while 194 management agencies are proposed to be designated for nonpoint source pollution abatement purposes, and 124 management agencies for lake management purposes. These designated management agencies are set forth in Table XVIII-11.

The plan implementation program includes the establishment of a continuing areawide water quality management planning effort. As the designated Section 208 water quality management planning agency, the Commission would bear primary responsibility for the conduct of that effort under a program conducted cooperatively with the Wisconsin Department of Natural Resources. The plan recommends that, since such areawide water quality management planning must be carried on throughout the entire State of Wisconsin, funding for such continuing efforts be

Table XVIII-11

SUMMARY OF LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS FOR IMPLEMENTATION OF THE RECOMMENDED AREAWIDE WATER QUALITY MANAGEMENT PLAN FOR THE REGION

| Designated Management Agency | Plan Implementation Responsibilities | | | |
|---|---|---|---|---|
| | Point Source Pollution Abatement | Urban Nonpoint Source Pollution Abatement | Rural Nonpoint Source Pollution Abatement | Lake Management |
| KENOSHA COUNTY | | | | |
| Kenosha County | -- | X | X | -- |
| City of Kenosha | X | X | -- | -- |
| Village of Paddock Lake | X | X | -- | -- |
| Paddock Lake Inland Lake Protection and Rehabilitation District | -- | X | -- | X |
| Village of Pleasant Prairie | -- | X | -- | -- |
| Sewer Utility District No. 1 | X | -- | -- | -- |
| Sewer Utility District D | X | -- | -- | -- |
| Sewer Utility District F | X | -- | -- | -- |
| Sanitary District No. 73-1 | X | -- | -- | -- |
| New District--Unnamed Quarry Lake | -- | -- | X | X |
| Village of Silver Lake | X | X | -- | -- |
| Village of Twin lakes | X | X | -- | -- |
| Twin Lakes Protection and Rehabilitation District | -- | X | -- | X |
| Town of Brighton | | | | |
| Wisconsin Department of Natural Resources (East Lake Flowage) | -- | -- | X | X |
| Town of Bristol | | | | |
| Utility District No. 1 | X | X | -- | -- |
| Utility District No. 3 | X | -- | -- | -- |
| Utility District No. 4 | X | -- | -- | -- |
| George Lake Protection and Rehabilitation District | -- | X | X | X |
| New District--Bennett/Shangrila Lakes | -- | X | X | X |
| Town of Randall | | | | |
| The Powers Lake Management District | -- | X | X | X |
| New District--Powers-Benedict-Tombeau Lakes | X | -- | -- | -- |
| New District--Benedict Lake | -- | X | X | X |
| Town of Salem | | | | |
| Sewer Utility District No. 1 | X | X | X | -- |
| Sewer Utility District No. 2 | X | X | X | -- |
| Camp and Center Lakes Rehabilitation District | -- | X | -- | X |
| Hooker Lake Management District | -- | X | -- | X |
| Voltz Lake Management District | -- | X | -- | X |
| Town of Somers | -- | X | -- | -- |
| Sanitary District No. 1 | X | -- | -- | -- |
| Utility District No. 1 | X | -- | -- | -- |
| Town of Wheatland | | | | |
| Lilly Lake Protection and Rehabilitation District | -- | X | X | X |
| New District--Dyer Lake | -- | -- | X | X |
| MILWAUKEE COUNTY | | | | |
| Milwaukee County | -- | X | X | -- |
| Milwaukee Metropolitan Sewerage District | X | -- | -- | -- |
| City of Cudahy | X | X | -- | -- |
| City of Franklin | X | X | -- | -- |
| City of Glendale | X | X | -- | -- |
| City of Greenfield | X | X | -- | -- |
| City of Milwaukee | X | X | -- | -- |
| City of Oak Creek | X | X | -- | -- |
| City of St. Francis | X | X | -- | -- |
| City of South Milwaukee | X | X | -- | -- |
| City of Wauwatosa | X | X | -- | -- |
| City of West Allis | X | X | -- | -- |
| Village of Bayside | X | X | -- | -- |
| Village of Brown Deer | X | X | -- | -- |
| Village of Fox Point | X | X | -- | -- |
| Village of Greendale | X | X | -- | -- |
| Village of Hales Corners | X | X | -- | -- |
| Village of River Hills | X | X | -- | -- |
| Village of Shorewood | X | X | -- | -- |
| Village of West Milwaukee | X | X | -- | -- |
| Village of Whitefish Bay | X | X | -- | -- |

| Designated Management Agency | Plan Implementation Responsibilities: Point Source Pollution Abatement | Urban Nonpoint Source Pollution Abatement | Rural Nonpoint Source Pollution Abatement | Lake Management |
|---|---|---|---|---|
| OZAUKEE COUNTY | | | | |
| Ozaukee County . . . . . . . . . . . . . . . . . . . . . | -- | X | X | -- |
| City of Cedarburg . . . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| City of Mequon . . . . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| New District--Lac du Cours . . . . . . . . . . . . . . | -- | X | X | X |
| City of Port Washington . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Belgium . . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Fredonia . . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| New District--Spring Lake . . . . . . . . . . . . . . | -- | X | X | X |
| Village of Grafton . . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Saukville . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Thiensville . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Town of Belgium | | | | |
| New District--Lake Church . . . . . . . . . . . . . . | X | -- | -- | -- |
| Town of Fredonia | | | | |
| Waubeka Area Sanitary District . . . . . . . . . . . | X | -- | -- | -- |
| Town of Saukville | | | | |
| New District--Mud Lake . . . . . . . . . . . . . . . . | -- | -- | X | X |
| RACINE COUNTY | | | | |
| Wisconsin Department of Health and Social Services . . | X | -- | -- | -- |
| Racine County . . . . . . . . . . . . . . . . . . . . . | -- | X | X | X |
| Western Racine County Sewerage District . . . . . . . . | X | -- | -- | -- |
| City of Burlington . . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| City of Racine . . . . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Elmwood Park . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of North Bay . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Rochester . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Sturtevant . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Union Grove . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Waterford . . . . . . . . . . . . . . . . . | X | X | -- | -- |
| Village of Wind Point . . . . . . . . . . . . . . . . . | -- | X | -- | |
| Town of Burlington | | | | X |
| Browns Lake Sanitary District . . . . . . . . . . . . | X | X | X | X |
| Bohner Lake Sanitary District . . . . . . . . . . . . | X | X | X | X |
| New District--Long Lake . . . . . . . . . . . . . . . | -- | X | X | X |
| New District--Echo Lake . . . . . . . . . . . . . . . | -- | X | X | -- |
| Town of Caledonia . . . . . . . . . . . . . . . . . . . | -- | X | -- | -- |
| Sewer Utility District No. 1 . . . . . . . . . . . . | X | -- | -- | -- |
| Caddy Vista Sanitary District . . . . . . . . . . . . | X | -- | -- | -- |
| Crestview Sanitary District . . . . . . . . . . . . . | X | -- | -- | -- |
| North Park Sanitary District . . . . . . . . . . . . | X | -- | -- | |
| Town of Dover | | | | X |
| Eagle Lake Sewer Utility District . . . . . . . . . . | X | X | X | -- |
| Town of Mt. Pleasant . . . . . . . . . . . . . . . . . | -- | X | -- | -- |
| Sewer Utility District No. 1 . . . . . . . . . . . . | X | -- | -- | -- |
| Town of Norway | | | | |
| Sanitary District No. 1 . . . . . . . . . . . . . . . | X | X | X | -- |
| Wind Lake Management District . . . . . . . . . . . . | -- | X | -- | X |
| Town of Rochester | | | | |
| Sewer Utility District No. 1 . . . . . . . . . . . . | X | X | -- | -- |
| Town of Waterford | | | | |
| Sanitary District No. 1 . . . . . . . . . . . . . . . | X | X | X | -- |
| New District--Buena Lake . . . . . . . . . . . . . . . | -- | X | X | X |
| Town of Yorkville | | | | |
| Sanitary District No. 1 . . . . . . . . . . . . . . . | X | X | -- | -- |

