

A PROSPECTUS FOR A REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE

Chapter 4

WORK PROGRAM

4.1 INTRODUCTION

This chapter outlines the proposed components and scope of work for a Regional Water Quality Management Plan update for Southeastern Wisconsin (RWQMPU). The major elements proposed to be included in the update are outlined in sufficient detail to allow for the development of cost estimates for budgetary purposes; to establish a reasonable time sequence and schedule for the necessary work; and to identify an organizational structure for the conduct of the necessary work, including determination of staff requirements. Major elements of the proposed RWQMPU and the processes required for their development include: identifying historical and recent water quality data to be collected and analyzed; defining necessary wastewater treatment facility inventories and assessments; identifying the types of point and nonpoint sources of pollution to be assessed and the processes for evaluating these pollution contributions; identifying supplementary inventories and maps to be included; and describing how Commission staff will prepare study findings and plan recommendations.

4.2 INVENTORY COMPONENTS AND ASSESSMENT FRAMEWORKS

Regional Watersheds

The full project area for the RWQMPU encompasses approximately 2,982 square miles and is shown on **Map 4.1**. The project area includes all or portions of the 12 major watersheds including the Des Plaines River, Fox River, Kinnickinnic River, Menomonee River, Milwaukee River, Oak Creek, Pike River, Rock River, Root River, Sauk Creek, and Sheboygan River Watersheds and lands directly tributary to Lake Michigan. The

area also covers the seven counties served by the Southeastern Wisconsin Regional Planning Commission (Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha) as well as significant areas outside of the Region that drain into the project area.

Addressing water quality problems in surface and groundwater resources often requires assessing conditions that go beyond regional and municipal boundaries. Areas upstream of a waterbody can have large impacts on downstream water quality conditions, regardless of political boundaries. The proposed RWQMPU will assess water quality conditions and trends on a watershed basis. This will provide a more comprehensive approach for understanding the factors that contribute to the health of a waterbody and will help guide more effective management strategies to improve the condition of lakes, streams, and groundwater in the Region.

Surface Water Quality Inventories and Assessments

Evaluations of streams, lakes, and groundwater will prioritize commonly monitored chemical and physical water quality parameters, compare observed conditions to water quality criteria and designated uses, and assess recent and historical trends. This approach will help identify waters in need of improvement, recognize and document successful restoration efforts, and better understand long-term patterns affecting the water resources in the Region. The proposed RWQMPU will also include a more comprehensive review of biological indicators of water quality, including macroinvertebrates, fish communities, and aquatic vegetation, where data are available. While physical and chemical measurements provide a snapshot of water quality conditions at a particular point in time, assessments of biological communities integrate environmental influences over longer periods. Assessing these biotic communities will allow for a broader and more representative understanding of overall and sustained water quality conditions and how those conditions are impacting aquatic life.

Streams and Rivers

To narrow the scope of the surface water quality inventories to be conducted, specific rivers and streams in the Region were selected. River and stream selection was based on several criteria. The WDNR 24K Hydrography geodatabase¹ was first used to identify large perennial streams. These included the mainstems of major rivers in the Region and most larger streams. Smaller streams identified as perennial streams that

¹ *Wisconsin Department of Natural Resources Bureau of Enterprise Information Technology & Applications, Wisconsin DNR 24K Hydrography User's Guide, Version 6, July 2007.*

flow through major municipalities or that currently or previously received WWTP effluent discharge were also selected. Those streams identified as impaired or included in a TMDL were also included. The rivers and streams selected for water quality assessments and inventories are shown on [Map 4.2](#).

Stream Water Quality Parameters

The type and frequency of water quality data available for streams in southeastern Wisconsin varies significantly from one stream to another and throughout the historical data record. Several water quality parameters that were commonly sampled in streams between 1960 and 2026 were selected for assessment in the proposed RWQMPU. A list of priority chemical, physical, and biological water quality parameters selected for the RWQMPU is provided in [Table 4.1](#).

