Community Assistance Planning Report No. 312 (2nd Edition)

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

PUBLIC HEARING DRAFT

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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Chapter 1

INTRODUCTION

The Milwaukee County Land and Water Resource Management Plan is intended to protect, improve, and restore ecological diversity and functionality and to promote the beneficial use of the land, water, and related resources found within the County. This plan establishes goals to guide County and other agency initiatives over the 10-year period from 2022 to 2031. These goals, along with the workplan objectives, planned actions, and strategies presented in this plan, provide a tool for guiding and coordinating the activities of a variety of agencies and programs and provide the basis for funding initiatives from a variety of private, local, State, and Federal sources.

1.1 OVERVIEW OF STUDY AREA

Milwaukee County is located in Southeastern Wisconsin and is bordered on the east by Lake Michigan, on the north by Ozaukee County, on the west by Waukesha County, and on the south by Racine County. The impacts of urbanization within the County and in the surrounding areas have continued to strain the County's resources.

The County covers approximately 243 square miles and is home to 10 cities and nine villages. There are seven natural watersheds located wholly or partially within the County. These include the entire Kinnickinnic River and Oak Creek watersheds; portions of the Fox River, Menomonee River, Milwaukee River, and Root River watersheds, and the areas draining directly to Lake Michigan. The County includes approximately 1,551 acres of inland surface waters. Because of the importance of considering entire watershed areas in water resource planning, this report and the associated workplan provides some consideration of the portions of the watersheds in Milwaukee County that extend outside of the County,

even though the focus of this planning effort is on Milwaukee County. While approximately 99 percent of the County is located within the Great Lakes drainage basin, the subcontinental divide between this basin and the Mississippi River basin traverses the southwestern corner of the County in the City of Franklin. This divide has important implications for some aspects of land and water resources planning.

According to the year 2020 U.S. Census, about 939,500 people lived in Milwaukee County. The highest population densities were found in the central portion of the County, mostly within the City of Milwaukee. While the County is highly urbanized, some land remains in agriculture, mostly in the Cities of Franklin and Oak Creek. The primary form of agriculture involves cash-grain farming for corn and soybeans. Major industries are located within the City of Milwaukee as well as in other County communities.

Milwaukee County continues to undergo urban growth, development, and redevelopment, and faces the challenge of balancing this growth with the need to protect and maintain its natural resources. The County has a diversified natural resource base, including the Lake Michigan nearshore area, major river systems, and several small inland lakes and ponds. In addition, the County contains significant areas of quality woodlands, wetlands, and grasslands, the most important of which are incorporated into areas designated as environmental corridors or isolated natural resource areas.

1.2 PLAN BACKGROUND AND PURPOSE

In 1997, the State Legislature, through Wisconsin Act 27, amended Chapter 92 of the *Wisconsin Statutes,* requiring that all counties develop a land and water resource management plan (LWRMP). The intent of this report is to foster and support a locally led process that is intended to address each individual county's unique natural resources; identify particular problems associated with the resource base; and establish a plan to help protect and restore those resources. Additionally, the county plans are intended to focus on State minimum nonpoint source pollution performance standards related to urban development and agriculture. The plan development process is intended to encourage innovative programming and leadership and to build local support. The plan identifies the natural resources and the current condition of those resources, the limitations of those resources, and sets forth a strategy that addresses the natural resource issues and problems. This plan also provides a means to educate the public about these issues and problems and include the public in the steps necessary to protect the natural resource base.

The initial Milwaukee County LWRMP was approved in 2001. A revised and updated version of the plan was approved in 2006, and was updated again in 2011, with assistance from the Southeastern Wisconsin

Regional Planning Commission (SEWRPC), and documented in a report entitled Community Assistance Planning Report No. 312, *A Land and Water Resource Management Plan for Milwaukee County: 2012 – 2021*, dated August 2011. The County submitted an interim plan to the Department of Agriculture, Trade and Consumer Protection (DATCP) in 2016 and DATCP extended State approval of the plan through 2021. The current planning effort, with assistance provided by SEWRPC, will culminate in a second edition of Community Assistance Planning Report No. 312.

Chapter 92 of the *Wisconsin Statutes* requires that county land and water resource management plans be reviewed and updated every five years in order for counties to be eligible to receive conservation staff funding and cost-share grant monies. Plans are approved for a 10-year period with a review by the Land and Water Conservation Board after the fifth year. The revised multi-year land and water resource management plan must meet the requirements of Section 92.06 of the *Wisconsin Statutes* and additional guidelines established by DATCP and the Wisconsin Land and Water Conservation Board. This plan will serve as a program guide for local conservation efforts in Milwaukee County.

1.3 PLAN DEVELOPMENT AND PUBLIC PARTICIPATION

This updated Milwaukee County Land and Water Resource Management Plan was developed through a collaborative effort on the part of a number of agencies and organizations under the overall direction of the Milwaukee County Land Conservation Committee (LCC) and the Milwaukee County Environmental Services Unit. The agencies involved include the Milwaukee County Department of Administrative Services—Architecture, Engineering, and Environmental Services Section; the Milwaukee County Parks Department; the Southeastern Wisconsin Regional Planning Commission (SEWRPC); the Wisconsin Department of Natural Resources (WDNR), and DATCP. From here and within the remainder of this plan, the Milwaukee County Parks, Energy and Environment Committee will be identified as the County Land Conservation Department (LCD). The plan was developed under the guidance of the Milwaukee County Land and Water Resource Management Plan Advisory Committee, which was created by the County specifically for plan development purposes and includes agency personnel and citizens knowledgeable in land and water resource matters. The membership and activities of the Advisory Committee are documented in Appendix A. In addition, documentation related to the activities of this Committee is on file with the Milwaukee County Department of Administrative Services—Architecture, Engineering, and Environmental Services Division.

Advisory Committee meetings were held in 2021 on February 9, April 5, and July 12 and the Committee reviewed each chapter of the plan in draft form and provided comments and recommendations, which were addressed in the final plan. In addition, the Advisory Committee assisted in identifying problem areas and conservation issues and concerns, provided information and technical data for the plan, advised the LCC on program options for the plan, and helped to coordinate agency programs with implementing this plan. As draft chapters of the plan were completed, copies were downloadable from the SEWRPC website. This website also included a webpage for members of the public to ask questions and submit comments on the draft plan update. Public comments on the plan are also documented in Appendix A.

After the plan was completed in draft form, it was recommended for approval by the Milwaukee County Land and Water Resource Management Plan Advisory Committee on _____, and then submitted to the DATCP and the WDNR for review. On _____, the Milwaukee County Land Conservation Committee met to approve the plan. This meeting was open to the public for citizen comment and input. This meeting was announced in the _____ prior to the meeting. In addition, agricultural landowners received announcements of the meeting by U.S. mail. The Milwaukee County Board of Supervisors approved the plan on _____. The Wisconsin Land and Water Conservation Board approved the plan on _____.

1.4 LAND AND WATER RESOURCE MANAGEMENT PLAN PRIORITY ISSUES

The Milwaukee County LWRMP is intended to identify, prioritize, and address land- and water-related natural resource conservation issues in Milwaukee County. A set of goals was developed to address these issues. These goals represent what the County wishes to accomplish over the long term. In support of these goals, work plan objectives were developed to identify approaches to achieve the goals of the plan. In addition, specific actions were identified to indicate the means of accomplishing the objectives. The goals identified in the 2011 plan update were:

1. Improve water quality through the reduction of sediment and nutrient delivery to surface waters in Milwaukee County

2. Protect, maintain, and restore land and water resources in Milwaukee County

3. Enhance Lake Michigan bluff protection initiatives

4. Maintain the existing information management network and land information web portal

5. Limit the introduction and reduce the spread of invasive species in Milwaukee County

These goals and the supporting objectives and action items from the 2011 plan update are listed in Appendix B. The activities that the County has undertaken since 2011 to address these goals, objectives, and actions are described in the next section of this chapter.

In developing the current update of the Milwaukee County LWRMP, the Advisory Committee reviewed the plan goals in light of the resource inventory and assessment and the discussion of related plans, regulations, and programs, presented in Chapters 2 and 3, respectively, of this report. The goals, objectives, and specific action items of the updated plan are presented in Chapter 4.

1.5 PLAN IMPLEMENTATION ACTIVITIES

Since adopting the Milwaukee County LWRMP, Milwaukee County and its partners (see Table 1.1) have conducted several projects to implement recommendations of the previous generation of this plan. Activities implemented relative to the goals of the 2011 plan update are described in the subsections below.

Implementation Activities Related to Goal #1: Improving Water Quality through the Reduction of Sediment and Nutrient Delivery to Surface Waters

The County and its partners conducted several projects and activities to reduce the delivery of sediment and nutrients to surface waters and improve water quality within Milwaukee County. These projects and activities, which are described below, reflected several different objectives related to the overall goal.

Encourage Public Awareness of Water Quality Problems and Stormwater Issues

The County and its partners provided presentations and held workshops on stormwater and water quality issues and technological strategies.

Turf Quality Workshop

In April 2012, Milwaukee County hosted a workshop, which was conducted by Fortin Consulting, on maintaining turf quality while using less fertilizer. The intent of the workshop was to educate attendees

about ways to reduce fertilizer amounts, thereby saving money and reducing negative impacts on nearby waterways.

Franklin Sports Complex Parking Lot

In November 2012, a media event was held to recognize the opening of the reconstructed parking lot at the Sports Complex. The parking lot features permeable pavement, which will reduce the impact from stormwater runoff to the nearby Root River. The Milwaukee County Parks also posted construction progress on their Facebook page. In February 2013 and March 2013, County Land Conservation Department (LCD) staff presented on the County's Sports Complex pervious pavement project to the Root River Watershed Restoration Plan Stakeholders and the Southeast Wisconsin Clean Water Network. In May 2014, Milwaukee County LCD staff presented the Sports Complex pervious pavement project to the Association of Metropolitan Milwaukee Public Works Administrators and Engineers.

Stormwater Best Management Practices (BMP) Design Guide for Parking Lots

In May 2013 and August 2013, Milwaukee County LCD staff presented "Practical Steps in Pursuit of Sustainability—Milwaukee County Steps Forward." The presentation focused largely on Milwaukee County's Stormwater Best Management Practices design guide for parking lots. The presentation was given at the 2013 American Public Works Association Sustainability in Public Works Conference in San Diego, CA and later at the 2013 International Public Works Congress in Chicago, IL.

Permeable Paver Workshop

Milwaukee County hosted a Permeable Pavement Workshop at the Sports Complex in the City of Franklin in September 2013. The workshop was conducted in conjunction with a green infrastructure promotion project, in which Milwaukee County is a partner along with the Milwaukee Metropolitan Sewerage District and 1,000 Friends of Wisconsin.

Fall Conservation Tour

In October 2013, Milwaukee County Environmental Services hosted a daylong tour of six green infrastructure projects located in Milwaukee County. Speakers and guides included staff from WDNR, Urban Ecology Center, the Rock Sports Complex, Milwaukee County Parks, and Milwaukee County Environmental Services.

Regional Success Using Pervious Pavement

In May 2014, Milwaukee County Land Conservation Department staff gave an overview of successful applications of permeable pavement in Wisconsin and in the north-central United States at the Clean Rivers Clean Lake Conference in the City of Milwaukee.

Native Landscaping for Stormwater Design

In October 2014, Milwaukee County LCD staff gave an overview of County projects using native landscaping and provided instruction on specifications and plans for the use inclusion of native landscaping into design plans in this course through the UW-Milwaukee Continuing Education Program.

Next Generation of Permeable Pavement Conference

In October 2015, Milwaukee County LCD staff presented the role of municipal codes on green infrastructure with emphasis on pervious pavement and lessons learned from the *Codes and Ordinances Project* completed by 1000 Friends of Wisconsin and Milwaukee County.

Tracking Sustainability Data and Goal Setting

In June 2015, Milwaukee County LCD staff co-presented the webinar, which included green infrastructure planning to the Federation of Environmental Technologists.

Nature Ignores Design That Ignores Nature

In November 2015, Milwaukee County LCD staff co-presented the green infrastructure design seminar to the Wisconsin Parks and Recreation Association.

Codes and Ordinances

In April 2016, at the Clean Rivers, Clean Lake Conference in the City of Milwaukee, Milwaukee County LCD staff presented a workshop on the results from WinSLAMM modeling of how stormwater runoff volume and Total Suspended Solids (TSS) loads would change if sites in Southeastern Wisconsin were redeveloped under different zoning requirements.

Collaborative Planning

In April 2016, at the Clean Rivers, Clean Lake Conference in the City of Milwaukee, Milwaukee County LCD staff presented on one of the first watershed-based municipal separate storm sewer system (MS4) permits, the eleven-community Menomonee River Watershed Permittees, and how the two-year process reached successful agreement to a collaborative project.

Menomonee River Public Education Committee

From 2012 through 2020, Milwaukee County made annual contributions to support a regional public education program spearheaded by the Menomonee River Group Public Education Committee. These funds were used to develop and implement a multi-media public education program, the Respect Our Waters campaign. For more information go to www.respectourwaters.org.

Codes and Ordinances Review Project

Milwaukee County partnered with 1000 Friends of Wisconsin for the Municipal Codes and Ordinances Review Project. The project involved a review of municipal codes and ordinances and made recommended revisions to the municipal codes that would remove barriers to promote green infrastructure. In 2013, ten municipalities within the Menomonee River Watershed participated in the code review. The program was so well received that it was expanded into 2014 and 2015 to include all the municipalities in the entire Milwaukee Metropolitan Sewerage District planning area. The project was funded by the Fund for Lake Michigan, the Milwaukee Metropolitan Sewerage District, and Wisconsin Coastal Management Program.

Clean Rivers Clean Lake Annual Conference

In April 2016, Milwaukee County staff presented the topic of adapting codes and ordinances to promote green infrastructure at the Clean Rivers Clean Lake annual conference.

Designing Green Infrastructure to Control Maintenance Costs Workshop

In May 2019, Milwaukee County hosted the Green Infrastructure operation and maintenance workshop that was attended by over 60 people, consisting of mainly regional units of government. The County also completed the Stormwater Best Management Practice Performance Assessment and presented the results at the workshop.

Salt Talk: Reducing Impacts of Road Salt Seminar

In November 2018, Milwaukee County collaborated with the City of Cudahy on hosting the chlorides reduction seminar intended for public works employees.

SWAN Luncheon Presentation

In January 2018, Milwaukee County staff hosted a luncheon presentation for SWAN (a local interest group) on Milwaukee County's winter salt application and road maintenance.

One-Day Workshop

In June 2017, Milwaukee County hosted a one-day workshop presenting conservation topics including water quality, urban agriculture, and urban natural resources management. The workshop was hosted in coordination with the Great Lakes Committee of the Wisconsin Land and Water Association, and included a tour of the UW School of Freshwater Sciences.

WAFSCM Conference

In October 2017, Milwaukee County staff presented and served on a panel discussion about Green Infrastructure at the Wisconsin Association for Floodplain, Stormwater, and Coastal Management Conference.

Root River Watershed Restoration Plan

Between 2012 and 2016. Milwaukee County staff was a member on the Advisory Group in preparing the Root River Watershed Restoration Plan.

Fox Valley Watershed Association (FVWA) Presentation

In March 2020, Milwaukee County staff gave a presentation about developing a coastline management policy at the FVWA conference.

Implement NR 216 Requirements

Implementing Milwaukee County's stormwater permit is a major part of the County's water quality objectives. The County annually completes planned actions that are required by State and Federal water quality regulations. These include dry weather screenings at major outfalls, maintaining Stormwater Pollution Prevention Plans at County facilities, inspecting County facilities and BMPs, and continuing to update the County's stormwater system map.

In addition to the annual requirements described above, the County continues to develop plans and projects to help reduce urban nonpoint pollution in its waterways by installing green infrastructure. With the implementation of Total Maximum Daily Loads (TMDLs) in Milwaukee County waterways, it will be important to apply Best Management Practices (BMPs) to improve water quality. Information for the Milwaukee River Basin TMDL is available at www.dnr.wisconsin.gov/topic/TMDLs/Milwaukee/index.html. Between 2012 and 2020, the County installed or developed various BMPs and projects to help clean the local waterways. The completion or installation of those projects are listed in Appendix C.

Stormwater Facility Maintenance Project

With the introduction of many green infrastructure projects, it is vital to maintain these facilities to ensure they work effectively, and for the projects to continue to be aesthetically pleasing to the public. In 2015, the County conducted the Stormwater Facility Maintenance Project. Stormwater Solutions Engineering and Applied Ecological Services, under contract to Milwaukee County, performed one year of maintenance activities on County-owned stormwater BMPs. Maintenance activities were performed on fifteen BMPs at five sites that included pervious pavement, rain gardens, bioinfiltration swales/basins, stormwater ponds, subsurface infiltration, and sedimentation chambers. The intent was to determine maintenance costs for various BMPs and make design parameter recommendations based on maintenance experiences. The project included a report that analyzed the costs, efforts, and activities associated with performing maintenance on green infrastructure in Milwaukee County.

Work with Partners to Provide Pet Litter Management Supplies and
Signage in High Traffic Areas within the Park System.

The County Parks Department works with Residents for Off-leash Milwaukee Parks (ROMP), an advocacy/friends group who helps to provide and raise funds for signage and doggie bag stations. ROMP has also helped raise funds for establishing new off-leash exercise areas and equipment. Additional information can be found at: milwaukeedogparks.org/about.

Work with Partners to Identify and Implement Measures to Prevent
Future Beach Closings Resulting from Bacterial Contamination

<u>South Shore Beach/South Shore Park</u>

In 2012, the County began investigating options for relocating South Shore Beach, which has been plagued with bacteria-related poor water quality as a result of nonpoint runoff, combined-sewer overflows, and a lack of dispersion and mixing due to the presence of the breakwater. The investigation included analyzing near-shore flow and mixing patterns created by the breakwater and searching for alternative locations for the beach. In 2014, the County began planning and redesigning South Shore Park which included best management practices to reduce nonpoint pollution sources from County property with a goal of improving beach and water quality. This effort included three public input and outreach sessions and a County-staffed booth at the South Shore Farmer's Market to solicit input and engage the public on planned stormwater improvements for the park. The project was completed in 2017 and included improved beach management, new native landscaping, regrading and reconstructing the parking lot, and dredging and removing a sandbank. Stormwater practices included biofiltration swales and relocation of the beach.

Milwaukee County also completed a master plan for reconstructing the South Shore Park/Marina parking lot area. The reconstruction included water quality best management practices, reconfigured parking and pedestrian/bike trail improvements, and features that provide better access to the water's edge. Stormwater best management practices and wildlife controls are expected to improve near-shore water quality and decrease the number of days of beach water quality advisories. In 2015, improvements to the north half of the parking lot, as identified in the master plan, were implemented. In 2016, grants from the Wisconsin Waterways Commission and MMSD were accepted to create a sea wall and promenade and add green infrastructure. The scope of work in 2017 included reconstructing the remaining portions of the South Shore Park boat launch and adjacent parking lot. Reconstructing the parking lots at the South Shore Marina included constructing recreational boating improvements, new stormwater treatment systems, boat wash facilities and improved fish cleaning facilities, beach management, and landscaping.

McKinley Marina

In 2013, the County began developing a master plan for the 11-acre McKinley Marina parking lot. The design incorporates stormwater BMPs to curb contaminated runoff from boat maintenance and vehicle parking areas. The project will include reconstructing the parking lots, enhancing stormwater management through permeable pavers and bio-infiltration basins, and installing new lighting, trees, and native landscaping. In 2015, the Parks Department completed a Master Plan for the parking lot and greater marina area. The planning effort identified several discreet areas that could be rebuilt in a phased strategy over several years without significantly affecting marina operations or the other sections of the parking lot.

From 2017 to 2020, the County Department of Parks, Recreation, and Culture (Parks) made incremental improvements to the McKinley Roundhouse. The Parks Department plans to replace the severely deteriorated parking lot to complement the investment in the Roundhouse. The project will also address improvements to the internal circulation and parking lot infrastructure such as lighting and stormwater drainage system. The plans include methods to improve near shore water quality utilizing green infrastructure and stormwater best management practices. The scope of the project includes replacing the parking lot at McKinley Marina (North Marina Parking Lot-Phase 1) and access improvements including constructing new stormwater best management practices. The project also includes the gatehouse, fencing for the storage area, and intersection improvements at Lincoln Memorial Drive and all underground utilities. With respect to Sustainability and Energy Efficiency, lighting will also be replaced with LED fixtures. Asphaltic concrete mixes used for surface course and binder course may contain salvaged or reclaimed asphaltic material. Crushed gravel base course may include crushed stone, crushed

gravel, crushed concrete, reclaimed asphaltic pavement, reprocessed material or blended material. The County completed Phase 1 of the project from 2019 to 2020, which included reconstructing one of four parking lots and developing a new entrance and driveway and walkways at the marina. The remaining three parking lots planned to be reconstructed are included in Phases 2 and 3 of the project. Phase 2 of the project, which includes the existing areas of the boat storage, boat-trailer parking, and boat launch, is currently on-going. In addition to reconstructing the remaining three parking lots, Phases 2 and 3 are also expected to include the construction of a fish cleaning station, bike racks, site signage, a dumpster enclosure, a boat launch, and a boat wash.

Bradford and South Shore Beaches

Milwaukee County partnered with the University of Wisconsin-Milwaukee's Department of Freshwater Sciences to obtain grants for the school to continue their research and testing on sources of bacteria and methods to help prevent beach closings at the County's Bradford and South Shore Beaches. This work has been ongoing since 2001. The County also continues to groom beaches annually in summer months. The County utilizes different types of grooming machines at the beaches, but in general, all the machines operate like farm tilling equipment that results in the sand being turned over with prongs. Grooming helps reduce bacteria levels in sand and near-shore water. Bradford Beach is groomed five to seven times per week, South Shore Beach is groomed approximately three times per week, Grant Park Beach is groomed once per week, and Bender Park Beach is groomed a few times in the summer.

Gull and goose abatement activities are performed seasonally at Bradford and South Shore Beaches and several golf courses are added to the schedule in fall in an effort to improve water quality. These activities are contracted out to Migratory Bird Management who use dogs to help manage the bird populations. In addition, the County works with the Wisconsin Department of Natural Resource to perform egg addling and the U.S. Fish and Wildlife Service for geese roundups near the airports.

Menomonee River

In 2012, the County began investigating sources of human fecal contamination in stormwater outfalls owned by Milwaukee County along the Menomonee River. Analytical results of outfall sampling performed by the Great Lakes Water Institute and others indicate widespread human fecal contamination and the presence of high levels of indicator organism species in rivers within the County. The investigation involves analyzing storm sewer and sanitary sewer mapping using GIS-based methods in correlation with recent analytical results. In 2013, several outfalls along the Menomonee River with a history of human fecal contamination were monitored during dry weather for flow and water samples were taken where

flow was present. Milwaukee County continues to monitor these outfalls as part of the Illicit Discharge Detection and Elimination (IDDE) program, while looking for a source of the human fecal contamination.

In 2014, Milwaukee County utilized the Menomonee River Group's new IDDE screening tool to identify priority outfalls for screening. Twenty outfalls, including all of the County's major outfalls, were identified for screening in 2015. Several outfalls are under continued investigation. The County intends to continue to re-inspect all outfalls that tested positive in previous years through the municipal stormwater permit. The current permit expires in March 2025, however, it is anticipated that the IDDE screening will be a continuing requirement in subsequent permits.

Conduct and Promote Streambank Stabilization Projects and Projects Employing Best Management Practices (BMPs) to Reduce Erosion

Milwaukee County started multiple projects to repair erosion caused by severe storm events. The projects ranged from eroded bluffs, streambanks, and slopes. The projects aimed to repair damage and stabilize slopes to prevent future erosion. Projects were funded by Milwaukee County and the Federal Emergency Management Agency and were completed between 2012 and 2019.

Bradford Beach Parking

The project included replacing the asphalt trail and filling, grading, and stabilizing the slope with slope interrupters, compost blankets, and native seed. In conjunction with grading and stabilizing the surface of the bluff with erosion control materials and vegetation, stone steps with a railing down the face of the restored bluff were also installed, in part as a mitigation item. Park users traverse up and down the bluff at this location as a short cut, resulting in loss of vegetation, which leaves the slope subject to erosion during storm events. Recognizing park users will continue to traverse the slope, providing steps to handle the historic amount of foot traffic will keep the foot traffic at a single location. Damage to vegetation on the slope should also be minimized, which will reduce the threat of slope erosion and failure in the future.

Estabrook Oak Leaf Trail Erosion

The project included replacing the asphalt trail, filling, grading, and stabilizing the slope with slope interrupters, furnishing and installing riprap, and revegetating the site. The trail was shifted slightly away from the top of the bluff to allow for an improved vegetated buffer from the edge of the paved trail to the top of the bluff and adequate space to reinstall the fence/guard rail.

Oak Creek Parkway

The project included repairing and reconstructing collapsed portions of the historic limestone and masonry walls built by the Civilian Conservation Corps (CCC) during the Great Depression. Riprap was used to stabilize the toe of the slope and further protect the wall. The eroded area is filled with borrow material and stabilized and planted with native landscaping. Additional construction also included erosion and sediment control measures, temporary stream diversion, fill import, and slope stabilization.

Estabrook-Wilson

The project included replacing the asphalt trails and filling, grading, stabilizing, and revegetating the slopes. Stabilization included, but was not limited to, placing geotextile fabric and riprap along the repaired slopes to protect against future damage due to runoff in heavy storm events.

Pleasant Valley

The project included rebuilding the access road to the park trails and existing sanitary sewers, and filling, stabilizing, grading, and revegetating the bluff. Drainage improvements and stabilization methods included installing riprap and geotextile fabric.

Grant Park

The project included replacing the storm sewer and grading the slope to approximately 3:1. Additionally, an approved mitigation effort was implemented to reduce the threat of future bluff damage. In conjunction with the grading, the bluff was stabilized using geocells for long-term protection and erosion matting for short-term protection to allow the vegetation to establish. The geocells will help stabilize the surface against erosion caused by foot traffic. The gabions proposed in the original mitigation are intended to accommodate foot traffic by providing a stepped ascent/descent. Permanent stabilization (geocells) will minimize the threat of bluff failure in the future.

Big Bay Erosion

The project included regrading the eroded ravine and stabilizing the flow line of the ravine. The existing storm system was cleaned and repaired, and the surrounding area stabilized with riprap.

Riverside Park

The project included reconstructing the eroded bluff with compacted fill material. The surface of the bluff was restored with seed, erosion matting and slope interrupters, and revegetating the slope. In conjunction with grading and stabilizing the surface of the bluff with erosion control materials and vegetation, Lannon

stone blocks that were salvaged from another location in Riverside Park were installed at the toe of the restored bluff. The Lannon stone blocks will protect the toe of the bluff during periods of high river flows, and also protect the existing pedestrian trail that sits at the bottom of the bluff. The Lannon stone blocks have a gravel drainage course at the interface with the bluff fill to relieve hydrostatic pressure that may build up during period of heavy rainfall.

Juneau Park Bluff

The project included filling, grading, and stabilizing the slope with slope interrupters, compost blankets, and native seed. In conjunction with the grading and stabilizing on the surface of the bluff with erosion control materials and vegetation, three catch basins were installed to intercept the overland storm runoff before it runs down the face of the slope. The intercepted runoff connects to an existing storm sewer manhole at the base of the bluff, minimizing the possibility of recurrence of bluff erosion and trail damage.

Beer Line Trail Erosion

The project consisted of stabilizing and restoring the slope adjacent to the Beerline Trail and restoring eroded areas of the river bluff between the existing Beerline Trail and the Milwaukee River. Work included filling, grading, and stabilizing the slope with slope interrupters, compost blankets, and native seeding; clearing and grubbing; filling eroded gullies; importing engineered fill material; installing temporary and permanent erosion control measures; and turf stabilization.

Hubbard Oak Leaf Trail Erosion

The project consisted of repairing the eroded trail embankment and included filling, grading, and stabilizing the slope with slope interrupters, compost blankets, and revegetating with deep rooting native seeding. The eroded area was cleared of vegetation, regraded and restored to the original contours, and protected with permanent stone ditch checks.

Menomonee River Streambank

A 250-foot unvegetated section of the Menomonee River streambank had eroded inward towards a County-owned golf course which is downstream from the Underwood Creek confluence. The gravel/cobble bar on the left bank forced flow against the sandy right bank, causing the section to collapse. The project included installing a hard toe to limit undercutting, applying upper bank bioengineering treatments, and manipulating the mid-channel bar.

Honey Creek Streambank

The project restored the damaged streambank by regrading and revegetating slopes using geocells and rip rap armoring.

County-Owned /Leased Agricultural Parcels

Milwaukee County also owns and leases agriculture parcels within the County. Currently, Milwaukee County Parks leases about 760 acres of undeveloped parkland for agricultural uses, and those leased lands are shown on Map 1.1. The County has been working with lessees to take parcels adjacent to rivers out of agricultural production in accordance with the Root River Watershed Restoration Plan. Parcels taken out of production are restored to woodland natural areas. In addition, lease agreements require a 75-foot buffer along wetland and riparian corridors.

Implement the Recommendations Outlined in the County Pond and Lagoon Management Plan

Milwaukee County owns 68 ponds and lagoons and the plan objective is to address water quality and shoreline management of the ponds and lagoons. In 2012, shoreline erosion was addressed at the Mitchell Park Lagoon. The project installed biologs and native shoreline and emergent wetland plant species. A pump and filter system that removes phosphorus from the pond through the use of sorptive media was installed.

The Milwaukee County Parks Department also conducts aquatic macrophyte management at 18 locations within the County. Permits are received annually for this work, but treatments are performed as needed. In 2016, 20 priority ponds and lagoons were inspected. In 2017, the County collected water quality samples from County-owned lands that contain ponds and lagoons and the data collected is provided in the Pond and Lagoon Management Plan update. From 2018 to 2019, the County installed a diffuse aeration in one-third of the Veteran's Park lagoon for over a year anticipating the aeration would help abate the blue-green algae, which became a nuisance and public health problem. The Pilot project for the Veteran's Park lagoon included ongoing testing and observations.

Comply with the NR 151 Agricultural Performance Standards

Milwaukee County continues to provide cost-share and technical assistance to priority farm landowners to implement BMPs. Information may be provided through newsletters, brochures, mailings, and one-on-one meetings. The County provided cost-share information for a well abandonment and for three critical area stabilizations and, in 2017, mailed a letter to local producers informing them about cost-share and technical assistance available to them by the State.

Implementation Activities Related to Goal #2: Protect, Maintain, and Restore Land and Water Resources in Milwaukee County

Continue to Manage the Milwaukee County-Owned Natural Areas Using the Latest Advancements in Restoration Ecology

The Natural Areas Program manages County Parks-owned natural areas. The program develops ecological restoration and management plans for the County's natural areas and leased agricultural land, partners with local organizations and Community Science volunteers to increase public awareness of natural resources, implements on the ground ecological restoration activities, and undertakes flora and fauna assessments. The Milwaukee County Parks Natural Areas Program and its partner organizations conduct ecological restoration/habitat management activities at approximately 50 natural areas within the Park System on an annual basis. Management decisions are guided by the ongoing flora and fauna research efforts that are currently inventorying and monitoring populations of invasive species, native plants, breeding and migratory birds, amphibians in relation to ephemeral wetlands, and invertebrates. Examples of invertebrate specie-assessments include bumble bees, crayfish, and odonates (dragonflies and damselflies) surveys. The research data collected is used to develop and implement comprehensive ecological restoration and management plans (ERMP). ERMPs have been recently developed for 1,162 acres of natural areas within the Oak Creek Parkway, Falk Park/Barloga Woods, and 652 acres within the Little Menomonee River Parkway. Additional ERMPs are currently being developed for the remainder of the Little Menomonee River Parkway and for the parks within the Milwaukee River Greenway.

Since 2015, the only project the Natural Areas Program has conducted on leased agricultural lands has been reforesting both leased agricultural fields at Barloga Woods. The program is also planning to reforest another previously leased agricultural field along the Root River at the end of 2021. The Natural Areas Program requires lessees to work with the NRCS and County to develop a conservation plan if a plan does not already exist for the leased parcel(s) of land. The conservation plan must describe and specify a crop rotation schedule, tillage methods, nutrient and pest management, streambanks, and other best management practices required to reduce soil loss, achieve water quality goals, and protect the natural resource base. In addition, all leased lands must maintain a log identifying fertilizers and pesticides used on County-owned parklands, no annual crops may be planted within 75 feet of any river or stream, and no wetlands may be filled or drained.

In addition, the County Parks Department will consider, on a case-by-case basis, an equitable method to share the cost of land improvements needed to prevent erosion and control sediment. The Parks

Department will seek Federal and State grants to help fund those projects that result in improved land and water quality and will also assist in the funding of a project if the project demonstrates improving water quality, recreational use, biodiversity, or other features that may advance the mission of the County's Park and Open Space Plan. As part of the lease agreement, the lessee must comply with all rules, regulations, ordinances, and laws, including those associated with NR 151.

Partnerships are essential for the success of the Natural Areas Program. Since 2015, staff have worked with 87 partner organizations on a variety of important projects within the park system's natural areas. Through staff efforts and the substantial efforts of their partner organizations, the program on average engages 1,400 volunteers who donate 40,000 hours annually to improve the ecology of the park system. The financial impact of volunteers and their community investment is valued at approximately $900,000 annually within the park system's natural areas.

In 2015 alone, staff, volunteers, and partner organizations undertook restoration projects that enhanced and protected the ecology of 1,565 acres of natural areas at 107 parks and parkways. They also maintained and stabilized approximately 22 miles of the Park Department's Forked Aster Hiking Trail System, and with the efforts of the Student Conservation Association, AmeriCorps, and staff they opened another three miles of hiking trails. The number of volunteers and the hours devoted by the volunteers are very comparable annually in every workplan period. As part of on-going research activities during 2016 to 2020, Natural Areas staff, partner organizations, and contractors documented 41 species of State-listed flora and 54 species of State-/Federally-listed fauna utilizing the natural areas within the park system. One example would be the Federally endangered Rusty Patched Bumble Bee (staff recently documented the first natural nest within Wisconsin in over a century) that inhabits numerous natural areas across the park system. On average, Milwaukee County Parks Natural Areas staff, partners, and contractors improve the ecology of approximately 800 acres of natural areas annually by removing invasive species (currently the County manages 40 different invasive species), reforesting leased farmland and turfgrass areas to native hardwoods and shrubs, installing/maintaining pollinator gardens and prairies, and undertaking numerous upland forest restoration projects.

A current major project undertaken by the County includes implementing the Parks/USEPA/WDNR Area of Concern (AOC) remedial action plan that covers portions of the Milwaukee River Parkway, Menomonee River Parkway, Little Menomonee River Parkway, lower Kinnickinnic River Parkway, and County Grounds Park. When the project is completed, it is envisioned that the restoration work will result in a $20 million

Federal investment towards improving terrestrial, aquatic, and semi-aquatic wildlife habitat, and the removal of historic contaminants within the park system.

The activities of the Natural Areas Program are guided by developing and implementing Ecological Restoration and Management Plans (ERMPs) for natural areas within the park system. These plans guide management efforts in 10-year time frames. In 2015 alone, components of these ERMPs were implemented for Bender, Dretzka, Falk, Grant, Greenfield, Grobschmidt, Jackson, Jacobus, McGovern, Noyes, and Warnimont Parks; the Cudahy Nature Preserve; and a section of the Little Menomonee River Parkway.

Increase Public Awareness of the Value of Land and Water Resources in Milwaukee County

Milwaukee County provides different forms of outreach. The County Parks Natural Areas staff typically provides 20 presentations annually to local community groups as well as formal presentations at Regional and National conferences. Presentation topics have included bird conservation, invertebrate conservation, living with coyotes, and restoration ecology. Staff also utilizes social media through the Natural Areas Program's Facebook page and posts were viewed over 120,000 times in 2019 alone.

Staff continues to provide interviews through more traditional media outlets (periodicals, newspapers, and television) on various subjects related to natural areas management within the park system. Public awareness is also generated through recognition by respected conservation outlets. For example, the County park system is currently a Wisconsin Bird City "High Flyer" and, in 2019, the entire park system was designated as Wisconsin's 93rd Important Bird Area (IBA) for its extensive bird conservation efforts and the immense value of the park system to migratory birds. The County park system became one of only 12,000 designated Important Bird Areas in the world.

Staff further expanded their annual outreach efforts through the Community Science Engagement Program where volunteers are trained to conduct scientific research to help the Natural Areas staff better manage Parks natural areas. Currently, community science volunteers assist in monitoring ephemeral wetland wildlife, bumble bees, bird populations, and bird nest boxes within the County's park system. Natural Areas volunteers are also trained to manage invasive species through The Park People's and Parks Weed-out Program where they work with the Natural Areas staff to remove woody and herbaceous invasive species such as common buckthorn, non-native honeysuckle, garlic mustard and dame's rocket.

Parks also continues to provide the Natural Areas Internship/Seasonal staff Program, which provides hands-on field experience to students and seasonal staff from various universities/colleges within Wisconsin.

Maintain and Acquire High-Quality Natural Areas in Accordance with the Milwaukee County Parks and Open Space Plan

From 2016 to 2020, the County acquired an additional 114 acres of natural areas that have filled in gaps within environmental corridors or act as buffers to existing natural areas within the park system.

Maintain Land in River Corridors for Recreational Use and Access

The Kletzsch Dam repair project is planned to repair the dam, add a fish passage, and for recreational purposes, add an improved portage, universally accessible river access, and an overlook to the Milwaukee River.

Implementation of Activities Related to Goal #3: Enhance Lake Michigan Bluff Protection Initiatives

Continue to Improve and Maintain Lake Michigan Shoreline Protection Measures and Abate Shoreline Erosion Problems in Milwaukee County Parks

Milwaukee County completed several projects that modified erosion problems within County-owned lands along the lakefront. Projects performed include Grant Park, Big Bay, Juneau Park (bluff), and Warnimont Park remediation. Bluffs and ravines along the lakefront at Warnimont Park are very steep and suffer from occasional erosion, in some cases severe erosion. Because the park ravines were once used for waste dumping in the mid-1900's, the steep slopes and erosion have caused the waste to be exposed. The County continues to work with the Wisconsin Department of Natural Resources to ensure these areas are managed properly and do not pose a hazard to the environment and to public health. The County is currently working to remove hazards caused by exposed wastes, regrade steep slopes, and stabilize slopes with rip rap, slope interrupters, and the planting of deep-rooted native plants.

Milwaukee County created a GIS inventory of coastal natural resources and developed features owned by the County that includes property boundaries, facilities, infrastructure, and natural resources. From the inventory, a list of County-owned coastal resources was developed and monetary value of the resources were assigned. Site visits were conducted to make visual assessments of site conditions and photo-document conditions. A vulnerability analysis report was conducted for the inventoried sites based on site

conditions, value assessments, and existing environmental hazard data. Milwaukee County hired a consultant to evaluate assets on Lake Michigan.

As part of a National Oceanic and Atmospheric Administration (NOAA) Coastal Resilience Grant, the Wisconsin Coastal Management Program awarded Milwaukee County a grant in support of a study entitled, *Coastline Management Guidelines for Milwaukee County*. The study, which was completed in February 2021, will develop a formal policy and set of coastal land management guidelines the County can use to proactively manage its coastal properties. The policy and management guidelines developed will be a valuable resource to the County and its coastal municipalities and also to those in the private sector considering coastal development projects. County staff worked with SEWRPC to develop the coastal management guidelines. As part of the NOAA Coastal Resilience Grant, the County Parks Planning and Development Division will undertake the Milwaukee County Coastal Resources Inventory project. The project, which was completed in October 2020, will identify and assess the vulnerability of Milwaukee County's property and recreational assets along the Lake Michigan shoreline to the effects of extreme weather.