Table XVIII-11 (cont'd)

| Designated Management Agency | Plan Implementation Responsibilities: Point Source Pollution Abatement | Urban Nonpoint Source Pollution Abatement | Rural Nonpoint Source Pollution Abatement | Lake Management |
|---|---|---|---|---|
| WALWORTH COUNTY | | | | |
| Walworth County | X | X | X | -- |
| Walworth County Metropolitan Sewerage District | X | -- | -- | -- |
| Fontana-Walworth Water Pollution Control Commission | X | -- | -- | -- |
| Geneva Lake Environmental Agency | -- | X | X | X |
| City of Delavan | X | X | -- | -- |
| City of Elkhorn | X | X | -- | -- |
| City of Lake Geneva | X | X | -- | -- |
| City of Whitewater | X | X | -- | -- |
| New District--Tripp Lake | -- | X | X | X |
| Village of Darien | X | X | -- | -- |
| Village of East Troy | X | X | -- | -- |
| Village of Fontana | X | X | -- | -- |
| Village of Genoa City | X | X | -- | -- |
| Village of Sharon | X | X | -- | -- |
| Village of Walworth | X | X | -- | -- |
| Village of Williams Bay | X | X | -- | -- |
| Town of Bloomfield | | | | |
| Pell Lake Sanitary District | X | X | X | X |
| Town of Delavan | | | | |
| Delavan Lake Sanitary District | X | X | X | X |
| Geneva National Sanitary District | X | -- | -- | -- |
| Town of East Troy | | | | |
| Sanitary District No. 1 | -- | X | X | -- |
| Sanitary District No. 2 | X | X | X | -- |
| Beulah Lake Sanitary District | -- | X | X | X |
| Pattens Lake Protection and Rehabilitation District | -- | X | X | X |
| New District--Army Lake | X | X | X | X |
| Town of Geneva | | | | |
| New District--Como Lake | X | X | X | X |
| Town of La Grange | | | | |
| Lauderdale Lakes Management District | -- | X | X | X |
| Pleasant Lake Protection and Rehabilitation District | -- | X | X | X |
| New District--LaGrange Lake | -- | X | X | X |
| Town of Linn | | | | |
| Sanitary District | X | X | X | -- |
| Town of Lyons | | | | |
| Sanitary District No. 2 | X | -- | -- | -- |
| Town of Richmond | | | | |
| New District--Lake Loraine | -- | X | X | X |
| New District--Turtle Lake | -- | X | X | X |
| Town of Spring Prairie | | | | |
| Honey Lake Protection and Rehabilitation District | -- | X | X | X |
| Town of Sugar Creek | | | | |
| New District--North Lake | -- | X | X | X |
| New District--Silver Lake | -- | X | X | X |
| New District--Wandawega Lake | -- | X | X | X |
| Town of Troy | | | | |
| New District--Booth Lake | X | X | X | X |
| New District--Lulu Lake | -- | X | X | X |
| New District--Peters Lake | -- | X | X | X |
| Town of Walworth | | | | |
| Utility District No. 1 | X | -- | -- | -- |
| Town of Whitewater | | | | |
| Whitewater-Rice Lakes Management District | -- | X | X | X |
| New District--Cravath Lake | -- | X | X | X |

| Designated Management Agency | Plan Implementation Responsibilities: Point Source Pollution Abatement | Urban Nonpoint Source Pollution Abatement | Rural Nonpoint Source Pollution Abatement | Lake Management |
|---|---|---|---|---|
| WASHINGTON COUNTY | | | | |
| Washington County | -- | X | X | -- |
| City of Hartford | X | X | -- | -- |
| City of West Bend | X | X | -- | -- |
| New District--Barton Pond | -- | X | X | X |
| Village of Germantown | X | X | -- | -- |
| Village of Jackson | X | X | -- | -- |
| Village of Kewaskum | X | X | -- | -- |
| Village of Newburg | X | X | -- | -- |
| Village of Slinger | X | X | -- | -- |
| Town of Addison | | | | |
| Allenton Sanitary District No. 1 | X | X | -- | -- |
| Town of Barton | | | | |
| New District--Smith Lake | -- | X | X | X |
| Town of Erin | | | | |
| Druid Lake Protection and Rehabilitation District | -- | X | X | X |
| Town of Farmington | | | | |
| New District--Green Lake | -- | X | X | X |
| New District--Lake Twelve | -- | X | X | X |
| Town of Hartford | | | | |
| Pike Lake Sanitary District | X | -- | -- | -- |
| New District--Pike Lake | -- | X | X | X |
| Town of Richfield | | | | |
| Richfield Sanitary District | -- | X | X | -- |
| New District--Bark Lake | -- | X | X | X |
| New District--Freiss Lake | -- | X | X | X |
| New District--Lake Five | -- | X | X | X |
| Town of Trenton | | | | |
| Wallace Lake Sanitary District | X | X | X | X |
| Town of West Bend | | | | |
| Big Cedar Lake Sanitary District | -- | X | X | -- |
| Big Cedar Lake District | -- | X | X | X |
| Little Cedar Lake District | -- | X | X | X |
| Silver Lake District | X | X | X | X |
| New District--Lucas Lake | -- | X | X | X |
| WAUKESHA COUNTY | | | | |
| Waukesha County | X | X | X | -- |
| Delafield-Hartland Water Pollution Control Commission | X | -- | -- | -- |
| City of Brookfield | X | X | -- | -- |
| City of Delafield | X | X | -- | -- |
| City of Muskego | X | X | -- | -- |
| Big Muskego Lake-Bass Bay Protection and Rehabilitation District | -- | X | X | X |
| Little Muskego Lake Protection and Rehabilitation District | -- | X | -- | X |
| City of New Berlin | X | X | -- | -- |
| City of Oconomowoc | X | X | -- | -- |
| Fowler Lake Management District | -- | X | -- | X |
| City of Waukesha | X | X | -- | -- |
| Village of Big Bend | -- | X | -- | -- |
| Village of Butler | X | X | -- | -- |
| Village of Chenequa | X | X | -- | -- |
| Village of Dousman | X | X | -- | -- |
| Village of Eagle | -- | X | -- | -- |
| Village of Elm Grove | X | X | -- | -- |
| Village of Hartland | X | X | -- | -- |

Table XVIII-11 (cont'd)