Stream Water Quality Data Analysis

The analysis of stream water quality data will focus on the compilation and collation of instream data for the constituents in [Table 4.1](#). Potential sources of existing water quality data include the USGS National Water Information System (NWIS), the USEPA Water Quality Portal (WQP), the WDNR Surface Water Information Systems (SWIMS) database, the MMSD water quality sampling program, counties and municipalities, universities, lake management groups, and Milwaukee Riverkeeper's volunteer stream monitoring program.

As noted previously in this Prospectus, an initial study (SEWRPC Technical Report No. 4) provided benchmark data that served as the foundation of future water quality planning in the Region.² Since that pivotal study, intermittent continued monitoring has provided additional water quality data for streams in the Region for more than 60 years. Water quality data from the sources mentioned above have been collected at various times, frequencies, and locations, but data has not been uniformly collected throughout the Region. However, all available data for the rivers and streams (identified in [Map 4.2](#)) collected between 1960 and 2026 will be compiled for analysis of historical trends and recent conditions.

Natural stream community type will also be defined for each stream in the proposed RWQMPU. A stream model has been developed by the WDNR to classify stream reaches into their biotic community by fish occurrence and abundance, as well as ecological conditions that largely determine the biotic community.

² SEWRPC Technical Report No. 4, Water Quality and Flow of Streams in Southeastern Wisconsin, November 1966.

These ecological conditions include parameters such as water temperature and streamflow.³ Although this model has some limitations, it does provide an objective, standardized, and ecologically meaningful framework to classify stream reaches and estimate certain stream characteristics.⁴ The proposed natural community classification has eleven natural community classes including: ephemeral, macroinvertebrate, cold headwater, cold mainstem, cool (cold-transition) headwater, cool (cold-transition) mainstem, cool (warm-transition) headwater, cool (warm-transition) mainstem, warm headwater, warm mainstem, and warm river.

Inland Lakes

Southeastern Wisconsin contains hundreds of lakes that span a wide range of lake types and watershed characteristics. The majority of the lakes in the Region are small (less than five acres) with minimal available water quality data. Conversely, there are lakes in the Region that are thousands of acres in size and have robust water quality datasets, such as Geneva Lake in Walworth County. The WDNR classifies lakes into distinct hydrological types based on how water enters or leaves the lake—seepage, spring, drainage, and drained lakes. These lake types can influence water fluctuations, chemistry, and aquatic life. Additionally, WDNR utilizes the natural community classification system to further classify lakes in the Region based on waterbody size, flow, and temperature. Lake natural community types in the Region include deep headwater lakes, deep seepage lakes, shallow seepage lakes, and deep lowland lakes. This natural community classification system can help to establish baseline expectations for biological health and water chemistry conditions and ensure the lakes are evaluated against appropriate ecological benchmarks.

Many of the larger lakes in the Region have relatively consistent water quality data that has been collected frequently by the WDNR, USGS, Commission staff, or volunteer groups affiliated with local lake associations. Larger “two-story” lakes in the Region have the most comprehensive water quality datasets. Conversely, many of the smaller lakes lack consistent monitoring and water quality condition assessments. However, assessing all lakes in the Region that have a reasonable amount of available water quality data will allow for a more comprehensive look at inland lake water quality conditions. This approach will also allow the RWQMPU to identify smaller, yet regionally significant lakes, such as highly-used urban lakes, that may lack consistent monitoring data and guide future monitoring recommendations.

³ J. Lyons, “Patterns in the Species Composition of Fish Assemblages Among Wisconsin Streams,” *Environmental Biology of Fishes*, 45: 329-341, 1996.

⁴ J. Lyons, *An Overview of the Wisconsin Stream Model*, Wisconsin Department of Natural Resources, 2007.

Inland Lake Water Quality Parameters

The type and frequency of water quality data collected for inland lakes in southeastern Wisconsin varies significantly from one lake to another and throughout history. Commission staff identified the water quality parameters most commonly monitored by MMSD, WDNR, and USGS in lakes throughout the Region. These constituents include phosphorus, chlorophyll-a, water clarity, dissolved oxygen, temperature, *E. coli* bacteria, metals, and aquatic vegetation. Additionally, available data for emerging contaminants such as PFAS and neonicotinoids will be included in water quality assessments. While none of the lakes in the Region currently have data related to the tire anti-ozonate bioproduct 6PPD (or 6PPD-quinone), zinc will be examined where possible as a proxy for this contaminant. Zinc is a byproduct of tire wear released to the environment in microscopic particles and may offer insight into tire contamination to surface water where 6PPD has not yet been monitored.