Implementation Activities Related to Goal #4: Maintain the Existing Information Management Network and Land Information Web Portal

Ensure that Mapping and the GIS Infrastructure Are Updated on a Regular Basis

The Milwaukee County Land Information Office (MCLIO) maintains partnerships with municipalities and other agencies within Milwaukee County (MMSD, WE Energies, etc.) to share GIS data and to provide those data to the public. The MCLIO supplies the core cadastral and planimetric data sets to most municipalities within the County as the base for their own local GIS systems. Data sets are updated continuously as new data become available.

Implementation Activities Related to Goal #5: Limit the Introduction and Reduce the Spread of Invasive Species in Milwaukee County

Provide Information to County Staff and Residents about How to Control Invasive Species

The Milwaukee County Parks Natural Areas Program is tasked with limiting the spread and introduction of invasive species in the County Parks.

The Natural Areas Program has conducted invasive species workdays or "weed-outs" in parks and in natural areas for community volunteers and "friends" groups on an annual basis. Weed-out site leaders are required to take an annual refresher course on invasive species management in order to oversee weed-out activities within their park. In 2015, approximately 700 volunteers worked to remove invasive species at Big Bay, Doctors, Estabrook, Grant, Holler, Hoy, Jacobus, Juneau, Kletzsch, Lake, Lincoln, Mitchel Boulevard, and South Shore Parks and along the Honey Creek, Menomonee River, and Oak Creek Parkways. Invasive species control and management continues to grow, with its current focus on "rapid response" invasive species. These are species that are not yet common in the park system, and effective rapid control will prevent them from becoming widespread.

On average, between 4,500 to 5,000 volunteers work with the Natural Areas Program and its partners each year and many of the volunteers work directly with invasive species control or are educated on the topic as they volunteer for other ecological restoration activities. The volunteers are trained on managing invasive species through The Park People's and Parks Weed-out Program where citizens work with Natural Areas staff to remove woody and herbaceous invasive species.

Develop a Comprehensive and Coordinated Approach to the Management of Invasive Species in Milwaukee County and Manage Infestations of Invasive Species in Milwaukee County-Managed Properties

In addition to the weed-outs described above, the Natural Areas staff work to manage invasive species within the County Parks. In 2015, staff engaged in invasive species control in the following County parks and County-owned lands: Back Bay, Bay View, Bender, Cambridge Woods, Copernicus, County Grounds, Cudahy, Cudahy Nature Preserve, Dale Creek, Dineen, Doyne, East-side Bike Trail, Estabrook, Falk, Gordon, Grant, Greenfield, Grobschmidt, Holler, Honey Creek Parkway, Jackson, Jacobus, Juneau, Kinnickinnic Parkway, Kohl, Lake, Little Menomonee River Parkway, Menomonee River Parkway, Milwaukee River Parkway, Noyes, Oak Creek Parkway, Rawson, Riverside, Root River Parkway, Underwood Creek Parkway, Warnimont, Washington, Wilson, and Zablocki. Though the specific parks may change from year to year, a similar number of parks are managed for invasive species on an annual basis.

Milwaukee County Parks Natural Areas staff have also developed an internal Invasive Species Procedure protocol to guide the invasive species management practices. In addition, the County Natural Area's staff worked internally with other County Parks Department staff in 2019 to redevelop the Parks Integrated Pest Management Plan, which guides the effective use of pesticides in the County park system. The plan includes information about how and when to appropriately use herbicides to control invasive species,

which is important because the Natural Areas staff, partners, and contractors work on controlling 40 different invasive species at approximately 50 different natural areas on an annual basis. The Natural Areas Program also developed and maintains an Invasive Species Quick Reference Guide (QRG) that details all the currently known effective treatments for the 40 species of invasives found within the park system. Natural Areas staff keep detailed records on the effectiveness of control on all treated invasive species populations so that they may adjust treatments or techniques accordingly.

SEWRPC Community Assistance Planning Report No. 312 (2nd Edition)

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

Chapter 1

INTRODUCTION

TABLES

Table 1.1
Notable Partners with Milwaukee County in Land and Water Resource Conservation Activities: 2012-2021

16th Street Community Center	Friends of Smith Park
Alliance for the Great Lakes	Friends of South Shore Park
Alverno College	Friends of the Domes
AmeriCorps	Friends of the Mill Pond
Animal and Plant Health Inspection Service (APHIS)	Friends of the Monarch Trail
Bird City Wisconsin	Friends of Tiefenthaler Park
Boy Scouts of America	Friends of Valley Park
Carthage College	Friends of Wedgewood Park
Cathedral Square Friends	Friends of Wehr Nature Center
City of Franklin	Friends of Wilson Park
City of Milwaukee	Fund for Lake Michigan
City of Oak Creek	Girls Scouts of America
City of South Milwaukee	Great Lakes Community Conservation Corps
City of West Allis	Hawley Environmental School
Conservancy for Healing	Humboldt Park Friends
Cream City Conservation Corps	Hunger Task Force
Doctors Park Friends	Juneau Park Friends
Friends of Bay View Park	Keep Greater Milwaukee Beautiful, Inc.
Friends of Boerner Botanical Gardens	Kelly Senior Center
Friends of Brown Deer Park	Lake Park Friends
Friends of Center Street Park	Mequon Nature Center
Friends of Cooper Park	Metro Audubon Society
Friends of County Grounds Park	Milwaukee Area Land Conservancy
Friends of Cudahy Park	Milwaukee Area Technical College
Friends of Estabrook Park	Milwaukee Metropolitan Sewerage District
Friends of Grant Park	Milwaukee Parks Foundation
Friends of Grobschmidt Park	Milwaukee River Advocates
Friends of Hales Corners Park	Milwaukee River Greenway Coalition
Friends of Hales Corners Park and Pool	Milwaukee Riverkeeper
Friends of Hoyt Park and Pool	Monarch Coalition
Friends of Jacobus Park	Mount Mary College
Friends of Johnsons Park	Nash Park Watch
Friends of Juneau Park	North Point Lighthouse Friends
Friends of Kletzsch Park	Ozaukee Washington Land Trust
Friends of LaFollette Park	Partners in Parks
Friends of Lake Park	Pheasants Forever—Southeast Wisconsin Chapter
Friends of Lincoln Park	Preserve Our Parks
Friends of Milwaukee County BMX Trails	River Revitalization Foundation
Friends of Milwaukee County's Trails	Riveredge Nature Center
Friends of Mitchell Airport Park	Save the County Grounds Coalition
Friends of Mitchell Boulevard Park	Schlitz Audubon Nature Center
Friends of Moody Park	Southeast Wisconsin Invasive Species Consortium Inc.
Friends of Morgan Triangle Park	Sheridan Park Friends
Friends of Oak Creek Mill Pond	Southeast Area Wisconsin Land and Water Conservation Association
Friends of Oak Creek Mill Pond and Watercourse	Southeastern Wisconsin Beach Task Force
Friends of Pulaski-Cudahy	Southeastern Wisconsin Invasive Species Consortium
Friends of Rainbow Park	Southeastern Wisconsin Regional Planning Commission
Friends of Sheridan Park	Story Hill Neighborhood Association

Table continued on next page.

Table 1.1 (Continued)

Sweet Water	University Wisconsin-Extension
The Brookby Foundation	University Wisconsin-Madison
The Greater Milwaukee Foundation	University Wisconsin-Milwaukee
The Nature Conservancy	University Wisconsin-Stevens Point
The Park People	Western Great Lakes Bird and Bat Observatory
United States Forest Service	Wisconsin Bird Conservation Partnership
Urban Ecology Center	Wisconsin Lutheran College
United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS)	Wild Ones Native Landscapers
United States Environmental Protection Agency (USEPA)	Wisconsin Coastal Management Program
United States Fish and Wildlife Service (USFWS)	Wisconsin Department of Natural Resources (WDNR)
United States Geological Survey (USGS)	Xerces Society

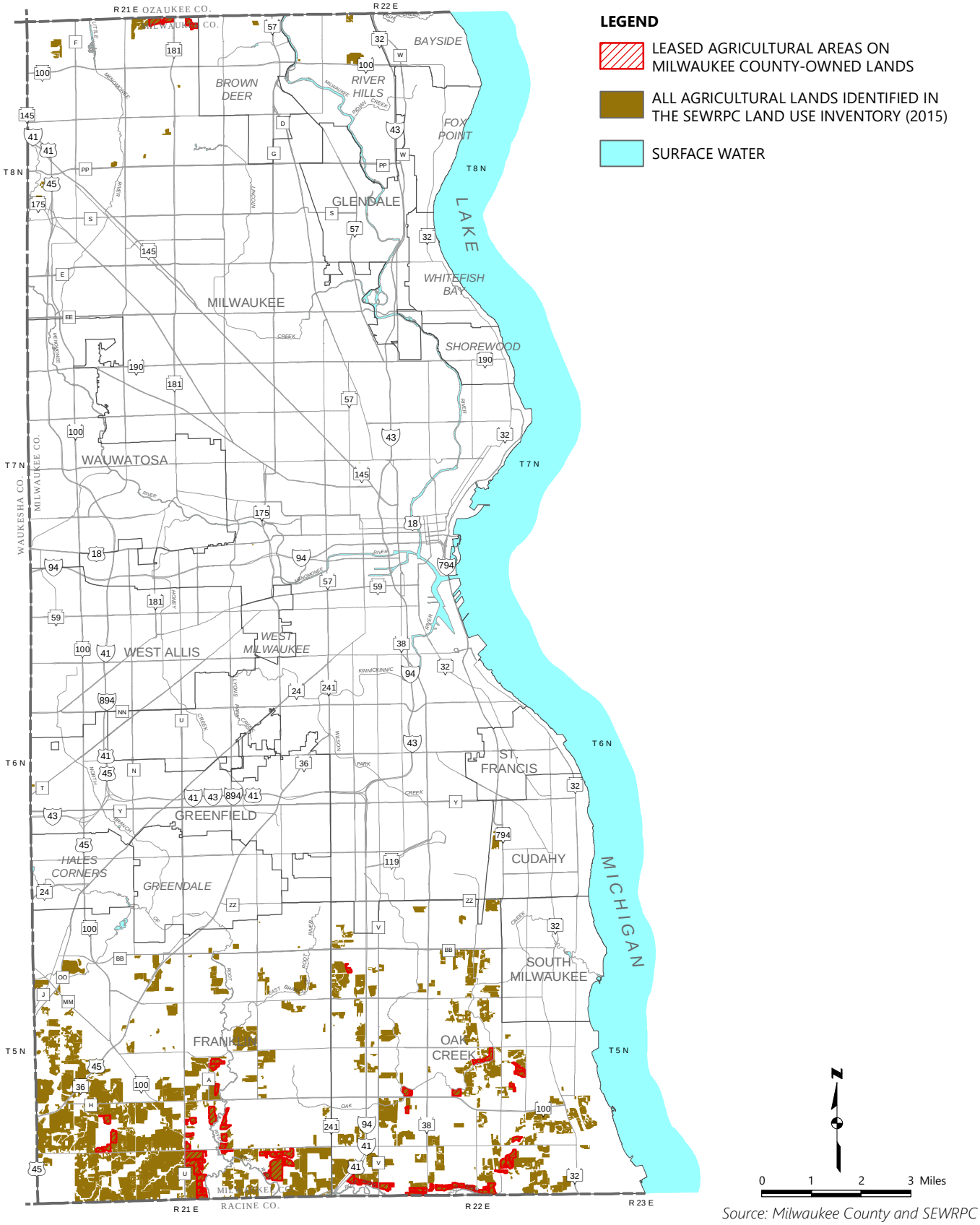
Source: Milwaukee County and SEWRPC

Chapter 1

INTRODUCTION

MAPS

Map 1.1
Leased Agricultural Areas on County-Owned Lands



Source: Milwaukee County and SEWRPC

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SEWRPC Community Assistance Planning Report No. 312 (2nd Edition)

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

Chapter 2

RESOURCE ASSESSMENT

2.1 INTRODUCTION

Conserving and thoughtfully using agricultural and natural resources and preserving cultural resources are important factors influencing the growth and development potential of Milwaukee County. The natural resource base of the County is one of the assets that make it a desirable place to reside and work. The natural resources of Milwaukee County not only provide recreational and aesthetic value, but also provide economic value. Protecting this resource base is important to maintain biological diversity, which could be degraded by inappropriate development. Accordingly, future development should be guided to be consistent with the ability of the natural resource base to support various forms of urban and rural development without deteriorating the existing natural resources in the County.

The natural resources in Milwaukee County are susceptible to permanent damage resulting from inappropriate land use, transportation, and public facility development. Additionally, traditional occupations such as farming and horticulture place significant burdens on the natural resource base. Sufficient understanding of the characteristics and elements of the natural resources must exist in order to prevent the environmental degradation and monetary costs associated with overuse and alteration of the existing natural resource base. A sound land and water resource planning program must recognize that natural resources in the County are limited. Milwaukee County and the local governments within the County must work together to develop a sound planning process that acknowledges the potential threats to the resource base; provides goals and objectives to preserve, protect, and enhance that resource base; and educates the public on the value of natural resources and the benefits of good land stewardship.

This chapter provides inventory information on existing agricultural, natural, and cultural resources in Milwaukee County. The resource assessments that are discussed include soil types, existing farmland, farming operations, topography and geology, Lake Michigan bluff and ravine areas, nonmetallic mineral resources, surface water and groundwater resources, forest resources, natural areas and critical species habitats, environmental corridors, park and open space sites, cultural (historical and archaeological) resources, and demographics and land use.

The base year for inventory data presented in this chapter ranges from 2010 to 2020. Much of the inventory data has been collected through regional land use, natural area, and water quality planning activities conducted by SEWRPC. Additional inventory data has been collected from and by Milwaukee County, local units of government, and State and Federal agencies including the Wisconsin Department of Natural Resources (WDNR); Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP); State Historical Society of Wisconsin; and the U.S. Department of Agriculture (USDA).

2.2 SOILS AND AGRICULTURAL RESOURCES

Soil Survey

Soil properties exert a strong influence on the manner in which the land is used, especially where land use is continually changing and evolving, as it is in Milwaukee County. Soils directly affect the types of land use that can take place, whether those uses are agricultural, recreational, commercial, or residential. Any comprehensive land and water resource management plan needs to evaluate how soils are currently being used, and also how soils should best be used and managed over time. Information contained in the soil survey of Milwaukee County, including soil association, series, and type, can help identify which areas of the County are suitable for agricultural use and which areas have limitations for development due to wet soils or bedrock near the surface.[1]

Soil Associations

A soil association is a landscape that has a distinctive pattern of soils. There are six soil associations in Milwaukee County and Map 2.1 shows their spatial distribution across the County. Soils are typically

[1] *Documented in the USDA Soil Conservation Service,* Soil Survey of Milwaukee and Waukesha Counties, Wisconsin, *1971. Updated by the USDA Natural Resources Conservation Service,* Soil Survey of Milwaukee and Waukesha Counties, Wisconsin, January 1998. *Unless otherwise noted, soil information, including the attributes of each soil type, were obtained via the NRCS Web Soil Survey (WSS) database.*

grouped into an association by drainage patterns, as well as surface horizon thickness. The general soil associations can be used for comparing suitability of relatively large areas for various land uses. However, for specific applications, the aforementioned detailed soil survey information should not be solely relied upon and an onsite field survey may be necessary for confirmation purposes. Soils, as a whole, are very diverse and polymorphic, making it necessary to field verify what is actually on the landscape.

Soil Erosion Potential

Topographical features, particularly slopes, have a direct bearing on the potential for soil erosion and the accumulation of sediment on the beds of surface waters. Map 2.2 shows the steepness of slopes in Milwaukee County. Slope steepness affects the velocity and, accordingly, the erosive potential of runoff. The amount of slope or relief on the land is one of the most important factors governing soil development processes and determines many of the physical and chemical properties of a specific soil.

Highly erodible lands (HEL) are those areas in the County that have slopes greater than 6 percent. Although areas that have slopes less than 6 percent are still prone to erosion without proper management, the areas that are greater than 6 percent slope are of most concern. The Natural Resources Conservation Service (NRCS) considers a farm field to be HEL if one-third or more of that field contains slopes of 6 percent or greater. The soils in these areas are difficult to manage, not only for agriculture, but also for urban development. Land surface slopes, based on soils classification interpretations, within Milwaukee County range from less than 1 percent to over 20 percent. The majority of land area in Milwaukee County, approximately 53.0 percent, has slopes that are between 0 and 6 percent based upon soil interpretations. The remaining classes of 7 to 12, 13 to 20, and greater than 20 percent occupy approximately 9.9 percent, 0.6 percent, and 0.3 percent, of the County land area respectively. All of the lands with a slope greater than 20 percent in the County are located along the Lake Michigan shoreline or along portions of streams that drain into Lake Michigan. Additionally, about 36.2 percent of the land area is not assigned a slope classification, either because soil surveys were not conducted because of the presence of urban development or because the land is described as disturbed land, such as landfills and gravel pits.

Soil Limitations for Development

A variety of soil characteristics can impact the suitability of land for development. Severe structural soils, as identified by the NRCS, impose significant limitations on developing dwellings with or without basements and structures requiring septic tank absorption fields. Severe structural soils possess properties or site features that are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. A high-water table, flooding, shrinking

and swelling, and organic layers can cause footings to move and affect dwellings with or without basements. Likewise, a high-water table, depth to bedrock, large stones, slope, and flooding can affect the ease of excavation and construction and also influence the performance of septic tank absorption fields.

Soils that are saturated with water or that have a water table at or near the surface are known as hydric soils, and can pose significant limitations for most types of development. High water tables often cause wet basements and poorly functioning absorption fields for private onsite waste treatment systems. The excess wetness may also restrict the growth of landscaping plants and trees. Wet soils also restrict or prevent the use of land for crops, unless the land is artificially drained. Map 2.3 depicts hydric soils in Milwaukee County, as identified by the NRCS. The land area covered by hydric soils identified in the County and each local government is shown in Table 2.1. Because soil survey data are unavailable for portions of the County, the areas shown in the table should be considered minimum values. Although such areas are generally unsuitable for development, they may serve as important locations for restoring wetlands and wildlife habitat.

Soil Suitability for Agricultural Production

The NRCS has classified soils into capability groupings that indicate their general suitability for most kinds of farming. The groupings are based upon composition and limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. Under the NRCS system, there are eight capability classes ranging from Class I, which have few limitations, to Class VIII, which have severe limitations due to soils and land forms so rough, shallow, or otherwise limited that they do not produce economically worthwhile yields of crops, forage, or wood products.[2] In general, Class I soils have the widest range of uses, the least risk of damage, and are most suitable for cropland; Class II soils have some limitations that reduce the choice of plants that can be grown, or require moderate conservation practices to reduce the risk of damage when used; Class III and IV soils have severe limitations that reduce the choice of plants, require special conservation practices, or both. The soils in the remaining classes have progressively greater natural

[2] It should be noted that the NRCS has also developed a land evaluation system for farming that considers soil-based factors, including a soil productivity factor, the capability class, and others. The land evaluation rating may be combined with the site assessment factors that are not related to soil characteristics, through a land evaluation and site assessment system ("LESA" system) that integrates soil-based and nonsoil-based factors to evaluate farmland. Site assessment factors may include the level of on-farm investment, compatibility with adjacent uses, proximity to urban development, distance to public utilities, and others. It is envisioned that, given the widespread familiarity with that system, the capability class system would be used for purposes of rating farmland under the Land and Water Resource Management Plan.

limitations not suitable for cropland, but may be used for pasture, grazing, woodland, wildlife, recreation, and aesthetic purposes. Generally, lands with Class I and II soils are considered "National Prime Farmlands" and lands with Class III soils are considered "Farmlands of Statewide Significance."

Class I, II, and III soils in Milwaukee County are shown on Map 2.4 and presented in Table 2.2. As shown on Map 2.4, those areas of the County that have a soil classification type are covered by soils that are well suited for agricultural use (mainly Class II soils). It is important to note that for much of the middle of the County (from east to west), soil survey data upon which to classify soil capability are not available, because these areas are highly urbanized and will likely not be used for agricultural purposes. This includes all or portions of the Cities of Cudahy, Glendale, Greenfield, Milwaukee, St. Francis, Wauwatosa, and West Allis and the Villages of Shorewood and Whitefish Bay.

Existing Farmland

Agricultural lands in 2015 were identified by SEWRPC as part of the regional land use inventory conducted as part of the regional planning program. The land use inventory identified croplands, pasture lands, orchards, nurseries, specialized farming, and nonresidential farm buildings. Farm residences, together with a 20,000-square-foot dwelling site, are classified as single-family residential land uses. Based on the land use inventory, about 8,507 acres, or about 13 square miles, representing about 5.5 percent of the County, were in agricultural use in 2015. This is a decrease of about 4,414 acres, or about 34 percent, from the amount of land in agricultural use in 2000 (as set forth in the previous Milwaukee County Land and Water Resource Management Plan). Agricultural land is primarily cultivated or used for pasture and excludes the wetland and woodland portions of farm fields. Table 2.3 sets forth the areas occupied by farmland in each community and the County in 2015.

Map 2.5 and Table 2.3 show the area devoted to farmland use in 2015, categorized as follows:

- Cultivated Lands, which includes lands used for the cultivation of crops, including row crops, grain crops, vegetable crops, and hay.

- Pasture Land and Unused Agricultural Lands, which includes lands used as pasture, or lands that were formerly cultivated or used for pasture that have not yet succeeded to a wetland or woodland plant community.

- Orchards and Nurseries, which includes lands used for orchards, nurseries, or Christmas tree farms.

- Specialty Agricultural Lands and Agricultural-Related Uses, which includes sod farms and lands used for crops such as mint, ginseng, berries and other specialty crops. Central Greens, which utilizes an aquaponics system to grow produce, is an example.

- Farm Buildings, which includes barns, silos, and other buildings used to store farm equipment or supplies or house farm animals.

Overall, cultivated lands were the predominant type of agricultural use in Milwaukee County accounting for about 77 percent of agricultural land in 2015 (which is slightly more than the 72 percent in 2000 identified in the previous Milwaukee County Land and Water Resource Management Plan).

Number and Size of Farms

Table 2.4 sets forth the number of farms by size category in Milwaukee County and Wisconsin. There were 86 farms in the County in 2017 (as compared to 96 farms in 2007). The largest percentages of farms in the County, about 56 percent (as compared to 42 percent in 2007), were less than 10 acres, and an additional 28 percent of farms were between 10 and 49 acres. Only about 2 percent of farms in the County were more than 500 acres in size. In 2017, 81 farms consisted of croplands and 67 of those farms harvested croplands. The primary type of farming in the County in 2017 was cash cropping, while the remaining farms raised livestock to be sold for various production purposes. Of the croplands identified at farms in the County in 2017, the largest number of acres consisted of soybeans that encompassed 1,717 acres (15 farms), followed by corn that encompassed 802 acres (10 farms); wheat that encompassed 334 acres (seven farms); and vegetables that encompassed 176 acres (33 farms). Thirty-nine farms in the County had some sort of livestock in 2017.

Farm Production and Revenue

Farm production and revenue inventory data[3,4] are useful in determining the economic impact of agriculture in Milwaukee County and the major types of agricultural products. Agricultural sectors in the County and State in 2017, and the amount and percentage of revenue associated with each sector, are set forth in Table 2.5. Horticulture was the predominant source of agricultural revenue in the County in 2017,

[3] Data included in this section are 2017 data for Milwaukee County from the National Agricultural Statistics Service. Data are reported at the County level and are not available by local government.

[4] The USDA defines a farm as any place from which $1,000 or more of agricultural products (crops and livestock) were sold or normally would have been sold during the year under consideration.

accounting for about 58 percent of agricultural revenue (as compared to 75 percent in 2007). A much lower percentage, about 2.3 percent, of agricultural revenue Statewide was based on horticulture. The relative importance of the horticultural industry in the County compared to the State is likely a response to the demand for landscaping material for urban development in the County and the Milwaukee metropolitan area.

Vegetables were the second-largest source of agricultural revenue in Milwaukee County in 2017, accounting for about 19 percent of sales (as compared to 12 percent in 2007). Statewide, vegetables accounted for just 4.7 percent of sales.

Table 2.6 sets forth total value of sales in 2017 for farms in Milwaukee County.[5] Unlike with the distribution of the value in sales by agricultural sector, the distribution of the value in sales by farm is relatively similar to the entire State, with the largest portion of farms in the County and the State having a total value in sales of less than $2,500 and the second-largest portion having a total value in sales of $100,000 or more.

Average net income from farm operations in the County in 2017 was $13,759 (as compared to $21,195 in 2007), which was lower than the State average of $36,842. Within the County, farming was the principal occupation of the farm operator on about 38 percent of the farms (as compared to 69 percent in 2007). Statewide, farming was the principal occupation of the farm operator on about 46 percent of farms.

Milwaukee County Parks Agricultural Land Lease

Milwaukee County Parks currently leases about 760 acres (as compared to approximately 1,000 acres in 2010) of undeveloped parkland for agricultural uses. As of January 2020, 16 individuals (as compared to 18 individuals in 2010) leased Milwaukee County parkland for agricultural uses. While most of the leased land lies along the Root River and Oak Creek Parkways in the southern portion of the County, there are several parcels at Kohl Park in the northern portion of the County. As resources allow, the majority of this leased agricultural land will be converted to conservation land through reforestation, wetland restoration, and prairie establishment.

[5] *The total value of sales is equal to the gross market value before taxes and production expenses for all agricultural products sold.*

In addition, UW-Extension also leases land within County-owned parklands for vegetation plots/gardens. Sites are located at Kohl Park, Firefly Ridge (located on Underwood Creek Parkway north of IH-41), and within the Oak Creek Parkway near Forest Hill Avenue.

2.3 NATURAL RESOURCES

Topography and Geology

The landforms and physical features of Milwaukee County, such as topography and drainage patterns, are an important determinant of growth and development. The physiography of the area not only must be considered in sound land use and supporting transportation, utility, and community facility planning and development, but it also contributes directly to the natural beauty and overall quality of life in the County. Milwaukee County varies from gently rolling glacial plains in the eastern half to steeper hills in the western half. The County is adjacent to Lake Michigan, one of the five Great Lakes. A steep escarpment is present along the Lake Michigan shore at the north and south ends of the County, away from the confluence of the Milwaukee River with Lake Michigan. In addition, the subcontinental divide, which separates the Mississippi River Basin and the Great Lakes-St. Lawrence River Basin, traverses the extreme southwestern portion of the County, in the City of Franklin.

Glaciations have largely determined the physiography and topography, as well as the soil within the County. Generalized landforms and topographic characteristics are shown on Map 2.6. Land surface elevations range from about 580 feet above National Geodetic Vertical Datum, 1929 adjustment (NGVD 29) at the mouth of the Milwaukee River to about 850 feet above NGVD 29 in the City of Greenfield. Most of the County is covered by gently sloping ground moraine consisting of heterogeneous material deposited beneath the ice of the glaciers, moraines consisting of material deposited at the forward margins of the ice sheet, and outwash plains formed by the action of flowing glacial meltwater.

The bedrock formations that underlie the unconsolidated surficial deposits of Milwaukee County consist of Silurian and Devonian dolomite. The uppermost bedrock unit throughout most of the County is Silurian dolomite, primarily Niagara dolomite underlain by a relatively impervious layer of Maquoketa shale. In northeastern Milwaukee County, it is primarily Devonian dolomite and shale of the Milwaukee Formation. In addition, in some of the pre-Pleistocene valleys in the southwestern portion of the County, the Niagara dolomite has been removed by erosion, and the uppermost bedrock unit is Maquoketa shale. All of these rock units dip toward the east.

The advances of glacial ice sheets resulted in a wide range of glacial deposits over the bedrock. As shown on Map 2.7, the most substantial glacial deposits, as represented by depth from the land surface to bedrock, are 200 to 400 feet thick, and located mostly in the southern portion of the County. Areas where the depth to bedrock ranges from zero to 100 feet are found in the north central portion of the County and along much of the western boundary of the County.

Lake Michigan Bluff and Ravine Areas

Shoreline erosion and bluff stability conditions are important considerations in planning for the protection, sound development, and redevelopment of lands located along the Lake Michigan shoreline. Shoreline erosion and bluff stability conditions in Southeastern Wisconsin were surveyed in 1977[6] and 1997,[7] and within the City of Milwaukee also in 1978[8] and 1982.[9] Bluff stability conditions were also surveyed in Warnimont Park in 2001[10] and Lake Park in 2002.[11] In addition, an integrated assessment study[12] of changing Lake Michigan water levels and the impact on coastal beaches and bluff erosion in Milwaukee County north shore communities was conducted in 2015.

In 2017, a project team consisting of the Wisconsin Coastal Management Program, the University of Wisconsin Sea Grant Institute, the University of Wisconsin-Madison Department of Civil and Environmental Engineering, and SEWRPC were awarded a three-year National Atmospheric and Oceanic Administration

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[6] *D.M. Mickelson, L. Acomb, N. Brouwer, T.B. Edis, C. Fricke, B. Haas, D. Hadley, C. Hess, R. Klauk, N. Lasca, and A.F. Schneider, Shore Erosion Study, Technical Report,* Shoreline Erosion and Bluff Stability Along Lake Michigan and Lake Superior Shorelines of Wisconsin, *Wisconsin Coastal Management Program, February 1977.*

[7] *SEWRPC Technical Report No. 36,* Lake Michigan Shoreline Recession and Bluff Stability in Southeastern Wisconsin: 1995, *December 1997.*

[8] *J.P. Keillor and R. DeGroot,* Recent Recession of Lake Michigan Shorelines in the City of Milwaukee, Wisconsin, *University of Wisconsin Sea Grant Program, 1978.*

[9] *SEWRPC Community Assistance Planning Report No. 163,* A Lake Michigan Coastal Erosion Management Study for the City of Milwaukee, Wisconsin, *October 1989.*

[10] *STS Consultants, LTD.,* Shoreline Erosion Study for Warnimont Park in the City of Cudahy, Wisconsin*, December 2002.*

[11] *SEWRPC Memorandum Report No. 156,* Lake Park Bluff Stability and Plant Community Assessment: 2003, Milwaukee County, Wisconsin, *September 2004.*

[12] *University of Wisconsin Sea Grant Institute,* Planning for an Integrated Assessment on Water Level Variability and Coastal Bluff Erosion in Northern Milwaukee County and Southern Ozaukee County, Wisconsin*, September 2015.*

(NOAA) Coastal Resilience Grant to enhance community capacity in Southeastern Wisconsin and to build resilience to coastal hazards. The purpose of the grant is to provide resources and assistance to communities in Milwaukee County as well as Ozaukee, Racine, and Kenosha Counties to plan and prepare for coastal hazards. A network of officials from municipalities, counties, State agencies, and Federal partners formed a project team to demonstrate resilience resources, discuss ongoing hazard issues, initiate collaboration, and develop consistent approaches to address coastal hazards in the Region. The project team evaluated and mapped shoreline recession rates by analyzing historical aerial photographs and assessed scenarios of potential shoreline recession under Lake Michigan level extremes and high-energy storm conditions and worked with counties and municipalities to assess their vulnerabilities to coastal hazards through a self-assessment exercise. A guided resilience assessment will be offered to communities to help identify and prioritize potential actions to address coastal hazards.

As part of the NOAA Coastal Resilience Grant, the Wisconsin Coastal Management Program awarded the funding for two grants to the Southeastern Wisconsin Coastal Resilience Program for Milwaukee County Parks in 2019. The grants are enabling the County to develop a formal policy and set of coastal land management guidelines to proactively manage its coastal properties and inventory Milwaukee County's coastal resources and prioritize them according to vulnerability and value.

One grant funded the Milwaukee County Coastal Resources Inventory project, which conducted a comprehensive study to identify and assess the vulnerability of Milwaukee County's property and recreational assets along the Lake Michigan shoreline to the effects of extreme weather. The project, which was completed in October 2020, inventoried Milwaukee County's coastal resources, summarized their status, assigned values to those resources, and prioritized them according to vulnerability and value.

The other grant is funding the Milwaukee County Coastline Management Guidelines project, which includes developing coastal land management guidelines for Milwaukee County to assist with preventing or reducing shoreline recession, bluff failure, or erosion on County lands. The project, which was completed in February 2021, provides policy and management practices that include guidance on setbacks from bluffs and ravines, vegetation management, viewshed management, stabilization techniques, and stormwater management. The guidelines also serve to help the County to evaluate projects affecting County-owned assets with respect to coastline area impacts. The County plans to utilize the guidelines as follows:

- To maintain the unique coastline resources that support recreational opportunities within County-owned lakefront lands

- To proactively manage the risks that coastline impacts present to the public, to County-owned assets, and to other publicly owned infrastructure

- To mitigate adverse coastline impacts and protect County-owned assets adjacent to Lake Michigan

- To standardize and expedite the process by which the County responds to local government requests to conduct land-disturbing activities while managing municipally owned infrastructure within County-owned lakefront lands

- To address the interests of the public and owners of property in proximity to County-owned lakefront land in maintaining a view of Lake Michigan through County-owned land

- To prioritize programs and activities in a manner that accounts for the vulnerability and value of coastline resources and County-owned assets

Shoreline erosion and bluff stability conditions can change over time since they are related, in part, to changes in climate, water levels, the geometry of the onshore beach and nearshore areas, the extent and condition of shore protection measures, the type and extent of vegetation, and the type of land uses in shoreland areas, among other related factors. People living on Wisconsin's Great Lakes coastlines are vulnerable to coastal hazards including erosion, lake level changes, waves, storm surge, floods, ice shove, and landslides. As of July 2020, the water level in Lake Michigan was at a record high and has been well above average since mid-2017. These water levels have the effect of increasing shoreline erosion, beach loss, flooding, bluff erosion, and property damage, especially to ports, harbors, and marinas. Portions of the Lake Michigan shoreline in Milwaukee County are highly vulnerable to shore and bluff erosion because much of the coastal landforms are comprised of mixed, unconsolidated glacial materials such as gravels, lake-deposited clays, and tills. Higher water levels can also benefit communities, businesses, and industries that depend on Great Lakes waters for commercial shipping, hydropower, and recreational boating. In addition, the cyclical nature of the Great Lakes indicates a return to lower or near average lake levels in the future.

In 1995, field surveys were conducted to measure the geometry of the bluff slope at 192 sites in Southeastern Wisconsin, including several sites within, or adjacent to, Milwaukee County. These measurements provided a basis for site-specific assessments of the bluff conditions at the selected

locations. In addition, beach and nearshore lakebed conditions were measured for selected sites in Milwaukee County.

The 1997 Lake Michigan coastal erosion and bluff stability study in Southeastern Wisconsin included the field surveys conducted in 1995 and evaluated the lands along the Lake Michigan shoreline in Kenosha, Racine, Milwaukee, and Ozaukee Counties that directly affect, or are directly affected by shoreline erosion, bluff recession, and storm damage processes. This relatively narrow strip of land along the Lake Michigan shoreline extends approximately 89 miles from the Wisconsin-Illinois state line to the Ozaukee-Sheboygan county line, including the shoreline along Milwaukee County. The Lake Michigan shoreline was divided into 17 reaches for analytical purposes, including five reaches within, or partially within, Milwaukee County. These reaches were selected so as to have relatively uniform beach and bluff characteristics. These reaches generally correspond to those utilized in the 1977 shoreline erosion study, with some refinement to reflect conditions at the time of the 1997 study.

Based upon the data collected and the assessment and analysis of those data, bluff stability and shoreline erosion conditions were developed. The five reaches located within Milwaukee County are summarized in Table 2.7 and are shown graphically on Map 2.8. Within northern Milwaukee County, many bluffs were generally found to be stable based upon conditions during the 1995 survey; however, bluffs in two areas were found to be unstable. One of these areas was located along the shoreline in the Village of Bayside. The other was located along the shoreline in the Villages of Fox Point and Whitefish Bay. In central Milwaukee County, the 1995 survey found that bluffs were generally stable. The 1995 survey found that bluffs in several areas in the southern part of the County were unstable. These areas are located along the shoreline in the Cities of Cudahy, South Milwaukee, and Oak Creek.

In 2001, bluff stability and erosion conditions were assessed along approximately 2,000 linear feet of bluff in Warnimont Park.[13] This study found visible evidence of erosion along the toe of the bluffs; evidence of recent bluff failures, including translational slides and rotational slumps; and visible water seeps at mid-bluff levels, some exhibiting relatively rapid discharge of water during field investigation.

In 2002, bluff stability conditions were assessed within Lake Park in the City of Milwaukee.[14] While the bluff stability analysis conducted as part of this study found that most bluffs in the park were stable, it concluded

[13] *STS Consultants,* op. cit.

[14] Ibid.

that bluffs in the southern portion of the park were marginally stable and less stable than bluffs in the other portions of the park. In addition, this study found evidence of active recession of the bluffs in the southern portion of the park, including evidence of top recession.

In 2015, coastal bluff conditions were analyzed along communities in northern Milwaukee County.[15] While the bluff analysis conducted as part of this assessment found that most bluffs in this area of the County were stable prior to 2013, it concluded that there were some areas of continued bluff failure. The assessment found new bluff toe failures have occurred due to decreased beach widths and bluffs that were initially stable were failing because an adjacent property owner built shoreline/bluff protection structures to stabilize their property, thus adversely affecting a neighboring property owner that didn't have protection structures in place. In addition, the assessment indicated that about 63 percent of the northern Milwaukee County shoreline was armored with a form of protection structure.

In January 2020, County staff observed areas of severe bluff erosion on several County properties along Lake Michigan. On the weekend of January 10, 2020, a strong weather system with a prolonged period of strong easterly winds, in conjunction with at or near record Lake Michigan water levels (nearly four feet above average), caused flooding and major lakeshore damage to property, infrastructure, and bluff erosion by pushing large waves and water into areas along the lake. Shoreline and infrastructure damage occurred at the Port of Milwaukee, 14 Milwaukee County Parks, the Milwaukee Water Works Pumping Station, and other County properties. The four County parks with the most severe bluff erosion sustained during this event occurred at Bay View, Grant, Sheridan, and Warnimont Parks. These observations were conducted with the County Office of Emergency Management, who subsequently prepared a damage assessment report in order to apply for State and Federal disaster relief funding. However, funding for the bluff failure damage was denied by FEMA, because the areas that were damaged were determined to not meet the criteria for protecting improved property, which would entail an eligible facility/structure to sustain damage that was located on the slope of the damaged bluff.

While analysis of Lake Michigan shoreline conditions indicates relatively stable conditions in many areas along the County's Lake Michigan shoreline, there are areas where there is the potential for shoreline and

[15] *University of Wisconsin Sea Grant Institute,* Integrated Assessment on Water Level Variability and Coastal Bluffs and Shores in Northern Milwaukee County and Southern Ozaukee County, Wisconsin, *Interdisciplinary Synthesis of Existing* Research, *November 2016*.

bluff erosion to occur. In addition, during severe climatic conditions, such as high-water levels or saturated ground conditions, large episodic bluff erosion events could occur.

In addition, WCMP, the Association of State Floodplain Managers (ASFPM), and Geo-Professional Consultants, LLC have developed a web mapping tool to view shoreline conditions along most of Wisconsin's Great Lakes coast. The Wisconsin Shoreline Inventory and Oblique Photo Viewer[16] can be used to view and compare assessments on shoreline protection and shore and bluff conditions. Shoreline characteristics and conditions were derived from interpreting oblique aerial photography[17] of the Lake Michigan coastline taken in 1976, 2007, and 2018. The interpretations represent conditions on the date that the photographs were taken and are limited by what can be seen in the photos. In addition, geotagged oblique images can be viewed and compared on the shoreline viewer tool from 1976, 2007, 2012, 2017, and 2018. These images can be used with the interactive mapping tool to understand and evaluate how bluffs along the Milwaukee County coast have changed over a 43-year period.

Map 2.9 summarizes the types of shore protection in the County in 2018, as provided on the shoreline viewer tool. About 36 percent of the shoreline in Milwaukee County was unprotected in 2018. The most common type of shore protection in the County was revetment (37 percent); followed by other armored areas (docks or marinas) (14 percent); seawall or bulkhead (9 percent); poorly organized riprap or rubble (3 percent); and offshore breakwater (1 percent).