| Designated Management Agency | Plan Implementation Responsibilities | | | |
|---|---|---|---|---|
| | Point Source Pollution Abatement | Urban Nonpoint Source Pollution Abatement | Rural Nonpoint Source Pollution Abatement | Lake Management |
| WAUKESHA COUNTY (continued) | | | | |
| Village of Lac La Belle | X | X | -- | -- |
| Village of Lannon | X | X | -- | -- |
| Village of Menomonee Falls | X | X | -- | -- |
| Village of Merton | -- | X | -- | -- |
| Village of Mukwonago | X | X | -- | -- |
| Village of Nashotah | X | X | -- | -- |
| Village of North Prairie | X | X | -- | -- |
| Village of Oconomowoc Lake | X | X | -- | -- |
| Village of Pewaukee | X | X | -- | -- |
| Village of Sussex | X | X | -- | -- |
| Village of Wales | X | X | -- | -- |
| Town of Brookfield | X | X | -- | -- |
| Town of Delafield | -- | X | -- | -- |
| Town of Eagle | | | | |
| Eagle Spring Lake Rehabilitation & Protection District | X | X | X | X |
| Town of Genesee | -- | X | -- | -- |
| Town of Lisbon | -- | X | -- | -- |
| Sanitary District No. 1 | X | -- | -- | -- |
| Town of Merton | | | | |
| North Lake Management District | -- | X | X | X |
| New District--North Lake | X | -- | -- | -- |
| New District--Beaver Lake | X | X | X | X |
| New District--Moose Lake | X | X | X | X |
| Lake Keesus Management District | -- | X | X | X |
| Town of Mukwonago | | | | |
| Phantom Lakes Protection and Rehabilitation District | -- | X | X | X |
| New District--Spring Lake | -- | X | X | X |
| Town of Oconomowoc | | | | |
| Mary Lane Sanitary District | X | -- | -- | -- |
| Blackhawk Drive Sanitary District | X | -- | -- | -- |
| Lac La Belle Management District | -- | X | X | X |
| New District--Oconomowoc Lake | -- | X | X | X |
| Okauchee Lake Management District | -- | X | X | X |
| New District--Okauchee Lake | X | -- | -- | -- |
| Ashippun Lake Protection and Rehabilitation District | -- | X | X | X |
| Town of Ottawa | | | | |
| Pretty Lake Protection and Rehabilitation District | -- | X | X | X |
| School Section Lake Protection and Rehabilitation District | -- | X | X | X |
| Town of Pewaukee | -- | X | -- | X |
| Sanitary District No. 3 | X | -- | -- | -- |
| Pewaukee Lake Sanitary District | X | X | -- | X |
| Town of Summit | -- | X | -- | -- |
| Middle Genesee Lake Management District | -- | X | X | X |
| Upper Nemahbin Lake Management District | -- | X | -- | X |
| New District--Upper Nashotah Lake | -- | X | X | X |
| New District--Crooked Lake | -- | X | X | X |
| New District--Nashotah-Nemahbin Lakes | X | -- | -- | -- |
| New District--Silver Lake | X | -- | -- | -- |
| Town of Vernon | -- | X | -- | -- |
| Town of Waukesha | -- | X | -- | -- |

Source: SEWRPC.

provided directly by the State of Wisconsin through the Department of Natural Resources.

MAJOR WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Several major issues relating to water quality management policies and programs were raised and highlighted during the conduct of the areawide water quality management plan updating program for Southeastern Wisconsin. These issues relateto the need for further subregional sewer service area sewerage system plans; the evaluation of water use objectives in specific stream reaches; and the evaluation of specific water quality trends. These issues could not be specifically addressed in the updating process since the data collection and analyses required could only be accomplished under a subsequent subregional planning effort; because of the need for the collection of extensive water quality and biological monitoring data; and because local intergovernmental agreements on the issue had not yet been achieved to allow for incorporation of an amendment into the regional plan to address the issues. It is recommended that these issues be addressed on a case-by-case basis under the continuing water quality management planning program for Southeastern Wisconsin. Amendments to the plan relating to these issues would then be developed, as appropriate, following the public hearing process. These issues are summarized below.

Sewer Service Areas and Sewerage System Evaluations

In the greater Kenosha area, the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991, remains to be resolved. The recommendations of that plan include revisions to the planned sewer service areas in the greater Kenosha area and provisions to abandon the two existing sewage treatment plants operated by the Village of Pleasant Prairie, with the areas served by these plants being connected to the City of Kenosha sewerage system for treatment purposes, as described in Chapter IV. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1991 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In the greater Racine area, the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Alvord, Burdick, and Howson, entitled A Coordinated Sanitary Sewerage and Water Supply System Plan, Greater Racine Area, September 1992, remains to be resolved. The recommendations of that plan include revisions to the planned sewer service areas in the greater Racine area and provisions to abandon the existing sewage treatment plant operated by the Town of Yorkville Utility District No. 1, with the area served by this plant being connected to the City of Racine sewerage system for treatment purposes, as described in Chapter XII. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1992 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In the Fox River watershed, based upon local facility planning, land use decisions, and identified onsite sewerage system problems, there is a need to conduct subsequent subregional sewerage system evaluations for five specific areas: the Village of North Prairie and environs in Waukesha County;[17] the Benedict, Tombeau, and Powers Lakes area in Kenosha County;[18] the Pell Lake area in Walworth County;[19] the Village of Big Bend and Town of Vernon areas in Waukesha County; and the Town of Wheatland-Silver Lake area in Kenosha County.[20] Subregional studies potentially leading to formal amendments to the regional water quality management plan are recommended to be conducted as budgeting and local support becomes available. The subregional planning program for the Powers-Benedict-Tombeau Lakes area and the Pell Lake area has been completed and an amendment[21] has been incorporated into the plan to reflect the findings of that planning program, following public information meetings and a public hearing on the matter. The results of that amendment are reflected in the plan update as summarized in this chapter. In addition, an amendment to the regional water quality management plan for the Bohner Lake area was completed in June 1994.[22] That amendment serves to add the urban development around Bohner Lake to the planned sewer service area of the City of Burlington based upon local facility planning studies.

In the Rock River watershed, the Regional Planning Commission has, at the request of and in cooperation with local units of government in northwestern Waukesha County, prepared a Prospectus for the Preparation of A Sanitary Sewerage System Plan for the Northwestern Waukesha County Area. The prospectus documents the need for conducting a system level sewerage system planning program for the northwestern Waukesha County area. In addition, the prospectus sets forth the planning program required to prepare a coordinated sanitary sewerage system plan for the area concerned. The plan is intended to address the intergovernmental, administrative, legal, and fiscal problems inherent in the development of the planned sewerage system, or systems, as well as to identify the configuration, capacity, and level of treatment to be provided by the planned sewerage system, or systems. Work is expected to be initiated on this subregional system during the first half of 1995.

Evaluation of Water Use Objectives

Based upon the inventory and analyses conducted, there are a number of stream reaches within the Region where it is recommended that the Wisconsin Department of Natural Resources consider changing the current adopted State stream classifi-

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[17]Ruekert & Mielke, Inc., Village of North Prairie Wastewater Facility Plan, Phase One, July 1986; Phase Two, December 1989.

[18]Crispell-Snyder, Inc., Powers, Benedict, and Tombeau Lakes Facility Plan, May 1992.

[19]Baxter & Woodman, Inc., Pell Lake Sanitary Facilities Planning Report, June 1993.

[20]Ruekert & Mielke, Inc., Town of Wheatland Facility Plan, September 1992.

[21]SEWRPC Amendment, Pell Lake Area and Powers-Benedict-Tombeau Lakes Area, Kenosha and Walworth Counties, December 1994.

[22]Crispell-Snyder, Inc., Bohner Lake Facilities Plan, May 1992.

cations. In some cases, the recommendation for upgrading has been to either a warmwater sport fish community or warmwater forage fish community. In these cases, detailed field inventories of the physical characteristics of the stream channel are required to make the distinction. The stream reaches for which it is recommended that a reevaluation of the current adopted stream classifications be reconsidered are listed in Table XVIII-12.

Evaluation of Specific Water Quality Trends

Increases in levels of chloride over the period of 1976 to 1993 were noted in selected stream reaches within the Region, including the lower reaches of the Fox River and the free-flowing portion of the Milwaukee River. These apparent increases in chloride levels may potentially be a result of increased urban development within the Region. The construction of additional streets and highways associated with increased urban development has the potential to contribute a greater amount of runoff from winter road maintenance to surface waters. While none of the chloride levels observed at the long-term monitoring stations violated the standard as set forth in Chapter II, it is recommended that chloride levels continue to be monitored on a long-term continual basis to assess the extent of further increases.

## SUMMARY AND CONCLUSION

The areawide water quality management plan provides another important element of the evolving comprehensive plan for the physical development of the seven-county Southeastern Wisconsin Region, and thereby provides a sound basis for the social and economic development of the Region. Together with the adopted regional land use and regional park and open space plans, the areawide water quality management plan provides the Region and its public officials and citizens with a sound coordinated guide to land use development and pollution abatement.