Commission staff will utilize all available data for the selected parameters (see [Table 4.1](#)) to assess both recent conditions and long-term trends in lake water quality. In addition, the proposed RWQMPPU will include a review of ice trends for lakes, where data are available, to determine if changes in long-term weather patterns in the Region have impacted winter ice coverage.

Inland Lake Water Quality Data Analysis

The analysis of inland lake water quality data will focus on the compilation and collation of data for the above-mentioned constituents. Possible sources of existing water quality data include the USGS National Water Information System (NWIS), the USEPA Water Quality Portal (WQP), the WDNR Surface Water Information Systems (SWIMS) database, and the Wisconsin Citizen Lake Monitoring Network (CLMN).

Inland lake water quality data has not been uniformly collected throughout the Region, and the breadth of lake water quality assessments was limited in both the original Regional Water Quality Management Plan (RWQMP) and the Regional Water Quality Management Plan Update for the Greater Milwaukee Area Watersheds. A more thorough assessment of inland lake water quality will therefore be a central component of the forthcoming RWQMPPU. Data will be compiled for all inland lakes in the Region with available data between 1960 and 2026 to summarize existing conditions and identify long-term trends in lake water quality.

Lake Michigan

Lake Michigan water quality assessments will be conducted for locations adjacent to the Southeastern Wisconsin Region. Analyses will aim to provide a general picture of the state of water quality in the Lake. The proposed RWQMPU will summarize Lake Michigan temperature, phosphorus, dissolved oxygen, and chloride data from the four USEPA and three MMSD sites shown on **Map 4.3**.

Groundwater Quality Assessment

The proposed RWQMPU will include a groundwater quality assessment to determine the current state of groundwater in southeastern Wisconsin. Recent conditions will be compared to historical trends in groundwater quality and to current groundwater quality standards. These analyses will utilize the regional groundwater data from shallow and deep municipal wells. Water quality constituents to be reviewed from municipal well samples include nitrate, chloride, sodium, PFAS (where data is available), and metals such as iron, manganese, and arsenic. Radium levels will also be assessed for deep wells, as groundwater stored deep underground for long periods of time is vulnerable to higher levels of radium. High radium levels are especially common in the eastern portion of Wisconsin (including the southeastern Region), where groundwater in deep wells comes from below a thick, confining layer of shale.

Wastewater Treatment

A review of current wastewater treatment plant (WWTP) locations, practices, and technologies will be a key element for the proposed RWQMPU. These inventories are necessary to assess current wastewater treatment capabilities, determine discharge impacts to the environment, review existing sanitary area planning processes, and identify if there is a need for further WWTP regionalization or the establishment of new facilities. These assessments and determinations will inform recommendations for improving wastewater treatment in the Region.

Wastewater Treatment Plant Inventory

There are 45 active, public WWTPs in southeastern Wisconsin. Six of these plants discharge treated effluent directly to Lake Michigan, and 13 discharge to streams tributary to Lake Michigan. The remaining 27 discharge treated effluent to streams in the Des Plaines, Fox, and Rock River basins. In addition, there are seven private wastewater treatment plants in operation within the Region that are regulated by the WDNR and discharge treated effluent to surface waters or groundwater, in the Des Plaines, Fox, and Root River basins. Facilities vary in size, age, and treatment practices and technologies. A regional WWTP inventory will

include information such as capacity, treatment processes, and sludge management procedures. It is envisioned that this information will be derived from WDNR databases and interviews with WWTP operators in the Region.

The proposed RWQMPPU will also include a review of discharge permits and variances for each WWTP, examining discharge pollutants such as five-day biological oxygen demand, total suspended solids (TSS), chlorides, phosphorus, pH, and *E. coli* bacteria. Facilities may be under a variance for one or multiple of these water quality constituents. For example, as of January 2024, 14 plants in the Region had chloride variances.