The shoreline viewer tool also provides insight into general conditions of Lake Michigan bluffs in 2018, as shown in Map 2.10. In 2018, about 17 percent of Milwaukee County's shoreline was considered to have moderately unstable to unstable or failing bluffs (as shown in green and red on Map 2.10). According to the dataset, some bluff areas considered to be unstable or failing were located in the same municipalities as the 1995-1997 assessment, especially in the southern portion of the County, which includes the Cities of Oak Creek, South Milwaukee, and Cudahy. As shown on Map 2.10, areas identified as having unstable or failing bluff conditions were located in the areas of three County-owned parks—Grant Park in the City of South Milwaukee and Sheridan and Warnimont Parks in the City of Cudahy. An area in the Village of Fox Point that was considered unstable or failing in the 1995-1997 assessment is now considered moderately unstable in the 2018 dataset and an area in the Village of Bayside that was also considered unstable or

[16] *Located at this website: Floodatlas.org/asfpm/oblique viewer.*

[17] *Mickleson, D and Stone J,* Wisconsin's Lake Superior and Lake Michigan Shoreline Oblique Photography: Analysis of *Changes 1976 (78) to 2018 (19)*, A Report to the Wisconsin Coastal Management Program.

failing in the 1995-1997 assessment has been upgraded to moderately stable. However, an area along Bay View Park in the City of St. Francis was considered stable in the 1995-1997 assessment is now considered unstable or failing in the 2018 dataset. As shown on Map 2.10, the majority of bluff areas in Milwaukee County that are the most vulnerable to the effects of extreme weather conditions and are considered moderately unstable or unstable or failing are located in the southern portion of the County.

Map 2.11 specifies the types of bluff failure that was occurring at the time of the 2018 dataset. Shallow slides were the most observed type of bluff failure, occurring at 16 percent of the assessed County shoreline, followed by creep failure (10 percent), and deep-seated slumps (2 percent). As shown on Map 2.11, about 70 percent of the County's bluff shoreline were observed as having minimal or no obvious failures.

Nonmetallic Mineral Resources

Nonmetallic minerals include, but are not limited to, crushed stone (gravel), dimension stone, peat, clay, topsoil, asbestos, beryl, diamond, coal, feldspar, talc, and sand. Nonmetallic mines (quarries) in Southeastern Wisconsin provide sand, gravel and crushed limestone or dolomite for road building; peat for gardening and horticulture; and dimension stone for use in buildings, landscaping, and monuments. Nonmetallic minerals are important economic resources that should be taken into careful consideration whenever land is being considered for development. If an adequate supply of stone and sand is desired for the future, wise management of nonmetallic mineral resources and access to them is important. In 2020, the only existing sand and gravel mining operation in Milwaukee County was a site owned by Payne and Dolan located in the City of Franklin on the south side West Rawson Avenue between South 51st and 68th Streets.

Areas Suitable for Sand and Gravel Extraction

Map 2.12 shows the location of potential commercially workable sand deposits and the location of potential commercially workable gravel deposits in the County, as identified by the NRCS. The NRCS rates each soil mapping unit as probable or improbable sources of sand or gravel. Milwaukee County has some probable sand and gravel deposits. These are mostly located in alluvial deposits along major streams and rivers and in glacial outwash areas where the washing action of glacial meltwaters has sorted the sand and gravel into somewhat homogeneous deposits. In addition, there are other small deposits scattered throughout other portions of the County. Most of these probable deposits are located in floodplains, environmental corridors, or urbanized areas and are therefore in areas unsuited for extractive activities. The existence of such deposits is extremely variable, and onsite investigations are necessary to determine the suitability of any given site for sand and gravel or rock extraction purposes.

Surface Water Resources

Surface water resources, consisting of streams and lakes and their associated wetlands, floodplains, and shorelands, form a particularly important element of the natural resource base. Surface water resources provide recreational opportunities, influence the physical development of the County, and enhance its aesthetic quality. Watersheds, subwatersheds, and the subcontinental divide within the County are shown on Map 2.13. Both surface water and groundwater are interrelated components of a single hydrologic system. The groundwater resources are hydraulically connected to the surface water resources inasmuch as the former provide the base flow of streams and contribute to inland lake levels.

Watersheds

The extreme southwest corner of Milwaukee County is traversed by the subcontinental divide that separates the Great Lakes-St. Lawrence River drainage basin from the Mississippi River drainage basin. That divide carries legal constraints that, with some exceptions, prohibit the diversion of any substantial quantities of Lake Michigan water across the divide. As shown on Map 2.13, there are seven watersheds within Milwaukee County. With the exception of the Fox River watershed, all of the watersheds in the County are part of the Great Lakes-St. Lawrence River drainage system. The Fox River watershed covers the extreme southwestern portion of the City of Franklin and ultimately discharges into the Mississippi River system.

The portion of the Fox River watershed within the County encompasses 1.3 square miles, or 0.5 percent of the County. The Kinnickinnic River watershed, which is entirely located within Milwaukee County, encompasses 24.5 square miles, or 10.1 percent of the County. Much of the Menomonee River watershed is located in Milwaukee County. The portion within the County encompasses 55.3 square miles, or 22.8 percent of the County. The lower portion of the Milwaukee River watershed that is located in Milwaukee County encompasses 57.7 square miles, or 23.8 percent of the County. The Oak Creek watershed, which is entirely located within Milwaukee County, encompasses 27.4 square miles, or 11.2 percent of the County. Most of the upper portion of the Root River watershed is located within Milwaukee County. The portion within the County encompasses 57.7 square miles, or 23.8 percent of the County. A seventh watershed encompasses those areas adjacent to Lake Michigan that drain directly into the Lake through small perennial or intermittent streams or overland flow. This watershed encompasses 18.9 square miles, or 7.8 percent of

the County. The Regional Planning Commission has developed comprehensive watershed plans for all of these watersheds except for the Lake Michigan direct drainage area.[18]

Streams

Perennial rivers and streams are defined as those that maintain, at a minimum, a small continuous flow throughout the year except under unusual drought conditions. There were 103 miles of named perennial rivers and streams in Milwaukee County reported by the WDNR in their 1964 surface water inventory for the County.[19] As noted above, the County includes at least portions of seven watersheds. No major streams in the Fox River watershed are located in Milwaukee County. Streams in the Kinnickinnic River watershed, which is located in the central portion of the County, include the Kinnickinnic River, Wilson Park Creek, S. 43rd Street Ditch, Lyons Park Creek, Villa Mann Creek, Cherokee Park Creek, and Holmes Avenue Creek. Streams in the Milwaukee County portion of the Menomonee River watershed, which includes the area in the northwestern portion of the County, include the Menomonee River, Woods Creek, Honey Creek, Underwood Creek, Grantosa Creek, and the Little Menomonee River. Streams in the Milwaukee County portion of the Milwaukee River watershed, which includes the area in the northeastern portion of the County, include the Milwaukee River, Lincoln Creek, Wahl Creek, Brown Deer Park Creek, Southbranch Creek, Beaver Creek, and Indian Creek. Streams in the Oak Creek watershed, which is located in the southeastern portion of the County, include Oak Creek, the Mitchell Field Drainage Ditch, and North Branch Oak Creek. Streams in the Milwaukee County portion of the Root River watershed, which includes the area in the southern and southwestern portions of the County, include the Root River, Crayfish Creek, the Root River Canal, Ryan Creek, East Branch Root River, Legend Creek, Dale Creek, Tess Corners Creek, Whitnall Park Creek, Wildcat Creek, and Hale Creek. The Lake Michigan direct drainage area is located along the eastern

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[18] *SEWRPC Planning Report No. 9,* A Comprehensive Plan for the Root River Watershed, *July 1966; SEWRPC Planning Report No. 12,* A Comprehensive Plan for the Fox River Watershed, *Volume One,* Inventory Findings and Forecasts, *April 1969, Volume Two,* Alternative Plans and Recommended Plan, *February 1970; SEWRPC Planning Report No. 13,* A Comprehensive Plan for the Milwaukee River Watershed, *Volume One,* Inventory Findings and Forecasts, *December 1970, Volume Two,* Alternative Plans and Recommended Plan, *October 1971; SEWRPC Planning Report No. 26,* A Comprehensive Plan for the Menomonee River Watershed, *Volume One,* Inventory Findings and Forecasts, *October 1976, Volume Two,* Alternative Plans and Recommended Plan, *October 1976; SEWRPC Planning Report No. 32,* A Comprehensive Plan for the Kinnickinnic River Watershed, *December 1978; and SEWRPC Planning Report No. 36,* A Comprehensive Plan for the Oak Creek Watershed, *August 1986.*

[19] *Wisconsin Department of Natural Resources (Wisconsin Conservation Department),* Surface Water Resources of Milwaukee County, *1964.*

margins of the County. Fish Creek is the only major stream located in the Milwaukee County portion of this watershed. Major streams in Milwaukee County are shown on Map 2.13.

Water Use Objectives

Pursuant to the Federal Clean Water Act (CWA), the State of Wisconsin, through the Natural Resources Board and the WDNR, has developed standards, or criteria, for the following water use objectives or classifications relating to fish and aquatic life: 1) Great Lakes communities, 2) coldwater community, 3) warmwater sportfish community, 4) warmwater forage fish community, 5) limited forage fish, and 6) limited aquatic life. Coldwater communities include surface waters capable of supporting a community of coldwater fish and other aquatic organisms or serving as a spawning area for coldwater fish species. Warmwater sportfish communities include surface waters capable of supporting a community of warmwater sport fish or serving as a spawning area for warmwater sport fish. Warmwater forage fish communities include those waters capable of supporting an abundant diverse community of forage fish and other aquatic organisms. Limited forage fish communities include surface waters of limited capacity and naturally poor water quality or habitat. These waters are capable of supporting only a limited community of forage fish and other aquatic organisms. Limited aquatic life communities include waters of severely limited capacity and naturally poor water quality or habitat. These waters are capable of supporting only a limited community of aquatic organisms.

For the purpose of the anti-degradation policy to prevent the lowering of existing water quality, Wisconsin has classified some waters of the State as outstanding or exceptional resource waters. These waters, listed in Sections NR 102.10 and NR 102.11 of the *Wisconsin Administrative Code,* are deemed to have significant value due to the presence of valuable fisheries, hydrologically or geographically unique features, outstanding recreational opportunities, or other unique environmental features or settings.

It is important to note that establishing a stream water use objective other than coldwater or warmwater fish and aquatic life is not necessarily an indication of reduced water quality, since such stream reaches may be limited by flow or size, but may still be performing well relative to other functions. For the most part, identical water quality criteria are applicable to the warmwater sport fish community and warm water forage fish community objectives. Because of this, these water use objectives are sometimes referred to as warmwater fish and aquatic life (FAL) waters. The WDNR has also developed standards, or criteria, for two recreational use classifications: 1) full recreational use and 2) limited recreational use, and it has developed standards, or criteria, for public health and welfare and wildlife protection.

These water use objectives and water quality standards supporting these objectives consist of three elements: designated uses, water quality criteria, and anti-degradation policy. These are set forth in Chapters NR 102, "Water Quality Standards for Wisconsin Surface Waters," NR 103, "Water Quality Standards for Wetlands," NR 104 "Uses and Designated Standards," NR 105, "Surface Water Quality Criteria and Secondary Values for Toxic Substances," and NR 207 "Water Quality Antidegradation and Antibacksliding," of the *Wisconsin Administrative Code*.

In addition, Chapter NR 106 establishes procedures for calculating water quality-based effluent limitations for toxic and organoleptic substances. Chapter NR 102 sets forth special variances for specific waters, including some located in Milwaukee County.

The water use objectives applied to streams in Milwaukee County are shown on Map 2.14. There are no streams classified as coldwater community waters in Milwaukee County. Most of the stream reaches in the County are classified as warmwater fish and aquatic life waters. The portion of Tess Corners Creek and most of Whitnall Park Creek in Milwaukee County are classified for limited forage fish. The East Branch Root River, the New Berlin Memorial Hospital Tributary, and a small portion of Whitnall Park Creek in the County are classified as limited aquatic life waters. The mainstem of the Kinnickinnic River; the downstream reaches of the Menomonee and Milwaukee Rivers; Honey, Indian, and Lincoln Creeks; the Burnham and South Menomonee Canals; and the portion of Underwood Creek in Milwaukee County are all subject to special variances under Chapter NR 102 of the *Wisconsin Administrative Code*.

The designated uses shown on Map 2.14 are regulatory designations. They serve to define the water quality criteria that apply to these waters and as the basis for determining whether water quality conditions in them meets the requirements set forth under the CWA and Wisconsin law. For management purposes, agencies such as the WDNR may also use other classification systems. These systems may be based on factors such as water temperature, stream discharge, stream depth, or stream width. These systems may provide useful information about water quality and biological conditions within waterbodies. While they may serve as a basis for evaluating such conditions for management purposes, until they are reflected in the water quality standards promulgated by the State, they lack the regulatory significance of the designated uses shown on Map 2.14.

The applicable water quality standards for all water uses designated in Milwaukee County are set forth in Tables 2.8 and 2.9. The water quality standards are statements of the physical, chemical, and biological characteristics of the water that must be maintained if the water is to be suitable for the specified uses.

Table 2.8 shows the applicable water quality criteria for all designated uses for five water quality parameters: dissolved oxygen concentration, pH, *Escherichia coli* bacteria (*E. coli*) concentration,[20] total phosphorus concentration, and chloride concentration. Table 2.9 shows the water quality criteria for temperature for each of the fish and aquatic life categories. As part of the temperature criteria, the warmwater communities are further categorized based on their seven-day, 10-percent probability low flow (7Q10).[21]

In addition to the numerical criteria presented in the tables, there are narrative standards that apply to all waters. All surface waters must meet these conditions at all times and under all flow conditions. Section NR 102.04(1) of the *Wisconsin Administrative Code* states that: "Practices attributable to municipal, commercial, domestic, agricultural, land development or other activities shall be controlled so that all waters including the mixing zone meet the following conditions 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 shall not be present in such amounts as to interfere with public rights in the waters of the State

- Floating or submerged debris, oil, scum or other material shall not be present in such amounts as to interfere with public rights in the waters of the State

- Materials producing color, odor, taste, or unsightliness shall not be present in such amounts as to interfere with public rights in the 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 such substances be present in amounts which are acutely harmful to animal, plant, or aquatic life

For streams within the Milwaukee River, Menomonee River, and Kinnickinnic River watersheds, the Milwaukee River Basin Total Maximum Daily Load (TMDL)[22] study sets a goal for total suspended solids

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[20] Prior to June 1, 2020, Wisconsin's water quality criteria for recreational use were based upon concentrations of fecal coliform bacteria. It should be noted that E. coli *is one species within the fecal coliform bacteria group.*

[21] This is the seven consecutive day low flow that has an annual probability of occurrence of 10 percent.

[22] A TMDL is the amount of a pollutant a waterbody can receive and still meet water quality standards.

(TSS) in which the concentration of TSS is not to exceed 12 milligrams per liter (mg/l).[23] While this goal is not a regulatory water quality criterion, the WDNR is using it as a basis for developing effluent limitations for discharge permits issued under the Wisconsin Pollutant Discharge Elimination System and for evaluating water quality conditions within streams within the Menomonee and Milwaukee River watersheds in Ozaukee County.

Chapter 281 of the *Wisconsin Statutes,* recognizes that different standards may be required for different waters or portions thereof. According to the Chapter, in all cases, the "standards of quality shall be such as to protect the public interest, which includes protecting public health and welfare and the present and prospective future use of such waters for public and private water supplies; propagating fish and aquatic life and wildlife; domestic and recreational purposes; and agricultural, commercial, industrial, and other legitimate uses."[24]

Water Quality Conditions in Milwaukee County Streams

Existing water quality conditions in streams in Milwaukee County were assessed as part of the Menomonee, Oak Creek, and Root River watershed plans,[25] which are updates to the regional water quality management plan for the Greater Milwaukee Watersheds,[26] and using surface water quality data provided for the Kinnickinnic and Milwaukee River watersheds, Fish Creek, and the Outer Harbor. As part of this assessment, the achievement of water use objectives were assessed for all streams in Milwaukee County by comparing the available water quality data collected during the study's baseline period to the water quality criteria supporting the applicable water use objective. The baseline period used for the Menomonee River watershed assessment was 2002 to 2011, the Oak Creek watershed was 2007 to 2016, and the Root River watershed was 2005 to 2012. Because there has not been a comprehensive assessment for the Milwaukee

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[23] *Milwaukee Metropolitan Sewerage District,* Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform: Milwaukee River Basin, Wisconsin, Final Report*, March 19, 2018, prepared by CDM Smith*.

[24] Wisconsin Statutes, *Section 281.15(1)*.

[25] *Documented in SEWRPC Memorandum Report No. 204,* Development of a Framework for a Watershed-Based Municipal Stormwater Permit for the Menomonee River Watershed, *January 2013; SEWRPC Community Assistance Planning Report No. 316,* A Restoration Plan for the Root River Watershed*, July 2014 and SEWRPC Memorandum Report No. 220,* Supplemental Information Developed for the Root River Watershed Restoration Plan, *April 2015, and SEWRPC Community Assistance Planning Report No. 330,* A Restoration Plan for the Oak Creek Watershed*, draft report*.

[26] *SEWRPC Planning Report No. 50,* A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds, *December 2007*.

and Kinnickinnic River watersheds since the regional water quality plan for the greater Milwaukee watersheds in 2007, the most recent data available are the surface water quality information collected by the Freshwater Resources Management group in conjunction with MMSD. The data include field measurements and grab samples from nearly 100 monitoring sites with samples collected one to two times per month at each site from the baseline period of 2018 to 2019. Data collected for these two watersheds, Fish Creek, and the Outer Harbor only include information on the percent of samples meeting water quality criteria for TSS, chloride, total phosphorous, and fecal coliform bacteria,[27] while the water use objective assessments for the three other watersheds are more extensive. This report did not assess the achievement of the water use objective in the Fox River watershed, because there are no major surface waterbodies in the portion of this watershed in Milwaukee County.

Tables 2.10, 2.11, and 2.12 show the results of comparing available water quality data from the baseline period to the applicable water quality standards that were in effect at the time that the analyses were conducted for the mainstems and tributaries of the Menomonee River, Oak Creek, and the Root River within Milwaukee County.

Menomonee River Watershed

The comparison of water quality conditions in streams of the Menomonee River watershed to the applicable water quality criteria is presented in Table 2.10. For this report, the assessment divides the mainstem of the Menomonee River into six reaches within Milwaukee County while the tributary streams were assessed along their entire length. The table also indicates the codified water use objective for each stream or stream reach. The following summarizes Table 2.10, which only includes data associated with the portion of the Menomonee River watershed within Milwaukee County.

It should also be noted that as set forth in Chapter NR 104.06(2)(a) of the *Wisconsin Administrative Code*, the Menomonee River downstream from the confluence with Honey Creek, Honey Creek, and Underwood Creek downstream from Juneau Boulevard are all designated for a special variance by the State indicating these streams had stricter water quality regulations than other streams in the Menomonee River watershed. In addition, as set forth in Chapter NR 104.06(2)(b) of the *Wisconsin Administrative Code,* Burnham Canal and South Menomonee Canal within the watershed are also designated by the State with a different special

[27] *Fecal coliform bacteria data was compared to the State's former water quality criterion, unless an* E. coli *dataset was provided. The State of Wisconsin's bacterial indicator for recreational use water quality changed from fecal coliform to* E. coli *in May 2020 because* E. coli *better predicts the risk of human illness caused by exposure to human fecal contamination.*

variance that has more strict water quality regulations than the other special variance for Honey Creek and portions of the Menomonee River and Underwood Creek. The streams within the watershed that are affected by a special variance are identified on Table 2.8. It should be noted that because of the completion and adoption of the Milwaukee River Basin TMDL study in 2018, the variances for fecal coliform criteria were removed for the five streams listed above, but other variances for those streams such as temperature and dissolved oxygen still remain.

As shown in Table 2.10, concentrations of dissolved oxygen in most reaches of the mainstem of the Menomonee River were equal to or above the applicable water quality criteria within Milwaukee County, indicating a high degree of compliance with criteria for dissolved oxygen. Burnham Canal, Grantosa Creek, Noyes Park Creek, and the portion of Underwood Creek between Juneau Boulevard and the Menomonee River confluence had dissolved oxygen concentrations in which 100 percent of the samples collected were above the applicable criteria. Honey Creek and the Little Menomonee River had concentrations of dissolved oxygen in which the samples collected were equal to or above the applicable criteria. The South Branch Underwood Creek had dissolved oxygen concentrations that were below the applicable criteria, indicating frequent violations of the standard. Overall, dissolved oxygen concentrations in most streams of the Menomonee River watershed appear to be in substantial compliance with the applicable water quality criteria.

As shown on Table 2.10, the maximum daily temperatures were almost always below the applicable acute temperature criteria along the entire stretch of the Menomonee River mainstem within Milwaukee County. Similarly, the calendar week averages of maximum daily temperatures were usually below the applicable sublethal temperature criteria. Therefore, the water temperatures in the mainstem of the Menomonee River display a high degree of compliance with the acute and sublethal temperature criteria. In three tributary streams in the watershed within Milwaukee County—Honey Creek, the Little Menomonee River, and Noyes Park Creek—the maximum daily temperatures were almost always below the applicable acute temperature criteria and Underwood Creek downstream of Juneau Boulevard to the Menomonee River confluence had maximum daily temperatures that were usually below the applicable acute temperature criteria. In Honey Creek and Noyes Park Creek, the calendar week averages of maximum daily temperatures were usually below the applicable sublethal temperature criteria, while in Underwood Creek downstream of Juneau Boulevard to the Menomonee River confluence the calendar week averages of maximum daily temperatures were below the applicable acute temperature criteria in about two-thirds of the weeks over which compliance with this criterion is measured. The portions of this reach of Underwood Creek are channelized, lined with concrete, and tend to be broad and shallow, which acts to increase temperatures in streams.

Stormwater discharges may not be the major contributor to the exceedances of the sublethal temperature criterion in this reach of Underwood Creek, especially considering that this reach is usually in compliance with the acute criterion. Overall, temperature conditions in most streams of the Menomonee River watershed appear to be in substantial compliance with the applicable water quality criteria.

As shown in Table 2.10, concentrations of chloride in most reaches of the mainstem of the Menomonee River were equal to or below the acute toxicity criterion and the concentrations of chlorides in these reaches were similarly usually equal to or below the chronic toxicity criterion. In four tributary streams in the watershed—Burnham Canal, Honey Creek, the Little Menomonee River, and Underwood Creek—the concentrations of chlorides were usually equal to or below the acute toxicity criterion and usually equal to or below the chronic toxicity criterion. It should be noted that samples collected by MMSD prior to 2010 were only collected from March through December, but since 2010, samples have been collected year-round. MMSD may still collect a reduced number of samples during the winter months in any given year, and the collection of samples is typically determined by the amount of ice covering the streams. Thus, some data may not reflect a certain timeframe within any given year when salt is most likely to be applied for snow and ice control. With a potential lack of samples collected during some of the winter months, the data on Table 2.10 may represent an overestimate of how frequently chloride concentrations in the Menomonee River and its tributaries are in compliance with the acute and chronic toxicity criteria. This data may overstate the degree of compliance because of the number of samples that may have been collected during the winter deicing season, when the greatest inputs of chlorides into surface waters is likely to occur. This is supported by the fact that samples collected from 17 Wisconsin streams, including 13 in the Milwaukee area, showed high concentrations of chloride during sampling that occurred in February and March 2007. Concentrations in many samples exceeded 1,000 milligrams per liter and in some samples exceeded 5,000 milligrams per liter. In addition, high concentrations of chloride are occasionally found in samples of discharge from stormwater outfalls.

It should be noted that increasing trends in chloride concentration have been observed in many waterbodies in Southeastern Wisconsin and Milwaukee County and have also been reported in other parts of the nation where snow and ice control operations are conducted during the winter. A USGS study[28] indicated concentrations of chloride are trending upwards in upper Midwest surface waters and sometimes

[28] *Steven R. Corsi, Laura A. DeCicco, Michelle A. Lutz, and Robert M. Hirsch,* River Chloride Trends in Snow-Affected Urban Watersheds: Increasing Concentrations Outpace Urban Growth Rate and Are Common Among All Seasons*, Science of the Total Environment, Volume 508, pages 488-497, 2015*.

exceeded the chronic toxicity levels. In addition, the Regional Planning Commission is also currently preparing a chloride impact study for southeastern Wisconsin. The comprehensive study will assess the environmental impacts of the use of chloride on the surface water and groundwater resources of the Region. Study work began in summer 2017 and includes monitoring for conductance at 30 to 40 stream locations throughout the Region. The intent is to monitor the streams for two winters from 2018 to 2020.

Total phosphorous water quality standards in the Menomonee River differ due to the special variance designated by the State. The mainstem of the Menomonee River downstream from the confluence with the Little Menomonee River is subject to a water quality criterion in which total phosphorus is not to exceed 0.100 milligrams per liter. The Menomonee River upstream from the confluence with the Little Menomonee River and the other streams in the watershed are subject to a water quality criterion in which total phosphorus is not to exceed 0.075 milligrams per liter. As shown in Table 2.10, concentrations of total phosphorus in the mainstem of the Menomonee River commonly exceeded the applicable water quality criteria. Over the entire length of the mainstem, total phosphorus concentrations in almost half of the samples collected were at or below the applicable water quality criteria. Data from five tributary streams within Milwaukee County—Burnham Canal, Honey Creek, the Little Menomonee River, South Branch Underwood Creek, and Underwood Creek—show that total phosphorus concentrations were commonly to usually higher than the applicable criteria. Overall, the total phosphorus concentrations in streams of the watershed were usually above the applicable water quality criteria. Slightly over one-third of samples collected from streams in the watershed complied with the applicable standard. Stormwater monitoring data and estimates of phosphorus loading suggest that urban stormwater management systems may constitute a major source of phosphorus to the surface waters of the watershed.

As shown in Table 2.10, counts of fecal coliform bacteria in the mainstem of the Menomonee River were commonly to usually greater than the applicable water quality criteria. On average, nearly one-half of samples collected from the mainstem of the river were in compliance with the applicable standard. Downstream reaches tend to show higher percentages of compliance than upstream reaches. Data from six tributary streams within Milwaukee County—Burnham Canal, Honey Creek, the Little Menomonee River, South Branch Underwood Creek, and Underwood Creek—show that counts of fecal coliform bacteria were commonly to usually greater than the applicable water quality criteria. Burnham Canal was an exception, where counts of fecal coliform bacteria were equal to or lower than the applicable criterion in nearly 90 percent of the samples collected. In addition, the high concentrations of fecal coliform bacteria in samples collected from urban stormwater discharges and inline storm sewer locations indicate that discharges of urban stormwater may be a major contributor of fecal coliform bacteria to surface waters of the

Menomonee River watershed. Overall, data show the concentrations of fecal coliform bacteria in surface waters of the Menomonee River watershed are usually above the applicable water quality criteria for recreational use. Stormwater monitoring data and estimates of fecal coliform bacteria loading suggest that urban stormwater management systems constitute a major source of indicator bacteria to the surface waters of the watershed.

Furthermore, those results from sample stations located along the mainstem of the Menomonee River and along the Burnham Canal and South Menomonee Canal tributaries that are within the Harbor Estuary[29] area, which is the area where the Milwaukee, Menomonee, and Kinnickinnic Rivers meet and mix with Lake Michigan water, are identified in Table 2.10.

Oak Creek Watershed

Table 2.11 presents a comparison of water quality constituents in streams within the Oak Creek watershed to applicable water quality criteria from 2007 to 2016. This comparison examines ambient levels of five water quality constituents: water temperature and concentrations of dissolved oxygen, chloride, total phosphorus, and fecal coliform bacteria. In the case of water temperature and chloride concentration, ambient levels were compared to two applicable criteria—acute and chronic conditions. Because data regarding concentrations of fecal coliform bacteria are not available for much of the watershed, Table 2.11 also compares concentrations of *E. coli* to levels in the USEPA's recommended recreational water quality criteria. The following summarizes the data associated with Table 2.11 and the Oak Creek watershed.

Dissolved oxygen concentrations in the mainstem of Oak Creek upstream from the confluence with the North Branch of Oak Creek were occasionally below the applicable water quality criterion, indicating occasional noncompliance with the standard. Dissolved oxygen concentrations downstream from the confluence with the North Branch were usually in compliance with the applicable water quality criterion. Dissolved oxygen concentrations in the North Branch of Oak Creek were usually above the criterion, indicating compliance with the standard. Dissolved oxygen concentrations in the Mitchell Field Drainage Ditch upstream from Rawson Avenue were usually below the applicable water quality criterion, indicating substantial noncompliance with the standard. Downstream from Rawson Avenue, dissolved oxygen concentrations were occasionally below the applicable water quality criterion, indicating occasional noncompliance with the standard. Dissolved oxygen concentrations in the Unnamed Creek 5, a tributary to

[29] *Fecal coliform bacteria data in the Milwaukee Harbor Estuary is being compared to a variance standard of 1,000 cells per 100 milliliters.*

the North Branch of Oak Creek, were often below the applicable water quality criterion, indicating substantial noncompliance with the standard.

Chloride concentrations in the mainstem of Oak Creek were almost always below the acute toxicity criterion, indicating compliance with this standard. Chloride concentrations in the mainstem of Oak Creek were occasionally above the chronic toxicity criterion, indicating occasional noncompliance with this standard. Chloride concentrations in the Mitchell Field Drainage Ditch were often above the acute toxicity criterion and usually above the chronic toxicity criterion, indicating substantial noncompliance with these standards. Fewer chloride samples may have been collected throughout the watershed during the winter deicing season, thus the level of compliance with the water quality criteria for chloride during the winter deicing season may be varied.

At all but one site examined along the mainstem of Oak Creek and at all sites examined along tributary streams, daily maximum water temperatures rarely exceeded the applicable acute criterion for temperature. Similarly, at most sites along the mainstem and tributary streams, the weekly means of maximum daily water temperatures were usually less than the applicable sublethal criterion for water temperature. The major exception to these generalizations occurred at a site within the Mill Pond that had shallow water, was off the main channel of the stream, and was exposed to the sun. With the exception of this site, water temperatures at sampling stations along streams in the watershed complied with the applicable water quality criteria for temperature.

Concentrations of total phosphorus in the mainstem of Oak Creek, the North Branch of Oak Creek, the Mitchell Field Drainage Ditch, and Unnamed Creek 5 were often above the applicable water quality criterion, indicating substantial noncompliance with the standard.

In the mainstem of Oak Creek, concentrations of fecal coliform bacteria were often higher than the single sample criterion and usually above the geometric mean criterion, indicating general noncompliance with the standard. In the mainstem of Oak Creek and in tributary streams for which data were available, concentrations of *E. coli* were often higher than the USEPA's recommended statistical test value and usually higher than the USEPA's geometric mean criterion. Concentrations in the streams within the watershed were usually above both of these recommended criteria, which suggests that these stream reaches would also not comply with the State's water quality criteria for fecal coliform bacteria.[30]

[30] E. coli *is one of the species of bacteria included in the fecal coliform bacteria group.*

During the period of 2007 to 2016, the recommended water use objectives were only partially achieved in the Oak Creek watershed.

Root River Watershed

Table 2.12 presents a comparison of water quality constituents in the streams of the Root River watershed to applicable water quality criteria from 2005 to 2012 within Milwaukee County. The comparison examines ambient levels of five water quality constituents: water temperature and concentrations of dissolved oxygen, chloride, total phosphorus, and fecal coliform bacteria. In the case of water temperature and chloride concentration, ambient levels were compared to two applicable criteria—acute and chronic conditions. Because data regarding concentrations of fecal coliform bacteria are not available for much of the watershed, Table 2.12 also compares concentrations of *E. coli* to levels in the USEPA's recommended recreational water quality criteria. The following summarizes Table 2.12, which only includes data associated with the Root River watershed within Milwaukee County.

Dissolved oxygen concentrations in the mainstem of the Root River in the upper nine miles upstream from W. Grange Avenue were usually below the applicable water quality criterion, indicating general noncompliance with the standard. In reaches downstream from W. Grange Avenue, dissolved oxygen concentrations were generally in compliance with the applicable water quality criterion, except in stream reaches along County Line Road, where dissolved oxygen concentrations were occasionally below the applicable water quality criterion, indicating occasional noncompliance with the standard. Dissolved oxygen concentrations in Legend Creek were occasionally below the applicable water quality criterion, indicating occasional noncompliance with the standard. Dissolved oxygen concentrations in other tributary streams within Milwaukee County for which data were available were generally in compliance with the applicable water quality criteria.

In the mainstem of the Root River where maximum daily water temperatures could be determined, data rarely exceeded the applicable acute criterion for temperature. Where the weekly means of maximum daily water temperatures could be determined, they rarely exceeded the applicable sublethal criterion for temperature. This result indicates that, at those locations where compliance could be assessed, water temperatures complied with the applicable water quality criteria for temperature.

Chloride concentrations in the mainstem of the Root River were almost always below the acute criterion, indicating compliance with this standard. Chloride concentrations between W. Cleveland Avenue and the intersection of W. National Avenue and W. Oklahoma Avenue were occasionally above the chronic criterion,

indicating occasional noncompliance with the standard in this reach. Fewer chloride samples may have been collected throughout the watershed during the winter deicing season, thus the level of compliance with the water quality criteria for chloride during the winter deicing season may be varied.

Concentrations of total phosphorus in the mainstem of the Root River and tributary streams were usually above the applicable water quality criterion, indicating general noncompliance with the standard.

In most reaches of the mainstem of the Root River for which data was available, concentrations of fecal coliform bacteria were usually higher than both the geometric mean criterion and the single sample criterion, indicating general noncompliance with the standard. In addition, in the mainstem of the Root River and in tributary streams for which data were available, concentrations of *E. coli* were often higher than the USEPA's recommended geometric mean criterion and the single sample criterion. In some reaches of streams, concentrations of *E. coli* were usually higher than the criteria, which suggests that these locations would also not comply with the State's water quality criteria for fecal coliform bacteria.

From 2005 to 2012, the recommended water use objectives were only partially achieved in much of the Root River watershed.

Kinnickinnic and Milwaukee River Watersheds and the Outer Harbor

Tables 2.13, 2.14, and 2.15 present a comparison of water quality constituents in the streams of the Kinnickinnic and Milwaukee River watersheds and the Outer Harbor, respectively, to applicable water quality criteria from 2018 to 2019 within Milwaukee County. The comparison examines the percent of samples meeting water quality criteria for four water quality constituents: concentrations of TSS, chloride, total phosphorus, and fecal coliform bacteria. It should be noted that the samples in the two watersheds do not include data collected during the winter deicing season, which may overestimate compliance with acute toxicity criterion for chloride. In addition, the data in these watersheds do not compare the chronic toxicity standard for chloride, which means this comparison may underestimate the effects of chloride on aquatic organisms. The following summarizes Table 2.13, the Kinnickinnic River watershed, and Table 2.14, the Milwaukee River watershed, which includes data with only those stream reaches within Milwaukee County.

It should also be noted that as set forth in Chapter NR 104.06(2)(a) of the *Wisconsin Administrative Code*, the Kinnickinnic River and Indian and Lincoln Creeks located in the Milwaukee River watershed are all designated for a special variance by the State indicating these streams had stricter water quality regulations than other streams in their watersheds. In addition, as set forth in Chapter NR 104.06(2)(b) of the *Wisconsin*

Administrative Code, the Milwaukee River downstream from the site of the former North Avenue Dam was also designated by the State with a different special variance that has more strict water quality regulations than the other special variance for the Kinnickinnic River and Indian and Lincoln Creeks. The streams within their watersheds that are affected by a special variance are identified on Table 2.8. It should be noted that because of the completion and adoption of the Milwaukee River Basin TMDL study in 2018, the variances for fecal coliform criteria were removed for the four streams listed above, but other variances for those streams such as temperature and dissolved oxygen still remain.

As shown on Table 2.13, all of the sample sites are meeting the criterion in more than 75 percent of the samples for TSS. All of the sample sites are meeting the Fecal Coliform (FC) bacteria criteria in less than 75 percent of samples. The Wilson Park Creek sample site is the only site meeting the Total Phosphorous (TP) criterion in more than 75 percent of samples, while the site located along the South 43rd Street Ditch is meeting the criterion for TP in only 3 percent of the samples. The sampling site located along the Kinnickinnic River downstream from the Jackson Park lagoon met the TP criterion in 0 percent of the samples. All of the sites are meeting the chloride criterion in more than 75 percent of the samples except for the site along the South 43rd Street Ditch.

As shown on Table 2.14, the sample sites in this area show varied results. None of the sampling sites are meeting the criteria for all four parameters in more than 75 percent of the samples. All of the sites are meeting the standard for chloride in more than 75 percent of the samples. Conversely, no sites have more than 75 percent of samples meeting the criteria for TP or FC bacteria. The results show that one-half of the sites are meeting the TSS criterion in more than 75 percent of the samples.

In addition, those results from sample stations located along the mainstems of the Kinnickinnic and Milwaukee Rivers that are within the Harbor Estuary area, which is the area where the Milwaukee, Menomonee, and Kinnickinnic Rivers meet and mix with Lake Michigan water, are identified in Tables 2.13 and 2.14, respectively.

The Outer Harbor is defined as the area from under the Hoan Bridge to the Lake Michigan breakwater, including the breakwater gaps. As shown on Table 2.15, all of the sample sites are classified as meeting the criteria for all four parameters in more than 75 percent of samples. Three sampling sites, sites OH-09, OH-10, and OH-11 met the criteria 100 percent of the time for all four parameters. Conditions within Fish Creek varied, TSS met the criterion in slightly more than 50 percent of the samples while both FC bacteria and TP

met the criterion in just one-third of samples. Chloride was able to meet the criteria for adequate water quality, meeting the criterion in 100 percent of the samples.

Biological Conditions

Evaluations of biological conditions in streams within Milwaukee County were conducted using two criteria. The quality of fishery communities were evaluated using the Index of Biotic Integrity, as calibrated for warmwater streams in Wisconsin[31] and the quality of macroinvertebrate communities were evaluated using the Hilsenhoff Biotic Index.[32] It is important to note that some generalizations are based upon limited data. Biological conditions for the Kinnickinnic, Milwaukee, and Menomonee Rivers within Milwaukee County are derived from two water quality plans[33] prepared by SEWRPC in 2007. Based on those plans, it was noted that the Kinnickinnic River watershed contained very poor fisheries. This fish community contains relatively few species of fishes, is trophically unbalanced, contains few or no top carnivores, and is dominated by tolerant fishes. The quality of the macroinvertebrate communities in the Kinnickinnic River watershed is also very poor. This community is depauperate and dominated by tolerant taxa. The portion of the Menomonee River watershed in Milwaukee County has a relatively poor fishery. The fish community contains relatively few species of fishes, is trophically unbalanced, contains few or no top carnivores, and is dominated by tolerant fishes. By contrast, the macroinvertebrate community in the Milwaukee County portion of the Menomonee River watershed is fair to very good. This community is trophically balanced and is not dominated by tolerant taxa. With the exception of the communities in Indian and Lincoln Creeks, the fish and macroinvertebrate communities in the Milwaukee County portion of the Milwaukee River watershed are of a better quality than those communities in the other watersheds of the County. The fish community in portions of the mainstem of the Milwaukee River contains a high abundance of warmwater species of fishes, seems trophically balanced in the highest quality areas, contains a good percentage of top carnivores (except for those species stocked), and is not dominated by tolerant fishes. Similarly, the macroinvertebrate communities are classified as fair to good-very good at present and are also generally trophically balanced and not dominated by tolerant taxa. For the Kinnickinnic River watershed and the portion of the

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[31] *John Lyons, "Using the Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams in Wisconsin," U.S. Department of Agriculture,* General Technical Report NC-149, *1992*.

[32] *William L. Hilsenhoff,* Rapid Field Assessment of Organic Pollution with Family-Level Biotic Index, *University of Wisconsin-Madison, 1988*.

[33] *SEWRPC Planning Report No. 50,* A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds, *December 2007*, and *SEWRPC Technical Report No. 39,* Water Quality Conditions and Sources of Pollution in the Greater Milwaukee Watersheds*, November 2007*.