Of the 1,223 stream miles assessed under this planning effort, 148 miles, or 12 percent, are estimated to currently be fully meeting the recommended water use objectives. The majority of the streams studied--773 miles, or 63 percent--are estimated to be partially meeting the recommended water use objectives. About 50 stream miles, or 4 percent, are estimated to be not meeting the water use objectives. For 252 stream miles, or 21 percent of the total stream miles, no data were available to assess the potential level of achievement of the water use objectives. For those streams which are not estimated to be meeting the recommended water use objectives, it was generally found that the phosphorus and fecal coliform levels exceeded the water quality standards. In some limited reaches, it was found that dissolved oxygen, un-ionized ammonia nitrogen, and metals levels also did not meet the standards some of the time. Chloride levels were generally found to meet the standards but were noted to be increasing over time in the lower reaches of some of the major streams.

Adequate water quality and biological condition data to evaluate long-term trends in water quality conditions were available for about 105 miles, or 9 percent of the stream miles in the Region. The available data indicate that water quality conditions have improved for selected stream reaches in the Region, totaling 60 stream miles, or about 57 percent of those streams for which data were available. The data also indicate that water quality conditions have deteriorated in short reaches, totaling about four miles, or 4 percent of the stream miles for which data were available. For 41 miles of stream, or 39 percent of the stream miles

Table XVIII-12

STREAM REACHES FOR WHICH REVISIONS TO THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES WATER USE OBJECTIVES ARE RECOMMENDED TO BE CONSIDERED

| Watershed | Stream Reach | Wisconsin Department of Natural Resources Water Use Objective | SEWRPC-Recommended Water Use Objective | Rationale for Change Recommended by SEWRPC |
|---|---|---|---|---|
| Des Plaines River | Salem Branch | Limited Forage Fish Community | Warmwater Sport Fish or Warmwater Forage Fish Community | Town of Salem Utility District No. 1 sewage treatment plant abandoned |
| | Pleasant Prairie tributary | Limited Forage Fish Community | Warmwater Forage Fish Community | Upgrading or abandonment of the Village of Pleasant Prairie Sewer Utility District 'D' sewage treatment plant is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| Fox River | Eagle Creek d/s CTH J | Limited Forage Fish Community | Warmwater Sport Fish Community | Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| | Eagle Creek u/s CTH J | Limited Aquatic Life | Warmwater Sport Fish Community | Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| | Deer Creek | Limited Aquatic Life | Warmwater Sport Fish Community | Stream appraisals and surveys support the assignment of a higher water use objective |
| | Poplar Creek d/s C&NW Railroad | Limited Forage Fish Community | Warmwater Sport Fish Community | Stream appraisals and surveys support the assignment of a higher water use objective |
| | Poplar Creek u/s C&NW Railroad | Limited Aquatic Life | Warmwater Sport Fish Community | Stream appraisals and surveys support the assignment of a higher water use objective |
| Rock River | Sharon Creek | Limited Forage Fish Community | Warmwater Forage Fish Community | Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| | Darien Creek | Limited Forage Fish Community | Warmwater Forage Fish Community | Abandonment of the Village of Darien sewage treatment plant is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| | Rubicon River d/s tributary confluence in NE ¼ Section 13 | Limited Forage Fish Community | Rubicon River d/s Hilldale Road: Warmwater Sport Fish Community | Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| | Rubicon River u/s tributary confluence in NE ¼ Section 13 | Limited Aquatic Life | Rubicon River u/s Hilldale Road: Warmwater Forage Fish Community | Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |

Table XVIII-12 (cont'd)

| Watershed | Stream Reach | Wisconsin Department of Natural Resources Water Use Objective | SEWRPC-Recommended Water Use Objective | Rationale for Change Recommended by SEWRPC |
|---|---|---|---|---|
| Root River | Hoods Creek | Limited Forage Fish Community | Warmwater Forage Fish Community | Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| | Tess Corners Creek | Limited Forage Fish Community | Warmwater Forage Fish Community | Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |
| Sheboygan River | East Branch Belgium Creek | Limited Aquatic Life | Warmwater Sport Fish Community | Upgrading of the Village of Belgium sewage treatment plant is expected to result in a water quality sufficient to permit the assignment of a higher water use objective |

Source: Wisconsin Department of Natural Resources and SEWRPC.

for which data were available, the data indicate that no significant changes in water quality conditions have occurred. For 1,118 miles of stream, or 91 percent of the stream miles in the Region, the available data were not adequate to characterize the long-term trends in water quality conditions. It should benoted that adequate long-term data were available for only a relatively small percentage of the stream mileage within the Region. The streams for which data did exist included the main stem reaches of the major rivers which traverse the most highly urbanized areas of the Region and thus are the most susceptible to water pollution from urban sources, and for which a knowledge of current conditions and trends within the Region is most important.

Current available lake water quality data were compared with available lake monitoring data collected prior to 1981 to determine any potential changes in lake water quality over time. Comparative data were available for 44 of the 101 major lakes in the Region. The data indicate that 10 of the 44 major lakes for which comparative data were available exhibited an improvement in lake water quality since the initial plan. For 34 lakes where comparative water chemistry data are available, water quality conditions appeared to be unchanged. Comparative water quality data was not available for the remaining 57 major lakes in the Region.

Available current water quality indicate that about 24, or about 35 percent, of the 69 lakes for which data were available have an estimated water quality which indicates that the recommended water use objectives are likely to be met. The available data indicate that 45 lakes, or 65 percent of the lakes for which data were available, do not fully meet the recommended water use objectives. No data were available for 32 of the major lakes in the Region.

The water quality management analyses conducted by the Commission under the plan update have indicated the recommendations for control at the major point sources of pollution in the Region developed in the initial plan have been largely implemented. However, only limited implementation has been achieved with regard to the nonpoint source pollution recommendations included in the initial plan. Significant additional effort will have to be mounted to abate pollution from nonpoint sources in both rural and urban areas. Such pollution control efforts are likely to be more difficult to bring about than point source pollution control measures, and will require an enlightened public for implementation. In addition, in order to assess water quality conditions in the Region and to measure the degree of improvement in those conditions, and in order to provide a sound basis to refine the recommendations contained herein in the future, it will be necessary to carry out a long-term water quality and biological monitoring program throughout the Region.

The updated water quality management plan includes definitive recommendations for land use development; for the establishment of sewer service areas; for the configuration and sizing of major trunk sewers; for the number and location of sewage treatment plants; for the abatement of pollution from sanitary sewer flow relief devices; and for reduction levels in nonpoint source pollutants from both urban and rural land. Within the context of the overall regional program, the updated recommended regional water quality management plan should meet all applicable Federal and State planning requirements and thereby should be able to continue to serve as the official regional water quality management plan of the Region. As such, the plan should serve as a sound basis for the approval of waste discharge permits and State and Federal grants-in-aid. It is recognized that the plan recommendations will need to be further refined and detailed through preparation at the local governmental level of specific facilities and practices plans. In this respect, the plan should serve as a sound point of departure for the necessary local studies. Most importantly, implementation of the plan will contribute toward enhancing the overall quality of the environment in the Region and thereby contribute toward making the Region a safer, more healthful, and more attractive area in which to live and work.

# APPENDICES

## Appendix A

# NONPOINT SOURCE POLLUTION CONTROL, STREAM CHANNEL REHABILITATION AND LAKE REHABILITATION MEASURES--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

## NONPOINT SOURCE POLLUTION CONTROL MEASURES

Nonpoint, or diffuse, sources of water pollution include urban sources such as runoff from residential, commercial, industrial, transportation, and recreational land uses; construction activities; and onsite sewage disposal systems and rural sources such as runoff from cropland, pasture, and woodland, atmospheric contributions, and livestock wastes. These sources of pollutants discharge to surface waters by direct overland drainage, by drainage through natural channels, by drainage through engineered stormwater drainage systems, and by deep percolation into the ground and subsequent return flow to the surface waters.