WWTPs in the Region use a variety of methods to meet nutrient limits and water quality standards. The proposed RWQMPPU will provide a summary of these methods including a tally of which WWTPs are opting to participate in water quality trading, adaptive management, or multi-discharge variance programs. Each of these programs are available to facilities through the WDNR Water Quality Trading Marketplace and are becoming more common for WWTPs striving to reach their permitted nutrient limits.

Review of Private Onsite Wastewater Treatment Systems

Throughout the Region, a significant amount of low-density residential development relies on private onsite wastewater treatment systems (POWTS), commonly known as septic systems, which typically discharge effluent to soils that eventually percolate to groundwater aquifers. The proposed RWQMPPU will feature updated maps displaying areas of development that are assumed to be served by POWTS. Assessing the locations, density, and historical use of septic systems in each watershed can help measure the possible correlation between patterns in private onsite wastewater treatment and water quality.

Additional Regional Inventories

Understanding water quality conditions of surface and groundwater in southeastern Wisconsin requires examining adjacent landscapes that drain into the Region. Inventorying natural environmental features and human-built infrastructure will help to provide the context needed to explain why current water quality conditions exist. Ultimately, these inventories are a critical component of regional water quality management planning, serving as the basis for identifying effective, targeted recommendations to improve the health of the water resources of the Region. Below are brief summaries of the inventories necessary to develop for the proposed RWQMPPU.

General Land Use

Land use is a key factor in determining the types and quantities of pollutants that affect surface and groundwater quality. Since 1963, the Commission has periodically conducted comprehensive inventories of land use patterns in the Region, tracking 67 distinct land use categories. The most recent of these inventories reflects 2020 conditions.

The proposed RWQMPPU will examine changes in land use throughout the Region over time using the SEWRPC historical land use inventories and will rely on 2020 data to assess recent land use conditions. Proportions of each land use category will be calculated for the 12 major watersheds within the RWQMPPU project area for inventories conducted between 1965 and 2020, and changes in land use will be analyzed over this period. These analyses will offer insights into possible pollution sources for each watershed and potential explanations for historical water quality trends. Furthermore, this information will help Commission staff identify watersheds with similar land uses across the Region. Using existing TMDL calculations as a template, land use data will allow for the extrapolation of pollutant loads for watersheds that do not currently have a TMDL in place. This process is discussed in more detail in the “Sources of Pollution” section (section 4.4) later in this chapter.

The preparation of a year 2060 regional land use plan is currently underway. This land use plan will provide data on probable future land use patterns within the Region and will be used to guide future management recommendations in the RWQMPPU. Maps displaying land use categories for each watershed will be included in the update.

Stream Connectivity and Fish Passage

To complete a regional evaluation of fish passage and stream connectivity, the proposed RWQMPPU will leverage readily available inventories to identify existing bridges, culverts, or other potential barriers on the project area streams. This will include work previously completed by the Commission and local non-profit monitoring groups such as the Root-Pike Watershed Initiative Network and Milwaukee Riverkeeper. This inventory will also include information from the WDNR dam inventory, county bridge and culvert inventories (where available), and WisDOT databases.

This information will be summarized in a series of watershed maps to display existing structures and possible barriers to fish passage in the streams selected for the RWQMPPU. Such passage and connectivity barriers

will be considered while interpreting stream biological community and water quality data. Based on the results of these inventories, the proposed RWQMPU may include recommendations for removing or modifying obstructive infrastructure to facilitate the passage of fish and other aquatic organisms, as well as riparian species, and to improve connectivity between surface waters.

Environmental Corridors and Natural Areas

Environmental corridors are strips of land within the larger landscape that encompass key elements of the Region's natural resource base. These areas include woodlands, prairies, wetlands, significant wildlife habitat, surface waters and associated floodplains and riparian buffers, designated natural areas and critical species habitat sites, and other regionally significant historic, scenic, and recreational sites.