Menomonee River watershed that is located in Milwaukee County, more recent examinations of biological conditions have mostly confirmed these findings.[34] However, it should be noted that the MMSD has removed a number of fish impediments within the Kinnickinnic and Menomonee Rivers since the publication of this more recent examination, which may allow fish passage to upstream reaches of both streams to be more manageable.

Biological conditions within the Root River and Oak Creek watersheds have been updated based on watershed plans[35] for both streams and their tributaries. A biological assessment for the Root River within Milwaukee County shows a strong negative relationship between both fishery indexes—the Index of Biotic Integrity (IBI) and the macroinvertebrate Hilsenhoff Biotic Index (HBI)—and increased levels of urbanization. More specifically, the highly developed upper reaches of the Root River watershed (at sites in the Cities of Franklin and Greenfield) have very poor fishery scores and fair macroinvertebrate scores. Overall aggregate bioassessment rankings in a USGS study[36] show that the Root River sites in the upper portion of the Root River watershed fall within the second quartile, indicating that part of the watershed is moderately degraded. The biological community in the Root River in Milwaukee County is therefore limited primarily due to 1) periodic stormwater pollutant loads, agricultural pollutant loads, and legacy loads from now-abandoned wastewater treatment plants; 2) decreased base flows and increased water temperatures due to urbanization; and 3) habitat loss and continued fragmentation due to culverts, the Horlick dam, and past channelization. Despite these impairments, the aquatic community within the Root River has improved in some areas of the watershed, which demonstrates its resilience and potential to continue to improve over time as best management practices are implemented.

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[34] *SEWRPC Memorandum Report No. 194,* Stream Habitat Conditions and Biological Assessment of the Kinnickinnic and Menomonee River Watersheds: 2000-2009, *January 2010.*

[35] *Documented in SEWRPC Community Assistance Planning Report No. 316,* A Restoration Plan for the Root River Watershed*, July 2014 and SEWRPC Memorandum Report No. 220,* Supplemental Information Developed for the Root River Watershed Restoration Plan, *April 2015, and SEWRPC Community Assistance Planning Report No. 330,* A Restoration Plan for the Oak Creek Watershed*, draft report.*

[36] *J.C. Thomas, M.A. Lutz, and others,* Water Quality Characteristics for Selected Sites Within the Milwaukee Metropolitan Sewerage District Planning Area, February 2004-September 2005*, U.S. Geological Survey Scientific Investigations Report 2007-5084, 2007.*

Fish passage impediments were also assessed and identified relatively recently in portions of the Root River watershed. In 2013, Commission staff conducted an inventory and assessment of stream crossings along the Root River in two stream reach areas, including one partially located within Milwaukee County. All crossings observed in the inventory were bridges, and they posed no fish passage barriers. Based upon this assessment, the majority of structures were identified to be passible by fish; however, five of the stream crossing structures, including one crossing located near Milwaukee County, were considered to be partial barriers to fish passage. STH 38 is considered to be a fish passage obstruction due to the 217-foot length of a culvert. Culverts this long often present passage problems for some species of fish, as there are very few resting areas and water velocities tend to be increased within the structure.

A biological assessment[37] shows Oak Creek contains a poor to fair fishery and poor to fair macroinvertebrate communities, the quality of which are limited by poor water quality, habitat alteration through stream channelization, and fragmentation by passage barriers. The fish community above the Mill Pond Dam contains relatively few species, with few or no top carnivores, and is largely dominated by tolerant fishes. The North Branch will likely continue to be a poor-quality fishery as re-introduction of fish species from the mainstem is limited by a major passage barrier. In addition, the passage barrier posed by the Mill Pond Dam limits the quality of the entire watershed fishery by inhibiting fish migration from Lake Michigan into the watershed. Temperature increases from climate change will further threaten coolwater species within the watershed, particularly with the potential decline in shading through loss of ash tree canopy cover. The macroinvertebrate community has largely been species-poor and dominated by tolerant taxa, particularly in the North Branch and Mitchell Field Drainage Ditch. However, the reemergence of the intolerant Iowa darter, higher species richness and HBI ratings of macroinvertebrate communities, and the observation of living mussels indicates that conditions have recently improved at least within a portion of the Oak Creek mainstem. Efforts to improve water quality, restore instream habitat, remove or reduce passage barriers, control and eradicate invasive species, and enhance riparian buffers can greatly improve biological conditions within waterbodies of the watershed.

Fish passage impediments were also assessed and identified within the Oak Creek watershed. Along Oak Creek, there were eight areas determined to be impediments to fish passage and eight areas considered to

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[37] *U.S. Geological Survey Scientific Investigations Report No. 2007-5084,* Water Quality Characteristics for Selected Sites within the Milwaukee Metropolitan Sewerage District Planning Area, Wisconsin: February 2004-September 2005*, 2007; U.S. Geological Survey Scientific Investigations Report No. 2010-5166,* Biological Water Quality Assessment of Selected Streams within the Milwaukee Metropolitan Sewerage District Planning Area of Wisconsin: 2007*, 2010.*

be potential (or partial) fish passage impediments to some species of fish. Along North Branch Oak Creek, there were four areas assessed to be fish passage impediments and two areas that were determined to be potential (or partial) impediments. Assessments along the Mitchell Field Drainage Ditch only included three structures downstream of Milwaukee Mitchell International Airport, and all were assessed to be passable for fish.

In some areas, water quality and habitat may be limiting the biological communities in these streams. It is also important to note there are several other factors that are likely limiting the aquatic community, including but not limited to 1) periodic stormwater loads; 2) decreased base flows; 3) continued fragmentation due to culverts, drop structures, and concrete lined channels, enclosed conduits, and a dam; 4) past channelization; and/or 5) increased water temperatures due to urbanization.

The biological condition of waterbodies in Milwaukee County is also affected by the presence of aquatic invasive species. Table 2.16 lists aquatic invasive species that have been reported as being present in inland waterbodies in Milwaukee County. Rusty crayfish, a crustacean species native to the Ohio River watershed, has been detected in streams within four watersheds in Milwaukee County. This species tends to displace native crayfish species and can substantially reduce aquatic macrophyte populations in waters that it has invaded. Grass carp, a fish species native to eastern Asia, was introduced to the United States to control aquatic plants in fish farms. Flooding of fish farms allowed the species to enter lakes and streams and are now widely established. Grass carp eat large amounts of aquatic plants—up to 100 percent of their body weight per day. Large populations can remove the vegetation other fish need for food, shelter, or spawning. In addition, all streams tributary to Lake Michigan are considered viral hemorrhagic septicemia waters, although the presence of this fish disease has not been verified in streams in Milwaukee County.

Another important indicator of water quality is TSS, as evaluated previously for the streams in Milwaukee County in Tables 2.10 through 2.15. Suspended solids consist of particles of sand, silt, and clay; planktonic organisms; and fine organic and inorganic debris and are mostly attributed to point sources, urban and nonurban nonpoint pollution, the erosion of streambeds and streambanks, and the resuspension of sediment present in the beds of waterbodies. High concentrations of TSS can cause several impacts in waterbodies, including reductions in photosynthesis in aquatic communities, increases in water temperature, and alterations of nutrient and pollutant transport. In addition, deposition of this material may alter the substrate, making it unsuitable as habitat for aquatic organisms or changing channel conditions.

It is also important to distinguish between instream water quality during dry weather conditions and during wet weather conditions. Differences between wet-weather and dry-weather instream water quality reflect differences between the dominant sources and loadings of pollutants associated with each condition. Dry-weather instream water quality reflects the quality of ground water discharge to the stream plus the continuous or intermittent discharge of various point sources, for example, industrial cooling or process waters, and leakage or other unplanned dry-weather discharges from sanitary sewers or private process water systems. While instream water quality during wet weather conditions includes the above discharges, and in extreme instances discharges from separate and/or combined sanitary sewer overflows, the dominant influence, particularly during major rainfall or snowmelt runoff events, is likely to be the soluble or insoluble substances carried into streams by direct land surface runoff. That direct runoff moves from the land surface to the surface waters by overland routes, such as drainage swales, street and highway ditches, and gutters, or by underground storm sewer systems.

Typically, water quality samples were assumed to represent wet-weather conditions when the daily mean flow was in the upper 20th percentile of the flow duration curve for the relevant flow gauge. This may include flows that are high due to rainfall events, runoff from snowmelt, or a combination of rainfall and snowmelt. When daily mean flows were in the lower 80th percentile of the flow duration curve for the relevant flow gauge, the corresponding water quality samples were considered to reflect dry-weather conditions.

For all five major streams within Milwaukee County, loads of TSS occurring during wet-weather periods were considerably higher than the estimated loads of TSS occurring during dry-weather periods. For the Kinnickinnic, Menomonee, and Milwaukee Rivers, TSS concentrations were lower in portions of the rivers that were within the Milwaukee Harbor Estuary than in portions of the rivers upstream from the Estuary. This reflects that portions of the Estuary may act as a settling basin in which material suspended in water sink and fall out into the sediment. TSS are also closely related to the high energy water that keeps the particles suspended in the water, as the amount of runoff increases, stream flows get faster and more turbulent. A natural stream will generally have less TSS exceedances from the criterion than an urbanized stream because an urbanized stream typically has more impervious surfaces surrounding it, which allows particles to runoff directly into the stream.

Stream Channel and Corridor Conditions

The conditions of the bed and bank of a stream are greatly affected by the flow of water through the channel. The great amount of energy possessed by flowing water in a stream channel is dissipated along

the stream length by turbulence, streambank and streambed erosion, and sediment resuspension. Sediments and associated substances delivered to a stream may be stored, at least temporarily, on the streambed, particularly where obstructions or irregularities in the channel decrease the flow velocity or act as particle traps or filters. On an annual basis or a long-term basis, streams may exhibit net deposition, net erosion, or no net change in internal sediment transport, depending on tributary land uses, watershed hydrology, precipitation, and geology. From 3 to 11 percent of the annual sediment yield in a watershed in Southeastern Wisconsin may be contributed by streambank erosion.[38] In the absence of mitigative measures, increased urbanization in a watershed may be expected to result in increased streamflow rates and volumes, with potential increases in streambank erosion and bottom scour, and flooding problems. In communities in Milwaukee County, the requirements of MMSD Chapter 13, "Surface Water and Storm Water," are applied to mitigate instream increases in peak rates of flow that could occur due to new urban development without runoff controls.

Milwaukee County commissioned an assessment of stability and fluvial geomorphic character of streams within four watersheds in the County. These included the Kinnickinnic River, Milwaukee River, Oak Creek, and Root River watersheds.[39] This study, conducted in fall 2003, examined channel stability in about 60 miles of stream channel along the mainstems of these rivers and several of their tributaries, and included development of a prioritized list of potential project sites related to mitigation of streambank erosion and channel incision, responses to channelization, and maintenance of infrastructure integrity. The MMSD had previously commissioned a study of sediment transport in the Menomonee River watershed.[40] This study, conducted in 2000, examined sediment transport in about 63 miles of stream channel along the mainstem of the River and several of its tributaries. Included among the factors assessed in this study were the characterization of channel bed and bank material composition, the evaluation of bed and bank stability, the examination of the integrity of the Works Progress Administration (WPA) walls lining portions of the channel, and the examination of bed and bank stability at road crossings. Data exist on channel conditions for only one stream in the Lake Michigan direct drainage area. The MMSD commissioned an assessment of geomorphic, hydrologic, and hydraulic conditions for Fish Creek and its watershed.[41] This study, conducted

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[38] *SEWRPC Technical Report No. 21,* Sources of Water Pollution in Southeastern Wisconsin: 1975, *September 1978*.

[39] *Inter-Fluve, Inc.,* Milwaukee County Stream Assessment, Final Report, *September 2004*.

[40] *Inter-Fluve, Inc.,* Menomonee River Watershed Sediment Transport Study Summary Report, *MMSD Contract No. W021-PE001, February 2001*.

[41] *W.F. Baird & Associates,* Fish Creek Geomorphic Study: Final Study Report, *January 2002*.

in 2000 to 2001, examined geomorphic and sediment characteristics and hydrologic and hydraulic conditions for about 3.5 miles of stream channel along Fish Creek, including reaches outside of Milwaukee County. Major goals of this study were to evaluate the mechanisms driving flood control, erosion, valley stability, and environmental management for the Creek and to identify engineering and management options to be considered in future studies.

Map 2.15 shows channel bed conditions in streams within Milwaukee County. Much of the stream network has been modified throughout the County. Many stream reaches have been channelized and straightened, and some stream reaches have been enclosed in conduit, including sections of Cherokee Park Creek, Edgerton Ditch, Holmes Avenue Creek, Lyons Park Creek, the South 43rd Street Ditch, Villa Mann Creek, and Wilson Park Creek in the Kinnickinnic River watershed; sections of Grantosa Creek, Honey Creek, and Woods Creek in the Menomonee River watershed; sections of Beaver Creek, Brown Deer Park Creek, Southbranch Creek, and unnamed tributaries to Indian Creek and Southbranch Creek in the Milwaukee River watershed; sections of the Mitchell Field Drainage Ditch, and tributaries to the Mitchell Field Drainage Ditch and North Branch of Oak Creek in the Oak Creek watershed; and small sections of Legend Creek and the New Berlin Memorial Hospital Tributary in the Root River watershed. In addition, some sections of stream channel have been concrete lined. These include substantial portions of the mainstem of the Kinnickinnic River and Wilson Park Creek and small reaches of Holmes Avenue Creek, Lyons Park Creek, and Villa Mann Creek in the Kinnickinnic River watershed; portions of Honey Creek, Underwood Creek, and Woods Creek in the Menomonee River watershed; reaches of Beaver Creek, Brown Deer Park Creek, Indian Creek, Lincoln Creek, Southbranch Creek, and Wahl Creek in the Milwaukee River watershed; and reaches along the mainstem of Oak Creek and a tributary to the North Branch of Oak Creek watershed. Table 2.17 summarizes the streambed conditions in each of the watersheds in the County. Since the previous County land and water resource plan was adopted in 2011, MMSD has removed concrete lining from three sections of streams and converted them to a natural streambed, including a 1,000-foot section of the Kinnickinnic River, a 3,700-foot section of the Menomonee River (including 1,000 feet of the steepest section upstream of the Bluemound Road bridge), and a 4,400-foot section of Underwood Creek.

MMSD is also in the process of or had just completed removing concrete lining and constructing a natural streambed for four additional stream sections within the Kinnickinnic River watershed, including three sections within the Kinnickinnic River. Within the Kinnickinnic River, MMSD removed 1,600 feet of concrete channel lining, improved two bridges, and enhanced natural resource and recreational assets at Pulaski Park, completing the project in October 2020. In addition, MMSD is planning to remove about 1,400 feet of concrete channel lining and 700 feet of stream enclosed in culverts, reshape portions of the park and dredge

contaminated sediments from the lagoon to improve flood storage, and enhance natural resource and recreational assets at Jackson Park; and remove 4,000 feet of concrete channel lining, expand the stream channel from 50 to 200 feet, acquire and remove 83 residential structures, and improve five bridges between 6th Street and 16th Street. MMSD also plans to remove 2,100 feet of concrete channel lining from Wilson Park Creek, improve two bridges, and construct a new flood storage detention basin along Wilson Park Creek.

These projects will restore fish passage, provide sustainable fish populations, and improve in-stream habitat, riparian plant communities and water-based recreational uses in highly urbanized and populated watersheds. Within the Menomonee River, removing the concrete and other impassable barriers and naturalizing the river allows fish to now travel to upstream reaches of the river as far north as the Village of Menomonee Falls (an additional 17 miles) and to tributaries that feed into the Menomonee River. Removing the concrete creates a more naturalized pool/riffle system to give fish areas to rest as they migrate north. In addition, restoring the natural flow of streams improves water quality, and water flowing through rock-lined streams restores natural turbulence. The churning motion aerates the water, which increases vital dissolved oxygen levels and slows the water flow. The turbulence and aeration also allows organic materials and pollutants an opportunity to break down rather than being quickly transported downstream and deposited in estuaries, which contributes to "dead zones" at the end of rivers.

Alluvial streams within urbanizing watersheds often experience rapid channel enlargement. As urbanization occurs, the fraction of the watershed covered by impervious surfaces increases. This can result in profound changes in the hydrology in the watershed. As a result of runoff being conveyed over impervious surfaces to storm sewers that discharge directly to streams, peak flows become higher and more frequent and streams become "flashier," with flows increasing rapidly in response to rainfall events. The amount of sediment reaching the channel often declines. Under these circumstances and in the absence of armoring, the channel may respond by incising. This leads to an increase in the height of the streambank, which continues until a critical threshold for stability is exceeded. When that condition is reached, mass failure of the bank occurs, leading to channel widening. Typically, incision in an urbanizing watershed proceeds from the mouth to the headwaters.[42] Lowering of the downstream channel bed increases the energy gradient upstream and in the tributaries. This contributes to further destabilization. Once it begins, incision typically follows a sequence of channel bed lowering, channel widening, and deposition of sediment within the

[42] *S.A. Schumm, "Causes and Controls of Channel Incision," In: S.E. Darby and A. Simon (eds.),* Incised River Channels: Processes, Forms, Engineering and Management, *John Wiley & Sons, New York, 1999.*

widened channel. Eventually, the channel returns to a stable condition characteristic of the altered channel geometry.

Map 2.16 summarizes bank stability for streams within Milwaukee County. Degrading channels and eroding banks are common in Milwaukee County. Most of the alluvial reaches that were examined in the Kinnickinnic River, Oak Creek, and Root River watersheds appeared to be degrading and actively eroding. While most of the reaches were found to be stable in the Menomonee and Milwaukee River watersheds, limited active areas of erosion were detected. Table 2.18 summarizes bank conditions in the watersheds of the County. It is important to note that the data reflected on Map 2.16 is represented from a generalized Countywide streambank assessment that was conducted in 2003. More recent site-specific streambank stability data is provided in watershed plans[43] for the Root River and Oak Creek and their tributaries. As identified in the Root River watershed plan, in 2006 and 2013, two separate streambank stability studies were conducted along the mainstem of the Root River within Milwaukee County. As identified in the Oak Creek watershed plan, Commission staff inventoried streambank stability data along Oak Creek, North Branch of Oak Creek, and the Mitchell Field Drainage Ditch.

In Milwaukee County, stream corridor protection has been focused on public acquisition of the lands adjacent to the streambanks and their preservation as river parkways. These lands are frequently incorporated into public parks and other natural areas. The provision of buffer strips around waterways represents an important intervention that addresses anthropogenic sources of contaminants, with even the smallest buffer strip providing environmental benefit.[44] Map 2.17 shows the status of riparian buffers along streams in Milwaukee County. Enclosed conduits, which comprise small portions of the stream systems in the Milwaukee River watershed, Oak Creek watershed, and Root River watershed stream systems and more substantial portions of the Kinnickinnic River watershed and Menomonee River watershed stream systems, offer limited opportunity for installation of buffers.

Table 2.19 shows the status of buffer widths ranging from less than 25 feet, 25 to 50 feet, 50 to 75 feet, and greater than 75 feet among the Kinnickinnic, Milwaukee, and Menomonee River watersheds within Milwaukee County. In the Milwaukee River watershed, buffers greater than 75 feet in width are the most

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[43] *SEWRPC Community Assistance Planning Report, op. cit.*

[44] *Southeastern Wisconsin Regional Planning Commission,* Managing the Water's Edge: Making Natural Connections, *May 2010; A. Desbonnet, P. Pogue, V. Lee, and N. Wolff, "Vegetated Buffers in the Coastal Zone – a Summary Review and Bibliography,"* CRC Technical Report No. 2064, *Coastal Resources Center, University of Rhode Island, 1994.*

common category of buffer, accounting for about 42 percent of the buffer widths in the watershed, however, in contrast, about 39 percent of the buffer widths in the watershed are less than 25 feet. In the Menomonee River watershed, buffers less than 25 feet in width are the most common category of buffer, accounting for about 37 percent of the buffer widths in the watershed, however, in contrast, about 34 percent of the buffer widths in the watershed are greater than 75 feet. In the Kinnickinnic River watershed, buffer widths less than 25 feet are the most common category of buffer, accounting for about 59 percent of the buffer widths in the watershed. Buffers greater than 75 feet in width in the Kinnickinnic River watershed are minimal, accounting for about 10 percent of the buffer widths in the watershed.

Riparian buffer widths within the Root River and Oak Creek watersheds have been updated based on watershed plans for both streams and their tributaries. However, riparian buffers identified in both plans were not designated by width, but as an area feature along streams within both watersheds, as shown on Map 2.17. Existing riparian buffer areas in the Root River watershed were developed by analyzing 2010 digital orthophotographs with the 2005 Wisconsin Wetland Inventory and inventories of primary and secondary environmental corridors and isolated natural resource areas. Areas were digitally mapped to delineate contiguous natural lands comprised of wetland, woodland, grasslands, prairies, and other open lands adjacent to waterbodies. Based on this analysis, existing riparian buffers comprised a total of 5,920 acres, or about 16 percent of the Root River watershed within Milwaukee County. About one-third of the existing riparian buffers within the watershed are protected through public interest ownership, and additionally, significant amounts of the existing riparian buffers are within the 1-percent-annual-probablity (100-year recurrence interval) floodplain and/or within designated wetlands, which provides additional protection for these areas. Table 23 in the SEWRPC report, the *Root River Watershed Restoration Plan*, provides detailed data about riparian buffer widths in the entire Root River watershed, including portions within Milwaukee County.

Existing riparian buffer areas in the Oak Creek watershed were developed similarly to those for the Root River watershed, using 2015 digital orthophotographs, the 2015 Wisconsin Wetland Inventory, and inventories of primary and secondary environmental corridors and isolated natural resource areas. Areas were digitally mapped to delineate contiguous natural lands comprised of wetland, woodland, grasslands, prairies, and other open lands adjacent to waterbodies. Based on this analysis, existing riparian buffers comprised a total of 3,201 acres, or about 18 percent of the total land area within the Oak Creek watershed. As shown on Map 2.17, existing riparian buffer lands made up 20 percent or more of the land area in the Grant Park Ravine, Middle Oak Creek, Middle Oak Creek—Drainage Ditches, and Oak Creek Headwaters assessment areas along the mainstem of Oak Creek; and the Southland Creek, Drexel Avenue Tributary, and

Rawson Avenue Tributary assessment areas in the North Branch Oak Creek subwatershed. Areas within the Mitchell Field Drainage Ditch contained less than 20 percent of their lands currently functioning as riparian buffers. About 38 percent of the existing riparian buffers within the watershed are protected through public interest ownership, and additionally, significant amounts of the existing riparian buffers are within the 1-percent-annual-probablity (100-year recurrence interval) floodplain and/or within designated wetlands, which provides additional protection for these areas. Table 4.9 in the *Oak Creek Watershed Restoration Plan* provides detailed data about riparian buffer widths in the Oak Creek watershed.

Since 2010, Parks Natural Areas staff have observed high levels of ash mortality and decline throughout Milwaukee County. The occurrence of pests and diseases affecting tree populations is an emerging issue within Southeastern Wisconsin, and has had a great impact on the riparian corridors within Milwaukee County watersheds. Of particular concern is the rapid emergence and spread of the emerald ash borer. Deceased ash trees killed by the emerald ash borer are evident within the riparian lands adjacent to most of the streams within the County. Habitat quality within these riparian buffer lands are also being significantly altered as the rapid decline of floodplain forest canopy is allowing increased sunlight to penetrate to the forest floor, thus giving other invasive species, particularly common buckthorn and reed canary grass, the opportunity to rapidly spread into areas that were previously too shaded for optimal growth. When the trees become deceased, it is also expected that the major streams and their tributaries within the County will encounter an increase in the amount of large woody material which would provide coarse woody habitats, but may also cause debris jams.

It should be noted that the amount of degraded habitat is also likely much higher because the vegetative cover types were last assessed prior to the extensive degradation that has occurred within the floodplain forests in Milwaukee County caused by emerald ash borer infestations. Degraded habitat is defined by Milwaukee County Parks as having vegetative cover types that have a coverage of 75 percent or greater consisting of non-native herbaceous and woody invasive species.

Impaired Waters

Under Section 303(d) of the Clean Water Act, states should periodically submit a list of impaired waters to the USEPA for approval. The WDNR revises the list of impaired waters every two years. The State of Wisconsin submitted a list in April 2020, and the list was subsequently approved by the USEPA in October 2020. Map 2.18 shows stream reaches in Milwaukee County that are classified as being impaired waters on the most recently approved list (listed in Tables 2.10 through 2.15). States are required to develop Total Maximum Daily Loads (TMDLs) to address impaired waterbodies that are not meeting water quality

standards and not achieving their designated uses. A TMDL includes both a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and an allocation of that load among the various sources of that pollutant. The TMDL must also account for seasonal variations in water quality and include a margin of safety to account for uncertainty in predicting how well pollutant reductions will result in meeting water quality standards.

A TMDL allocates the allowable load between wasteloads from point sources such as municipal wastewater treatment plants, industrial dischargers, concentrated animal feeding operations, and municipal separate storm sewer systems (MS4s); loads from nonpoint sources such as agricultural sources, urban sources not covered under a discharge permit, and natural background loads; and a margin of safety. Wasteload allocations are implemented through limits established in discharge permits under the Wisconsin Pollutant Discharge Elimination System (WPDES). Nonpoint load allocations are implemented through a wide variety of Federal, State, and local programs as well as voluntary action by citizens. These programs may include regulatory, non-regulatory, or incentive-based elements, depending on the program. Implementing load allocations is typically an adaptive process, requiring diverse stakeholders to collaborate on prioritizing and targeting available programmatic, regulatory, financial, and technical resources.

The entire stretch of the mainstem of the Kinnickinnic River has at least one type of impairment, however, one section of the mainstem has more listed types of impairments than any other reach of the river. As listed on Table 2.13, the Kinnickinnic River between the Jones Island Ferry and S. 8th Street is considered impaired due to aquatic toxicity, bacterial contamination, degraded biological community, and fish consumption advisories necessitated by high concentrations of PCBs in the tissue of fish collected from this reach, and lack of compliance with standards for dissolved oxygen concentration. Fecal coliform and *E. coli* bacteria, metals, phosphorus, and PCBs from contaminated sediment and a combination of point and nonpoint sources are cited as factors contributing to the impairment of this section of the river. As listed on Table 2.13, five tributaries in the Kinnickinnic River watershed are also considered impaired, with all five tributaries considered to have high bacteria concentrations that may cause recreational use impairments.

The entire stretch of the mainstem of the Menomonee River within Milwaukee County has at least one type of impairment, however, one section of the mainstem has more listed types of impairments than any other reach of the river. As listed on Table 2.10, the eight-mile reach of variance water between the confluence with the Milwaukee River and 70th Street is considered impaired due to aquatic toxicity, bacterial contamination, fish consumption advisories necessitated by high concentrations of PCBs in the tissue of fish collected from this reach, and lack of compliance with standards for dissolved oxygen concentration. Fecal

coliform and *E. coli* bacteria, metals, phosphorus, and PCBs from contaminated sediment and a combination of point and nonpoint sources are cited as factors contributing to the impairment of this section of the river. As listed on Table 2.10, seven tributaries in the Menomonee River watershed are also considered impaired. Three tributaries with reaches in Milwaukee County—Little Menomonee River, Honey Creek, and a section of Underwood Creek from the Menomonee River confluence to the Milwaukee-Waukesha County line—have three or more impairments. Six of the seven tributaries are considered impaired due to aquatic toxicity related to the presence of PAHs in contaminated sediment.

As listed on Table 2.14, the entire stretch of the mainstem of the Milwaukee River within Milwaukee County has at least three types of impairments. The 3.1-mile section of the river from the mouth of the Milwaukee River to the former North Avenue Dam is considered impaired due to bacterial contamination, fish consumption advisories necessitated by high concentrations of PCBs in the tissue of fish collected from this reach, and the lack of compliance with standards for dissolved oxygen concentration. *E. coli* bacteria, metals, phosphorus, and PCBs from contaminated sediment and a combination of point and nonpoint sources are cited as factors contributing to the impairment of this section of the river. The section of the river upstream from the former North Avenue Dam to the Milwaukee-Ozaukee County line is considered impaired due to bacterial contamination, temperature, and fish consumption advisories necessitated by high concentrations of PCBs in the tissue of fish collected from this reach. *E. coli* bacteria, phosphorus, and PCBs from contaminated sediment and a combination of point and nonpoint sources are cited as factors contributing to the impairment of this section of the river. This reach extends beyond the Milwaukee-Ozaukee County line up to the Lime Kiln Dam in the Village of Grafton.

In addition, five tributaries in the watershed within Milwaukee County are also listed as impaired. As shown on Table 2.14, all five tributaries are impaired due to aquatic toxicity, including Crestwood Creek, which was added to the State's impaired waters listed in 2020. The entire length of Lincoln Creek, which is classified as a variance water, is considered impaired due to aquatic toxicity, degraded habitat, lack of compliance with standards for dissolved oxygen concentration, high temperatures, and fish consumption advisories necessitated by high concentrations of PCBs in the tissue of fish collected. Metals, PAHs, phosphorus, PCBs from contaminated sediment and a combination of point and nonpoint sources, and sedimentation from undetermined sources are cited as factors contributing to the impairment of this stream. The entire length of Indian Creek, which is classified as a variance water, is considered impaired due to aquatic toxicity, degraded habitat, lack of compliance with standards for dissolved oxygen concentration, and high temperatures. Metals, phosphorus, and sedimentation related to nonpoint source pollution are cited as contributing to the

impairment of this stream. It should be noted that Beaver Creek has been delisted for aquatic toxicity from the State's impaired waters list in 2020.

As shown on Table 2.11, the entire 13.0-mile-length of the mainstem of Oak Creek is listed as impaired due to aquatic toxicity and degraded habitat related to phosphorous and undetermined pollutants. A combination of point and nonpoint sources are cited as factors contributing to the impairment of the stream. In addition, the North Branch Oak Creek tributary and the Mitchell Field Drainage Ditch tributary, which was added to the State's impaired waters list in 2020, are listed as impaired within the watershed. Both tributaries are impaired due to aquatic toxicity because of high concentrations of chloride.

As shown on Table 2.12, the sections of the mainstem of the Root River that are located within Milwaukee County are considered impaired due to degraded habitat and the lack of compliance with standards for dissolved oxygen concentration, however, reaches of the river upstream from Ryan Road are also impaired with aquatic toxicity due to high concentrations of chloride. Phosphorus and sedimentation from a combination of point and nonpoint sources are also cited as factors contributing to the impairment of the river within Milwaukee County. In addition, the Root River Canal and Ryan Creek within the County are considered impaired due to the lack of compliance with standards for dissolved oxygen concentration and for degraded habitat, respectively. Phosphorus and sedimentation mostly from nonpoint sources are cited as factors contributing to the impairments of these streams.

As shown on Table 2.15, Fish Creek, which drains directly into Lake Michigan, is listed as impaired due to aquatic toxicity and degraded habitat related to phosphorous and high concentrations of chloride. The Milwaukee Harbor Estuary and Outer Harbor are also classified as impaired waters. As noted in Tables 2.10, 2.13, and 2.14, portions of the Menomonee, Kinnickinnic, and Milwaukee Rivers located in the harbor estuary are listed as impaired due to aquatic toxicity, high bacteria concentrations, low concentrations of dissolved oxygen, and fish consumption advisories necessitated by high concentrations of PCBs in the tissue of fish collected from this area. Fecal coliform and *E. coli* bacteria, metals, phosphorus, and PCBs from contaminated sediment and a combination of point and nonpoint sources are cited as factors contributing to the impairment of the estuary. As shown Table 2.15, the Outer Harbor is listed as impaired due to aquatic toxicity, high bacteria concentrations, and fish consumption advisories necessitated by high concentrations of PCBs in the tissue of fish collected from this area. *E. coli* bacteria, metals, and PCBs from contaminated sediment and a combination of point and nonpoint sources are cited as factors contributing to the impairment of the Outer Harbor. Three public beaches along the Lake Michigan shore in the Lake Michigan direct drainage area are also listed as impaired. Grant Park Beach, McKinley Beach, and South Shore Beach

are considered impaired due to *E. coli* bacteria counts exceeding the recreational water quality criteria formulated in 2012, which amended the Beach Act of 2000.

In addition, Lake Michigan and the entire length of the Lake Michigan shoreline from the Door County peninsula to the Wisconsin-Illinois State line, which includes Milwaukee County, is also listed as impaired with fish consumption advisories necessitated by high concentrations of PCBs and Mercury in the tissue of fish collected.

Lakes and Ponds

While Milwaukee County contains no major lakes with surface areas over 50 acres, it has a number of small lakes, pond, and lagoons. Most of these waterbodies have less than 10 acres of surface area. Many of them are located within the County parks system. The lakes, ponds, and lagoons in the County are listed in Table 2.20.

Lakes are readily susceptible to degradation through improper land use development and management. Water quality can be degraded by excessive pollutant loads, including nutrient loads, which enter from malfunctioning and improperly located onsite waste treatment systems, from sanitary sewer overflows, from construction and other urban runoff, from direct inputs from storm-drain outlets, from large concentrations of waterfowl, and from careless agricultural practices. The water quality of lakes may also be adversely affected by the excessive development of riparian areas and by the filling of peripheral wetlands, which remove valuable nutrient and sediment traps while adding nutrient and sediment sources. It is important that existing and future development in riparian areas be managed carefully to avoid further water quality degradation and to enhance the recreational and aesthetic values of surface water resources.

The trophic status of the lakes, ponds, and lagoons in Milwaukee County is set forth in Table 2.20. Trophic status is an indicator of overall water quality. In 2003 and 2004, the trophic status of 16 lakes, ponds, and lagoons, was evaluated as part of the development of the County's pond and lagoon management plan.[45] The trophic status of a seventeenth waterbody, Upper Kelly Lake, was assessed in 2005 as part of the updating of its lake protection plan.[46] In 2017, the County resampled various lakes, ponds, and lagoons to continue to evaluate the water quality issues at the sites, and updated and inventoried the data associated

[45] *Milwaukee County Environmental Services,* Milwaukee County Park & Lagoon Management Plan, *June 2005.*

[46] *SEWRPC Memorandum Report No. 135 (2nd Edition),* A Lake Protection Plan for the Kelly Lakes, Milwaukee and Waukesha Counties, Wisconsin, *April 2007.*

with those sites. Of the lakes, ponds, and lagoons for which data were available, two were classified as mesotrophic, one was classified as meso-eutrophic, five were classified as eutrophic, eight were classified as eutrophic-hypertrophic, and two were classified as hypertrophic. The tendency toward eutrophy and hypertrophy in the lakes, ponds, and lagoons for which data exist suggests that many of these waterbodies are experiencing considerable nutrient enrichment.

Aquatic invasive species have also been detected in several lakes and ponds in Milwaukee County. Table 2.16 lists those lakes and ponds in which invasive species have been reported as being present.

Wetlands

Wetlands are important resources for the ecological health and diversity of the County. Wetlands form the transition between surface water and groundwater resources and land resources. Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency, and with duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally occur in depressions and near the bottom of slopes, particularly along lakeshores and streambanks, and on large land areas that are poorly drained. Wetlands may, however, under certain conditions, occur on slopes and even on hilltops. They provide essential breeding, nesting, sanctuary, and feeding grounds, as well as offer escape cover for many forms of fish and wildlife. In addition, wetlands perform an important set of natural functions, which include: water quality protection; stabilization of lake levels and streamflows; reduction in stormwater runoff by providing areas for floodwater impoundment and storage; and protection of shorelines from erosion.

The location and extent of wetlands in Milwaukee County are shown on Map 2.19. These wetlands are based upon the Wisconsin Wetlands Inventory completed in the Region in 1982, and updated in the years 2000, 2010, and 2015 as part of the regional land use inventory. The land area covered by wetlands within cities and villages in the County is presented in Table 2.21. In total, the County's wetlands encompassed about 8,084 acres[47] (12.6 square miles), or 5.2 percent of the County area, in 2015. These wetlands are classified predominantly as potholes, fresh meadows, shallow marshes, deep marshes, shrub swamps, timber swamps, and bogs.

[47] The wetland acreage does not include certain categories of wetlands that overlap other natural resource features, are primarily classified as an open water, or have been filled or drained.

It should be noted that wetlands are constantly changing in response to changes in drainage patterns and climatic conditions. While wetland inventory maps provide a sound basis for areawide planning, they should be viewed as providing a point of departure to be supplemented with detailed field investigations for regulatory purposes.

A number of invasive plant species have been detected in wetlands in Milwaukee County. County Parks personnel have reported expending considerable efforts in controlling these species in parklands and natural areas. County Parks conducts control efforts for over 40 species of invasive terrestrial plants, including wetland species such as glossy buckthorn, purple loosestrife, reed canary grass, phragmites, and narrow-leaf cattail.

Ephemeral Wetlands

Ephemeral wetlands are defined by the WDNR as depressions with impeded drainage, usually in forest landscapes, that hold water for a period of time following snowmelt and spring rains but typically dry out by mid-summer. These wetlands flourish with productivity during their brief existence and provide critical breeding habitat for some invertebrates, as well as many amphibians such as wood frogs and several salamander species. They also provide feeding, resting, and breeding habitat for songbirds and a source of food for many mammals. Ephemeral ponds contribute in many ways to the biodiversity of a woodlot, forest stand, and the larger landscape. Historic surveys by SEWRPC and on-the-ground surveys by Parks Natural Areas staff have documented over 350 ephemeral ponds within the park system.

Shoreland and Floodplain

Shorelands are defined by the *Wisconsin Statutes* as lands within the following distances from the ordinary high-water mark of navigable waters: 1,000 feet from a lake, pond, or flowage; 300 feet from a river or stream; or to the landward side of the floodplain, whichever is greater. Because all of the municipalities in Milwaukee County are incorporated, local regulation of shorelands and floodplains is conducted by the cities and villages within the County.

Floodplains in Milwaukee County, as identified by the Federal Emergency Management Agency (FEMA) under the National Flood Insurance Program, are shown on Map 2.13. In total, 1-percent-annual-probability (100-year recurrence interval) floodplains shown on Map 2.13 encompass about 11,067 acres, or about 7 percent, of the County. The area of floodplains for cities and villages in the County is presented in Table 2.21. FEMA has completed updating floodplain maps for Milwaukee County under its Map Modernization Program. The updated maps have an effective date of August 2, 2019. Map 2.13 shows both detailed

floodplain delineations with known flood elevations and approximate floodplain delineations. The Commission staff continues to prepare updated, digital floodplain and floodway maps for all of Milwaukee County and portions of Ozaukee, Washington, and Waukesha Counties that are adjacent to Milwaukee County. The preparation is being performed for the Milwaukee County Land Information Council and MMSD.

Groundwater Resources

Groundwater resources constitute another key element of the natural resource base. Groundwater not only sustains lake levels and wetlands and provides the base flows of streams, but also comprises a source of water supply for domestic, municipal, and industrial water users.

There are three major aquifers within Milwaukee County, which contain the usable groundwater of the County. The surficial sand and gravel aquifer and the Niagara dolomite aquifer are often treated as a single aquifer commonly referred to as the "shallow" aquifer due to its proximity and intimate hydraulic interconnection to the land surface. The third, accordingly, is commonly identified as the "deep" aquifer since it underlies the shallow aquifer. The sand and gravel aquifer consists of unconsolidated sand and gravel deposits in glacial drift and alluvium. These deposits occur over the majority of the County, either at the land surface or buried beneath less permeable drift such as glacial till. This aquifer interacts extensively with the surface water system of the County. The Niagara dolomite aquifer in Milwaukee County consists of Devonian and Silurian Age dolomite, which overlie the Maquoketa shale stratum throughout the entire County. The Maquoketa shale separates the Niagara and sandstone aquifers. The shale layer has very low permeability, which restricts the vertical movement of water and largely confines water within the sandstone aquifer. The sandstone aquifer includes all sedimentary bedrock below the Maquoketa shale stratum. The bottom of the sandstone aquifer is the surface of the impermeable Precambrian rocks. This aquifer is continuous throughout the County and is a part of the larger regional aquifer that is used as a source of water supply for major concentrations of urban development throughout southeastern Wisconsin and northeastern Illinois. This aquifer is relatively unimportant in terms of its influence on the surface water resources of the County since it does not intersect surface water features.