A summary of the methods and estimated effectiveness of nonpoint source water pollution control measures is set forth in Table A-1. These measures have been grouped for planning purposes into two categories: basic practices and additional. Application of the basic practices will have a variable effectiveness in terms of control level of pollution control depending upon the subwatershed area characteristics and the pollutant considered. The additional category of nonpoint source control measures has been subdivided into four subcategories based upon the relative effectiveness and costs of the measures. The first subcategory of practices can be expected to generally result in an about 25 percent reduction in pollutant runoff. The second and third subcategory of practices, when applied in combination with the minimum and additional practices, can be expected to generally result in up to a to and 75 percent reduction in pollutant runoff, respectively. The fourth subcategory would consist of all of the preceding practices, plus those additional practices that would be required to achieve a reduction in ultimate runoff of more than 75 percent.

Table A-1 sets forth the diffuse source control measures applicable to general land uses and diffuse source activities, along with the estimated maximum level of pollution reduction which may be expected upon implementation of the applicable measures. The Table also includes information pertaining to the costs of developing the alternatives set forth in this chapter.[1] These various individual nonpoint source control practices are summarized by group in Table A-2.

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[1] Costs are presented in more detail in the following SEWRPC Technical Reports: No. 18, State of the Art of Water Pollution Control in Southeastern Wisconsin, Volume three: Urban Storm Water Runoff, July 1977; No. 18, State of the Art of Water Pollution Control in Southeastern Wisconsin, Volume four: Rural Storm Water Runoff, December 1976; and No. 31, Costs of Urban Nonpoint Source Water Pollution Control Measures, June 1991.

Table A-1

GENERALIZED SUMMARY OF METHODS AND EFFECTIVENESS OF DIFFUSE SOURCE WATER POLLUTION CONTROL MEASURES

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Urban | Litter and pet waste control ordinance | Prevent the accumulation of litter and pet waste on streets and residential, commercial, industrial, and recreational areas | 2-5 | Ordinance administration and enforcement costs are expected to be funded by violation penalties and related revenues |
| | Improved timing and efficiency of street sweeping, leaf collection and disposal, and catch basin cleaning | Improve the scheduling of these public works activities, modify work habits of personnel, and select equipment to maximize the effectiveness of these existing pollution control measures | 2-5 | No significant increase in current expenditures is expected |
| | Management of onsite sewage treatment systems | Regulate septic system installation, monitoring, location, and performance; replace failing systems with new septic systems or alternative treatment facilities; develop alternatives to septic systems; eliminate direct connections to drain tiles or ditches; dispose of septage at sewage treatment facility | 10-30 | Replace one-half of estimated existing failing septic systems with properly located and installed systems and replace one-half with alternative systems, such as mound systems or holding tanks; all existing and proposed onsite sewage treatment systems are assumed to be properly maintained; assume system life of 25 years. The estimated cost of a septic tank system is $5,000-$6,000 and the cost of an alternative system is $10,000. The annual maintenance cost of a disposal system is $250. An in-ground pressure system is estimated to cost $6,000-$10,000 with an annual operation and maintenance cost of $250. A holding tank would cost $5,500-$6,500 with an annual operation and maintenance cost of $1,800. |
| | Increased street sweeping | On the average, sweep all streets in urban areas an equivalent of once or twice a week with vacuum street sweepers; require parking restrictions to permit access to curb areas; sweep all streets at least eight months per year; sweep commercial and industrial areas with greater frequency than residential areas | 30-50 | Estimate curb miles based on land use, estimated street acreage, and Commission transportation planning standards; assume one street sweeper can sweep 2,000 curb miles per year; assume sweeper life of 10 years; assume residential areas swept once weekly, commercial and industrial areas swept twice weekly. The cost of a vacuum street sweeper is approximately $120,000. The cost of the operation and maintenance of a sweeper is about $25 per curb/mile swept. |

Table A-1 (continued)

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Urban (continued) | Increased leaf and clippings collection and disposal | Increase the frequency and efficiency of leaf collection procedures in fall; use vacuum cleaners to collect leaves; implement ordinances for leaves, clippings, and other organic debris to be mulched, composted, or bagged for pickup | 2-5 | Assume one equivalent mature tree per residence plus five trees per acre in recreational areas; 75 pounds of leaves per tree; 20 percent of leaves in urban areas not currently disposed of properly. The cost of the collection of leaves in a vacuum sweeper and disposal is estimated at $180-$200 per ton of leaves |
| | Increased catch basin cleaning | Increase frequency and efficiency of catch basin cleaning; clean at least twice per year using vacuum cleaners; catch basin installation in new urban development not recommended as a cost-effective practice for water quality improvement | 2-5 | Determine curb miles for street sweeping; vary percent of urban area served by catch basins by watershed from Commission inventory data; assume density of 10 catch basins per curb mile; clean each basin twice annually by vacuum cleaner. The cost of cleaning a catch basin is approximately $10. |
| | Reduced use of deicing salt | Reduce use of deicing salt on streets; salt only intersections and problem areas; prevent excessive use of sand and other abrasives | Negligible for pollutants addressed in this plan but helpful for reducing chlorides and associated damage to vegetation | Increased costs, such as for slower transportation movement, are expected to be offset by benefits such as reduced automobile corrosion and damage to vegetation |
| | Improved street maintenance and refuse collection and disposal | Increase street maintenance and repairs; increase provision of trash receptacles in public areas; improve trash collection schedule; increase cleanup of parks and commercial centers | 2-5 | Increase current expenditures by approximately 15 percent |
| | Parking lot stormwater temporary storage and treatment measures | Construct gravel-filled trenches, sediment basins, or similar measures to store temporarily the runoff from parking lots, rooftops, and other large impervious areas; if treatment is necessary, use a physical-chemical treatment measure such as screens, dissolved air flotation, or a swirl concentrator | 5-10 | Design gravel-filled trenches for 24-hour, five year recurrence interval storm; apply to off-street parking acreages. For treatment--assume four-hour detention time. The capital cost of stormwater detention and treatment facilities is estimated at $40,000-$80,000 per acre of parking lot area, with an annual operation and maintenance cost of about $200 per acre |
| | Onsite storage--residential | Remove connections to sewer systems; construction onsite stormwater storage measures for subdivisions | 5-10 | Remove roof drains and other connections from sewer system wherever needed; use lawn aeration if applicable; apply dutch drain storage facilities to 15 percent of residences. The capital cost would approximate $500 per house, with an annual maintenance cost of about $25 |

Table A-1 (continued)