In the 1960s, the environmental corridor concept was included in the Commission's first regional land use plan. Since then, Commission staff have updated environmental corridor inventories every five years using the most current orthophotography. As the landscape of the Region is consistently evolving with both new development and conservation efforts, the size and connectivity of environmental corridors changes over time. According to current records, the Region is home to 489 square miles of primary environmental corridors (encompassing 18 percent of the Region), 80 square miles of secondary environmental corridors (3 percent of the Region), and 72 square miles of isolated natural resource areas (3 percent of the Region). The location, extent, and status of preservation of these corridors will be an important consideration for the proposed RWQMPU.

The proposed RWQMPU will utilize the most recent 2020 environmental corridor and floodway inventories in the context of land use and water quality planning. From this latest data, maps will be generated for each watershed that will help Commission staff identify currently protected areas as well as areas to be excluded from development during sewer service area planning (discussed in further detail later in this Prospectus).

Steep Slopes

The WDNR defines steep slopes as any slope or gradient equal to or greater than 12 percent. These slopes possess highly erodible soils, which can be of any soil type.⁵ Steep slopes are a necessary consideration and

⁵ For more information see the Wisconsin Department of Natural Resources Sewer Service Area Planning webpage: dnr.wisconsin.gov/topic/SurfaceWater/SSAPPlanning.html or SEWRPC, SSA Environmental Corridors and Steep Slope Guidelines, July 2022.

limitation for sewer service area planning as well as for surface water quality. Wisconsin Administrative Code NR 121 states that major areas unsuitable for the installation of waste treatment systems because of physical or environmental constraints are to be excluded from the service area. Areas to be considered for exclusion from the sewer service area due to potential for adverse water quality impacts from both point and nonpoint sources of pollution include steep slopes and highly erodible soils, among other areas.⁶

It is recommended that steep slopes near surface waters be excluded from sewered development areas and that sites with a combination of steep slopes and other environmental features be protected as environmentally sensitive areas. For the proposed RWQMPU, Commission staff will review and update current maps identifying steep slopes in the Region to inform recommendations for sewer service area planning and water quality protection. Steep slopes will be identified by analyzing the most recent topographic data.

Riparian Buffer Analysis

The proposed RWQMPU will include a general assessment of riparian buffer conditions within the 12 watersheds of the Region for the project area streams only. This assessment will include estimates of the percentage of streams that are protected by riparian buffers. Additionally, relative amounts of riparian buffer areas within the Region that are currently protected against development by either designated environmental corridors or floodway will be estimated. The Commission recommends a minimum 75-foot riparian buffer width for lakes and streams to minimize the impact of nonpoint source pollution. A buffer of at least 400-feet on either side of a stream is recommended to preserve core habitat for wildlife, and the ideal buffer for preserving optimal core habitat for wildlife is 1000-feet. Using ArcGIS Pro and 2020 land use and environmental corridor inventories, and the most current FEMA floodway spatial layers, various buffer sizes will be delineated on either side of the project area streams and around select inland lakes to assess the percentage of undeveloped buffers protected from development.

Wisconsin Wetland Inventory and Identification of Potentially Restorable Wetlands

State statutes define a wetland as "an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions." The WDNR maintains a record of the location, type, and size of all wetlands throughout the State, summarizing this information on Wisconsin Wetland Inventory maps. These maps make use of data

⁶ *Wisconsin Administrative Code, NR121: Areawide Water Quality Management Plans, November 2024.*

from high altitude imagery, soil surveys, topographic maps, and field surveys. An inventory of southeastern Wisconsin wetlands will be completed for the proposed RWQMPU using the most recent WDNR Wisconsin Wetland Inventory data and geospatial files. The number, types, and size of the wetlands within each of the watersheds in the Region will be summarized.

In conjunction with the wetland inventory, an assessment of potentially restorable wetlands will be conducted to guide possible management recommendations in the proposed RWQMPU. The WDNR maintains a dataset, most recently updated in 2016, with potentially restorable wetland sites derived from the Soil Survey Geographic Database (SSURGO) surveys, topographic data, the Wisconsin Hydrography database, the Wisconsin Wetlands Inventory, and the Restoration Database.

Hydric Soils

The proposed RWQMPU will include an inventory of soil types in the Region, including the identification of hydric soils. This inventory will rely on the most recent Natural Resources Conservation Service (NRCS) soil data and ArcGIS Pro spatial layers to generate updated hydric soils maps for each of the 12 major watersheds in the Region.