Recharge of the aquifers underlying Milwaukee County is derived largely by precipitation. The groundwater in the shallow aquifer typically originates from precipitation that has fallen within a radius of about 20 miles or less from where it is found. The deep aquifer is recharged mostly by infiltration of precipitation beyond the western limits of the Maquoketa shale to the west of the County.

Like surface water, groundwater is susceptible to depletion in quantity and to deterioration in quality as a result of contamination and over-usage. The depth to the shallow water table in Milwaukee County is illustrated on Map 2.20. The vulnerability of groundwater to contamination is a combination of several factors, including soil type, subsurface material characteristics, and depth to groundwater levels. As shown on Map 2.20, areas of the County with a depth of less than 25 feet to groundwater are chiefly associated with the valleys of rivers and streams. This shallowness to groundwater, in combination with the stratified sand and gravel characteristics of glacial outwash soils, makes these areas the most sensitive to contamination. Thus, land use planning must appropriately consider the potential impacts of urban and rural development on this important resource. Land use planning must also take into account, as appropriate, natural conditions that may limit the use of groundwater as a source of water supply.

It should be noted that all 14 municipal water supply utility systems within Milwaukee County rely on Lake Michigan as the source of potable water, either directly or indirectly through wholesale or resale purchase. There are areas outside of the municipal water utility systems within Milwaukee County that are served by private wells and are provided water through groundwater aquifers. These areas are primarily located in the far northern and southern portions of the County, including portions of the Cities of Franklin and Oak Creek and the Villages of Bayside and River Hills. There are also various privately owned, self-supplied, water systems operating in Milwaukee County that utilize groundwater as a source of water.

The Regional Planning Commission, working with the U.S. Geological Survey, Wisconsin Geological and Natural History Survey, the University of Wisconsin-Milwaukee, and the WDNR, completed major groundwater studies for the Region that are important resources for regional and local planning. These studies include a regional groundwater inventory and analysis, the development of a regional groundwater aquifer simulation model, the identification of important groundwater recharge areas, and a regional water supply system plan, utilizing the results of the inventory and analysis work and the aquifer model. In addition, the WDNR, in conjunction with local water utilities, has undertaken an effort to identify areas of contribution to municipal wells that can be used for well protection planning. More detailed information on groundwater conditions in Southeastern Wisconsin, including Milwaukee County, is set forth in SEWRPC Technical Report No. 37, *Groundwater Resources of Southeastern Wisconsin,* June 2002; SEWRPC Technical Report No. 41, *A Regional Aquifer Simulation Model for Southeastern Wisconsin,* June 2005; SEWRPC Technical Report No. 47, *Groundwater Recharge in Southeastern Wisconsin Estimated by a GIS-Based Water-Balance Model,* July 2008; and SEWRPC Planning Report No. 52, *A Regional Water Supply Plan for Southeastern Wisconsin*, December 2010.

As part of the regional water supply planning program, areas within Milwaukee County and the remainder of southeast Wisconsin were analyzed and classified based on their potential for water recharge. The analysis was based on a combination of topography, soil hydrologic groups, soil water storage, and land use. An "average" weather year was selected for the analysis, since the amount of precipitation received also affects the amount of water that reaches (and recharges) the groundwater. Areas were placed into the following classifications: very high (more than six inches of recharge per year), high (four to six inches of recharge per year), moderate (three to four inches per year), and low (less than three inches of recharge per year). Areas for which no soil survey data was available, "undetermined," were not classified. Areas within the "very high," "high," and "moderate" recharge classifications are shown on Map 2.20. The majority of the recharge areas within these classifications are located in the far northern and far southern portions of the County.

City of Waukesha Water Diversion

The City of Waukesha has long relied on a deep aquifer groundwater supply, but depressed water levels in the deep aquifer have compounded high radium concentration levels. The City submitted applications for use of Lake Michigan water to the WDNR in 2010 and 2013. The City sought an exception from the prohibition of diversions under the Great Lakes – St. Lawrence River Basin Water Resources Compact and the Great Lakes – St. Lawrence River Basin Sustainable Water Resources Agreement. Following the WDNR's technical review and preliminary final environmental impact statement (EIS) analysis, the City of Waukesha's Great Lakes diversion application was approved, with conditions, by the Compact Council in 2016. In 2019, the WDNR completed a final EIS[48] for the project. As of January 2020, the WDNR has issued a waterway and wetland permit for the construction of water supply and return flow pipelines and has reissued the City of Waukesha's Wisconsin Pollutant Discharge Elimination System (WPDES) wastewater permit, which includes conditions and requirements for the discharge of treated wastewater to the Root River. In June 2021, the WDNR granted final approval of the water diversion project and the project is expected to be completed and fully operational in 2023.

The diversion project includes obtaining treated Lake Michigan drinking water from the City of Milwaukee, treating the water after it is used at the Waukesha Wastewater Treatment Plant and returning the water to the Root River, with the proposed discharge to be located near Oakwood Road and South 60th Street in

[48] *Wisconsin Department of Natural Resources,* City of Waukesha Proposed Great Lakes Diversion: Final Environmental Impact Statement, *December 2019*.

the City of Franklin. The project includes constructing drinking water supply and drinking water conditioning features, as well as wastewater treatment and treated effluent return flow features.

Based on the EIS, environmental effects on Lake Michigan, the Root River and the Fox River and its tributaries, and groundwater are expected to be the same for all water supply proposals. The EIS determined that the Root River return flow is expected to have no impacts to minimal impacts on the water quality of Lake Michigan and the withdrawal from Lake Michigan with required return flow is not anticipated to result in a measurable change in Lake Michigan water levels. Phosphorus concentrations in the Root River downstream from the discharge point will likely decrease due to the lower phosphorus concentrations of treated wastewater discharging into the river, however, the return flow could slightly increase the aquatic plant communities in the river, which may increase the range of diurnal dissolved oxygen levels in portions of the river. The return flow may reduce instream Total Suspended Solids (TSS) concentrations through dilution and improve sediment carrying capacity due to increased stream velocity. It is anticipated that little to no impact is expected from the proposed return flows of TSS concentrations and loadings to the Root River.

A change from a groundwater water supply to a Lake Michigan surface water supply would significantly reduce the need for home water softening. Currently, salt residue from residential home water softening is the largest source of chlorides to the City of Waukesha's Wastewater Treatment Plant. The City is also expecting reductions in the baseline effluent chloride concentrations and loading since concentrations of chloride would be lower with a Lake Michigan water supply. It is anticipated that minimal impacts to the Root River may occur downstream of the discharge point after switching from groundwater water to a Lake Michigan water supply. Dissolved Oxygen levels downstream from the discharge point may be low, if untreated, due to the long length of the return flow pipeline (approximately 27 miles) and the lack of exposure to air in the force main. To address this issue, the City of Waukesha plans to install a reaeration system at the return flow location to meet the proposed daily minimum dissolved oxygen limit. Downstream, Dissolved Oxygen levels of the Root River could be affected by possible increases in aquatic plant growth caused by phosphorus loading. The temperature of the Root River downstream of the return flow outfall would depend on the time of year, temperature of the discharge water, and temperature and amount of flow in the Root River. It is anticipated that a temperature monitoring system will be developed at the return flow outfall location to provide temperature data. Looking beyond the immediate mixing zone, the return flow discharge could potentially improve temperature water quality conditions for fish and aquatic life by insulating the river from extremely cold or warm air temperatures. Little to no impact is expected to the Root River outside of the primary mixing zone due to temperature from the effluent.

Flooding and the geomorphic conditions are also not expected to change or affect the Root River downstream with the addition of the return flow from the discharge point. The flood maps for the Root River would not be required to be revised.

Overall, the proposed diversion would not have any significant adverse direct impacts or cumulative impacts to the quantity or quality of the waters of the Great Lakes basin or to water dependent natural resources,

Forest Resources

Woodlands

With sound management, woodlands can serve a variety of beneficial functions. In addition to contributing to clean air and water and regulating surface water runoff, woodlands help maintain a diversity of plant and animal wildlife. Destroying woodlands, particularly on hillsides, can contribute to excessive stormwater runoff, siltation of lakes and streams, and loss of wildlife habitat. Woodlands identified under the 2015 regional land use inventory are shown on Map 2.19. Woodlands are defined as upland areas of one acre or more in area, having 17 or more trees measuring at least four inches in diameter 4.5 feet above the ground per acre and having canopy coverage of 50 percent or greater. Upland woodland plant communities[49] found within Milwaukee County include: Conifer Plantations, Northern Dry-Mesic Forest, Oak Woodland, Southern Dry-Mesic Forest, and Southern Mesic Forest Coniferous tree plantations and reforestation projects are also classified as woodlands. Table 2.21 lists the number of acres of woodlands in the County and each civil division. In 2015, woodlands encompassed 5,691 acres, or about 4 percent of the County.[50]

A number of invasive plant species have been detected in woodlands in Milwaukee County. County Parks personnel have reported expending considerable efforts in controlling these species in parklands and natural areas. County Parks conducts control efforts for over 40 species of invasive terrestrial plants, including woodland species such as common buckthorn, garlic mustard, and honeysuckle.

Natural Areas and Critical Species Habitat Sites

A comprehensive inventory of "natural areas" and "critical species habitat sites" in Southeastern Wisconsin was completed by the Regional Planning Commission in 1994.[51] The inventory identified the most significant

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[49] *Inventoried by the WDNR Natural Heritage Division.*

[50] *These data include upland woods only, not lowland woods, such as tamarack swamps, which are classified as wetlands.*

[51] *SEWRPC Planning Report No. 42,* A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, *September 1997.*

remaining natural areas—essentially, remnants of the pre-European settlement landscape—as well as other areas vital to the maintenance of endangered, threatened, and rare plant and animal species in the Region. A 2010 amendment to this plan has added or removed natural areas and critical species sites since the publication of the initial plan.[52]

Natural Areas

Natural areas are tracts of land or water so little modified by human activity, or sufficiently recovered from the effects of such activity, that they contain intact native plant and animal communities believed to be representative of the landscape before European settlement. Natural areas are classified into one of three categories: natural areas of statewide or greater significance (NA-1), natural areas of countywide or regional significance (NA-2), and natural areas of local significance (NA-3). Classifying an area into one of these three categories is based upon consideration of the diversity of plant and animal species and community types present; the structure and integrity of the native plant or animal community; the extent of disturbance from human activity; the commonness of the plant or animal community; the uniqueness of the natural features; the size of the site; and the educational value.

As illustrated on Map 2.21 and indicated in Table 2.22, a total of 56 known natural areas were identified in Milwaukee County as part of the updated inventory. In combination, these sites encompassed about 2,954 acres (4.6 square miles) or 2 percent of the total area of the County.

Critical Species Habitat Sites and Aquatic Sites

Critical species habitat sites consist of areas, exclusive of identified natural areas, which are important for their ability to support State-designated endangered, threatened, or rare plant or animal species. Such areas constitute "critical" habitat considered to be important to the survival of a species or group of species of special concern. As shown on Map 2.21 and described in Table 2.23, a total of 55 critical species habitat sites were identified in Milwaukee County as part of the updated inventory. Together, these critical species habitat sites encompassed about 1,037 acres (1.6 square miles), or 0.7 percent of the County.

The regional natural areas plan also identified several critical aquatic habitat areas in the County. These areas were identified because they either support rare fish, herptile, or mussel species or bisect terrestrial natural areas. These areas include the portion of the mainstem of the Menomonee River upstream from the

[52] *SEWRPC,* Amendment to the Natural Areas and Critical Species Habitat Plan for the Southeastern Wisconsin Region, *December 2010.*

confluence with Underwood Creek; the portion of the mainstem of the Milwaukee River upstream from Walnut Street; the mainstem of the Root River downstream from W. Ryan Road; and Fish Creek, the Root River Canal, Tess Corners Creek, and Whitnall Park Creek.

Flora & Fauna

Due to Milwaukee County's location within Wisconsin's Ecological Tension Zone, which is an area within the State where northern plant communities meet southern plant communities, the County is home to a higher diversity of native plants and wildlife than other areas of the State. While the loss of natural areas, diminished landscape connectivity, and the overall mistreatment have reduced the ecological diversity of Milwaukee County in the last 200 years, a large number of native species of plants and wildlife persist. To date, surveys within the park system conducted by Parks Natural Areas staff, SEWRPC, WDNR, and other local conservation organizations have documented 675 species of native plants, 353 species of birds (125 are breeding species recently documented during the Wisconsin Birding Bird Atlas update), 10 species of bumble bees, 53 species of odonates (dragonflies and damselflies), 7 species of crayfish, 25 species of herptiles (reptiles and amphibians), and 34 species of mammals. Certainly, countless other species of native invertebrates are also present, however, formalized surveys have not regularly been conducted for them. All told, 95 State and Federally listed species have been documented using the natural areas within the park system within the last decade.

Geological Sites

A total of 14 geological sites, all of which are bedrock geology sites, were identified in the County in 2009. Geological sites were identified on the basis of scientific importance, significance in industrial history, natural aesthetics, ecological qualities, educational value, and public access potential. The 14 sites include six sites of statewide significance (GA-1), five sites of countywide or regional significance (GA-2), and three sites of local significance (GA-3). Together, these sites encompass 138 acres in Milwaukee County, and 70 acres, or about 51 percent, are located within County parklands.

Wisconsin Legacy Places

In 2006, the WDNR completed an inventory intended to identify the places believed to be most critical to meet the State's conservation and recreation needs over the next 50 years.[53] The resulting report provides background information for use by landowners, nonprofit conservation groups, local governments, State

[53] *Wisconsin Department of Natural Resources,* Wisconsin Land Legacy Report: An Inventory of Places to Meet Wisconsin's Future Conservation and Recreational Needs, *2006.*

and Federal agencies, and other interests in decision-making about land protection and management in the vicinity of the identified legacy places. A total of 229 such legacy places were identified statewide.

The inventory identified six legacy places in Milwaukee County. As identified in the report, the following six legacy sites are part of the Southeast Glacial Plains and Southern Lake Michigan Coastal Landscape areas located wholly or partially within Milwaukee County: Havenwoods State Forest Preserve, the Menomonee and Little Menomonee Rivers, the Milwaukee River, Oak Creek, the Root River, and Seminary Woods-St. Francis Lakeshore. In addition to the statewide legacy sites, the study also identified "other areas of interest," including Fitzsimmons Woods, the Milwaukee County Grounds, Ryan Creek, and the Whitnall Park Woods.

Environmental Corridors and Isolated Natural Resource Areas

One of the most important tasks completed under the regional planning program for Southeastern Wisconsin has been identifying and delineating areas containing concentrations of the best remaining elements of the natural resource base. Preserving these areas has been recognized as essential to maintaining the overall environmental quality of the Region and continually providing the amenities required to maintain a high quality of life for residents.

Seven elements of the natural resource base are considered essential to maintaining the ecological balance and the overall quality of life in the Region, and served as the basis for identifying the environmental corridor network. These seven elements are: 1) lakes, rivers, and streams and associated shorelands and floodplains; 2) wetlands; 3) woodlands; 4) prairies; 5) wildlife habitat areas; 6) wet, poorly drained, and organic soils; and 7) rugged terrain and high relief topography. In addition, there are certain other features which, although not a natural resource base element, are closely related to the natural resource base and were used to identify areas with recreational, aesthetic, ecological, and natural value. These features include existing park and open space sites, potential park and open space sites, historic sites, scenic areas and vistas, and natural areas.

These natural resource elements and resource-related features, when mapped on the landscape, concentrate in an essentially linear pattern of relatively narrow, elongated areas that have been termed "environmental corridors" by the Regional Planning Commission. Primary environmental corridors include a wide variety of the most important natural resources and are at least 400 acres in size, two miles long, and 200 feet wide. Secondary environmental corridors serve to link primary environmental corridors, or encompass areas containing concentrations of natural resources between 100 and 400 acres in size. Where secondary environmental corridors serve to link primary corridors, no minimum area or length criteria apply.

Secondary environmental corridors that do not connect primary corridors must be at least 100 acres in size and one mile long. An isolated concentration of natural resource features, encompassing at least five acres but not large enough to meet the size or length criteria for primary or secondary environmental corridors, is referred to as an isolated natural resource area. Environmental corridors and isolated natural resource areas in Milwaukee County in 2015 are shown on Map 2.22.

The primary environmental corridors in the Milwaukee County planning area are primarily located along major stream valleys and along the Lake Michigan shoreline. These primary environmental corridors contain almost all of the best remaining woodlands, wetlands, and wildlife habitat areas in the County planning area, and represent a composite of the best remaining elements of the natural resource base. Primary environmental corridors encompassed approximately 10,078 acres (15.7 square miles), or about 6.5 percent of the County, in 2015.

Secondary environmental corridors are generally located along the small perennial and intermittent streams within the County. Secondary environmental corridors also contain a variety of resource elements, often remnant resources from primary environmental corridors that have been developed for intensive urban or agricultural purposes. Secondary environmental corridors facilitate surface-water drainage, maintain pockets of natural resource features, and provide corridors for the movement of wildlife, as well as for the movement and dispersal of seeds for a variety of plant species. In 2015, secondary environmental corridors encompassed approximately 3,734 acres (5.8 square miles), or about 2.4 percent of the County.

In addition to the primary and secondary environmental corridors, other smaller pockets of wetlands, woodlands, surface water, or wildlife habitat exist within the Region. These pockets are isolated from the environmental corridors by urban development or agricultural use, and although separated from the environmental corridor network, these isolated natural resource areas have significant value. They may provide the only available wildlife habitat in an area, usually provide good locations for local parks, and lend unique aesthetic character and natural diversity to an area. Widely scattered throughout the County (see Map 2.22), isolated natural resource areas encompassed approximately 2,514 acres (3.9 square miles), or about 1.6 percent of the County, in 2015.

Preserving environmental corridors and isolated natural resource areas in essentially natural, open uses can help reduce flood flows, reduce noise pollution, and maintain air and water quality. Preserving corridors is important to the movement of wildlife and for the movement and dispersal of seeds for a variety of plant species. In highly urbanized areas, such as Milwaukee County, it is also important to protect and preserve

those natural resource areas located under major highways in order to maintain the warranted movement and protection of wildlife within and between corridors. In addition, because of the many interacting relationships between living organisms and their environment, destroying and deteriorating any one element of the natural resource base may lead to a chain reaction of deterioration and destruction. For example, destroying woodland cover may result in soil erosion and stream siltation, more rapid stormwater runoff and attendant increased flood flows and stages, as well as destroying wildlife habitat. Although the effects of any single environmental change may not be overwhelming, the combined effects will eventually create serious environmental and developmental problems. These problems include flooding, water pollution, deteriorating and destroying wildlife habitat, reducing groundwater recharge, as well as a decline in the scenic beauty of the County. The importance of maintaining the integrity of the remaining environmental corridors and isolated natural resource areas thus becomes apparent.

Fish and wildlife, songbirds, native plant distribution, and even clean water are all dependent upon movement through environmental corridors—and upon the vital functions they perform. Protecting and properly managing the resources found within environmental corridors helps prevent serious environmental problems. Maintaining environmental corridor wetlands as open space will allow them to function to their full natural capacity, thus protecting wildlife habitat and fish spawning beds, filtering stormwater runoff, storing floodwater, and preserving diverse, rare, or endangered plant communities. Preserving high quality woodlands within environmental corridors provides scenic beauty, upland plant and animal habitat, and protects against soil erosion that occurs with a loss of corridor. Woodlands are also vitally effective at infiltrating precipitation for groundwater recharge, which provides clean, cool groundwater inflow to lakes, streams, and wetlands, and replenishes well water supplies. If protected, environmental corridors can add value to the adjacent urban development and may be incorporated into the new development as private park and open space areas.

Park and Open Space Sites

A comprehensive regionwide inventory of park and open space sites was conducted in 1973 under the initial regional park and open space planning program conducted by SEWRPC. The inventory is updated periodically. The inventory identified all park and open space sites owned by a public agency, including Federal, State, County, and local units of government and school districts. The inventory also included privately owned outdoor recreation sites such as golf courses, campgrounds, boating access sites, hunting clubs, group camps, and special use outdoor recreation sites. As of 2020, there were 864 sites encompassing 22,839 acres of park and open space land in Milwaukee County.

Park and Open Space Sites Owned by Milwaukee County

Park and open space sites owned by Milwaukee County in 2020 are shown on Map 2.23 and listed in Table 2.24. In 2020, Milwaukee County owned 159 such sites. Of these sites, 157 were under the jurisdiction of the Parks Department, and encompassed 15,321 acres. These sites include 19 major parks, and 12 major parkways.[54] Two sites, encompassing 178 acres, were not under County Parks' jurisdiction.

The existing major parks are Bender Park; Brown Deer Park; Currie Park; Dretzka Park; Estabrook Park; Falk Park; Franklin Park; Greenfield Park; Grobschmidt Park; Jackson Park; Kletzsch Park; Kohl Park; Lake Michigan North, which is comprised of Back Bay, Bradford Beach, Juneau Park, Lake Park, McKinley Park, and Veterans Park; Lake Michigan South, which is comprised of Bay View Park, Cupertino Park, Grant Park, Sheridan Park, South Shore Park and Warnimont Park; Lincoln Park; Mitchell Park; Washington Park; Whitnall Park; and Wilson Park/Wilson Recreation Center. In addition to the existing major parks, the County also owns the Milwaukee County Zoo and the War Memorial and Art Center Grounds.

As listed in Table 2.24, there were two County-owned park and open space sites not under the jurisdiction of Milwaukee County Parks in 2020, including the 10-acre Camelot Park, which is leased to the City of Oak Creek, and the 168-acre Milwaukee County Zoo. Additional County park and open space sites with leases for facilities between Milwaukee County Parks and local governments or districts and private organizations are identified in Table 2.26.

From 2015 to 2017, the County recommended the rezoning of all County parklands throughout the County, at the discretion and formal approval of each community within the County, as an additional protective measure. When rezoned, the lands would be under the control of the County Board. Nearly all of the County park system parcels have been rezoned as park zoning or an equivalent zoning district.

The County-owned park and open space sites in Milwaukee County encompass about 10 percent of the total area of the County.

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[54] Major parks are defined as large, publicly owned outdoor recreation sites containing significant natural resource amenities which provide for opportunities for such resource-oriented activities as camping, golfing, picnicking, and swimming. Major parks included those classified as regional parks, which have an area of 100 acres or more.

Park and Open Space Sites Owned by the State of Wisconsin

As indicated in Table 2.25 and shown on Map 2.23, in 2015 there were 12 State-owned park and open space sites in Milwaukee County, encompassing 921 acres, or about 0.6 percent of the County. Of these sites, seven sites encompassing 439 acres were owned by the WDNR; one site, encompassing 203 acres, was owned by the Wisconsin State Fair Park Board; one site, encompassing 221 acres, was owned by the Southeast Wisconsin Professional Baseball Park District; one site, encompassing 25 acres, was owned by the University of Wisconsin; one site (11 acres) was owned by the Wisconsin Department of Transportation (WisDOT); and one site (22 acres) was the Monarch Conservancy Area, which involved lands owned by the University of Wisconsin-Milwaukee and WisDOT.

WDNR-owned sites include the Big Muskego Lake Wildlife Area, Forestry Education Center, Hank Aaron State Trail Access, Havenwoods State Forest, Lake Shore State Park, a wetland mitigation site, and a wildlife habitat site. The Wisconsin State Fair Park Board owns the State Fairgrounds; the Southeast Wisconsin Professional Baseball Park District owns Miller Park,[55] which consists of the Brewers Baseball Club stadium and surrounding lands; and the University of Wisconsin owns the Downer Woods.

Park and Open Space Sites Owned by Local Units of Government,
Public School Districts, and the Milwaukee Metropolitan Sewerage District

In addition to County and State-owned park and open space sites, there were 485 park and open space sites owned by local governments, public schools, or other public agencies in Milwaukee County in 2020. Those sites encompassed about 3,363 acres, or about 2.2 percent of the County. These sites are listed in Table 2.26 and shown on Map 2.24. The area attributed to school district sites includes only those portions of the site used for recreational purposes or in open space.

In addition to sites owned by local units of government, MMSD has acquired several sites in Milwaukee County as part of its Greenseams program. Greenseams is a flood management program that permanently protects key lands that store floodwaters. The program makes voluntary purchases of undeveloped, privately-owned properties in areas expected to have major growth and development within the near future, but which currently contain open space along streams, shorelines and wetlands. All land acquired will remain undeveloped, protecting water resources and providing the ability to store floodwaters. Maintaining and restoring wetlands at these sites will provide further water storage. As of 2020, MMSD had acquired 22 Greenseams sites in Milwaukee County encompassing about 593 acres.

[55] *As of January 2021, the stadium has been renamed to American Family Field.*

Private, Commercial, and Organizational Park and Open Space Sites

In 2020, there were 188 park and open space sites owned by organizations and/or owned for commercial purposes encompassing about 2,515 acres, or about 1.6 percent of the County. These sites include privately owned golf courses, schools, subdivision parks, ball fields, hunting clubs, campgrounds, boat access sites, horse stables, sports complexes, and soccer parks. Also included in this category are sites owned by private nonprofit conservancy organizations, such as the National Audubon Society. In 2020, there were six sites owned by private nonprofit conservancy organizations, encompassing 259 acres. All private sites are listed in Table 2.27 and are shown on Map 2.25.

2.4 CULTURAL RESOURCES

Cultural resources are evidence of past human activities and they are unique and nonrenewable. Cultural resources encompass archaeological sites and historic buildings, structures and sites, and also have important recreational and educational value in Milwaukee County. Cultural resources provide the County and each of its distinct communities with a sense of heritage, identity, and civic pride. Resources such as historical and archaeological sites and historic districts can also provide economic opportunities through tourism.

The NRCS is specifically required by the National Historical Preservation Act, the National Environmental Policy Act, and various other State and Federal laws to consider the impacts its conservation programs may have on cultural resources. To ensure protection, NRCS may require a cultural resource inventory as part of the conservation planning process. A qualified professional cultural resource consultant will prepare an inventory and report, which is submitted to the Wisconsin State Historic Preservation Office (SHPO). SHPO determines the eligibility of historical or archaeological site(s). The U.S. Army Corps of Engineers is also required by Federal law to protect cultural resources and cannot permit a wetland disturbance without a cultural resource assessment. New development, therefore, requires a detailed description of all structures or areas of archaeological or historic interest on the proposed site, and a detailed explanation of how the development will affect such structures or areas. To protect and preserve cultural resources, recommendations are made during the preliminary planning process to move roads, redesign structures, or change practices to avoid adverse effects to cultural resources.

Historical Resources

In 2020, there were 289 historic places and districts in the County listed on the National Register of Historic Places and the State Register of Historical Places. Of the 289 historic places and districts listed on the

National and State Registers, 215 are historic buildings or structures, 59 are historic districts, and 15 are historic sites. Sites and districts listed on the National and State Registers of Historic Places have an increased measure of protection against degradation and destruction. Listing on the National or State Register requires government agencies to consider the impact of their activities, such as the construction or reconstruction of a highway, or a permit that they issue, on the designated property. If the property would be adversely affected, the agency must work with the State Historic Preservation Officer to attempt to avoid or reduce adverse effects.

The 289 historic places and districts listed on the National and State registers of historic places are only a small fraction of the buildings, structures, and districts listed in the Wisconsin Architecture and History Inventory. The Wisconsin Architecture and History Inventory is a database administered by the State Historical Society of Wisconsin that contains historical and architectural information on approximately 148,000 properties statewide. The listed sites have architectural or historical characteristics that may make them eligible for listing on the National and State registers of historic places. In 2020, there were 32,315 properties in Milwaukee County included in the Wisconsin Architecture and History Inventory. The inventory can be accessed through the State of Wisconsin Historical Society website at www.wisconsinhistory.org/ahi.

Archaeological Resources

Preserving archaeological resources is also important in preserving the cultural heritage of Milwaukee County. Like historical sites and districts, significant prehistoric and historic archaeological sites provide the County and each of its communities with a sense of heritage and identity, which can provide for economic opportunities through tourism if properly identified and preserved. Archaeological sites found in Milwaukee County fall under two categories: prehistoric sites and historic sites. Prehistoric sites are defined as those sites which date from before written history. Historic sites are sites established after history began to be recorded in written form (the State Historical Society of Wisconsin defines this date as A.D. 1650).

As of August 2019, there were 577 known prehistoric and historic archaeological sites in Milwaukee County listed in the State Historical Society's Archaeological Sites Inventory, including prehistoric and historic camp sites, villages, and farmsteads; marked and unmarked burial sites; and Native American mounds.

2.5 DEMOGRAPHICS AND LAND USE

Demographics

The historical and current population of Milwaukee County is set forth in Table 2.28. Between 1850 and 1890, the total population in Milwaukee County increased rapidly from 31,077 to 236,101 residents. The County experienced less rapid growth rates in the decades between 1890 and 1930, with population gains during these decades being between about 25 percent and almost 40 percent. Growth stagnated during the 1930s Depression Era, but picked up again during the decades from 1940 to 1960, including a population gain of almost 19 percent from 1950 to 1960. Rapid growth during this period can be attributed to both the migration of new residents to Milwaukee County and the natural increase of the existing population (more births than deaths). After World War II, the existing population grew as soldiers returned home and began families, creating the baby-boom generation. Federal subsidies for home ownership led to suburban migration, as families sought newer single-family homes outside the central city. Federal legislation adopted in 1956 led to the construction of a new network of freeways and expressways, providing convenient highway access between suburbs and central city areas. The County's growth slowed between 1960 and 1970 to a rate of about 2 percent. In each of the decades between 1970 and 2000, the population of the County decreased. Between 1970 and 1980, the decrease was greater than 8 percent. In both decades between 1980 and 2000, the decreases were 2 percent or less. From 2000 to 2010, the County population increased by almost 7,600 residents. Based on the 2020 Decennial U.S. Census, the population for Milwaukee County in 2020 was 939,489 people. This represents a decrease of 8,246 people, or about 1 percent, since 2010.

The historical growth and development of Milwaukee County is depicted on Map 2.26. As shown on that map, urban development in the County was largely confined to the City of Milwaukee area along Lake Michigan and the Menomonee and Milwaukee Rivers before 1850. Over the next 50 years, from 1850 to 1900, as public water and sewer systems, electricity, telephone, and gas used for cooking and heating became available, growth continued in the City of Milwaukee area. Additional growth also occurred away from the historic downtown center of Milwaukee with an emergence of small urban centers in the Cities of Cudahy, Wauwatosa, and South Milwaukee and the Villages of Hales Corners and Whitefish Bay. Between 1900 and 1950, urban development continued to expand outward from the City of Milwaukee as well as around the smaller urban centers. During the period between 1950 and 1963, significant growth was experienced adjacent to existing urban areas and in scattered enclaves in the southern part of the County. In the decades after 1963, scattered urban development continued to occur throughout the County, particularly in the southern and northwestern portions of the County.

Land Use

Soil erosion problems, water pollution problems, land use conflicts, including recreational use and the risk of damage to the environment, as well as the ultimate means for abatement of these problems, are primarily a function of human activities within the County, and of the ability of the underlying natural resource base to sustain those activities. This becomes especially significant in areas near lakes, wetlands, and streams. Accordingly, the land uses and attendant population levels in the County are important considerations in the development of Milwaukee County's land and water resource management plan. The Regional Planning Commission's land use inventory delineates and quantifies the area devoted to various urban and nonurban land uses throughout the Southeastern Wisconsin Region. The initial regional land use inventory was completed in 1963, while the most recent inventory was completed in 2015. Existing land uses in the County in 2015 are shown on Map 2.27 and are quantitatively summarized in Table 2.29 and Figure 2.1.

Urban Land Uses

Urban land uses consist of residential; commercial; industrial; governmental and institutional; and transportation, communication, and utility uses. As indicated in Table 2.29 and on Map 2.27, urban land uses encompassed about 117,666 acres, or about 76 percent of the County, in 2015. Residential land uses comprised the largest urban land use category in the County, encompassing 51,869 acres, or about 44 percent of all urban land and about 33 percent of all land in the County. Intensively used recreational land encompassed about 8,000 acres, or about 7 percent of all urban land and about 5 percent of all land in the County.

Nonurban Land Uses

Nonurban land uses consist of agricultural lands; natural resource areas, including surface waters, wetlands, and woodlands; quarries and landfills; and open land. As indicated in Table 2.29 and on Map 2.27, nonurban land uses encompassed about 37,677 acres, or about 24 percent of the County, in 2015. Agricultural land encompassed 8,507 acres, or about 23 percent of nonurban land uses and about 5 percent of all land in the County. As indicated on Map 2.27, most of the existing agricultural land is located in the Cities of Franklin and Oak Creek. Agricultural lands include all croplands, pasture lands, orchards, nurseries, and nonresidential farm buildings.

Natural resource areas, consisting of surface water, wetlands, and woodlands, encompassed 14,686 acres, or about 39 percent of nonurban land uses and about 10 percent of all land in the County in 2015. Natural resource areas are located in the southern and northern portions of the County and along major streams and rivers. In 2015, Milwaukee County contained 7,440 acres of wetland, representing about 20 percent of

nonurban land uses and about 5 percent of all land in the County, and 5,691 acres of woodland, representing about 15 percent of nonurban land uses and about 4 percent of all land in the County. The remaining 1,555 acres of natural resource areas consisted of surface water, which represented about 4 percent of nonurban land uses and 1 percent of all land in the County.

The remaining 14,484 acres consisted of a combination of quarries and other extractive lands, landfills, and open lands. In 2015, these lands represented about 38 percent of nonurban land uses and about 9 percent of all land in the County.

Chapter 2

RESOURCE ASSESSMENT

TABLES

Table 2.1
Hydric Soils in Milwaukee County: 2018

Civil Division	Hydric Soils (acres)[a]	Percent of Civil Division Area
City of Cudahy	111.0	3.6
City of Franklin	2,759.1	12.4
City of Glendale	135.3	3.5
City of Greenfield	859.5	11.6
City of Milwaukee	1,664.4	2.7
City of Oak Creek	2,911.4	16.0
City of St. Francis	--	--
City of South Milwaukee	19.3	0.6
City of Wauwatosa	245.8	2.9
City of West Allis	498.9	6.8
Village of Bayside	--	--
Village of Brown Deer	118.1	4.2
Village of Fox Point	9.8	0.5
Village of Greendale	683.9	19.2
Village of Hales Corners	183.4	9.0
Village of River Hills	110.7	3.2
Village of Shorewood	--	--
Village of West Milwaukee	--	--
Village of Whitefish Bay	--	--
Milwaukee County Total	10,310.6	6.6

[a] *Because soil survey data are not available for portions of Milwaukee County, these acreages should be considered minimum values.*

Source: U.S. Department of Agriculture Natural Resources Conservation Service and SEWRPC

Table 2.2
Agricultural Soil Capability in Milwaukee County Communities

Civil Division	Class I Soils (acres)	Class II Soils (acres)	Class III Soils (acres)	Class IV, V, VI, VII, and VIII Soils (acres)	Unclassified Soils (acres)	Surface Water (acres)	Total (acres)
City of Cudahy	0.0	2,159.6	28.7	454.5	404.8	6.6	3,054.2
City of Franklin	53.8	18,158.0	2,258.0	1,339.9	44.3	344.2	22,198.2
City of Glendale	2.7	1,182.3	344.5	250.5	1,901.0	136.5	3,817.5
City of Greenfield	0.0	4,226.4	595.8	597.0	1,960.3	9.5	7,389.0
City of Milwaukee	18.7	15,535.5	1,345.6	5,984.6	38,390.4	606.0	61,880.8
City of Oak Creek	27.9	15,214.9	1,729.9	1,046.3	45.4	151.9	18,216.3
City of St. Francis	0.0	0.0	0.0	0.0	1,644.9	1.5	1,646.4
City of South Milwaukee	0.0	2,667.0	18.9	401.4	0.7	9.0	3,097.0
City of Wauwatosa	3.0	3,676.8	729.7	1,301.8	2,679.2	75.3	8,465.8
City of West Allis	0.0	2,237.7	299.6	1,097.2	3,647.3	18.0	7,299.8
Village of Bayside	0.0	1,268.4	31.5	174.5	0.2	4.8	1,479.4
Village of Brown Deer	76.7	2,351.9	100.1	268.1	0.6	14.4	2,811.8
Village of Fox Point	0.0	1,487.1	111.7	235.2	2.4	1.6	1,838.0
Village of Greendale	0.0	2,101.6	694.8	749.8	3.6	14.8	3,564.6
Village of Hales Corners	0.0	1,679.7	196.2	159.2	1.5	9.2	2,045.8
Village of River Hills	0.2	2,770.3	363.6	119.5	7.7	149.8	3,411.1
Village of Shorewood	0.0	0.0	0.0	0.0	1,021.0	1.0	1,022.0
Village of West Milwaukee	0.0	0.0	0.0	0.0	719.0	0.8	719.8
Village of Whitefish Bay	0.0	1.2	0.0	2.1	1,354.9	0.2	1,358.4
Milwaukee County Total	183.0	76,718.4	8,848.6	14,181.6	53,829.2	1,555.1	155,315.9[a]
Percent of Total County Lands	0.1	49.4	5.7	9.1	34.7	1.0	100.0

[a] *The total acreage for Milwaukee County is 155,343 acres. Areas along the Lake Michigan shoreline within Milwaukee County (totaling about 27 acres) were neither labeled as a classified soil nor an unclassified soil by the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS). The difference between total acreages is primarily due to mapping discrepancies between the USDA-NRCS and SEWRPC.*

Source: U.S. Department of Agriculture Natural Resources Conservation Service and SEWRPC

Table 2.3
Existing Agricultural Lands in Milwaukee County: 2015

Civil Division	Cultivated Lands (acres)	Percent of Agricultural Lands	Pasture Land and Unused Agricultural Lands (acres)	Percent of Agricultural Lands	Orchards and Nurseries (acres)	Percent of Agricultural Lands	Special Agriculture (acres)	Percent of Agricultural Lands	Farm Buildings (acres)	Percent of Agricultural Lands	Total Agricultural Lands (acres)
City of Cudahy	33.1	100.0	--	--	--	--	--	--	--	--	33.1
City of Franklin	4,203.4	79.7	761.1	14.4	238.0	4.5	--	--	72.2	1.4	5,274.7
City of Glendale	--	--	--	--	--	--	--	--	--	--	0.0
City of Greenfield	--	--	--	--	2.4	100.0	--	--	--	--	2.4
City of Milwaukee	149.0	87.7	7.1	4.2	11.9	7.0	0.7	0.4	1.2	0.7	169.9
City of Oak Creek	2,143.9	72.4	747.8	25.2	41.7	1.4	--	--	28.4	1.0	2,961.8
City of St. Francis	--	--	--	--	--	--	--	--	--	--	0.0
City of South Milwaukee	--	--	--	--	--	--	--	--	--	--	0.0
City of Wauwatosa	--	--	--	--	--	--	--	--	--	--	0.0
City of West Allis	--	--	--	--	--	--	--	--	--	--	0.0
Village of Bayside	--	--	--	--	--	--	--	--	--	--	0.0
Village of Brown Deer	7.2	100.0	--	--	--	--	--	--	--	--	7.2
Village of Fox Point	--	--	--	--	--	--	--	--	--	--	0.0
Village of Greendale	--	--	--	--	--	--	--	--	--	--	0.0
Village of Hales Corners	--	--	--	--	--	--	--	--	--	--	0.0
Village of River Hills	42.7	74.0	13.3	23.1	--	--	--	--	1.7	2.9	57.7
Village of Shorewood	--	--	--	--	--	--	--	--	--	--	0.0
Village of West Milwaukee	--	--	--	--	--	--	--	--	--	--	0.0
Village of Whitefish Bay	--	--	--	--	--	--	--	--	--	--	0.0
Milwaukee County Total	6,579.3	77.3	1,529.3	18.0	294.0	3.5	0.7	<0.1	103.5	1.2	8,506.8
Percent of Total County Lands	4.2	--	1.0	--	0.2	--	<0.1	--	0.1	--	5.5