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Urban (continued) | Stormwater infiltration--urban | Construct gravel-filled trenches for areas of less than 10 acres or basins to collect and store temporarily stormwater runoff to reduce volume, provide groundwater recharge and augment low stream flows | 45-90 | Design gravel-filled trenches or basins to store the first 0.5 inch of runoff; provide at least a 25-foot grass buffer strip to reduce sediment loadings. The capital cost of a stormwater infiltration is estimated at $12,000 for a six-foot deep, 10-foot wide trench, and at $70,000 for a one-acre basin, with an annual maintenance cost of about $10-$350 for the trench, and of about $2,500 for the basin |
| | Stormwater storage--urban | Store stormwater runoff from urban land in surface storage basins or, where necessary, subsurface storage basins | 10-35 | Design all storage facilities for a 1.5 inch of runoff event, which corresponds approximately to a five-year recurrence interval event with a storm event being defined as a period of precipitation with a minimum antecedent and subsequent dry period of from 12 to 24 hours; apply subsurface storage tanks to intensively developed existing urban areas where suitable open land for surface storage is unavailable; design surface storage basins for proposed new urban land, existing urban land not storm sewered, and existing urban land where adequate open space is available at the storm sewer discharge site. The capital cost for stormwater storage would range from $35,000 to $110,000 per acre of basin, with an annual operation and maintenance cost of about $40-$60 per acre |
| | Stormwater treatment | Provide physical-chemical treatment which includes screens, microstrainers, dissolved air flotation, swirl concentrator, or high-rate filtration, and/or disinfection, which may include chlorination, high-rate disinfection, or ozonation to stormwater following storage | 10-50 | To be applied only in combination with stormwater storage facilities above; general cost estimates for microstrainer treatment and ozonation were used; same costs were applied to existing urban land and proposed new urban development. Stormwater treatment has an estimated capital cost of from $900-$7,000 per acre of tributary drainage area, with an average annual operation and maintenance cost of about $35-$100 per acre |

Table A-1 (continued)

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Rural | Conservation practices | Includes such practices as strip cropping, contour plowing, crop rotation, pasture management, critical area protection, grading and terracing, grassed waterways, diversions, wood for management, fertilization and pesticide management, and chisel tillage | Up to 50 | Costs for Natural Resources Conservation Service (NRCS)-recommended practices are applied to agricultural and related rural land; the distribution and extent of the various practices were determined from an examination of 56 existing farm plan designs within the Region. The capital cost of conservation practices ranges from $3,000-$5,000 per acre of rural land, with an average annual operation and maintenance cost of from $5-$10 per rural acre |
| | Animal waste control system | Construct stream bank fencing and crossovers to prevent access of all livestock to waterways; construct a runoff control system or a manure storage facility, as needed, for major livestock operations; prevent improper applications of manure on frozen ground, near surface drainageways, and on steep slopes; incorporate manure into soil | 50-75 | Cost estimated per animal unit; animal waste storage (liquid and slurry tank for costing purposes) facilities are recommended for all major animal operations within 500 feet of surface water and located in areas identified as having relatively high potential for severe pollution problems. Runoff control systems recommended for all other major animal operations. It is recognized that dry manure stacking facilities are significantly less expensive than liquid and slurry storage tanks and may be adequate waste storage systems in many instances. The estimated capital cost and average operation and maintenance cost of a runoff control system is $100 per animal unit and $25 per animal unit, respectively. The capital cost of a liquid and slurry storage facility is about $1,000 per animal unit, with an annual operation and maintenance cost of about $75 per unit. An animal unit is the weight equivalent of a 1,000-pound cow |

Table A-1 (continued)

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Rural (continued) | Base-of-slope detention storage | Store runoff from agricultural land to allow solids to settle out and reduce peak runoff rates. Berms could be constructed parallel to streams | 50-75 | Construct a low earthen berm at the base of agricultural fields, along the edge of a floodplain, wetland, or other sensitive area; design for 24-hour, 10-year recurrence interval storm; berm height about four feet. Apply where needed in addition to basic conservation practices; repair berm every 10 years and remove sediment and spread on land. The estimated capital cost of base-of-slope detention storage would be about $500 per tributary acre, with an annual operation and maintenance cost of $25 per acre. |
| | Bench terraces | Construct bench terraces, thereby reducing the need for many other conservation practices on sloping agricultural land | 75-90 | Apply to all appropriate agricultural lands for a maximum level of pollution control. Utilization of this practice would exclude installation of many basic conservation practices and base-of-slope detention storage. The capital cost of bench terraces is estimated at $1,500 per acre, with an annual operation and maintenance cost of $100 per acre |
| Urban and Rural | Public education programs | Conduct regional- and county-level public education programs to inform the public and provide technical information on the need for proper land management practices on private land, the recommendations of management programs, and the effects of implemented measures; develop local awareness programs for citizens and public works officials; develop local contact and education efforts | Intermediate | For first 10 years includes cost of one person, materials, and support for each 25,000 population. Thereafter, the same cost can be applied to for every 50,000 population. The cost of one person, materials, and support is estimated at $55,000 per year |
| | Construction erosion control practices | Construct temporary sediment basins; install straw bale dikes; use fiber mats, mulching and seeding; install slope drains to stabilize steep slopes; construct temporary diversion swales or berms upslope from the project | 20-40 | Assume acreage under construction is the average annual incremental increase in urban acreage; apply costs for a typical erosion control program for a construction site. The estimated capital cost and operation and maintenance cost for construction erosion control is $250-$5,500 and $250-$1,500 per acre under construction, respectively. |

Table A-1 (continued)

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Urban and Rural (continued) | Materials storage and runoff control facilities | Enclose industrial storage sites with diversions; divert runoff to acceptable outlet or storage facility; enclose salt piles and other large storage sites in crib and dome structures | 5-10 | Assume 40 percent of industrial areas are used for storage and to be enclosed by diversions; assume existing salt storage piles enclosed by cribs and dome structures. The estimated capital cost of industrial runoff control is $2,500 per acre of industrial land. Material storage control costs are estimated at $75 per ton of material |
| | Stream protection measures | Provide vegetative buffer zones along streams to filter direct pollutant runoff to the streams; construct stream bank protection measures, such as rock riprap, brush mats, tree revetment, jacks, and jetted willow poles where needed | 5-10 | Apply a 50-foot-wide vegetative buffer zone on each side of 15 percent of the stream length; apply stream bank protection measures to 5 percent of the stream length. Vegetative buffer zones are estimated to cost $21,200 per mile of stream, and streambank protection measures cost about $37,000 per stream mile |
| | Pesticide and fertilizer application restrictions | Match application rate to need; eliminate excessive applications and applications near or into surface water drainageways | 0-3 | Cost included in public education program |
| | Critical area protection | Emphasize control of areas bordering lakes and streams; correct obvious erosion and other pollution source problems | Intermediate | Intermediate |

[a] Not all control measures are required for each subwatershed. The characteristics of the watershed, the estimated required level of pollution reduction needed to meet the applicable water quality standards, and other factors will influence the selection and estimation of costs of specific practices for any one subwatershed. Although the control measures costed represent the recommended practices developed at the regional level on the basis of the best available information, the local implementation process should provide more detailed data and identify more efficient and effective sets of practices to apply to local conditions.

[b] The approximate effectiveness refers to the estimated amount of pollution produced by the contributing category (urban or rural)that could be expected to be reduced by the implementation of the practice. The effectiveness rates would vary greatly depending on the characteristics of the watershed and individual diffuse sources. It should be further noted that practices can have only a "sequential" effect, since the percent pollution reduction of a second practice can only be applied against the residual pollutant load which is not controlled by the first practice. For example, two practices of 50 percent effectiveness would achieve a theoretical total effectiveness of only 75 percent control of the initial load. Further, the general levels of effectiveness reported in the table are not necessarily the same for all pollutants associated with each source. Some pollutants are transported by dissolving in water and others by attaching to solids in the water; the methods summarized here reflect typical pollutant removal levels.

[c] For highly urbanized areas which require retrofitting of facilities into developed areas, the costs can range from $400,000 to $1,000,000 per acre of storage.

Source: SEWRPC.