Groundwater Recharge Areas and Depth to Groundwater

Inventories for groundwater recharge areas and depth to groundwater within the Region will be mapped for each watershed. This inventory was completed as part of the Regional Water Supply Plan (PR-52).⁷ This information will be used to identify areas that are most vulnerable to groundwater pollution and those that may require additional protection or management actions to prevent aquifer contamination. Furthermore, identifying high groundwater recharge areas is essential for informed land use decisions, as these zones maintain the aquifer levels needed to sustain baseflows for streams, wetlands, and lakes.

Agricultural Practices

A generalized regional agricultural practices inventory will be developed in partnership with county conservationists to better understand key agricultural land use factors and current practices. Examples of information that will be included in an agricultural practices inventory include the percentage of land in nutrient management planning programs, the distribution of crop types, the presence and location of

⁷ SEWRPC Planning Report No. 52, A Regional Water Supply Plan for Southeastern Wisconsin, December 2010.

concentrated animal feeding operations (CAFOs), and the extent of best management practices (BMPs) being implemented to control agricultural runoff and protect water quality. This information will be used to assess possible pollutant contributions from cropped lands and CAFOs within each watershed, evaluate the impacts of various farming practices on water quality, and estimate the percentage of agricultural lands using BMPs to reduce nutrient, contaminant, and sediment runoff into surface waterbodies.

Climatological Data

Climatological data—specifically air temperatures, annual and seasonal precipitation patterns and frequencies, and storm intensity—will be compiled to assess the impact of long-term weather trends on water quality. This data will help interpret current trends and plan for future climate conditions for the Region.

Sanitary Sewer Service Area Inventories

The proposed RWQMPPU will incorporate an inventory of the currently served sanitary sewer service areas within the Region. This inventory will entail collecting up-to-date service area data from communities for the year 2026 and producing a series of maps that delineate the areas currently served by sanitary sewer systems across each major watershed in the Region. Communities will be asked to share maps and Arc GIS shapefiles delineating areas currently served, when available. Commission staff will then update regional maps to reflect these current service boundaries to assist communities in formulating planning recommendations for future expansion and development. Mapping the extent of these service areas is critical for assessing the implications of current wastewater discharges on surface water quality.

A planned sanitary sewer service area is a designated region where wastewater infrastructure is expected by public WWTP operators to occur within the next 20 years. The Commission maintains and updates planning areas for communities in the Region. This planning area inventory will provide a foundational dataset for forecasting future potential plant limitations and identifying unserved areas where extending public wastewater systems could mitigate pollution risks associated with POWTS.

4.3 SOURCES OF POLLUTION – For later review

4.4 PLAN OUTCOMES AND MANAGEMENT RECOMMENDATIONS – For later review

4.5 PLAN BUDGET AND TIMELINE – For later review

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TABLES

Table 4.1
Stream and Lake Water Quality Parameters Proposed to be Included in RWQMPU Inventories

Water Quality Parameters	Rivers and Streams	Inland Lakes	Lake Michigan
Chemical			
Dissolved Oxygen ^a	X	X	X
Hydrogen Ion Exchange (pH)	X	X	
Total Phosphorus ^a	X	X	X
Nitrate-Nitrogen	X	X	
Chloride	X	X	X
Biological Oxygen Demand (BOD)		X	
Alkalinity		X	
Physical			
Temperature ^a	X	X	X
Total Suspended Sediment/Solids	X	X	
Clarity ^a		X	
Bacteriological and Biological			
Chlorophyll-a ^a		X	
E. coli Bacteria		X	
Fishery Index of Biotic Integrity Values	X		
Macroinvertebrate HBI Values	X		
Macroinvertebrate ETP Values	X		
Aquatic Plant Community		X	
Aquatic Invasive Species	X	X	
Ice On/Ice Off Conditions		X	
Toxic and Hazardous Materials			
Heavy Metals	X	X	
Pesticides and Herbicides	X	X	
Polychlorinated Biphenyls (PCBs)	X		
PFAS Substances	X	X	
Pharmaceuticals	X		
Microplastics	X	X	

^a Parameters used to determine inland lake trophic status.