Source: SEWRPC

Table 2.4
Farm Size in Milwaukee County and Wisconsin: 2017

	Milwaukee County		State of Wisconsin	
Size (acres)[a]	Number	Percent	Number	Percent
Less than 10	48	55.8	5,923	9.1
10 to 49	24	27.9	16,919	26.1
50 to 179	4	4.7	21,254	32.8
180 to 499	8	9.3	14,177	21.9
500 to 999	2	2.3	4,180	6.5
1,000 or More	0	0.0	2,340	3.6
Total	86	100.0	64,793	100.0

[a] *These data include land owned by the farmer, not lands that the farmer may rent.*

Source: U.S. Department of Agriculture National Agricultural Statistics Service, 2017 Census of Agriculture

Table 2.5
Agricultural Sectors in Milwaukee County and Wisconsin: 2017

	Milwaukee County		State of Wisconsin	
Value of Sales	2017 Sales (in thousands)	Percent of Total Agricultural Revenue	2017 Sales (in thousands)	Percent of Total Agricultural Revenue
Livestock, Poultry, and their Products[a]	260	3.8	7,359,987	64.4
Horticulture	3,971	58.4	264,098	2.3
Grains (crops)	1,133	16.7	2,772,764	24.3
Vegetables	1,267	18.6	542,954	4.7
Other	167	2.5	487,620	4.3
Total	6,798	100.0	11,427,423	100.0

[a] *This includes poultry and eggs; cattle and calves; milk and other dairy products from cows; hogs and pigs; and sheep, goats, and their products.*

Source: U.S. Department of Agriculture National Agricultural Statistics Service, 2017 Census of Agriculture

Table 2.6
Farms in Milwaukee County and Wisconsin by Value of Sales: 2017

	Milwaukee County		State of Wisconsin	
Value of Sales	Number	Percent	Number	Percent
Less than $2,500	24	27.9	20,714	32.0
$2,500 to $4,999	15	17.4	4,837	7.5
$5,000 to $9,999	11	12.8	5,653	8.7
$10,000 to $24,999	9	10.5	7,186	11.1
$25,000 to $49,999	1	1.2	4,951	7.6
$50,000 to $99,999	8	9.3	5,572	8.6
$100,000 or More	18	20.9	15,880	24.5
Total	86	100.0	64,793	100.0

Source: U.S. Department of Agriculture National Agricultural Statistics Service, 2017 Census of Agriculture

Table 2.7
Bluff Stability and Shoreline Recession along Lake Michigan in Milwaukee County: 1995

Shoreline Analysis Reach (see Map 2.8)	Bluff Heights (feet)	Deterministic Bluff Stability Safety Factor		Shoreline Recession Data 1963-1995		Estimated Beach Width (feet)	
		1995 Conditions	1977 Conditions	Total (feet)	Annual Average (feet per year)	1995 Conditions	1977 Conditions
Reach 7	60-125	0.08-1.59	0.54-1.43	10-400	0.3-12.5	0-150	0-20
Reach 8	25-110	0.74-1.95	0.33-1.69	10-330	0.3-10.3	0-600	0-20
Reach 9	0-25	2.40	1.21	20-70	0.6-2.2	0-200	0-20
Reach 10	70-120	0.95-1.62	0.45-2.97	90-80	2.8-2.5	0-150	10-30
Reach 11[a]	80-100	1.07-2.34	0.85-1.71	10-70	0.3-2.1	5-170	15-30

[a] *Data are presented for only that portion of Reach 11 that is in Milwaukee County*

Source: SEWRPC

Table 2.8
Applicable Water Use Objectives and Water Quality Criteria and Guidelines for Lakes and Streams Within Milwaukee County

Water Quality Parameter	Designated Use Category[a,b]					Source
	Warmwater Fish and Aquatic Life	Limited Forage Fish Community (Variance Category)	Special Variance Category A[c]	Special Variance Category B[d]	Limited Aquatic Life Community (Variance Category)	
Temperature (°F)	See Tables 2.10, 2.11, and 2.12					NR 102 Subchapter II
Dissolved Oxygen (mg/l)	5.0 minimum	3.0 minimum	2.0 minimum	2.0 minimum	1.0 minimum	NR 102.04(4) NR 102.04(3) NR 102.06(2)
pH Range (Standard Units)	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	6.0-9.0	NR 102.04(4)[e]
Fecal Coliform Bacteria (MFFCC per 100 ml)[f]						NR 102.04(5) NR 104.06(2)
Geometric Mean	200	200	1,000	1,000	200	
Single Sample Maximum	400	400	2,000	--	400	
E. Coli Bacteria (cfu per 100 ml)[g]						NR 102.04(5)
Geometric Mean	126	126	126	--	126	NR 104.06(2)
Single Sample Maximum	410	410	410	--	410	
Total Phosphorus (mg/l)						NR 102.06(3)
Designated Streams[h]	0.100	0.100	0.100	0.100	0.100	NR 102.06(4)
Other Streams	0.075	0.075	0.075	0.075	--	NR 102.06(5)
Stratified Reservoirs	0.030	0.030	0.030	0.030	--	NR 102.06(6)
Unstratified Reservoirs	0.040	0.040	0.040	0.040	--	
Stratified Two-story Fishery Lakes	0.015	0.015	0.015	0.015	--	
Stratified Drainage Lakes	0.030	0.030	0.030	0.030	--	
Unstratified Drainage Lakes	0.040	0.040	0.040	0.040	--	
Stratified Seepage Lakes	0.020	0.020	0.020	0.020	--	
Unstratified Seepage Lakes	0.040	0.040	0.040	0.040	--	
Chloride (mg/l)						NR 105.05(2)
Acute Toxicity[i]	757	757	757	757	757	NR 105.06(5)
Chronic Toxicity[j]	395	395	395	395	395	

[a] *NR 102.04(1) All surface waters shall meet the following conditions at all times and under all flow conditions: (a) Substances that will cause objectionable deposits on the shore or in the bed of a body of water, shall not be present in such amounts as to interfere with public rights in waters of the state. (b) Floating or submerged debris, oil, scum, or other material, shall not be present in amounts as to interfere with public rights in waters of the state. (c) Materials producing color, odor, taste, or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state. (d) Substances in concentrations 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.*

[b] *There no streams classified as Coldwater Community in Milwaukee County.*

[c] *As set forth in Chapter NR 104.06(2)(a) of the* Wisconsin Administrative Code. *This includes Honey Creek, Indian Creek, the Kinnickinnic River, Lincoln Creek, the Menomonee River downstream from the confluence with Honey Creek, and Underwood Creek downstream from Juneau Boulevard.*

[d] *As set forth in Chapter NR 104.06(2)(b) of the* Wisconsin Administrative Code. *This includes the Milwaukee River downstream from the site of the former North Avenue Dam, Burnham Canal, and the South Menomonee Canal.*

[e] *The pH shall be within the stated range with no change greater than 0.5 unit outside the natural seasonal maximum and minimum.*

[f] *In May 2020, the WDNR changed the indicator used in Wisconsin's recreational use water quality criteria from fecal coliform bacteria to the bacterium* Escherichia coli (E. coli).

Table continued on next page.

Table 2.8 (Continued)

[g] *Under the changed criteria, the geometric mean of* E. coli *in samples collected over any 90-day period between May 1 and September 30 shall not exceed the standard listed in the table. In addition, the concentrations of* E. coli *shall not exceed the standard listed in the table in more than 10 percent of the samples collected over any 90-day period between May 1 and September 30.*

[h] *Designated in Chapter NR 102.06(3)(a) of the Wisconsin Administrative Code. This includes the Milwaukee River throughout the County, the Kinnickinnic River downstream from the confluence with Wilson Park Creek, and the Menomonee River downstream from the confluence with the Little Menomonee River.*

[i] *The acute toxicity criterion is the maximum daily concentration of a substance which ensures adequate protection of sensitive species of aquatic life from the acute toxicity of that substance and will adequately protect the designated fish and aquatic life use of the surface water if not exceeded more than once every three years.*

[j] *The chronic toxicity criterion is the maximum four-day concentration of a substance which ensures adequate protection of sensitive species of aquatic life from the chronic toxicity of that substance and will adequately protect the designated fish and aquatic life use of the surface water if not exceeded more than once every three years.*

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 2.9
Ambient Temperatures and Water Quality Criteria for Temperature for Streams and Lakes in Milwaukee County: 2020[a,b]

	Large Warmwater Communities[c] (°F)			Small Warmwater Communities[d] (°F)			Limited Forage Fish Communities[e] (°F)			Inland Lakes and Impoundments[f] (°F)		
Month	Ta	SL	A	Ta	SL	A	Ta	SL	A	Ta	SL	A
January	33	49	76	33	49	76	37	54	78	35	49	77
February	33	50	76	34	50	76	39	54	79	39	52	78
March	36	52	76	38	52	77	43	57	80	41	55	78
April	46	55	79	48	55	79	50	63	81	49	60	80
May	60	65	82	58	65	82	59	70	84	58	68	82
June	71	75	85	66	76	84	64	77	85	70	75	86
July	75	80	86	69	81	85	69	81	86	77	80	87
August	74	79	86	67	81	84	68	79	86	76	80	87
September	65	72	84	60	73	82	63	73	85	67	73	85
October	52	61	80	50	61	80	55	63	83	54	61	81
November	39	50	77	40	49	77	46	54	80	42	50	78
December	33	49	76	35	49	76	40	54	79	35	49	77

Note: Acronyms for temperature criteria categories include: Ta-ambient temperature, SL-sublethal temperature, and A-acute temperature. The ambient temperature, sublethal temperature water quality criterion, and acute temperature water quality criterion specified for any calendar month shall be applied simultaneously to establish the protection needed for each identified fish and other aquatic life use. The sublethal criteria are to be applied as the mean of the daily maximum water temperatures over a calendar week. The acute criteria are to be applied as the daily maximum temperature. The ambient temperature is used to calculate the corresponding acute and sublethal criteria and for determining effluent limitations in discharge permits under the Wisconsin Pollutant Discharge Elimination System.

[a] *As set forth in Section NR 102.25 of the* Wisconsin Administrative Code.

[b] *There no streams classified as Coldwater Community in Milwaukee County.*

[c] *Waters with a fish and aquatic life use designation of "warmwater sportfish community" or "warmwater forage fish community" and unidirectional 7Q10 flows greater than or equal to 200 cubic feet per second. The 7Q10 flow is the seven-day consecutive low flow with a 10 percent annual probability of occurrence (10-year recurrence interval).*

[d] *Waters with a fish and aquatic life use designation of "warmwater sportfish community" or "warmwater forage fish community" and unidirectional 7Q10 flows less than 200 cubic feet per second. The 7Q10 flow is the seven-day consecutive low flow with a 10 percent annual probability of occurrence (10-year recurrence interval).*

[e] *Waters with a fish and aquatic life use designation of "limited forage fish community."*

[f] *Values are applicable for those lakes and impoundments south of STH 10.*

Source: Wisconsin Department of Natural Resources

Table 2.10
Characteristics of Streams in the Menomonee River Watershed in Milwaukee County: 2002-2011

Stream Reach	Stream Length (miles)	Codified Water Use Objective[b]	Percent of Samples Meeting Water Quality Criteria[a] (total number of samples indicated in parentheses)							303(d) Impairments
			Dissolved Oxygen	Temperature		Chloride		Total Phosphorus	Fecal Coliform Bacteria	
				Sublethal	Acute	Chronic	Acute			
Mainstem										
Menomonee River between N. 124th Street and County Line Road	10.0	FAL	99.9 (1,415)	91.7 (254)	100.0 (1,856)	97.5 (448)	99.6 (448)	33.8 (480)	34.5 (220)	Aquatic toxicity, impairment unknown
Menomonee River between W. Hampton Avenue and N. 124th Street	1.0	FAL	98.7 (230)	- -	- -	98.7 (234)	100.0 (234)	34.9 (232)	35.0 (226)	Aquatic toxicity, impairment unknown
Menomonee River between N. 70th Street and W. Hampton Avenue	4.5	FAL	99.9 (1,095)	92.3 (155)	99.9 (1,168)	91.0 (546)	97.3 (546)	46.4 (640)	20.9 (282)	Aquatic toxicity, impairment unknown
Menomonee River between N. 25th Street and N. 70th Street	6.2	Variance Water (NR 104.06(2)(a)(7))	100.0 (171)[c]	95.2 (42)	99.0 (314)	97.1 (137)	98.5 (137)	24.5 (143)	58.1 (322)	Aquatic toxicity, bacteria, dissolved oxygen, fish consumption advisory
Menomonee River between Muskego Avenue and N. 25th Street[d]	0.9	Variance Water (NR 104.06(2)(a)(7))	100.0 (485)[c]	- -	- -	94.6 (662)	98.8 (662)	46.4 (659)	49.6 (274)	Aquatic toxicity, bacteria, dissolved oxygen, fish consumption advisory
Menomonee River from confluence with Milwaukee River to Muskego Avenue[d]	0.9	Variance Water (NR 104.06(2)(a)(7))	100.0 (499)[c]	- -	- -	98.8 (483)	99.8 (483)	58.0 (490)	69.8 (245)	Aquatic toxicity, bacteria, dissolved oxygen, fish consumption advisory
Tributary Streams										
Dretzka Park Creek	3.1	FAL	--	--	--	--	--	--	--	--
Noyes Park Creek	2.5	FAL	100.0 (13)	81.0 (21)	99.3 (153)	--	--	--	--	Aquatic toxicity, temperature
Little Menomonee River	11.2	FAL	87.5 (1,239)	93.7 (189)	98.8 (501)	99.1 (114)	99.1 (114)	14.1 (269)	16.7 (24)	Aquatic toxicity, bacteria, degraded habitat, temperature
Grantosa Creek	1.4	FAL	100.0 (2)	--	--	--	--	--	--	High Phosphorous

Table continued on next page.

Table 2.10 (continued)

Stream Reach	Stream Length (miles)	Codified Water Use Objective[b]	Percent of Samples Meeting Water Quality Criteria[a] (total number of samples indicated in parentheses)							303(d) Impairments
			Dissolved Oxygen	Temperature		Chloride		Total Phosphorus	Fecal Coliform Bacteria	
				Sublethal	Acute	Chronic	Acute			
Tributary Streams (continued)										
South Branch of Underwood Creek	1.0	FAL	73.6 (34)	--	--	--	--	43.3 (30)	21.9 (32)	Aquatic toxicity, degraded habitat
Underwood Creek concrete channel from confluence with the Menomonee River to Juneau Boulevard	1.5	Variance Water (NR 104.06(2)(a)(1))	100.0 (601)[c]	63.2 (87)	93.3 (640)	90.4 (307)	97.3 (307)	19.9 (176)	63.0 (46)	Aquatic toxicity, bacteria, degraded habitat, temperature
Honey Creek	10.0	Variance Water (NR 104.06(2)(a)(6))	99.3 (1,130)[c]	92.3 (130)	100.0 (946)	80.8 (360)	95.0 (360)	12.2 (377)	39.5 (142)	Aquatic toxicity, bacteria, degraded habitat
Woods Creek	0.5	FAL	--	--	--	--	--	--	--	--
South Menomonee Canal[d]	0.4	Variance Water (NR 104.06(2)(b)(2))	--	--	--	--	--	--	--	--
Burnham Canal[d]	1.2	Variance Water (NR 104.06(2)(b)(2))	100.0 (138)	--	--	97.8 (136)	99.3 (136)	25.0 (136)	86.0 (136)	Aquatic toxicity

[a] *Number in parentheses shows number of samples.*

[b] *FAL indicates warmwater fish and aquatic life.*

[c] *A special variance standard for dissolved oxygen concentration of 2.0 milligrams per liter applies to the Menomonee River downstream from the confluence with Honey Creek, Honey Creek, and Underwood Creek from the confluence with the Menomonee River upstream to Juneau Boulevard.*

[d] *Site is also located within the Milwaukee Harbor Estuary, which encompasses the Menomonee River from below the former Falk Corporation Dam to the Lake Michigan breakwater. The Estuary is the area where the Milwaukee, Menomonee, and Kinnickinnic Rivers meet and mix with Lake Michigan water.*

Source: Milwaukee Metropolitan Sewerage District, U.S. Geological Survey, Wisconsin Department of Natural Resources, U.S. Environmental Protection Agency, University of Wisconsin-Extension, Milwaukee Riverkeeper, and SEWRPC

Table 2.11
Characteristics of Streams in the Oak Creek Watershed in Milwaukee County: 2007-2016

Stream Reach	Stream Length (miles)	Percent of Samples Meeting Water Quality Criteria[a]										303(d) Impairments
			Temperature		Chloride			Bacteria				
								Fecal Coliform Bacteria		*Escherichia coli (E. coli)*		
		Dissolved Oxygen	Sublethal	Acute	Chronic	Acute	Total Phosphorus	Single Sample Value	Geometric Mean	Statistical Test Value	Geometric Mean	
Mainstem												
Oak Creek above W. Ryan Road-west crossing	1.5	72.1 (61)	84.4 (32)	100.0 (229)	--	--	71.4 (14)	--	--	26.5 (83)	13.3 (83)	Aquatic toxicity, degraded habitat
Oak Creek between W. Ryan Road-west crossing and the confluence with North Branch Oak Creek	2.7	81.8 (187)	86.0 (136)	99.4 (990)	77.4 (84)	97.6 (84)	76.5 (102)	59.0 (83)	43.4 (83)	53.7 (95)	20.0 (95)	Aquatic toxicity, degraded habitat
Oak Creek between confluence with North Branch Oak Creek and E. Forest Hill Avenue	3.5	89.2 (288)	85.5 (83)	100.0 (603)	83.1 (172)	97.1 (172)	58.4 (197)	60.0 (170)	43.5 (170)	56.1 (173)	24.6 (173)	Aquatic toxicity, degraded habitat
Oak Creek between E. Forest Hill Avenue and S. Pennsylvania Avenue	1.6	92.5 (201)	87.5 (64)	100.0 (458)	84.9 (86)	98.8 (86)	52.3 (111)	56.5 (85)	35.3 (85)	48.7 (197)	18.7 (197)	Aquatic toxicity, degraded habitat
Oak Creek between S. Pennsylvania Avenue and 15th Avenue	1.9	98.5 (200)	91.4 (116)	100.0 (845)	74.1 (108)	90.7 (108)	62.0 (100)	31.3 (83)	19.3 (83)	29.9 (97)	15.5 (97)	Aquatic toxicity, degraded habitat
Oak Creek between 15th Avenue and Oak Creek Parkway	1.6	100.0 (64)	84.4 (32)	100.0 (229)	--	--	83.3 (12)	--	--	35.8 (120)	13.3 (120)	Aquatic toxicity, degraded habitat
Oak Creek between Oak Creek Parkway and Oak Creek Millpond	0.2	99.6 (274)	56.3 (64)	81.9 (458)	88.4 (86)	100.0 (86)	70.4 (115)	43.5 (85)	22.4 (85)	44.9 (243)	23.5 (243)	Aquatic toxicity, degraded habitat
Oak Creek between Oak Creek Millpond and confluence with Lake Michigan	1.0	100.0 (178)	80.6 (31)	100.0 (225)	89.5 (86)	100.0 (86)	68.9 (106)	51.8 (85)	37.6 (85)	52.1 (169)	21.3 (169)	Aquatic toxicity, degraded habitat
Tributary Streams												
Mitchell Field Drainage Ditch between S. Howell Avenue and College Avenue	1.5	35.6 (87)	81.3 (32)	100.0 (229)	45.5 (33)	63.6 (33)	41.7 (24)	--	--	63.0 (100)	19.0 (100)	Aquatic toxicity
Mitchell Field Drainage Ditch between College Avenue and Rawson Avenue	1.0	41.7 (60)	91.2 (114)	99.7 (933)	--	--	30.8 (13)	--	--	72.4 (58)	39.7 (58)	Aquatic toxicity
Mitchell Field Drainage Ditch between Rawson Avenue and confluence with Oak Creek	0.8	84.4 (32)	--	--	--	--	--	--	--	--	--	Aquatic toxicity
Unnamed Tributary to Oak Creek (near E. Puetz Road)	1.0	--	93.3 (30)	100.0 (222)	--	--	--	--	--	--	--	--
North Branch Oak Creek above S. 6th Street-north crossing	1.9	96.6 (59)	79.7 (64)	100.0 (458)	--	--	46.2 (13)	--	--	74.4 (82)	53.7 (82)	Aquatic toxicity
North Branch Oak Creek between S. 6th Street-north crossing and Weatherly Drive	2.1	93.2 (59)	79.7 (64)	100.0 (458)	--	--	76.9 (13)	--	--	72.0 (100)	43.0 (100)	Aquatic toxicity
North Branch Oak Creek between Weatherly Drive and confluence with Oak Creek	1.8	96.3 (54)	81.9 (171)	98.3 (1,235)	--	--	0.0 (1)	--	--	--	--	Aquatic toxicity
Southland Creek	2.3	--	93.8 (32)	100.0 (229)	--	--	--	--	--	--	--	--
Unnamed Creek 5	1.3	62.1 (58)	84.4 (32)	100.0 (229)	--	--	58.3 (12)	--	--	63.8 (58)	37.9 (58)	--
Unnamed Creek	2.0	--	84.4 (32)	100.0 (229)	--	--	--	--	--	--	--	--
Unnamed Creek	--	--	--	--	--	--	--	--	--	--	--	--

[a] *Number in parentheses shows number of samples.*

Source: SEWRPC

Table 2.12
Characteristics of Streams in the Root River Watershed in Milwaukee County: 2005-2012

Stream Reach	Stream Length (miles)	Codified Water Use Objective[b]	Percent of Samples Meeting Water Quality Criteria[a]										303(d) Impairments
				Temperature		Chloride			Bacteria				
									Fecal Coliform Bacteria		*Escherichia coli (E. coli)*		
			Dissolved Oxygen	Sublethal	Acute	Chronic	Acute	Total Phosphorus	Single Sample	Geometric Mean	Single Sample	Geometric Mean	
Mainstem													
Root River above W. Cleveland Avenue	1.1	FAL	57.5 (73)	--	--	100.0 (74)	100.0 (74)	46.6 (73)	26.0 (73)	16.4 (73)	--	--	Aquatic toxicity, dissolved oxygen, degraded habitat
Root River between the intersection of W. National Avenue and W. Oklahoma Avenue and Cleveland Avenue	0.5	FAL	48.3 (263)	91.7 (22)	100.0 (184)	71.6 (76)	97.4 (76)	18.8 (80)	16.0 (75)	9.3 (75)	--	--	Aquatic toxicity, dissolved oxygen, degraded habitat
Root River between W. Cold Spring Road and the intersection of W. National Avenue and W. Oklahoma Avenue	0.8	FAL	22.9 (376)	94.9 (39)	100.0 (282)	96.1 (76)	100.0 (76)	26.5 (83)	29.7 (74)	29.7 (74)	14.9 (74)	--	Aquatic toxicity, dissolved oxygen, degraded habitat
Root River between W. Grange Avenue and W. Cold Spring Road	2.5	FAL	37.2 (392)	97.4 (38)	100.0 (291)	89.9 (79)	98.7 (79)	24.4 (86)	26.8 (82)	14.6 (71)	0.0 (6)	0.0 (6)	Aquatic toxicity, dissolved oxygen, degraded habitat
Root River between W. Drexel Avenue and W. Grange Avenue	5.8	FAL	100.0 (1)	--	--	--	--	--	--	--	--	--	Aquatic toxicity, dissolved oxygen, degraded habitat
Root River between W. Ryan Road and W. Drexel Avenue	2.9	FAL	93.7 (79)	--	--	98.7 (76)	100.0 (76)	39.0 (82)	62.5 (80)	42.5 (80)	57.1 (7)	28.6 (7)	Aquatic toxicity, dissolved oxygen, degraded habitat
Root River between County Line Road and W. Ryan Road	5.2	FAL	85.4 (82)	--	--	100.0 (76)	100.0 (76)	9.3 (75)	65.8 (73)	38.4 (73)	--	--	Dissolved oxygen, degraded habitat
Tributary Streams													
Hale Creek	1.0	FAL	--	--	--	--	--	--	--	--	--	--	--
West Branch Root River (New Berlin Memorial Hospital Tributary)	2.5	LAL	--	--	--	--	--	--	--	--	--	--	--
104th Street Branch	1.0	FAL	--	--	--	--	--	--	--	--	--	--	--
Wildcat Creek	1.6	FAL	--	--	--	--	--	--	--	--	--	--	--
Unnamed Tributary 5 to Root River	0.8	FAL	--	--	--	--	--	--	--	--	--	--	--
Unnamed Tributary 4 to Root River	1.0	FAL	--	--	--	--	--	--	--	--	--	--	--
Unnamed Tributary 3 to Root River	0.4	FAL	--	--	--	--	--	--	--	--	--	--	--
Whitnall Park Creek upstream from the former Hales Corners WWTP	0.6	LAL	--	--	--	--	--	--	--	--	--	--	Impairment unknown
Whitnall Park Creek downstream from the former Hales Corners WWTP	2.4	LFF	--	--	--	--	--	--	--	--	--	--	Impairment unknown
Northwest Branch Whitnall Park Creek	1.4	FAL	--	--	--	--	--	--	--	--	--	--	--
North Branch Whitnall Park Creek	0.4	FAL	--	--	--	--	--	--	--	--	--	--	--
Tess Corners Creek	4.0	LFF	--	--	--	--	--	--	--	--	--	--	Impairment unknown
Dale Creek	1.4	FAL	--	--	--	--	--	--	--	--	--	--	--
Scout Lake Creek	0.7	FAL	--	--	--	--	--	--	--	--	--	--	--
Unnamed Tributary 2 to Root River	1.5	FAL	--	--	--	--	--	--	--	--	--	--	Impairment unknown

Table continued on next page.

Table 2.12 (Continued)

Stream Reach	Stream Length (miles)	Codified Water Use Objective[b]	Percent of Samples Meeting Water Quality Criteria[a]										303(d) Impairments
				Temperature		Chloride			Bacteria				
									Fecal Coliform Bacteria		*Escherichia coli (E. coli)*		
			Dissolved Oxygen	Sublethal	Acute	Chronic	Acute	Total Phosphorus	Single Sample	Geometric Mean	Single Sample	Geometric Mean	
Tributary Streams (continued)													
East Branch of the Root River (Franklin Tributary)	4.0	LAL	--	--	--	--	--	--	--	--	--	--	--
Woods Creek (Unnamed Tributary 1 to the East Branch Root River)	1.4	FAL	--	--	--	--	--	--	--	--	--	--	--
Legend Creek	3.0	FAL	81.8 (66)	--	--	--	--	50.0 (8)	--	--	53.8 (65)	43.1 (65)	--
Tuckaway Creek	1.2	FAL	--	--	--	--	--	--	--	--	--	--	--
Root River Canal	5.5	FAL	93.1 (72)	--	--	--	--	37.5 (8)	--	--	74.2 (66)	51.5 (66)	Dissolved oxygen
Ryan Creek	6.0	FAL	--	--	--	--	--	--	--	--	--	--	Degraded habitat
Oakwood Tributary (Unnamed Creek west of 92nd Street)	4.5	FAL	--	--	--	--	--	--	--	--	--	--	--
Oakwood Park Tributary	1.9	FAL	--	--	--	--	--	--	--	--	--	--	--
Crayfish Creek	2.7	FAL	--	--	--	--	--	--	--	--	--	--	Impairment unknown

[a] *Number in parentheses shows number of samples.*

[b] *FAL indicates warmwater fish and aquatic life, LFF indicates limited forage fish, and LAL indicates limited aquatic life.*

Source: SEWRPC

Table 2.13
Characteristics of Streams in the Kinnickinnic River Watershed in Milwaukee County: 2018-2019[a]

Monitoring Site	Percent of Samples Meeting Water Quality Criteria				303(d) Impairments
	Total Suspended Solids	Chloride	Total Phosphorus	Fecal Coliform Bacteria	
Mainstem					
Kinnickinnic River Downstream of Jackson Park Lagoon North of Forest Home Avenue	83.0	83.0	0.0	64.0	Aquatic toxicity, degraded habitat, bacteria
Kinnickinnic River at S. 27th Street	91.0	81.0	69.0	59.0	Aquatic toxicity, degraded habitat, bacteria
Kinnickinnic River at S. 8th Street	88.0	88.0	72.0	50.0	Aquatic toxicity, dissolved oxygen, degraded habitat, bacteria, fish consumption advisory
Kinnickinnic River at S. 1st Street[b]	67.0	100.0	67.0	74.0	Aquatic toxicity, dissolved oxygen, degraded habitat, bacteria, fish consumption advisory
Kinnickinnic River at Greenfield Avenue[b]	95.0	100.0	80.0	90.0	Aquatic toxicity, dissolved oxygen, degraded habitat, bacteria, fish consumption advisory
Kinnickinnic River at Jones Island Ferry[b]	80.0	100.0	80.0	85.0	Aquatic toxicity, dissolved oxygen, degraded habitat, bacteria, fish consumption advisory
Tributary Streams					
Wilson Park Creek East of 31st Street	90.0	87.0	84.0	65.0	Aquatic toxicity, bacteria, impairment unknown
Holmes Avenue Creek	--	--	--	--	Bacteria
Villa Mann Creek	--	--	--	--	Bacteria
Cherokee Park Creek	--	--	--	--	Bacteria
Lyons Park Creek	--	--	--	--	--
South 43rd Street Ditch South of Lincoln Avenue	81.0	74.0	3.0	45.0	Bacteria, degraded habitat

[a] *Data are derived from the Freshwater Resources Monitoring group that conducts routine surface water monitoring at fixed monitoring sites for MMSD within the MMSD Planning Area. Field measurements and grab samples were taken one to two times per month at each site in 2018 and 2019.*

[b] *Site is also located within the Milwaukee Harbor Estuary, which encompasses the Kinnickinnic River from below the Chase Avenue bridge to the Lake Michigan breakwater. The Estuary is the area where the Milwaukee, Menomonee, and Kinnickinnic Rivers meet and mix with Lake Michigan water.*

Source: Metropolitan Milwaukee Sewerage District and SEWRPC

Table 2.14
Characteristics of Streams in the Milwaukee River Watershed in Milwaukee County: 2018-2019[a]

Monitoring Site	Percent of Samples Meeting Water Quality Criteria				303(d) Impairments
	Total Suspended Solids	Chloride	Total Phosphorus	Fecal Coliform Bacteria	
			Mainstem		
Milwaukee River at Pioneer Road[b]	77.0	100.0	63.0	70.0	Bacteria, fish consumption advisory
Milwaukee River at Brown Deer Road	70.0	100.0	68.0	61.0	Bacteria, temperature, fish consumption advisory, impairment unknown
Milwaukee River at Silver Spring Drive	63.0	100.0	73.0	57.0	Bacteria, temperature, fish consumption advisory, impairment unknown
Milwaukee River at Port Washington Road	56.0	100.0	56.0	53.0	Bacteria, temperature, fish consumption advisory, impairment unknown
Milwaukee River at Former North Avenue Dam	47.0	100.0	53.0	45.0	Bacteria, dissolved oxygen, fish consumption advisory
Milwaukee River at Pleasant Street[c]	68.0	100.0	64.0	93.0	Bacteria, dissolved oxygen, fish consumption advisory
Milwaukee River at Wells Street[c]	71.0	100.0	76.0	88.0	Bacteria, dissolved oxygen, fish consumption advisory
Milwaukee River at Water Street[c]	71.0	100.0	77.0	87.0	Bacteria, dissolved oxygen, fish consumption advisory
Milwaukee River at Union Pacific Railroad[c]	50.0	100.0	65.0	85.0	Bacteria, dissolved oxygen, fish consumption advisory
			Tributary Streams		
Beaver Creek	--	--	--	--	--
Southbranch Creek at Green Bay Court	89.0	100.0	39.0	39.0	Aquatic toxicity, degraded habitat
Brown Deer Park Creek	--	--	--	--	Aquatic toxicity, impairment unknown
Indian Creek at Bradley Road	83.0	94.0	50.0	72.0	Aquatic toxicity, dissolved oxygen, degraded habitat, temperature
Crestwood Creek	--	--	--	--	Aquatic toxicity, impairment unknown
Wahl Creek	--	--	--	--	--
Lincoln Creek at 60th Street	67.0	94.0	39.0	72.0	Aquatic toxicity, dissolved oxygen, degraded habitat, temperature, fish consumption advisory
Lincoln Creek at Congress Street and 47th Street	78.0	94.0	22.0	61.0	Aquatic toxicity, dissolved oxygen, degraded habitat, temperature, fish consumption advisory
Lincoln Creek at Green Bay Avenue	78.0	100.0	0.0	50.0	Aquatic toxicity, dissolved oxygen, degraded habitat, temperature, fish consumption advisory

[a] *Data are derived from the Freshwater Resources Monitoring group that conducts routine surface water monitoring at fixed monitoring sites for MMSD within the MMSD Planning Area. Field measurements and grab samples were taken one to two times per month at each site in 2018 and 2019.*

[b] *Site is located in Ozaukee County, 10 miles upstream from the Milwaukee County border.*

[c] *Site is also located within the Milwaukee Harbor Estuary, which encompasses the Milwaukee River from below the former North Avenue Dam to the Lake Michigan breakwater. The Estuary is the area where the Milwaukee, Menomonee, and Kinnickinnic Rivers meet and mix with Lake Michigan water.*

Source: Metropolitan Milwaukee Sewerage District and SEWRPC

Table 2.15
Characteristics of Streams in the Fish Creek Watershed in Milwaukee County and the Outer Harbor Area: 2018-2019[a]

Monitoring Site	Percent of Samples Meeting Water Quality Criteria				303(d) Impairments
	Total Suspended Solids	Chloride	Total Phosphorus	Fecal Coliform Bacteria	
Lake Michigan Direct Drainage Area					
Fish Creek at Broadmoor Road and Union Pacific Railway	56.0	100.0	33.0	33.0	Aquatic toxicity, degraded habitat
Outer Harbor[b]					
OH-1	86.0	100.0	79.0	88.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-2	100.0	100.0	77.0	95.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-3	100.0	100.0	94.0	78.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-4	100.0	100.0	95.0	100.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-5	100.0	100.0	95.0	100.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-7	100.0	100.0	94.0	91.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-9	100.0	100.0	100.0	100.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-10	100.0	100.0	100.0	100.0	Aquatic toxicity, bacteria, fish consumption advisory
OH-11	100.0	100.0	100.0	100.0	Aquatic toxicity, bacteria, fish consumption advisory

[a] *Data are derived from the Freshwater Resources Monitoring group that conducts routine surface water monitoring at fixed monitoring sites for MMSD within the MMSD Planning Area. Field measurements and grab samples were taken one to two times per month at each site in 2018 and 2019.*

[b] *The Outer Harbor is the area from under the Hoan Bridge to the Lake Michigan breakwater.*

Source: Metropolitan Milwaukee Sewerage District and SEWRPC

Table 2.16
Aquatic Invasive Species Detected in Inland Waterbodies in Milwaukee County

Waterbody	Species
Streams and Rivers	
Indian Creek	Rusty crayfish
Kinnickinnic River	Grass Carp
Lincoln Creek	Reed Manna Grass, Purple loosestrife
Little Menomonee River	Rusty crayfish, Chinese mystery snail
Menomonee River	Rusty crayfish, Grass Carp
Milwaukee River	Rusty crayfish, Eurasian water milfoil, Reed manna grass, Grass carp, Yellow iris, Japanese knotweed
Oak Creek	Rusty crayfish, Reed manna grass
Root River	Rusty crayfish, Chinese mystery snail
Root River Canal	Rusty crayfish
Unnamed Tributary to Lincoln Creek	Reed manna grass
Unnamed Tributary to the Root River	Reed manna grass
Unnamed Tributary to the Milwaukee River	Java waterdrop/Vietnamese water celery
Ryan Creek	Rusty crayfish
Lakes and Ponds	
Anderson Lake	Curly-leaf pondweed, Eurasian water milfoil
Brown Deer Park Pond 1	Eurasian water milfoil, Chinese mystery snail, Purple loosestrife
Brown Deer Park Pond 2	Chinese mystery snail
Brown Deer Park Pond 3	Chinese mystery snail
Dineen Park Pond	Chinese mystery snail
Estabrook Park Lagoon	Eurasian water milfoil, Chinese mystery snail
Greenfield Park Pond	Eurasian water milfoil, Chinese mystery snail, Purple loosestrife, Phragmites
Greenfield Park Pond 2	Chinese mystery snail, Purple loosestrife
Greenfield Park Pond 4	Chinese mystery snail
Greenfield Park Pond 5	Phragmites
Holler Park Pond	Eurasian water milfoil, Chinese mystery snail, Yellow floating heart
Humboldt Park Pond 1	Eurasian water milfoil, Chinese mystery snail
Humboldt Park Pond 2	Chinese mystery snail
Jackson Pond	Chinese mystery snail
Jackson Park Pond	Chinese mystery snail
Juneau Park Lagoon	Eurasian water milfoil
McCarty Park Pond	Purple loosestrife, Phragmites
McGovern Park Pond	Eurasian water milfoil, Chinese mystery snail, Phragmites
Middle Oakwood Golf Course Pond	Eurasian water milfoil
Mitchell Park Pond	Eurasian water milfoil, Chinese mystery snail
North Oakwood Golf Course Pond	Eurasian water milfoil
Oak Creek Parkway – Mill Pond	Chinese mystery snail, Eurasian water milfoil, Curly-leaf pondweed, Purple loosestrife
Saveland Park Pond	Banded mystery snail, Chinese mystery snail
Scout Lake	Curly-leaf pondweed, Eurasian water milfoil, Chinese mystery snail
Sheridan Park Pond	Chinese mystery snail
South Oakwood Golf Course Pond	Curly-leaf pondweed, Eurasian water milfoil
Upper Kelly Lake	Curly-leaf pondweed, Eurasian water milfoil, Phragmites
Warnimont Park Pond	Curly-leaf pondweed
Washington Park Pond	Chinese mystery snail
Whitnall Park Pond 2	Curly-leaf pondweed, Chinese mystery snail
Whitnall Park Pond 3	Curly-leaf pondweed, Eurasian water milfoil, Flowering Rush
Wilson Park Pond	Rusty Crayfish

Source: Milwaukee County, Wisconsin Department of Natural Resources, and SEWRPC

Table 2.17
Streambed Characteristics within Milwaukee County Watersheds

Streambed Characteristic	Percent of Stream System in the Watershed					
	Kinnickinnic River Watershed	Menomonee River Watershed[a]	Milwaukee River Watershed	Oak Creek Watershed	Root River Watershed	Lake Michigan Direct Drainage Area[b]
Natural Channel	46.6	60.8	89.6	92.8	99.0	37.8
Concrete-Lined	19.8	14.7	5.6	4.4	0.0	0.0
Enclosed Channel	18.8	8.9	4.8	2.8	1.0	0.0
Not Assessed	14.8	15.6	--	--	--	62.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

[a] *Streams in the Menomonee River watershed were assessed in 2000.*

[b] *Fish Creek in the Lake Michigan direct drainage area was assessed during 2000 and 2001.*

Source: Inter-Fluve, Inc. W.F. Baird & Associates, and SEWRPC

Table 2.18
Streambank Characteristics within Milwaukee County Watersheds

Bank Characteristic	Percent of Stream System in the Watershed					
	Kinnickinnic River Watershed	Menomonee River Watershed[a]	Milwaukee River Watershed	Oak Creek Watershed	Root River Watershed	Lake Michigan Direct Drainage Area[b]
Stable[c]	33.4	87.0	60.0	12.6	25.2	24.0
Eroding[d]	1.4	8.7	8.7	44.8	43.0	13.8
Not Assessed[e]	65.2	31.3	31.3	42.6	31.8	62.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

[a] *Streams in the Menomonee River watershed were assessed in 2000.*

[b] *Fish Creek in the Lake Michigan direct drainage area was assessed during 2000 and 2001.*

[c] *Includes channels with strong gravel substrate consolidation, localized bank erosion with a relatively constant width, narrow vegetated bars, local erosion and scour at pools and natural obstructions, average channel width to depth ratios, single thread channel patterns, bank slopes greater than 3:1, and extensive vegetative bank protection.*

[d] *Includes channels with high banks, gravitational collapse and variable channel width, poorly formed bars, extensive bank erosion, low channel width to depth ratios, single thread channel pattern, bank slopes less than 3:1, and sparse to bare vegetative bank cover.*

[e] *Includes concrete channels or channels impacted heavily by riprap, stone walls, or gabion walls.*

Source: Inter-Fluve, Inc., W.F. Baird & Associates, and SEWRPC

Table 2.19
Riparian Corridor Buffer Widths/Areas along Streams in Milwaukee County: 2015

Buffer Width/Area Category	Percent of Assessed Bank Length Associated with a Given Buffer Width			Oak Creek Watershed	Root River Watershed
	Kinnickinnic River Watershed	Menomonee River Watershed	Milwaukee River Watershed		
0 to 25 Feet	58.5	37.3	38.8	--	--
25 to 50 Feet	5.6	8.4	8.3	--	--
50 to 75 Feet	3.8	9.9	5.7	--	--
Greater than 75 Feet	9.6	34.1	41.5	--	--
Enclosed Channel	22.5	10.3	5.7	--	--
Buffer Area (acres)	--	--	--	3,201	5,920[a]
Percent Buffer Area in Watershed Within Milwaukee County	--	--	--	18.0	16.0
Total	100.0	100.0	100.0	--	--

[a] *Includes those buffer areas within Milwaukee County only.*

Source: SEWRPC

Table 2.20
Lakes and Ponds in Milwaukee County

Lake	Surface Area (acres)	Maximum Depth (feet)	Mean Depth (feet)	Lake Type[a]	Trophic Status
Aviary Ponds	<1	--	--	--	--
Boerner Botanical Garden Pond No. 1[b]	2	3	--	Drainage	--
Boerner Botanical Garden Pond No. 2[c]	1	4	--	Drainage	--
Boerner Botanical Garden Pond No. 3[d]	8	5	--	Drainage	--
Brown Deer Golf Course Lagoon Hole No. 1	<1	--	--	--	--
Brown Deer Golf Course Lagoon Hole No. 16	<1	--	--	Drainage	--
Brown Deer Golf Course Lagoon Hole No. 18	<1	--	--	Drainage	--
Brown Deer Park Pond	6	6	4	Drainage	Eutrophic
County Grounds Pond No. 1[e]	2	8	--	--	--
County Grounds Pond No. 2[e]	1	8	--	--	--
County Grounds Pond No. 3[e]	<1	8	--	--	--
County Grounds Pond No. 10	1	--	--	--	--
Dineen Park Pond	2	5	--	Drainage	Meso-eutrophic
Dumkes Lake	7	11	--	Seepage	Eutrophic
Estabrook Park Lagoon	1	6	--	Drainage	--
General Mitchell International Airport Parking Structure Pond	<1	<1	--	--	--
Grant Park Golf Course Pond	<1	4	--	--	--
Grant Park Lagoon—Central	<1	--	--	--	--
Grant Park Pond—North	1	6	--	Seepage	--
Greenfield Golf Course Pond	<1	3	--	--	--
Greenfield Park Lagoon—North Pond East of Baseball Diamond	<1	6	--	--	--
Greenfield Park Lagoon—South Pond East of Baseball Diamond	<1	--	--	--	--
Greenfield Park Lagoon by Park Entrance	<1	--	--	--	--
Greenfield Park Pond	7	6	4	Seepage	Eutrophic-hypertrophic
Hansen Park Golf Course Pond	<1	--	--	--	--
Holler Park Pond	1	5	--	Drainage	--
Humboldt Park Lily Pond	<1	--	--	--	--
Humboldt Park Pond	4	3	2	Drainage	Meso-eutrophic
Jackson Park Pond	8	8	5	Drainage	Hypertrophic
Jacobus Park Pond	1	5	--	Drainage	Eutrophic
Juneau Park Lagoon[f]	15	6	4	Drainage	--
Koepmier Lake	8	35	--	Seepage	--
Kosciuszko Park Pond	3	4	3	Seepage	--
Lincoln Park Lagoon	21	--	--	--	--
Linden Pond	2	15	--	Seepage	--
Little Menomonee River Parkway Pond[g]					--
McCarty Park Pond	4	9	--	Drainage	Eutrophic-hypertrophic
McGovern Park Pond	5	5	3	Drainage	Eutrophic-hypertrophic
Menomonee Parkway Pond	2	4	--	Drainage	--
Milwaukee County Zoo—Monkey Island Pond	<1	--	--	--	--
Mitchell Park Pond	2	6	5	Seepage	Eutrophic
Monastery Lake	12	30	--	Seepage	--
Moose Yard Pond	<1	--	--	--	--
Mud Lake[h]	4	21	--	Seepage	--

Table continued on next page.