Table A-2

ALTERNATIVE GROUPS OF DIFFUSE SOURCE WATER POLLUTION CONTROL MEASURES
PROPOSED FOR STREAMS AND LAKE WATER QUALITY MANAGEMENT

| Pollution Control Category | Level of Pollution[b] Control | Practices to Control Diffuse Source Pollution from Urban Areas[c] | Practices to Control Diffuse Source Pollution from Rural Areas[b] |
|---|---|---|---|
| Basic Practices | Variable | Construction erosion control; onsite sewage disposal system management; streambank erosion control | Streambank erosion control |
| | 25 percent | Public education programs; litter and pet waste control; restricted use of fertilizers and pesticides; construction erosion control; critical areas protection; improved timing and efficiency of street sweeping, leaf collection, and catch basin cleaning; material storage facilities and runoff control | Public education programs; fertilizer and pesticide management; critical area protection; crop residue management; chisel tillage; pasture management; contour plowing; livestock waste control |
| Additional Diffuse Source Control Practices[a] | 50 percent | Above, plus: Increased street sweeping; improved street maintenance and refuse collection and disposal; increased catch basin cleaning; stream protection; increased leaf and vegetation debris collection and disposal; stormwater storage; stormwater infiltration | Above, plus: Crop rotation; contour strip-cropping; grass waterways; diversions; wind erosion controls; terraces; stream protection |
| | 75 percent | Above, plus: An additional increase in street sweeping, stormwater storage and infiltration; additional parking lot stormwater runoff storage and treatment | Above, plus: Base-of-slope detention storage |
| | More than 75 percent | Above, plus: Urban stormwater treatment with physical-chemical and/or disinfection treatment measures | Bench terraces[c] |

[a] In addition to diffuse source control measures, lake rehabilitation techniques may be required to satisfy lake water quality standards - see Table A-4.

[b] Groups of practices are presented here for general analysis purposes only. Not all practices are applicable to, or recommended for, all lake and stream tributary watersheds. For costing purposes, construction erosion control practices, public education programs, and material storage facilities and runoff controls are considered urban control measures and stream protection is considered a rural control measure.

[c] The provision of bench terraces would exclude most basic conversation practices and base-of-slope detention storage facilities.

Source: SEWRPC.

Of the sets of practices recommended for various levels of diffuse source pollution control presented in Table A-2, not all practices are needed, applicable, or cost-effective for all watersheds, due to variations in pollutant loadings and land use and natural conditions among the watersheds. Therefore, it is recommended that the practices indicated as needed for nonpoint source pollutant control be refined by local level nonpoint source control practices planning, which would be analogous to sewerage facilities planning for point source pollution abatement. A locally prepared plan for nonpoint abatement measures should be better able to blend knowledge of current problems and practices with a quickly evolving technology to achieve a suitable, site specific approach to pollution abatement.

STREAM CHANNEL REHABILITATION MEASURES

The ability of streams in southeastern Wisconsin to satisfy desired water use objectives is contingent on the tributary pollution loads to the stream and the instream characteristics. In recognizing the need to harmonize these two management aspects within a comprehensive water quality plan, the Commission proposes stream bank protection measures as a best management practice, in addition to land management measures. Stream bank protection measures--primarily designed to prevent erosion and preserve stream side vegetation--are most applicable to natural stream channels. However, portions of streams which flow through the highly urbanized areas of the Region--such as the Menomonee and Kinnickinnic River watersheds--have undergone major channel modifications. These channelized stream reaches require specialized management techniques to provide a suitable habitat for fish and other aquatic life which serve as important indicators of the chemical and biological condition of a stream.

Channel modifications--more commonly called channelization--may include one or more of the following major changes to the natural stream channel, all designed to increase the capacity of the channel: straightening, widening, and deepening; placement of a concrete invert and concrete sidewalls; and construction of culverts to carry the stream under roads and railroads as needed. In some instances, a completely new length of channel may be constructed so as to bypass a natural channel reach, as has been done for a portion of Underwood Creek in the City of Wauwatosa. The function of channel modifications or enclosures are to yield a lower, hydraulically more efficient waterway through which a given flood discharge can be conveyed at a much lower flood stage relative to that which would exist under natural or prechannelization conditions. However, modified channels are detrimental to the support of fish and aquatic life for the following reasons:

1. They eliminate habitat areas needed by fish, aquatic insects, and benthic organisms. These habitat areas provide food, shelter, and spawning substrate necessary for the support of fish and other aquatic animals.

2. They eliminate plant substrate. Besides providing food, shelter, and spawning substrate for aquatic animals, aquatic plants provide oxygen to the water, remove nutrients, and trap sediments and other pollutants. Plants also provide shade, thereby lowering the temperature of the stream.

3. Some structures and dams provide barriers to the migration of fish and other aquatic animals, often necessary for feeding, spawning, and colonization purposes.

In addition, the aesthetic qualities of modified channels are generally poor, thereby reducing recreational use potential. Temporary storage of pollutants within the stream channel is also minimized, thereby increasing the first flush pollutant load effects on downstream receiving waters. These factors indicate that habitat improvement techniques, in addition to water pollution control measures, may need to be implemented to satisfy fish and aquatic life objectives within these channelized stream reaches.

The basic approach to improving the biological potential of a modified stream channel is to: 1) provide protective areas where a suitable sediment substrate may at least temporarily accumulate; 2) increase vegetative growth; and 3) eliminate barriers to aquatic animal migration. Table A-3 presents a description of selected measures which could be used to increase the biological potential of existing and future modified channels. In addition to providing suitable habitat for aquatic life, stream channel rehabilitation enhances the aesthetic qualities of the stream and--through temporary sediment storage, aeration, increased shading, and biological nutrient uptake--improves the water quality of the stream. It is recognized that most of these rehabilitation measures by their nature decrease the hydraulic efficiency of the stream channel. However, in many cases the hydraulic efficiency could be maintained at a level which would not preclude achievement of flood control design. A site-specific study would be required to determine the potential of each stream reach to provide biological habitat and at the same time be acceptable for flood control purposes.

LAKE REHABILITATION MEASURES

The reduction of nutrient inputs to lakes in southeastern Wisconsin, while preventing further water quality deterioration, may not necessarily result in the elimination of existing water quality problems. The indicated water quality improvements expected from a reduced nutrient input will be inhibited or prevented by conditions which include, for example, in eutrophic lakes, the presence of continued mixing or an anaerobic hypolimnion (the lower layer of a stratified lake), which may release significant amounts of phosphorus from the sediments to the overlying water column. Similarly, rooted aquatic plants may continue to grow prolifically in nutrient-rich bottom sediments, regardless of the nutrient content of the overlying water. If this occurs, or if other characteristics of a lake result in a restricted water use potential, the application of lake rehabilitation techniques should be considered.

Lake rehabilitation techniques that are applicable to southeastern Wisconsin include dredging, sediment covering or consolidation, nutrient inactivation, hypolimnetic aeration, and total aeration. Other techniques, perhaps more properly classified as lake management practices, would include macrophyte harvesting or chemical control, algae chemical control, and fish management. The applicability of experimental techniques, such as biological control, selective discharge, algal harvesting, dilution/flushing, and inflow treatment, requires additional study. Many of these techniques require federal and/or state permits to be issued prior to implementation. A brief description of lake rehabilitation techniques is set forth in Table A-4.