Source: SEWRPC

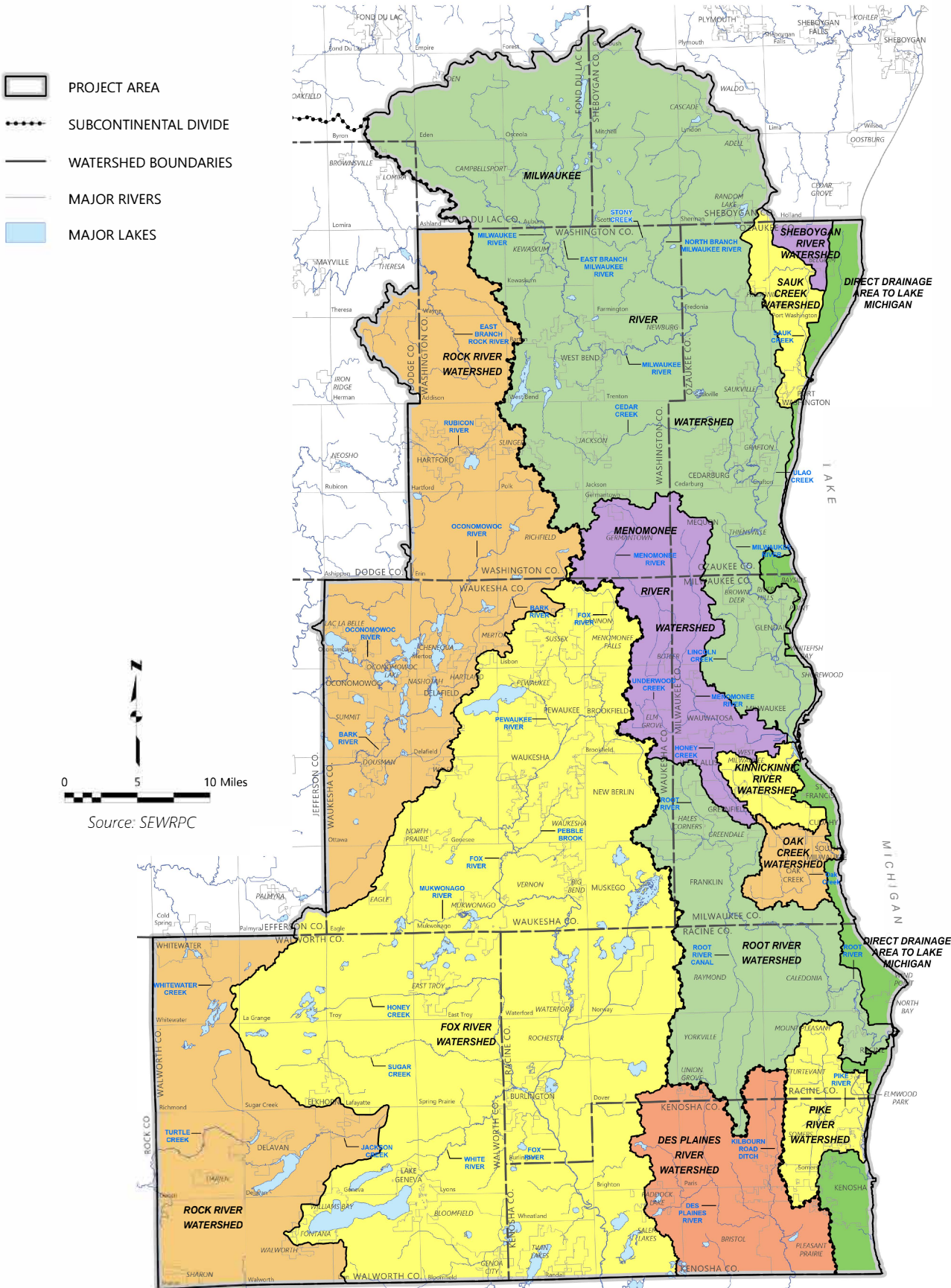
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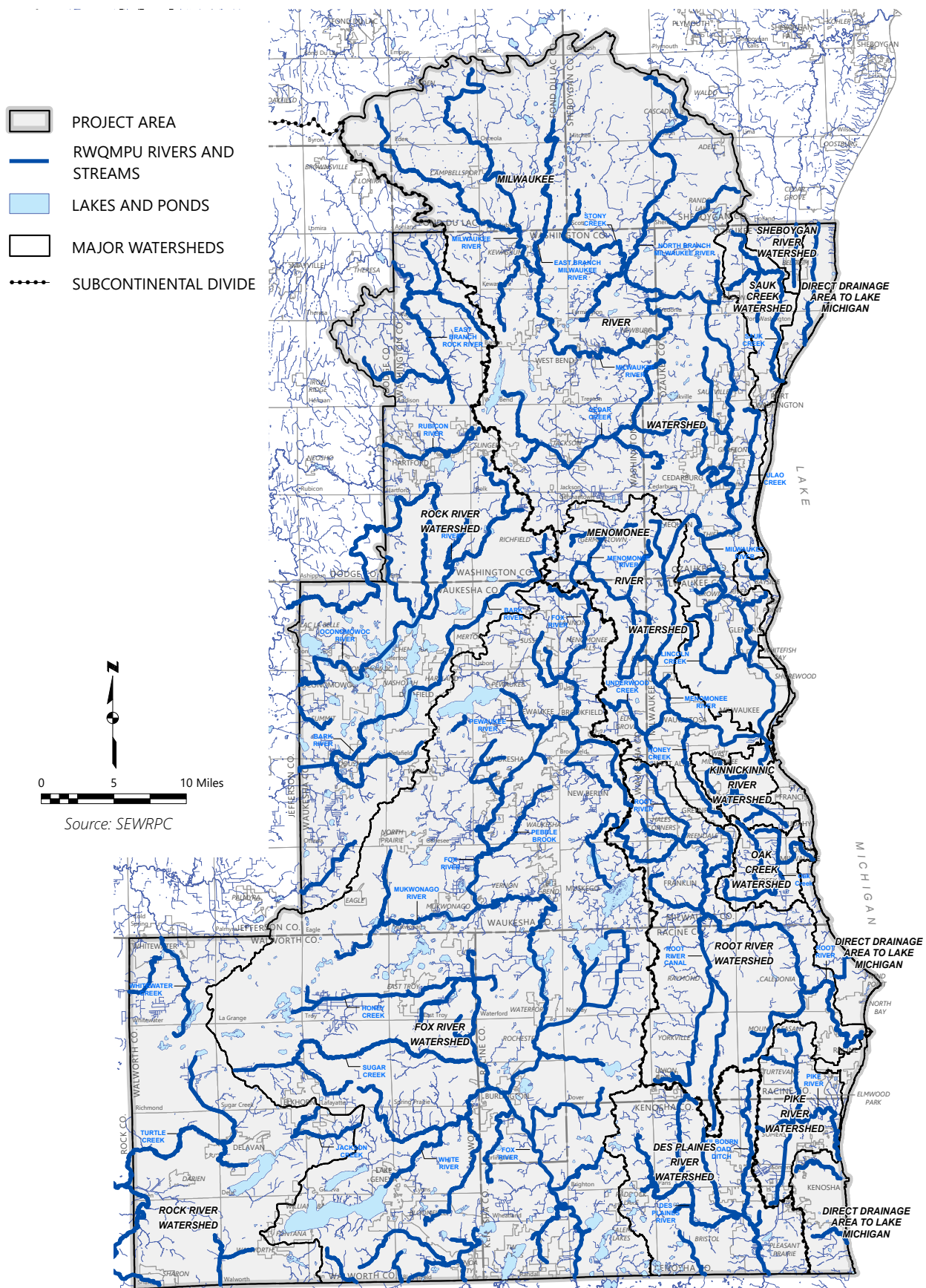
WORK PROGRAM

MAPS

Map 4.1 Major Watersheds in Southeastern Wisconsin



Map 4.2
Rivers and Streams Selected for the Regional Water Quality Management Plan Update



Map 4.3 Lake Michigan Monitoring Stations