Table 2.20 (Continued)

Lake	Surface Area (acres)	Maximum Depth (feet)	Mean Depth (feet)	Lake Type[a]	Trophic Status
New Zoo Pond[i]	5	11	--	Seepage	Eutrophic-hypertrophic
North Golf Course Pond No. 1[j]	1	4	--	Drainage	--
North Golf Course Pond No. 2[k]	1	4	--	Drainage	--
North Golf Course Pond No. 3[l]	3	8	--	Drainage	--
Noyes Pond	1	1	--	Drainage	--
Oak Creek Parkway Pond	5	8	5	Drainage	--
Oak Creek Parkway Pond	3	10	--	--	--
Oakwood Golf Course Pond—Central	2	--	--	--	--
Oakwood Golf Course Pond—North	2	--	--	--	--
Oakwood Golf Course Pond—South	1	--	--	--	--
Research Park Pond	2	--	--	--	--
Root River Parkway Pond[m]	8	17	--	Seepage	--
Root River Parkway Pond	1	17	--	--	--
Root River Parkway Pond	6	--	--	--	--
Saveland Park Pond	1	6	--	Drainage	Eutrophic
Schroedel Pond	5	8	--	Seepage	--
Scout Lake	8	19	6	Seepage	Mesotrophic
Sheridan Park Pond	1	8	4	Seepage	Eutrophic
Timmerman Airfield Basin	6	--	--	--	--
Ueihlein Pond	1	7	-	Drainage	--
Underwood Creek Detention Pond	2	--	--	--	--
Upper Kelly Lake	12	9	--	Spring	Eutrophic
Warnimont Golf Course Pond	<1	--	--	--	--
Washington Park Pond	11	5	3	Drainage	Hypertrophic
Whitnall Park Pond	15	10	6	Drainage	Eutrophic
Whitnall Park Golf Course Pond—No. 13 Fairway	<1	--	--	--	--
Wilson Park Pond	9	5	3	Drainage	Eutrophic
Wisconsin Avenue Park Pond No. 7	1	--	--	--	--
Wood Hospital Pond	1	4	--	Drainage	--

[a] *Drainage lakes are lakes having both a defined inlet and a defined outlet. These waterbodies are commonly referred to as flow-through lakes. Seepage lakes are lakes without either a defined inlet or defined outlet. These waterbodies are sometimes referred to as internally drained lakes. Spring lakes are lakes that have no defined inlet, but have a defined outlet.*

[b] *This pond is also known as Whitnall Park Arboretum Pond.*

[c] *This pond is also known as Whitnall Park Arboretum Pond—North of Drive.*

[d] *This pond is also known as Whitnall Park Arboretum Pond—South of Drive.*

[e] *This pond consists of three basins in a series.*

[f] *This pond is also known as Veterans Park Lagoon.*

[g] *This pond is also known as North Lake.*

[h] *This pond is also known as Grobschmidt Park Pond.*

[i] *This pond is also known as Lake Evinrude.*

[j] *This pond is also known as Dretzka Park Golf Course Pond-N.*

[k] *This pond is also known as Dretzka Park Golf Course Pond-S.*

[l] *This pond is also known as Dretzka Park Golf Course Pond-C.*

[m] *This pond is also known as Anderson Lake.*

Source: Milwaukee County, Wisconsin Department of Natural Resources, and SEWRPC

Table 2.21
Woodlands, Surface Water, Wetlands, and 1-Percent-Annual-Probability (100-Year Recurrence Interval) Floodplains in Milwaukee County

Civil Division	Woodlands (Acres)	Surface Water (Acres)	Wetlands (Acres)	1-Percent-Annual-Probability Floodplain (Acres)
City of Cudahy	98.1	6.6	73.4	74.8
City of Franklin	1,561.8	344.2	2,705.0	2,632.1
City of Glendale	56.2	136.5	119.4	502.2
City of Greenfield	129.3	9.5	349.7	352.4
City of Milwaukee	1,073.6	606.0	1,264.5	2,431.6
City of Oak Creek	1,001.1	151.9	2,185.0	2,651.0
City of St. Francis	83.7	1.5	34.5	25.5
City of South Milwaukee	214.7	9.0	97.8	138.9
City of Wauwatosa	222.3	75.3	304.6	548.3
City of West Allis	113.9	18.0	112.2	242.5
Village of Bayside	210.4	4.8	64.8	29.9
Village of Brown Deer	40.3	14.4	26.0	133.7
Village of Fox Point	113.2	1.6	20.7	55.7
Village of Greendale	319.5	14.8	406.5	643.1
Village of Hales Corners	110.1	9.2	90.5	155.7
Village of River Hills	297.2	149.8	211.8	414.8
Village of Shorewood	21.8	1.0	13.7	20.6
Village of West Milwaukee	0.0	0.8	2.9	0.0
Village of Whitefish Bay	23.9	0.2	0.8	14.5
Total	5,691.1	1,555.1	8,083.8	11,067.3

Source: SEWRPC

Table 2.22
Natural Area Sites in Milwaukee County: 2009

Site Type[a]	Number on Map 2.22	Site Name	Location[b]	Ownership	Size (acres)	Description and Comments
NA-1	1	Fairy Chasm State Natural Area	T8N R22E Sections 4, 5 Village of Bayside T9N R22E Sections 32, 33 City of Mequon	The Nature Conservancy and other private	33[c]	An 80- to 100-foot-deep wooded ravine that extends approximately 1.25 miles west from its confluence with Lake Michigan. Steep slopes with white pine, white cedar, and yellow birch on north-facing slopes and dry-mesic hardwoods on the more exposed south-facing slopes. Ravine has special significance because cold air drainage enables several plant species with more northerly affinities to occur this far south. The flora includes the State-designated endangered pinedrops (*Pterospora andromedea*). Extends into Ozaukee County
				Subtotal: 1 Site	33	--
NA-2	2	Adams Prairie	T5N R21E Section 32 City of Franklin	Private	37	Species-rich, high-quality wet-mesic prairie and sedge meadow complex
	3	Cudahy Woods	T5N R22E Section 4 City of Oak Creek	Milwaukee County and private	47	An upland hardwood forest containing two major forest types separated by a small stream. To the north is a dry-mesic forest of oak, cherry, and hickory; southward is an old-growth mesic forest of sugar maple, beech, and red oak. One of the best forests of its kind in the vicinity. Has history of past scientific research
	4	Falk Park Woods	T5N R22E Section 7 City of Oak Creek	Milwaukee County and private	78	A diverse, relatively large north-south stand of woods. Consists mostly of good-quality dry-mesic uplands, with mesic stands of beech and sugar maple at the north end, and low areas of ephemeral ponds, wet-mesic hardwoods, and stream interspersed throughout. Past disturbances appear minimal
	5	Greenfield Park Woods	T6N R21E Section 6 City of West Allis	Milwaukee County	52	A good stand of southern dry-mesic hardwoods dominated by red and white oaks, sugar maple, and basswood. Ephemeral ponds and a lowland hardwood swamp
	6	Rawson Park Woods	T5N R22E Section 2 City of South Milwaukee	Milwaukee County	23	Despite heavy human use, especially from the adjacent high school, this site contains probably the best remaining example of beech-maple forest in Milwaukee County. The north half is in best condition. The rich ground flora contains a good population of blue-stemmed goldenrod (*Solidago caesia*), a State-designated endangered species
	7	Root River Canal Woods	T5N R21E Section 34 City of Franklin T4N, R21E, Section 3 Town of Raymond	Milwaukee County and private	152[d]	A mixture of good-quality dry-mesic and lowland hardwood forest along Root River Canal. One of the largest intact forested tracts in this part of the Region. Extends south into Racine County

Table continued on next page.

Table 2.22 (Continued)

Site Type[a]	Number on Map 2.22	Site Name	Location[b]	Ownership	Size (acres)	Description and Comments
NA-2 (continued)	8	Root River Wet-Mesic Woods – West	T5N R21E Sections 35, 36 City of Franklin	Milwaukee County and private	273	Mixture of medium-aged lowland and upland hardwoods that is recovering well from past disturbance. The ground flora is rich and diverse, including good populations of several rare species. An important part of Root River environmental corridor
	9	Root River Wet-Mesic Woods – East	T5N R22E Section 32 City of Oak Creek T4N R22E Section 5 Town of Caledonia	Milwaukee County and Racine County	50[e]	Wet-mesic and mesic woods bordering a gravel-bottom stream that is a tributary of the Root River. Contains a rich, diverse flora, including several rare species. Extends south into Racine County
	10	St. Francis Seminary Woods	T6N R22E Sections 14, 15 City of St. Francis	St. Francis Seminary and City of St. Francis	52	This southern mesic forest features mature basswood, sugar maple, beech, red oak, and paper birch. The site is divided by a gravel road, a small stream tributary to Lake Michigan, and numerous trails. The relatively diverse ground flora includes the State-designated endangered blue-stemmed goldenrod (*Solidago caesia*)
	11	Warnimont Park Fens	T6N R22E Section 36 City of Cudahy	Milwaukee County	2	Clay bluffs with spring seepages along Lake Michigan support calcareous fens that contain an unusual flora. Regionally uncommon plants include buffaloberry (*Shepherdia canadensis*), variegated scouringrush (*Equisetum variegatum*), purple false oats (*Trisetum melicoides*), Ohio goldenrod (*Solidago ohioensis*), small fringed gentian (*Gentiana procera*), and false asphodel (*Tofieldia glutinosa*), a State-designated threatened species
				Subtotal: 10 Sites	766	--
NA-3	12	60th Street Woods	T5N R21E Section 27 City of Franklin	Milwaukee County	11	Small, but species-rich upland woods
	13	Bike Trail Marsh	T5N R21E Section 3 City of Franklin	Milwaukee County	3	Good-quality shallow marsh
	14	Blue Mound Country Club Woods	T7N R21E Section 17 City of Wauwatosa	Milwaukee County and private	17	A small patch of southern dry-mesic woods containing critical species habitat
	15	Bradley Woods	T8N R21E Section 9 City of Milwaukee	City of Milwaukee and private	34	An old-growth southern mesic forested island, dominated by sugar maple, beech, and basswood. One of the few remnants of the original forest remaining in northern Milwaukee County. The western portion, owned by the County, is least disturbed
	16	Brown Deer Park Woods	T8N R21E Section 13 Village of Brown Deer	Milwaukee County	43	Small islands of remnant southern mesic hardwoods within a golf course matrix, dominated by beech and sugar maple
	17	Convent Woods	T8N R21E Section 10 City of Milwaukee	Private	9	Small though floristically diverse mesic forest remnant
	18	Menomonee River Parkway Low Woods	T7N R21E Section 8 City of Wauwatosa	Milwaukee County	27	A portion of the Menomonee River bordered by disturbed lowland hardwoods and upland dry-mesic hardwoods. The ground flora is rich, including such rare species as the State-designated threatened forked aster (*Aster furcatus*)

Table continued on next page.

Table 2.22 (Continued)

Site Type[a]	Number on Map 2.22	Site Name	Location[b]	Ownership	Size (acres)	Description and Comments
NA-3 (continued)	19	Downer Woods	T7N R22E Section 10 City of Milwaukee	University of Wisconsin-Milwaukee	11	A disturbed southern dry-mesic hardwood forest where scattered large oak and smaller ash and basswood dominate the tree stratum. There is a thick shrub layer of natives and exotics. One of the few undeveloped woods within this part of the County
	20	Elm Road Woods	T5N R21E Section 36 City of Franklin	Private	20	A small, mostly second-growth woodlot of southern mesic forest and lowland hardwoods. American beech is present at the western edge of its range. Contains good populations of two State-designated special concern species: American gromwell (*Lithospermum latifolium*) and black haw (*Viburnum prunifolium*)
	21	Barloga Woods	T5N R22E Section 18 City of Oak Creek	Milwaukee County, Wisconsin Department of Transportation, private	64	A patchy mix of low woods, second-growth upland forest, and relatively undisturbed beech woods. Integrity threatened by encroaching residential development
	22	Fitzsimmons Woods	T5N R21E Section 25 City of Franklin	Milwaukee County and Milwaukee Area Land Conservancy	39	The south and east portions of this dry-mesic woods are mostly second-growth; the west portion is less disturbed, with larger, mature trees. In the northwest are several ephemeral ponds where the State-designated endangered hop-like sedge (*Carex lupuliformis*) is found
	23	Franklin (Puetz Road) Woods	T5N R21E Sections 23, 24 City of Franklin	City of Franklin	34	Situated along the headwaters of Oak Creek, this site consists of mature dry-mesic hard-woods, lowland hardwoods, and stands of younger growth. The rich and diverse flora includes black haw (*Viburnum prunifolium*), a State-designated special concern species
	24	Franklin Oak Woods and Oak Savanna	T5N R21E Section 29 City of Franklin	Milwaukee County	79	The entire site is a former oak savanna, but only the north portion retains this appearance. Large, scattered, open-grown bur oaks with understory consisting mainly of weeds, with a few prairie species persisting. The south portion has degraded into a dense shrubland. Restoration efforts, including cutting and burning, are attempting to restore the site to more of a pre-settlement condition
	25	Glenwood School Woods	T6N R21E Section 14 City of Milwaukee	Glenwood School	7	Relatively good-quality dry-mesic woods on school grounds
	26	Grant Park Woods – Old Growth	T5N R22E Section 1 City of South Milwaukee	Milwaukee County	42	Dissected by ravines, this site has long been used as a park. Despite the heavy human influence, this beech-maple woods, which is a remnant of the original Lake Michigan forest, retains some of its pre-settlement character. Rich ground flora includes the State-designated endangered blue-stemmed goldenrod (*Solidago caesia*)
	27	Grant Park Woods – South	T5N R22E Sections 1, 12 City of South Milwaukee	Milwaukee County	45	A remnant, narrow wooded strip of moderate quality of the once more-widespread beech-maple mesic woods along Lake Michigan. In Grant Park. Bordered by golf course
	28	Granville Low Woods	T8N R21E Section 6 City of Milwaukee	Milwaukee County and private	50	Good quality wet-mesic woods supporting critical species habitat

Table continued on next page.

Table 2.22 (Continued)

Site Type[a]	Number on Map 2.22	Site Name	Location[b]	Ownership	Size (acres)	Description and Comments
NA-3 (continued)	29	Grobschmidt Park Wetlands and Upland Woods	T5N R21E Sections 1, 2 City of Franklin	Milwaukee County and private	83	A combination of moderate-quality deep and shallow marsh, sedge meadow, shrub-carr, and disturbed dry-mesic woods. Site contains restored prairie
	30	Grootemaat Woods	T6N R21E Section 35 City of Greenfield	City of Greenfield	20	Dry-mesic woods with ephemeral ponds
	31	Harbinger Woods	T8N R21E Section 18 City of Milwaukee T8N R20E Section 13 Village of Menomonee Falls	Milwaukee County and private	34[f]	Mesic upland woods and lowland hardwoods bordering the Menomonee River that extend into Waukesha County. The spring flora of the mesic woods is rich and diverse, including American gromwell (*Lithospermum latifolium*), a State-designated special concern species. Also present are several chinkapin oaks (*Quercus muehlenbergii*), a State-designated special concern tree species. Extends west into Waukesha County
	32	Haskell Noyes Park Woods	T8N R21E Section 21 City of Milwaukee	Milwaukee County	20	Disturbed southern mesic hardwood forested island with a substantial amount of beech. Best old-growth remnant is near center of woods. Pond and wetlands are present at south end
	33	Jacobus Park Woods	T7N R21E Section 27 City of Wauwatosa	Milwaukee County	11	A small remnant of the original southern dry-mesic forest on bluffs overlooking the Menomonee River. Contains several populations of the State-designated threatened forked aster (*Aster furcatus*), as well as other regionally rare species
	34	Kletzsch Park Woods	T8N R22E Section 19 City of Glendale	Milwaukee County	13	A remnant of southern mesic to dry-mesic forest on the west bank of the Milwaukee River. The diversity of habitats (upland woods, ravine, flood-plain, and slope) has resulted in a diverse ground flora, including the State-designated threatened forked aster (*Aster furcatus*)
	35	McGovern Park Woods	T8N R21E Section 35 City of Milwaukee	Milwaukee County	14	Remnant woodland within urban park
	36	Menomonee River Swamp – South	T7N R21E Section 6 City of Wauwatosa	Milwaukee County, City of Milwaukee, and Wisconsin Department of Transportation	99	A portion of the Menomonee River bordered by lowland hardwood forest and dry-mesic upland woods. Contains American gromwell (*Lithospermum latifolium*) and heart-leaved skullcap (*Scutellaria ovate*), both State-designated special concern species
	37	Menomonee River Swamp – North	T8N R21E Sections 19, 30 City of Milwaukee T8N R20E Section 24 Village of Menomonee Falls	Milwaukee County and private	75[g]	Discontinuous patches of disturbed floodplain forest bordering the Menomonee River. Extends west into Waukesha County
	38	Mission Hills Wetlands	T5N R21E Sections 16, 17 City of Franklin	Private	38	Complex of sedge meadow, shallow marsh, and wet prairie
	39	Mitchell's Woods	T6N R21E Section 11 City of Milwaukee	Milwaukee County	37	Mixed-quality woods bordering Kinnickinnic River
	40	Monastery Lake Wetlands	T5N R21E Section 8 City of Franklin	Private	48	A diverse wetland plant community complex consisting of deep and shallow marsh, sedge meadow, fresh (wet) meadow, shrub-carr, and the last tree-size tamaracks in Milwaukee County

Table continued on next page.

Table 2.22 (Continued)

Site Type[a]	Number on Map 2.22	Site Name	Location[b]	Ownership	Size (acres)	Description and Comments
NA-3 (continued)	41	Oak Creek Low Woods	T5N R22E Sections 26, 27 City of Oak Creek	Milwaukee County and private	68	Moderate-quality wet-mesic woods, with small areas of mesic woods
	42	Oak Creek Parkway Woods	T5N R22E Section 11, 12 City of Oak Creek	Milwaukee County	24	Dry-mesic woods along Oak Creek
	43	Root River Bike Trail Woods	T5N R21E Section 15 City of Franklin	Milwaukee County	108	Relatively diverse combination of wet-mesic and dry-mesic woods bordering Root River
	44	Root River Low and Upland Woods	T5N R21E Sections 1, 2 City of Franklin	Milwaukee County	76	Primarily wet-mesic and floodplain woods along Root River, with upland dry-mesic forest at north end
	45	Root River Parkway Prairie	T5N R21E Sections 27 City of Franklin	Milwaukee County	51	Wet-mesic prairie located within the Root River Parkway wetland complex. Characteristic species include big bluestem, saw-toothed sunflower, Virginia mountain mint, prairie cordgrass, leadplant, azure aster, bottle gentian, prairie dock, and slender ladies'-tresses orchid. It is the largest prairie remaining in Milwaukee County
	46	Mangan Woods	T5N R21E Section 4 Village of Greendale	Milwaukee County	64	Dry-mesic forest on undulating topography, dominated by relatively large red oaks. Ground layer is sparse. Contains hiking and ski trails
	47	Root River Riverine Forest	T5N R22E Sections 31, 32, 33, 34 City of Oak Creek T4N R22E Sections 3, 4, 5, 6 Town of Caledonia	Milwaukee County, Racine County, Wisconsin Department of Transportation, and private	147[h]	A significant portion of the Root River corridor. Extends south into Racine County
	48	Ryan Creek Woods	T5N R21E Section 28 City of Franklin	Private	102	One of the larger woodlots remaining in Milwaukee County. A dry-mesic woods of varying quality recovering from past disturbance. An east-west stream crosses at south
	49	Ryan Road Woods	T5N R22E Section 29 City of Oak Creek	Milwaukee County	42	Dry-mesic woods containing critical species
	50	Schlitz Audubon Center/ Doctors Park Woods and Beach	T8N R22E Sections 9, 10 Village of Bayside	Schlitz Audubon Center and Milwaukee County	72	Mesic and dry-mesic woods on bluffs and in steep ravines along Lake Michigan. Site includes lake sand beach
	51	Warnimont Park Woods	T6N R22E Section 36 City of Cudahy	Milwaukee County	47	Mix of mesic and dry-mesic woods located on bluffs along Lake Michigan, traversed by ravines that provide cooler and moister micro-habitats
	52	Wedge Woods	T5N R22E Section 23 City of Oak Creek	Private	17	A small, disturbed woods consisting of lowland hardwoods at the low, wet west end, and dry-mesic woods at the drier east end. Contains one of the largest populations of the State-designated endangered blue-stemmed goldenrod (*Solidago caesia*) in the State. Threatened by residential development
	53	West Branch Root River Woods	T6N R21E Section 7 City of West Allis	Private	12	Small remnant portion of native forest in highly developed area

Table continued on next page.

Table 2.22 (Continued)

Site Type[a]	Number on Map 2.22	Site Name	Location[b]	Ownership	Size (acres)	Description and Comments
NA-3 (continued)	54	Whitnall Park Woods – North	T6N R21E Section 32 Village of Hales Corners	Milwaukee County and City of Milwaukee	82	Stands of dry-mesic and lowland hardwoods within Whitnall Park. Contains forked aster (*Aster furcatus*), a State-designated threatened species
	55	Whitnall Park Woods – South	T5N R21E Sections 5, 8 City of Franklin T6N R21E Section 32 Village of Hales Corners	Milwaukee County and private	175	Site consists of several more-or-less connected stands of dry-mesic upland woods. The area of highest quality is surrounded by golf links. Here, mature red oaks and sugar maples provide a canopy over a representative ground flora that includes two State-designated species: American gromwell (*Lithospermum latifolium*) and black haw (*Viburnum prunifolium*)
	56	Wil-O-Way Woods	T7N R21E Section 20 City of Wauwatosa	State of Wisconsin and Milwaukee County	41	Moderate-quality southern dry-mesic hardwoods containing a representative ground flora
				Subtotal: 45 sites	2,155	--
				Total: 56 sites	2,954	--

[a] *Natural area sites are classified as follows:*

NA-1 identifies natural area sites of statewide significance or greater
NA-2 identifies natural area sites of countywide or regional significance
NA-3 identifies natural area sites of local significance.

[b] *Indicates the U.S. Public Land Survey Township, Range and Section in which the site is located.*

[c] *An additional 47 acres are located in Ozaukee County.*

[d] *An additional 163 acres are located in Racine County.*

[e] *An additional 2 acres are located in Racine County.*

[f] *An additional 12 acres are located in Waukesha County.*

[g] *An additional 4 acres are located in Waukesha County.*

[h] *An additional 184 acres are located in Racine County.*

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 2.23
Critical Species Habitat Sites Located Outside Natural Areas in Milwaukee County: 2009

Number on Map 2.22	Site Name	Location	Ownership	Size (acres)	Species of Concern[a]
57	35th Street Woods	T5N R21E Section 12 City of Franklin	Private	14	Red trillium (*Trillium recurvatum*) (R) Black haw (*Viburnum prunifolium*) (R)
58	Army Reserve Woods and Open Space	T8N R21, Section 26 City of Milwaukee	U.S. Army and Wisconsin Department of Natural Resources	166	Blue-stemmed goldenrod (*Solidago caesia*) (E)
59	Bender Clay Banks and Ravine South	T5N R22E Section 36 City of Oak Creek	Milwaukee County	2	Slender bog arrow-grass (*Triglochin palustre*) (R)
60	Bender Park Stream and Meadow	T5N R22E Section 25 City of Oak Creek	Milwaukee County	2	Waxy meadow rue (*Thalictrum revolutum*) (R)
61	Bender Park Woods North	T5N R22E Section 25 City of Oak Creek	Milwaukee County	11	Blue-stemmed goldenrod (*Solidago caesia*) (E)
62	Bender Park Woods South	T5N R22E Section 25 City of Oak Creek	Milwaukee County	5	Blue-stemmed goldenrod (*Solidago caesia*) (E)
63	Blakewood School Woods	T5N R22E Section 15 City of South Milwaukee	Blakewood School	1	Blue-stemmed goldenrod (*Solidago caesia*) (E)
64	Brynwood Country Club Woods	T8N R21E Section 15 City of Milwaukee	Private	5	Broad-leaved puccoon (*Lithospermum latifolium*) (R)
65	Cambridge Avenue Woods	T7N R22E Section 9 City of Milwaukee	Milwaukee County	17	Forked aster (*Aster furcatus*) (T)
66	Camelot Park Woods	T5N R22E Section 10 City of Oak Creek	Milwaukee County	15	Blue-stemmed goldenrod (*Solidago caesia*) (E)
67	Clay Ravine Woods	T5N R22E Section 36 City of Oak Creek	WE Energies	12	Blue-stemmed goldenrod (*Solidago caesia*) (E)
68	Cold Spring Road Thicket	T6N R21E Section 19 City of Greenfield	Private	2	Broad-leaved puccoon (*Lithospermum latifolium*) (R)
69	Countryside Woods	T5N R21E Section 12 City of Franklin	City of Franklin and Milwaukee Metropolitan Sewerage District	26	Black haw (*Viburnum prunifolium*) (R)
70	County Grounds Woods	T7N R21E Section 21 City of Wauwatosa	Milwaukee County	10	Forked aster (*Aster furcatus*) (T)
71	Cudahy Park Woods	T6N R22E Section 34 City of Cudahy	Milwaukee County	4	Blue-stemmed goldenrod (*Solidago caesia*) (E)
72	Doyne Park Woodland	T7N R21E Section 26 City of Milwaukee	Milwaukee County	4	Hoptree (*Ptelea trifoliata*) (R)
73	Elm Road Woods North	T5N R21E Section 36 City of Franklin	Private	32	Red trillium (*Trillium recurvatum*) (R) Black haw (*Viburnum prunifolium*) (R)
74	Fittshur Wetland	T5N R22E Section 23 City of Oak Creek	Private	6	Blue-stemmed goldenrod (*Solidago caesia*) (E)
75	Fox Point Bluffs and Ravines	T8N R22E Sections 9, 16, 21, 28 Village of Fox Point	Private	93	False asphodel (*Tofieldia glutinosa*) (T) Snow trillium (*Trillium nivale*) (T)
76	Grange Avenue Woods	T6N R21E Section 33 Village of Greendale	Milwaukee County	14	Hoptree (*Ptelea trifoliate*) (R)
77	Greene Park Woods	T6N R22E Section 23 City of St. Francis	Milwaukee County	7	Blue-stemmed goldenrod (*Solidago caesia*) (E)
78	Green Tree Road Woods and Open Space	T8N R21, Section 23 City of Milwaukee	Private	45	Broad-leaved puccoon (*Lithospermum latifolium*) (R)

Table continued on next page.

Table 2.23 (continued)

Number on Map 2.22	Site Name	Location	Ownership	Size (acres)	Species of Concern[a]
79	Hart Park/Psychiatric Hospital Woods	T7N R21E Section 22 City of Wauwatosa	Milwaukee County	41	Forked aster (*Aster furcatus*) (T) Golden seal (*Hydrastis canadensis*) (R) Twinleaf (*Jeffersonia diphylla*) (R) Broad-leaved puccoon (*Lithospermum latifolium*) (R) Hoptree (*Ptelea trifoliata*) (R) Black haw (*Viburnum prunifolium*) (R)
80	Harwood Avenue Woods	T7N R21E Section 21 City of Wauwatosa	Milwaukee County	46	Forked aster (*Aster furcatus*) (T) Twinleaf (*Jeffersonia diphylla*) (R) Hoptree (*Ptelea trifoliate*) (R)
81	Hawthorn Glen	T7N R21E Section 23 City of Milwaukee	City of Milwaukee	16	Broad-leaved puccoon (*Lithospermum latifolium*) (R) Hoptree (*Ptelea trifoliata*) (R)
82	Holt Park Woods	T6N R21E Section 17 City of Greenfield	Milwaukee County	8	Red trillium (*Trillium recurvatum*) (R)
83	Honey Creek Parkway Woods	T6N R21E Section 9 City of West Allis	Milwaukee County	5	Red trillium (*Trillium recurvatum*) (R) Forked aster (*Aster furcatus*) (T) Hoptree (*Ptelea trifoliate*) (R)
84	Howell Avenue Woods and Meadows	T5N R22E Section, 21 City of Oak Creek	City of Oak Creek, Milwaukee County, and private	67	Black haw (*Viburnum prunifolium*) (R)
85	Industrial Park Mesic Woods	T5N R22E Section 8 City of Oak Creek	Private	5	Golden seal (*Hydrastis canadensis*) (R)
86	Lake Park Woods	T7N R22E Sections 14,15 City of Milwaukee	Milwaukee County	46	Red trillium (*Trillium recurvatum*) (R)
87	Loomis Road Woods	T5N R21E Section 9 City of Franklin	Private	13	Red trillium (*Trillium recurvatum*) (R) Broad-leaved puccoon (*Lithospermum latifolium*) (R)
88	Lyons Park Woods	T6N R21E Section 14 City of Milwaukee	Milwaukee County	6	Red trillium (*Trillium recurvatum*) (R)
89	Menomonee River PCA No. 10	T7N R21E Section 27 City of Wauwatosa	Milwaukee County	3	Hoptree (*Ptelea trifoliata*) (R)
90	Meyers Woods	T5N R22E Section 19 City of Oak Creek	Private	10	Black haw (*Viburnum prunifolium*) (R)
91	Oak Creek Bluffs and Beach North	T5N R22E Section 12 City of South Milwaukee	Milwaukee County	4	Ohio goldenrod (*Solidago ohioensis*) (R); False asphodel (*Tofieldia glutinosa*) (R)
92	Oak Creek Bluffs and Beach South	T5N R22E Section 36 T5N R23E Section 31 City of Oak Creek	Milwaukee County	24	Sea rocket (*Cakile edentula*) (R)
93	Oak Creek Parkway Bike Trail Woods	T5N R22E Section 2 City of South Milwaukee	Milwaukee County	2	Blue-stemmed goldenrod (*Solidago caesia*) (E)
94	Oak Creek Power Plant Woods	T5N R22E Section 36 City of Oak Creek	WE Energies	16	Blue-stemmed goldenrod (*Solidago caesia*) (E)
95	Oakwood Park Oak Woods	T5N R21E Section 25, 26 City of Franklin	Milwaukee County and private	8	Red trillium (*Trillium recurvatum*) (R)
96	PPG Woods	T5N R22E Section 32 City of Oak Creek	City of Oak Creek	19	Red trillium (*Trillium recurvatum*) (R)

Table continued on next page.

Table 2.23 (continued)

Number on Map 2.22	Site Name	Location	Ownership	Size (acres)	Species of Concern[a]
97	Puetz Road Woods	T5N R22E Section 19 City of Oak Creek	Private	22	Red trillium (*Trillium recurvatum*) (R) Black haw (*Viburnum prunifolium*) (R)
98	Research Center Woods	T8N R21E Section 4 City of Milwaukee	Private	22	Blue-stemmed goldenrod (*Solidago caesia*) (E)
99	Russell Avenue Woods	T5N R21E Section 2 City of Franklin	Private	9	Red trillium (*Trillium recurvatum*) (R)
100	Ryan Road Upland Woods East	T5N R22E Section 29 City of Oak Creek	Milwaukee County	4	Black haw (*Viburnum prunifolium*) (R)
101	Schmidt/Johnson Woods	T5N R22E Section 23 City of Oak Creek	Private	6	Black haw (*Viburnum prunifolium*) (R)
102	Scout Lake Park Woods	T6N R21E Section 35 Village of Greendale	Milwaukee County	43	Broad-leaved puccoon (*Lithospermum latifolium*) (R)
103	Shooting Star Prairie and Shrubland (Carity Prairie)	T5N R21E Section 20 City of Franklin	Milwaukee Area Land Conservancy and private	18	Cream gentian (*Gentiana alba*) (T)
104	Silver Maple Island	T8N R21E Section 12 Village of Brown Deer	Bureau of Land Management	1	Sweet Indian plantain (*Hasteola suaveolens*) (R)
105	Stadium Bluff Woods	T7N R21E Section 35 City of Milwaukee	Zablocki Veterans Affairs Medical Center	6	Forked aster (*Aster furcatus*) (T)
106	Trestle Ravine Woods	T6N R22E Section 14 City of St. Francis	WE Energies	3	Blue-stemmed goldenrod (*Solidago caesia*) (E)
107	Truck Stop Woods	T5N R22E Section 30 City of Oak Creek	Private	11	Red trillium (*Trillium recurvatum*) (R) Black haw (*Viburnum prunifolium*) (R)
108	Underwood Parkway Woods	T7N R21E Section 20 City of Wauwatosa	Milwaukee County	16	Hoptree (*Ptelea trifoliate*) (R)
109	West Granville Mesic Woods	T8N R21E Section 17 City of Milwaukee	Private	8	Golden seal (*Hydrastis canadensis*) (R)
110	Westway Woods	T6N R21E Section 34 Village of Greendale	Village of Greendale	9	Red trillium (*Trillium recurvatum*) (R)
111	Wood Creek Woods	T5N R22E Section 20 City of Oak Creek	Private	27	Red trillium (*Trillium recurvatum*) (R) Black haw (*Viburnum prunifolium*) (R) False hop sedge (*Carex lupuliformus*) (E)
			Total: 55 Sites	1,037	--

[a] *Species of concern are classified as follows:*

E - refers to species designated as endangered

T - refers to species designated as threatened

R - refers to species designated as rare or special concern.

Source: SEWRPC

Table 2.24
Park and Outdoor Recreation Sites Owned by Milwaukee County: 2020

Number on Map 2.24	Site Name	Typology[a]	Location[b]	Size (Acres)
1	Alcott Park	NP	T06N, R21E, Section 17	17
2	Algonquin Park	NP	T08N, R21E, Section 14	9
3	Armour Park	NP	T06N, R21E, Section 22	15
4	Atkinson Triangle	NP	T07N, R22E, Section 08	1
5	Back Bay[c]	RP	T07N, R22E, Section 22	7
6	Baran Park	CP	T06N, R22E, Section 08	24
7	Barnard Park	NP	T06N, R21E, Section 25	10
8	Bay View Park[d]	RP	T06N, R22E, Section 14	40
9	Bender Park	RP	T05N, R22E, Section 25	303
10	Big Bay Park	NP	T08N, R22E, Section 33	9
11	Bradford Beach[c]	RP	T07N, R22E, Section 15	28
12	Brown Deer Park	RP	T08N, R21E, Section 13	362
13	Burns Commons	MP	T07N, R22E, Section 21	1
14	Caesar Park	NP	T07N, R22E, Section 21	3
15	Cambridge Woods	OS/NA	T07N, R22E, Section 09	14
16	Cannon Park	NP	T07N, R21E, Section 29	8
17	Carver Park	CP	T07N, R22E, Section 20	12
18	Cathedral Square	NP	T07N, R22E, Section 28	2
19	Center Street Park	NP	T07N, R21E, Section 15	5
20	Chippewa Park	NP	T07N, R21E, Section 30	11
21	Clarke Square	NP	T07N, R22E, Section 31	2
22	Clas Park	MP	T07N, R22E, Section 29	1
23	Cooper Park	NP	T07N, R21E, Section 16	8
24	Copernicus Park	NP	T06N, R22E, Section 31	20
25	County Grounds	OS/NA	T07N, R21E, Section 20	55
26	Cudahy Nature Preserve	OS/NA	T05N, R22E, Section 04	42
27	Cudahy Park	NP	T06N, R22E, Section 34	18
28	Cupertino Park[d]	RP	T06N, R22E, Section 10	7
29	Currie Park	RP	T07N, R21E, Section 07	195
30	Dale Creek Parkway	PW	--	45
31	Dineen Park	CP	T07N, R21E, Section 10	65
32	Doctors Park	CP	T08N, R22E, Section 10	55
33	Doyne Park	CP	T07N, R21E, Section 26	35
34	Dretzka Park	RP	T08N, R21E, Section 07	326
35	East Side Bike Trail	GW	T07N, R22E, Section 05	74
36	Estabrook Park	RP	T07N, R22E, Section 04	112
37	Euclid Park	NP	T06N, R21E, Section 16	9
38	Falk Park	RP	T05N, R22E, Section 07	258
39	Franklin Park	RP	T05N, R21E, Section 29	165
40	Froemming Park	NP	T05N, R21E, Section 23	17
41	Garden Homes Square	NP	T07N, R22E, Section 06	2
42	Gilman Triangle	MP	T07N, R22E, Section 15	--[e]
43	Gordon Park	CP	T07N, R22E, Section 16	24
44	Grant Park[d]	RP	T05N, R22E, Section 01	381
45	Grantosa Parkway	PW	--	16
46	Granville Dog Park	SUF	T08N, R21E, Section 18	25
47	Greene Park	CP	T06N, R22E, Section 23	36
48	Greenfield Park	RP	T06N, R21E, Section 06	282
49	Grobschmidt Park	RP	T05N, R21E, Section 01	152

Table continued on next page.