Table A-3

SELECTED BIOLOGICAL LIFE HABITAT REHABILITATION MEASURES
FOR EXISTING AND PLANNED CHANNEL MODIFICATIONS

| Rehabilitation Measure | | Description and Application |
|---|---|---|
| Existing Modified Channels | Riffle and Pool Development | Use various methods below to create riffle-pool sequences. Riffles are sections of streams containing rocks, gravel, or other coarse substrate in which the current is swift enough to remove silt and sand. Riffles should occur at intervals equal to five to seven channel widths. A water depth of six inches is desirable. Riffles help aerate the stream and provide ideal biological habitat. Pools are deeper, slower sections of streams and provide valuable food and resting and refuge areas for fish. Pools ideally should be designed so that the sediments are not completely flushed out during storm events |
| | Installation of Low Gabion, Rock, or Concrete Check Dams | Low dams provide a pooling effect and accumulate sediment for biological habitat. Dams should be low enough to provide for fish migration |
| | Installation of Gabion or Rock Wing Deflectors | Wing deflectors provide a riffle-pool effect and accumulate sediment. They provide cover for fish and other aquatic life |
| | Use of Scattered Rocks | Installation of rocks create a riffle effect and provide cover for fish and other aquatic life. They also temporarily trap some sediment |
| | Vegetation Improvement | Plant erosion-resistant native grasses, shrubs, and trees as close as practical to the stream channel to provide cover, food supply, and shade. Provide buffer strip along channel |
| | Removal of Barriers to Migrating Species | Remove dams, drop structures, chutes, and steep grades which cannot be crossed by migrating fish and other aquatic life. Construct alternative grade control structures |
| Planned Modified Channels | Channel Section and Grade Design | The low flow channel cross-section should approach a natural stream condition. The bottom width of the channel and the channel grade can be varied to create a riffle-pool sequence |
| | Avoidance of Straight Channels | Constructed channels should be aligned as much as possible with the natural stream curvature |
| | Vegetation and Wetland Preservation | Preserve native vegetation and wetlands as much as possible to provide shade trees and shrubs and maintain the water quality, environmental, and aesthetic benefits of wetlands |
| | Installation of Channel Bank Reservoirs | Various storage measures may be incorporated into the channel bank design to temporarily store runoff, reduce size requirements for downstream channels, and accumulate sediment, thereby providing suitable biological habitat |
| | Avoidance of Barriers to Migrating Species | Do not construct steep drop structures which cannot be crossed by fish or other aquatic life |
| | Use of Construction Erosion Controls | Construction erosion controls are essential for channel modification projects. Stabilize the exposed surface, control runoff, and prevent sediment delivery to the stream |

Source: SEWRPC.

Table A-4

DESCRIPTION OF LAKE REHABILITATION TECHNIQUES APPLICABLE TO SOUTHEASTERN WISCONSIN

| Technique | Description and Effectiveness | Disadvantages |
|---|---|---|
| Dredging | Dredging is effective in deepening lakes. A hydraulic dredge is often used. Benefits are an increased depth, possible induced lake stratification, and reduced mixing of the sediments and water layers; removal of a suitable bottom substrata for macrophytes; improved navigation; and, if nutrient-poor sediments can be exposed, reduced nutrient release from sediments | Possible adverse environmental effects,[a] increased turbidity during operation, nutrient release from disturbed sediments, and high costs |
| Sediment Covering | Covering lake sediments may prevent release of nutrients and organic material from the sediments, prevent continued resuspension of the sediments, inhibit macrophyte growth by elimination of suitable bottom stabilization of sediments, and minimization of water loss via infiltration. Several cover materials have been proposed, including sand, clay, plastic, rubber, fly ash, and gels | Unknown ecological and environmental impacts, possible return of macrophytes if an organic layer is deposited above the covering, possible algal problems if macrophytes are eliminated, and questionable long-term effectiveness |
| Sediment Consolidation | This technique involves lake drawdown and sediment drying. The dewatering reduces the volume of sediments which are highly organic, and increases the lake depth. The effects are irreversible; the sediments will not expand upon lake refilling | Sediment chemical changes may occur, increasing nutrient release to the water |
| Nutrient Inactivation | This technique has worked effectively for stratified lakes. The treatment may convert nutrients into a form unavailable for plant uptake, remove nutrients from the water column, and prevent release of nutrients from the sediments. The most commonly used material is alum (an aluminum compound), although iron compounds, calcium compounds, ion exchange resins, fly ash, and clay have also been used. Application may be on ice surfaces or under ice cover, or through water surface broadcast or subsurface manifold injection. This technique is effective in reducing algal problems | Limited applicability |
| Hypolimnetic (bottom) Aeration | The intent of this technique is to increase the dissolved oxygen content in the hypolimnion of stratified lakes without destroying the stratification. Typically, bottom water is lifted to the surface via a vertical tube and oxygenated water is returned to the hypolimnion. The decomposition of organic matter is increased and nutrient release is decreased. Available habitat for desirable fish species may be increased | The ecological effects of aeration need to be more thoroughly addressed. The practice is too expensive to be feasible in lakes larger than one or two hundred acres in size |

Table A-4 (continued)

| Technique | Description and Effectiveness | Disadvantages |
|---|---|---|
| Total Aeration/Circulation | The prevention of fish winterkill and the destratification of lakes to provide oxygen to bottom layers are the primary intents of this technique. The general approach has been to circulate and thereby destratify lakes by pumping or injecting compressed air to the bottom water. The effect of destratification during winter is the maintenance of an open water area, which increases photosynthesis and oxygen diffusion from the air | Destratification could eliminate cold water areas during summer required for some fish species |
| Macrophyte (weed) Harvesting | Harvesting macrophytes with mechanical harvesters increases the recreational use potential of lakes subject to with excessive plant growth | The macrophytes must be harvested every year and disposal may be a problem. Some nutrients are removed from the lake but the amounts are usually minimal in terms of the total nutrient content of the lake |
| Chemical Control | Excessive macrophyte growths, algal blooms, and undesirable fish populations may be controlled by chemical treatment. It is most applicable in highly eutrophic lakes where nutrient loads cannot be sufficiently reduced and where severe water use restrictions occur | Because of the potential adverse effects of adding poisonous chemicals to lakes, this technique requires cautious use in only the most extreme circumstances |
| Inflow Treatment | It is possible to treat inflowing surface runoff by many of the same procedures recommended for treatment of urban runoff | Required high levels of sophisticated equipment and technical expertise and high costs have prevented the adequate demonstration of this technique |
| Dilution/Flushing | This technique involves the replacement of nutrient-rich lake water with nutrient-poor water from a stream or the groundwater. The method may be effective in reducing algal blooms | Long-term effects are questionable. Dilution/Flushing is probably not applicable to most lakes in the Region, which are characteristically shallow and contain nutrient-rich sediments |
| Selective Discharge | Selective discharge involves the release of nutrient-rich, anaerobic water from the hypolimnion of a eutrophic lake. Nutrient levels are reduced and dissolved oxygen in the hypolimnion is increased | Further research on the overall effectiveness of this technique is needed, and it appears that the water quality of downstream reaches would be adversely affected |
| Biological Controls | This technique is a highly desirable approach and is inexpensive. Techniques are generally categorized into predatory-prey relationships; species manipulation; and pathological reactions. Control organisms being evaluated include the white amur (grass carp), walleye, northern pike, snails, crayfish, waterfowl, insects, aquatic mammals, plant viruses, and fish parasites | This technique is still in the experimental stage and possible adverse environmental impacts could be substantial; grass carp are prohibited from being imported into Wisconsin |

Source: Wisconsin Department of Natural Resources and SEWRPC.

The applicability of specific lake rehabilitation techniques is highly dependent on the characteristics of an individual lake. As most techniques available have a relatively high cost, and as the state-of-the-art of lake management, for the most part, is still in its early stages of development, a cautious approach to implementing lake rehabilitation techniques is desirable. Application of any lake rehabilitation technique, therefore, should be contingent upon the completion of detailed, local, lake-specific management plans, which would be analogous to sewerage facilities planning for point source pollution abatement, and upon the actual experiences with the proposed technique in similar waterbodies in the Region, if possible. For these reasons, it is recommended that lake rehabilitation techniques be applied first to lakes in which: 1) nutrient inputs to the lake have been reduced to below the critical level on the basis of watershed point and nonpoint source pollution control measures; 2) there is the greatest probability of success based upon the results of in-lake studies to be conducted prior to implementing a lake rehabilitation program; and 3) the possibility of adverse environmental impacts is minimal. Proper technical support and monitoring programs, together with additional research and development, should maximize the chance of successful lake management and minimize adverse environmental impacts, and provide a range of management experiences that can be transferred to other situations as appropriate.