Table 2.24 (Continued)

Number on Map 2.24	Site Name	Typology[a]	Location[b]	Size (Acres)
50	Hales Corners Park	CP	T06N, R21E, Section 31	33
51	Hansen Park	SUF	T07N, R21E, Section 20	51
52	Hanson A.C. Park	NP	T08N, R21E, Section 03	14
53	Highland Park	NP	T07N, R21E, Section 25	3
54	Holler Park	CP	T06N, R22E, Section 29	15
55	Holt Park	OS/NA	T06N, R21E, Section 17	21
56	Honey Creek Parkway	PW	--	114
57	Hoyt Park	CP	T07N, R21E, Section 21	20
58	Humboldt Park	CP	T06N, R22E, Section 09	70
59	Indigenous Peoples' Park[f]	NP	T07N, R21E, Section 03	10
60	Jackson Park	RP	T06N, R21E, Section 12	113
61	Jacobus Park	CP	T07N, R21E, Section 27	25
62	James W. Beckum Park	SC	T07N, R22E, Section 20	16
63	Johnsons Park	NP	T07N, R22E, Section 19	13
64	Johnstone Park	NP	T05N, R22E, Section 06	13
65	Joseph-Lichter Park	OS/NA	T08N, R21E, Section 05	34
66	Juneau Park[c]	RP	T07N, R22E, Section 28	16
67	Kern Park	CP	T07N, R22E, Section 09	30
68	King Park	CP	T07N, R22E, Section 19	21
69	Kinnickinnic River Parkway	PW	--	193
70	KK Sports Center	SC	T06N, R22E, Section 07	20
71	Kletzsch Park	RP	T08N, R22E, Section 19	128
72	Kohl Park	RP	T08N, R21E, Section 03	272
73	Kops Park	NP	T07N, R21E, Section 09	8
74	Kosciuszko Park	CP	T06N, R22E, Section 05	34
75	Kulwicki Park	CP	T06N, R21E, Section 19	28
76	La Follette Park	CP	T07N, R21E, Section 32	18
77	Lake Park[c]	RP	T07N, R22E, Section 15	138
78	Lincoln Creek Parkway	PW	--	102
79	Lincoln Park	RP	T08N, R22E, Section 31	313
80	Lingbergh Park	NP	T07N, R22E, Section 07	3
81	Lindsay Park	NP	T07N, R21E, Section 04	13
82	Little Menomonee River Parkway	PW	--	866
83	Lyons Park	NP	T06N, R21E, Section 14	12
84	Madison Park	CP	T07N, R21E, Section 05	59
85	Maitland Park	CP	T06N, R22E, Section 31	33
86	Manitoba Park	NP	T06N, R21E, Section 11	4
87	McCarty Park	CP	T06N, R21E, Section 09	52
88	McGovern Park	CP	T08N, R21E, Section 35	61
89	McKinley Park[c,g]	RP	T07N, R22E, Section 22	102
90	Meaux Park	CP	T08N, R22E, Section 31	25
91	Melody View Preserve	OS/NA	T08N, R21E, Section 16	14
92	Menomonee River Parkway	PW	--	597
93	Milwaukee County Sports Complex	SC	T05N, R21E, Section 23	117
94	Milwaukee River Parkway	PW	--	111
95	Milwaukee Rotary Centennial Arboretum	SUF	T07N, R22E, Section 16	6
96	Mitchell Airport Park	NP	T06N, R22E, Section 21	19
97	Mitchell Boulevard	NP	T07N, R21E, Section 26	16
98	Mitchell Park	RP	T07N, R22E, Section 31	61
99	Moody Park	NP	T07N, R22E, Section 07	4
100	Morgan Triangle	MP	T06N, R22E, Section 15	1
101	Nash Park	NP	T07N, R21E, Section 09	9
102	North Shore Right of Way	GW	T05N, R22E, Section 09	70
103	Noyes Park	CP	T08N, R21E, Section 21	72
104	Oak Creek Parkway	PW	--	1,206

Table continued on next page.

Table 2.24 (Continued)

Number on Map 2.24	Site Name	Typology[a]	Location[b]	Size (Acres)
105	Oakwood Park	SUF	T05N, R21E, Section 25	276
106	Park Maintenance	SUF	T07N, R21E, Section 27	4
107	Pere Marquette Park	NP	T07N, R22E, Section 29	2
108	Pleasant Valley Park	NP	T07N, R22E, Section 09	23
109	Popuch Park	NP	T08N, R21E, Section 08	12
110	Prospect Triangle	MP	T07N, R22E, Section 15	1
111	Pulaski Park (Cudahy)	NP	T06N, R22E, Section 26	16
112	Pulaski Park (Milwaukee)	NP	T06N, R22E, Section 07	26
113	Rainbow Park	CP	T07N, R21E, Section 31	26
114	Rawson Park	CP	T05N, R22E, Section 02	30
115	Red Arrow Park	NP	T07N, R22E, Section 29	1
116	Riverfront Launch Site	SUF	T07N, R22E, Section 33	--[e]
117	Riverside Park	CP	T07N, R22E, Section 16	25
118	Riverton Meadows	NP	T05N, R22E, Section 15	12
119	Root River Parkway	PW	--	4,045[h]
120	Rose Park	CP	T07N, R22E, Section 17	10
121	Rover West Dog Park	SUF	T07N, R22E, Section 09	3
122	Runway Dog Park	SUF	T05N, R22E, Section 04	26
123	Saveland Park	NP	T06N, R22E, Section 17	3
124	Schoenecker Park	NP	T08N, R21E, Section 26	18
125	Scout Lake Park	CP	T06N, R21E, Section 35	64
126	Servite Park Preserve	OS/NA	T08N, R21E, Section 09	20
127	Sheridan Park[d]	RP	T06N, R22E, Section 25	132
128	Sherman Park	CP	T07N, R21E, Section 13	21
129	Smith Park	NP	T08N, R21E, Section 36	19
130	South Shore Park[d,i]	RP	T06N, R22E, Section 10	48
131	Southwood Glen	NP	T05N, R21E, Section 24	9
132	St. Martin's Park	NP	T05N, R21E, Section 07	20
133	Story Parkway	PW	T07N, R21E, Section 26	8
134	Tiefenthaler Park	NP	T07N, R22E, Section 19	11
135	Tippecanoe Park	NP	T06N, R22E, Section 16	17
136	Trimborn Farm	SUF	T06N, R21E, Section 33	7
137	Uihlein Soccer Park	SC	T08N, R21E, Section 22	67
138	Underwood Creek Parkway	PW	--	179
139	UP Railroad Corridor	GW	T08N, R22E, Section 32	37
140	Valley Park	NP	T07N, R21E, Section 25	2
141	Veterans Park[c]	RP	T07N, R22E, Section 28	91
142	Vogel Park	NP	T08N, R21E, Section 33	12
143	Wahl Park	NP	T07N, R21E, Section 02	12
144	Walker Square	NP	T07N, R22E, Section 32	2
145	War Memorial and Art Center	SUF	T07N, R22E, Section 18	7
146	Warnimont Park[d]	RP	T06N, R22E, Section 36	248
147	Washington Park	RP	T07N, R21E, Section 23	130
148	Webster Park	NP	T07N, R21E, Section 06	5
149	Wedgewood Park	NP	T06N, R21E, Section 15	6
150	West Milwaukee Park	CP	T06N, R21E, Section 02	21
151	Whitnall Park	RP	T05N, R21E, Section 05	627
152	Wilson Park	RP	T06N, R22E, Section 19	77
153	Wilson Recreation Center	RP	T06N, R22E, Section 19	54
154	Wisconsin Avenue Park	NP	T07N, R21E, Section 29	18
155	Wyrick Park	NP	T08N, R21E, Section 23	18
156	Zablocki Park	CP	T06N, R21E, Section 24	45
157	Zeidler Union Square	NP	T07N, R22E, Section 29	1
			Subtotal: 157 Sites	15,321

Table continued on next page.

Table 2.24 (Continued)

Number on Map 2.24	Site Name	Typology[a]	Location[b]	Size (Acres)
	County-Owned Sites Not Under the Jurisdiction of Milwaukee County Parks			
158	Camelot Park (leased to the City of Oak Creek)	NP	T05N, R22E, Section 10	10
159	Milwaukee County Zoo	--	T07N, R21E, Section 29	168
			Subtotal - 2 Sites	178
			Total County-Owned Sites - 159 Sites	15,499

[a] *This plan uses the following typology, which is described in detail in Appendix A, for each County-owned park and open space site:*

RP – Regional Park: Large outdoor recreation site (typically 100 acres or more in size) serving multiple communities or counties
CP – Community Park: Intermediate size recreation site (typically 25 to 100 acres in size) serving a community or multiple neighborhood areas
NP – Neighborhood Park: Smaller park site (typically three to 25 acres in size) serving an individual neighborhood area
PW – Parkway: Linear park and open space site that consists of a natural resource corridor along the major rivers and streams in the County or a trail right-of-way linking neighborhoods or other park and open space sites
GW – Greenway: Typically, a narrow trail right-of-way that links neighborhoods or other park and open space sites and facilities
OS/NA – Open Space/Natural Area: Natural resource preservation site with development typically limited to parking and trails
MP – Mini Park: Small green space site (typically two acres or smaller in size) with limited recreational facilities
SC – Sports Center: Site dedicated to only intensive indoor or outdoor recreational facilities
SUF – Special Use Facility: Site that provides a single purpose recreational facility such as a golf course or dog park

[b] *Indicates location given in Township, Range, and Section based on the U.S. Public Land Survey System (PLSS). Specific PLSS locations are not listed for linear sites that extend through multiple quarter sections.*

[c] *Back Bay, Bradford Beach, Juneau Park, Lake Park, McKinley Park, and Veterans Park comprise Lake Michigan North, which is classified as a major park. The total area of these seven sites is 404 acres.*

[d] *Bay View Park, Cupertino Park, Grant Park, Sheridan Park, South Shore Park, and Warnimont Park comprise Lake Michigan South, which is classified as a major park. The total area of these six sites is 856 acres.*

[e] *Amounts to less than one acre.*

[f] *Columbus Park was renamed Indigenous Peoples' Park while this plan was under preparation.*

[g] *Includes Milwaukee Yacht Club, which is privately owned.*

[h] *Includes 38 acres in Racine County.*

[I] *Includes South Shore Yacht Club, which is privately owned, and nine acres of breakwater that is considered to be part of the park.*

Source: Milwaukee County Parks and SEWRPC

Table 2.25
State of Wisconsin Recreation and Open Space Lands in Milwaukee County: 2020

Number on Map 2.24	Site Name	Location[a]	Size (Acres)
	Wisconsin Department of Natural Resources Sites (WDNR)		
160	Big Muskego Lake Wildlife Area	T05N, R21E, Section 19	119
161	Forestry Education Center	T07N, R21E, Section 20	67
162	Hank Aaron State Trail Access	T07N, R21E, Section 36	--[b]
163	Havenwoods State Forest	T08N, R21E, Section 26	222
164	Lake Shore State Park	T07N, R22E, Section 28	20
165	Wetland Mitigation Site	T05N, R22E, Section 06	9
166	Wildlife Habitat	T06N, R22E, Section 09	2
		WDNR Sites Total – 7 Sites	439
	Other State Sites		
167	American Family Field[c]	T07N, R21E, Section 35	221
168	State Fairgounds	T07N, R21E, Section 33	203
169	University of Wisconsin-Milwaukee - Downer Woods	T07N, R22E, Section 10	25
170	University of Wisconsin-Milwaukee/WisDOT – Monarch Conservancy/Habitat	T07N, R21E, Section 20	22
171	WisDOT Site	T05N, R22E, Section 18	11
		Other State Sites Total: 5 Sites	482
		Total Sites – 12 Sites	921

[a] *Indicates location given in Township, Range, and Section based on the U.S. Public Land Survey System.*

[b] *Less than one acre.*

[c] *Owned by the Southeast Wisconsin Professional Baseball Park District, a special purpose district established by the State. The site was previously known as Miller Park.*

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 2.26
Park and Open Space Sites Owned by Cities, Villages, or Public School Districts in Milwaukee County: 2020

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	Village of Bayside			
1	Bayside Middle School	8	T08N, R22E, Section 04	5
2	Ellsworth Park	5	T08N, R22E, Section 04	8
3	Pelham Heath-Indian Creek Water Detention Area	5	T08N, R22E, Section 09	5
4	Village Hall Open Space	5	T08N, R22E, Section 05	14
	Village of Brown Deer			
5	Badger Meter River Park	5	T08N, R21E, Section 01	3
6	Brown Deer Public Schools	8	T08N, R21E, Section 11	40
7	Fairy Chasm Park	5	T08N, R21E, Section 02	10
8	Village Park	5	T08N, R21E, Section 02	13
	Village of Fox Point			
9	Bradley Road-Lake Drive Park	5	T08N, R22E, Section 16	1
10	Dunwood School	8	T08N, R22E, Section 17	7
11	Indian Creek Park	5	T08N, R22E, Section 08	8
12	Longacre Park South	5	T08N, R22E, Section 16	4
13	Longacre Pavilion and Park	5	T08N, R22E, Section 16	5
14	Mapledale School	8	T08N, R22E, Section 08	6
15	Stormonth School	8	T08N, R22E, Section 16	9
16	Village Swimming Pool	5	T08N, R22E, Section 21	6
	Village of Greendale			
17	84th and Grange Athletic Fields	5	T06N, R21E, Section 33	11
18	Ambruster Fields Open Space	5	T06N, R21E, Section 27	2
19	Bentwood Hill Park	5	T06N, R21E, Section 34	1
20	Canterbury Woodlands	5	T06N, R21E, Section 34	7
21	College Park	5	T06N, R21E, Section 35	20
22	College Park School	8	T05N, R21E, Section 02	6
23	Edgerton Park	5	T06N, R21E, Section 27	16
24	Greendale Community Center	5	T06N, R21E, Section 34	22
25	Greendale High School	8	T06N, R21E, Section 34	27
26	Greendale Middle School and Canterbury	8	T06N, R21E, Section 34	17
27	Highland View School	8	T06N, R21E, Section 35	10
28	Lions Park	5	T06N, R21E, Section 34	3
29	Sherwood Heights Park	5	T06N, R21E, Section 34	10
30	Village Green	5	T06N, R21E, Section 35	27
31	Village Green Park	5	T06N, R21E, Section 35	31
	Village of Hales Corners			
32	Cobb Park	5	T06N, R21E, Section 31	7
33	Edgerton School	8	T06N, R21E, Section 30	4
34	Greenway Open Space	5	T06N, R21E, Section 30	11
35	Hales Corners School	8	T06N, R21E, Section 31	4
36	Potter's Forest	8	T06N, R21E, Section 32	51
37	Schoetz Park	5	T06N, R21E, Section 30	21
	Village of River Hills			
38	Indian Hill School	8	T08N, R22E, Section 08	4
	Village of Shorewood			
39	Atwater Park and Beach	5	T07N, R22E, Section 03	7
40	Atwater School	8	T07N, R22E, Section 03	5
41	Hubbard Park	5	T07N, R22E, Section 09	6

Table continued on next page.

Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	Village of Shorewood (continued)			
42	Humble Park	5	T07N, R22E, Section 10	1
43	Lake Bluff School	8	T07N, R22E, Section 04	8
44	Menlo Park	5	T07N, R22E, Section 10	1
45	Nature Preserve	5	T07N, R22E, Section 10	8
46	River Park	5	T07N, R22E, Section 09	8
47	Shorewood Intermediate and High Schools	8	T07N, R22E, Section 09	13
48	Shorewood Library Green Space	5	T07N, R22E, Section 10	1
49	Triangle Park	5	T07N, R22E, Section 04	1
	Village of West Milwaukee			
50	Greenfield Avenue and Beloit Road Open Space	5	T06N, R21E, Section 02	1
51	Lions Park	5	T06N, R21E, Section 02	1
52	Pershing School	8	T07N, R21E, Section 35	2
53	West Milwaukee High School	8	T07N, R21E, Section 35	3
	Village of Whitefish Bay			
54	Buckley Park	5	T08N, R22E, Section 33	2
55	Cahill Square	5	T08N, R22E, Section 33	8
56	Craig Counsell Park	5	T08N, R22E, Section 29	6
57	Cumberland School	8	T07N, R22E, Section 04	8
58	Klode Park	5	T08N, R22E, Section 28	11
59	Lydell School	8	T08N, R22E, Section 32	4
60	Richards School	8	T08N, R22E, Section 28	4
61	School House Park	5	T08N, R22E, Section 33	1
62	Silver Spring Park	5	T08N, R22E, Section 28	1
63	Whitefish Bay Armory	5	T08N, R22E, Section 33	4
64	Whitefish Bay High School	8	T08N, R22E, Section 33	8
65	Whitefish Bay Middle School	8	T08N, R22E, Section 33	2
	City of Cudahy			
66	Cudahy High School	8	T06N, R22E, Section 25	20
67	Cudahy Middle School	8	T06N, R22E, Section 35	3
68	General Mitchell School	8	T06N, R22E, Section 34	4
69	Immigrant Family Park	4	T06N, R22E, Section 23	1
70	J.E. Jones School	8	T06N, R22E, Section 35	2
71	Kosciuszko School	8	T06N, R22E, Section 26	2
72	Lincoln School	8	T06N, R22E, Section 23	2
73	Parkview School	8	T06N, R22E, Section 34	8
	City of Franklin			
74	Ben Franklin Elementary School	8	T05N, R21E, Section 09	7
75	Cascade Creek Park	4	T05N, R21E, Section 14	9
76	Country Dale Elementary School	8	T05N, R21E, Section 07	6
77	Countryside Open Space	4	T05N, R21E, Section 12	6
78	Dr. Lynette Fox Memorial Park	4	T05N, R21E, Section 02	1
79	Ernie Lake Park	4	T05N, R21E, Section 17	14
80	Forest Park Middle School/Environmental Education Center	8	T05N, R21E, Section 16	24
81	Franklin High School	8	T05N, R21E, Section 14	63
82	Franklin Woods Nature Center	4	T05N, R21E, Section 24	39
83	Friendship Park	4	T05N, R21E, Section 13	2
84	Glenn Meadows Park	4	T05N, R21E, Section 12	1
85	Jack E. Workman Park	4	T05N, R21E, Section 13	12
86	Ken Windl Park	4	T05N, R21E, Section 07	4
87	Lion's Legend Park	4	T05N, R21E, Section 16	41
88	Market Square	4	T05N, R21E, Section 07	1
89	Meadowlands Park	4	T05N, R21E, Section 21	14

Table continued on next page.

Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Franklin (continued)			
90	Mission Hills Neighborhood Wetlands	4	T05N, R21E, Section 08	17
91	Ollie Pederson Field	4	T05N, R21E, Section 28	20
92	Pleasant View Elementary School	8	T05N, R21E, Section 11	11
93	Pleasant View Park	4	T05N, R21E, Section 11	24
94	Robinwood Elementary School	8	T05N, R21E, Section 08	3
95	Southwood Glen Elementary School	8	T05N, R21E, Section 24	3
96	Victory Creek Park	4	T05N, R21E, Section 12	72
	City of Glendale			
97	Glen Hills School	8	T08N, R22E, Section 19	10
98	Good Hope Elementary School	8	T08N, R22E, Section 19	7
99	Nicolet High School	8	T08N, R22E, Section 20	20
100	Parkway School	8	T08N, R22E, Section 30	7
101	Richard E. Maslowski Community Park	4	T08N, R22E, Section 30	32
	City of Greenfield			
102	Bicentennial Park	4	T06N, R21E, Section 23	1
103	Brookside Meadow Drive Park Site	4	T06N, R21E, Section 29	15
104	Coopers Hawk Park	4	T06N, R21E, Section 14	1
105	Creekwood Park	4	T06N, R21E, Section 26	3
106	Dan Jansen Park	4	T06N, R21E, Section 27	3
107	Edgewood School	8	T06N, R21E, Section 26	5
108	Elmdale School	8	T06N, R21E, Section 25	5
109	Falcon View Park	4	T06N, R21E, Section 19	2
110	Glenwood School	8	T06N, R21E, Section 14	10
111	Greenfield High School	8	T06N, R21E, Section 26	32
112	Greenfield Middle School	8	T06N, R21E, Section 25	12
113	Greenfield School District Administration	8	T06N, R21E, Section 21	10
114	Haker Park	4	T06N, R21E, Section 24	4
115	Honey Bear Park	4	T06N, R21E, Section 23	1
116	Jim Smrz Park	4	T06N, R21E, Section 36	1
117	Konkel Park	4	T06N, R21E, Section 26	40
118	Lavies Park	4	T06N, R21E, Section 22	1
119	Maple Grove School	8	T06N, R21E, Section 22	5
120	Pond View Park	4	T06N, R21E, Section 24	7
121	Towering Woods Nature Area	4	T06N, R21E, Section 21	4
122	Whitnall High School	8	T06N, R21E, Section 30	29
123	Whitnall Middle School	8	T06N, R21E, Section 30	8
124	Wildcat Creek Nature Corridor	4	T06N, R21E, Section 19	10
	City of Milwaukee			
125	16th and Edgerton	4	T06N, R22E, Section 30	1
126	16th and Hopkins Play Area	4	T07N, R22E, Section 18	1
127	17th and Vine	4	T07N, R22E, Section 19	1
128	19th and Meinecke Avenue Totlot	4	T07N, R22E, Section 18	1
129	1st and Hadley Green Space	4	T07N, R22E, Section 17	1
130	1st and Keefe Play Area	4	T07N, R22E, Section 08	1
131	1st and Wright	4	T07N, R22E, Section 17	1
132	21st and Keefe	4	T07N, R22E, Section 07	1
133	29th and Meinecke	4	T07N, R21E, Section 13	1
134	29th and Melvina	4	T07N, R21E, Section 12	1
135	30th and Cawker	4	T07N, R21E, Section 13	1
136	30th and Fardale Green Space	4	T06N, R21E, Section 13	8
137	30th and Galena	4	T07N, R21E, Section 24	1
138	31st and Lloyd	4	T07N, R21E, Section 24	1
139	34th and Mount Vernon	4	T07N, R21E, Section 25	1

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Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Milwaukee (continued)			
140	35th and Lincoln	4	T06N, R21E, Section 01	1
141	37th Place and W. McKinley Avenue Park	4	T07N, R21E, Section 24	1
142	38th and Vliet Street Open Space	4	T07N, R21E, Section 24	1
143	40th and Douglas	4	T08N, R21E, Section 25	1
144	4th and Mineral	4	T07N, R22E, Section 32	1
145	5th and Randolph	4	T07N, R22E, Section 08	1
146	62nd and Kaul Play Area	4	T08N, R21E, Section 71	1
147	65th and Medford Green Space	4	T07N, R21E, Section 03	1
148	68th Street School	8	T07N, R21E, Section 15	1
149	84th and Florist	4	T08N, R21E, Section 28	1
150	8th Street Middle School	8	T07N, R22E, Section 29	1
151	90th and Bender	4	T08N, R21E, Section 28	3
152	Academy of Accelerated Learning	8	T06N, R21E, Section 16	12
153	Adams Park	4	T07N, R22E, Section 08	1
154	Alcott School	8	T06N, R21E, Section 17	8
155	Allen-Field School	8	T06N, R22E, Section 05	2
156	Allis Street Totlot	4	T06N, R22E, Section 04	1
157	Arlington Heights Play Area	4	T07N, R21E, Section 36	2
158	Audubon Middle School	8	T06N, R21E, Section 13	5
159	Auer Avenue School	8	T07N, R22E, Section 07	3
160	Barton School and Playfield	8	T08N, R21E, Section 23	5
161	Bay View Basketball	4	T06N, R22E, Section 04	1
162	Bay View Dog Park[c]	4	T06N, R22E, Section 04	2
163	Bay View High School	8	T06N, R22E, Section 09	5
164	Bell Middle School and Honey Creek School	8	T06N, R21E, Section 15	6
165	Beulah Brinton Park	4	T06N, R22E, Section 09	6
166	Bradley Woods Natural Area	4	T08N, R21E, Section 09	20
167	Bridging the Gap Golf Learning Center	4	T07N, R22E, Section 30	1
168	Brown Street School	8	T07N, R22E, Section 19	2
169	Browning School and Playfield	8	T08N, R21E, Section 33	5
170	Bruce School and Playfield	8	T08N, R21E, Section 21	5
171	Bryant School and Playfield	8	T08N, R21E, Section 28	11
172	Buffum Street Play Area	4	T07N, R22E, Section 16	1
173	Burbank School and Playfield	8	T07N, R21E, Section 34	8
174	Burdick School	8	T06N, R22E, Section 21	2
175	Burnham Playfield	4	T06N, R21E, Section 01	13
176	Butterfly Park	4	T07N, R21E, Section 13	2
177	Byron Kilbourn School	8	T08N, R21E, Section 34	3
178	Carleton School	8	T08N, R21E, Section 25	3
179	Carmen Playfield	4	T08N, R21E, Section 27	4
180	Cass Street Playground	4	T07N, R22E, Section 21	2
181	Catalano Square	4	T07N, R22E, Section 33	1
182	Children's Park	4	T06N, R22E, Section 06	1
183	Clarke Street School and Playfield	8	T07N, R21E, Section 13	3
184	Clemens School and Playfield	8	T07N, R21E, Section 01	4
185	Clement Avenue School	8	T06N, R22E, Section 16	3
186	Clovernook Playfield	4	T08N, R21E, Section 22	7
187	Columbia Playground	4	T07N, R22E, Section 18	3
188	Community Health Center	8	T07N, R22E, Section 17	1
189	Congress School	8	T07N, R21E, Section 02	3
190	Cooper School and Playfield	8	T06N, R22E, Section 30	7
191	Craig School	8	T07N, R21E, Section 04	2
192	Curtin School	8	T06N, R21E, Section 13	5

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Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Milwaukee (continued)			
193	Custer High School and Stadium	8	T08N, R21E, Section 35	19
194	Custer Playfield	4	T08N, R21E, Section 36	5
195	Darien and Kiley Playlot	4	T08N, R21E, Section 24	3
196	Doerfler School	8	T07N, R21E, Section 36	1
197	Douglas Community Academy	8	T07N, R22E, Section 07	2
198	Douglass School	8	T07N, R21E, Section 12	1
199	Dover School	8	T06N, R22E, Section 09	2
200	Dr. Benjamin Carson Academy of Science	8	T07N, R21E, Section 02	1
201	Dr. L. Carter Park	4	T07N, R22E, Section 18	1
202	Dyer Playfield	4	T07N, R21E, Section 28	7
203	Edison Middle School	8	T08N, R21E, Section 36	1
204	Ellen Park	4	T06N, R22E, Section 15	5
205	Elm Creative Arts School	8	T07N, R22E, Section 20	3
206	Emerson School	8	T07N, R21E, Section 04	2
207	Emigh Playfield	4	T06N, R22E, Section 16	12
208	Enderis Playfield	4	T07N, R21E, Section 15	9
209	Engleburg School	8	T08N, R21E, Section 33	2
210	Erie Street Plaza	4	T07N, R22E, Section 33	1
211	Ezekiel Gillespie Park	4	T07N, R22E, Section 18	1
212	Fairview School and Playfield	8	T06N, R21E, Section 10	10
213	Fernwood School	8	T06N, R22E, Section 15	3
214	Forest Home Avenue School	8	T06N, R22E, Section 06	2
215	Franklin School	8	T07N, R22E, Section 16	2
216	Franklin School	8	T07N, R22E, Section 07	1
217	Franklin Square Playground	4	T07N, R22E, Section 18	3
218	Fratney Elementary School	8	T07N, R22E, Section 09	2
219	Fritsche Middle School	8	T06N, R22E, Section 09	7
220	Gaenslen School	8	T07N, R22E, Section 09	3
221	Gale Crest Park	4	T07N, R21E, Section 15	1
222	Garden Homes School and Playfield	8	T07N, R22E, Section 06	7
223	Garfield Avenue School	8	T07N, R22E, Section 20	1
224	Garland School	8	T06N, R22E, Section 31	3
225	Goodrich School	8	T08N, R21E, Section 08	6
226	Grant School	8	T06N, R21E, Section 01	2
227	Grantosa School	8	T08N, R21E, Section 33	5
228	Granville Woods Natural Area	4	T08N, R21E, Section 10	16
229	Gra-Ram Playfield	4	T06N, R21E, Section 36	5
230	Green Bay Avenue School and Playfield	8	T07N, R22E, Section 08	4
231	Greenfield School	8	T06N, R21E, Section 01	1
232	Halyard Park	4	T07N, R22E, Section 20	1
233	Hamilton High School and Playfield	8	T06N, R21E, Section 15	13
234	Hampton School and Playfield	8	T08N, R21E, Section 35	10
235	Hanson Avenue Park	4	T06N, R22E, Section 16	1
236	Hartford University School	8	T07N, R22E, Section 10	2
237	Hartung Park	4	T07N, R21E, Section 08	18
238	Hawley Environmental School	8	T07N, R21E, Section 26	1
239	Hawthorn School	8	T08N, R21E, Section 24	3
240	Hawthorne Glen Outdoor Education Center	4	T07N, R21E, Section 26	22
241	Hayes School	8	T06N, R22E, Section 08	1
242	Haymarket Square	4	T07N, R22E, Section 20	1
243	Hickman Academy	8	T07N, R21E, Section 02	2
244	Highland Community School	8	T07N, R22E, Section 30	2
245	Hi-Mount School	8	T07N, R21E, Section 23	2

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Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Milwaukee (continued)			
246	Hmong American Peace Academy-Main Campus	8	T07N, R21E, Section 04	9
247	Hmong American Peace Academy-Happy Hill Campus	8	T08N, R21E, Section 10	5
248	Holmes School	8	T07N, R22E, Section 16	3
249	Holt Playground	4	T06N, R22E, Section 18	4
250	Hopkins Lloyd Elementary	8	T07N, R22E, Section 18	1
251	Humboldt Park School	8	T06N, R22E, Section 16	2
252	James Groppi High School	8	T07N, R22E, Section 19	1
253	Jewel Playfield	4	T05N, R22E, Section 06	6
254	John Muir Middle School	8	T08N, R21E, Section 34	5
255	Juneau Playfield	4	T07N, R21E, Section 27	8
256	Kagel School	8	T07N, R22E, Section 32	2
257	Kaszube's Park	4	T07N, R22E, Section 33	1
258	Keefe School	8	T07N, R22E, Section 07	2
259	Kilbourn Reservoir Park	4	T07N, R22E, Section 21	30
260	King High School	8	T07N, R22E, Section 06	8
261	Kosciuszko Middle School and South Stadium	8	T06N, R22E, Section 05	8
262	LaFollette School	8	T07N, R22E, Section 08	3
263	Lancaster School and Playfield	8	T08N, R21E, Section 34	5
264	Lee School	8	T07N, R22E, Section 17	2
265	Lewis Playfield	4	T06N, R22E, Section 09	5
266	Lincoln Avenue School	8	T06N, R22E, Section 07	2
267	Lincoln Field	4	T06N, R22E, Section 05	6
268	Lincoln Middle School	8	T07N, R22E, Section 21	1
269	Lisbon Avenue and Sarnow Street Triangle	4	T07N, R21E, Section 24	1
270	Longfellow School	8	T07N, R22E, Section 31	3
271	Lowell School and Playfield	8	T06N, R22E, Section 19	8
272	Lynden Hill	4	T07N, R22E, Section 19	3
273	MacDowell School	8	T07N, R21E, Section 27	2
274	Madison University High School	8	T08N, R21E, Section 28	5
275	Maier Festival Park	4	T07N, R22E, Section 33	72
276	Malcom X Academy	8	T07N, R22E, Section 17	2
277	Manitoba School	8	T06N, R21E, Section 12	6
278	Maple Tree School and Playfield	8	T08N, R21E, Section 20	8
279	Marcus DeBack Playground	4	T07N, R21E, Section 14	1
280	Marshall High School and Playfield	8	T07N, R21E, Section 03	7
281	Martin Luther King Jr. Elementary School	8	T07N, R22E, Section 08	1
282	Mary McLeod Bethune Academy	8	T07N, R21E, Section 24	2
283	Maryland Avenue School	8	T07N, R22E, Section 15	2
284	McNair Academy School and Playfield	8	T08N, R22E, Section 31	5
285	Meir School	8	T07N, R22E, Section 20	1
286	Menomonee Valley Community Park	4	T07N, R21E, Section 36	14
287	Merrill Park Playfield	4	T07N, R21E, Section 25	12
288	Mervis-McCormack Brady Street Park	4	T07N, R22E, Section 21	1
289	Metcalfe Playfield	4	T07N, R21E, Section 13	7
290	Metcalfe Rising Park	4	T07N, R21E, Section 13	1
291	Milwaukee Environmental Sciences School and Playfield	8	T07N, R21E, Section 10	5
292	Milwaukee French Immersion School and Playfield	8	T06N, R21E, Section 16	6
293	Milwaukee German Immersion School	8	T07N, R21E, Section 09	7
294	Milwaukee High School of the Arts	8	T07N, R22E, Section 30	2
295	Milwaukee School of Languages	8	T07N, R21E, Section 09	5
296	Milwaukee Sign Language and Morse Middle Schools	8	T08N, R21E, Section 21	9
297	Milwaukee Spanish Immersion School	8	T06N, R21E, Section 11	4
298	Milwaukee Trade and Technical High School	8	T07N, R22E, Section 32	3

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Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Milwaukee (continued)			
299	Mitchell School	8	T06N, R22E, Section 06	1
300	MLK Peace Place	4	T07N, R22E, Section 08	1
301	Modrzejewski Playground	4	T06N, R22E, Section 08	4
302	Montreal Street Park	4	T07N, R21E, Section 01	4
303	Morgandale School	8	T06N, R22E, Section 18	1
304	N. 12th and Wright Playlot	4	T07N, R22E, Section 17	1
305	N. 20th and Capitol Triangle	4	T07N, R22E, Section 06	1
306	N. 20th and Olive Playlot	4	T07N, R22E, Section 06	1
307	N. 21st Street School	8	T07N, R22E, Section 18	3
308	N. 26th and Medford Totlot	4	T07N, R22E, Section 18	1
309	N. 35th Street School	8	T07N, R21E, Section 01	1
310	N. 45th and W. Keefe Totlot	4	T07N, R21E, Section 11	1
311	N. 49th and Juneau Totlot	4	T07N, R21E, Section 23	1
312	N. 53rd Street School and Playfield	8	T07N, R21E, Section 11	6
313	N. 65th and Stevenson Totlot	4	T07N, R21E, Section 27	3
314	N. 66th and Port	4	T08N, R21E, Section 15	6
315	N. 67th and Spokane Playlot	4	T08N, R21E, Section 22	2
316	N. 78th and Fiebrantz Playlot	4	T07N, R21E, Section 04	2
317	N. 81st Street School	8	T07N, R21E, Section 16	3
318	N. 84th and Burbank Playlot	4	T08N, R21E, Section 21	1
319	N. 95th Street School and Playfield	8	T07N, R21E, Section 08	4
320	N. 97th and Thurston Playlot	4	T08N, R21E, Section 29	1
321	Nancy Elizabeth Trowbridge Square	4	T06N, R21E, Section 01	1
322	Neeskara School	8	T07N, R21E, Section 23	3
323	Norris Playground	4	T07N, R22E, Section 30	2
324	North Division High School	8	T07N, R22E, Section 17	2
325	Ohio Playground	4	T06N, R22E, Section 17	4
326	Paliafito Park	4	T07N, R22E, Section 32	1
327	Palmer School	8	T07N, R22E, Section 20	2
328	Parklawn Playground	4	T07N, R21E, Section 02	7
329	Parkview School and Playfield	8	T08N, R21E, Section 31	5
330	Philipp School	8	T07N, R22E, Section 06	2
331	Polk Green	4	T07N, R22E, Section 33	2
332	Pulaski High School and Stadium	8	T06N, R22E, Section 07	17
333	Pulaski Street Playfield	4	T07N, R22E, Section 21	3
334	Pumping Station Playfield	4	T07N, R22E, Section 16	13
335	Ralph H. Metcalfe Neighborhood School	8	T07N, R21E, Section 13	1
336	Reiske Park/Southside Health Center	4	T06N, R22E, Section 06	4
337	Richard Kluge School	8	T08N, R21E, Section 27	4
338	Riley School	8	T06N, R22E, Section 08	1
339	River Bend	4	T06N, R21E, Section 15	1
340	River Trail School	8	T08N, R21E, Section 30	6
341	Riverside High School and Playfield	8	T07N, R22E, Section 16	5
342	Riverwalk Park	4	T07N, R22E, Section 29	1
343	Rogers Playfield	4	T06N, R21E, Section 01	6
344	Roosevelt Middle School/Lapham Park Playground	8	T07N, R22E, Section 20	8
345	S. 13th and Lapham Totlot	4	T06N, R22E, Section 06	1
346	S. 15th and Windlake Open Space	4	T06N, R22E, Section 07	1
347	S. 18th and Washington Totlot	4	T07N, R22E, Section 31	1
348	S. 21st and Rogers Totlot	4	T06N, R22E, Section 06	1
349	S. 36th and Rogers Playlot	4	T06N, R21E, Section 01	3
350	S. 51st and Stack Totlot	4	T06N, R21E, Section 11	1
351	S. 63rd and Cleveland Green Space	4	T06N, R21E, Section 10	1

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Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Milwaukee (continued)			
352	Scholars Park	4	T07N, R21E, Section 13	1
353	Scott Middle School	8	T07N, R22E, Section 30	2
354	Sherman Boulevard Open Space	4	T07N, R21E, Section 12	1
355	Sherman School	8	T07N, R21E, Section 14	2
356	Sholes Middle School	8	T06N, R22E, Section 30	10
357	Siefert School	8	T07N, R22E, Section 19	2
358	Sijan Playfield/Beulah Brinton Playfield	4	T06N, R22E, Section 09	15
359	Silver Spring School	8	T08N, R22E, Section 31	3
360	Snail's Crossing Play Area	4	T07N, R22E, Section 16	1
361	South Division High School	8	T06N, R22E, Section 06	2
362	Southlawn Playground	4	T06N, R22E, Section 18	2
363	Stark Playfield	4	T08N, R21E, Section 36	5
364	Starms School	8	T07N, R22E, Section 19	1
365	Steuben Middle School	8	T07N, R21E, Section 14	2
366	Story School	8	T07N, R21E, Section 25	2
367	Stuart School	8	T08N, R21E, Section 21	3
368	Sunshine Park	4	T07N, R22E, Section 19	1
369	Teutonia and Fairmount Green Space	4	T08N, R21E, Section 36	1
370	Thoreau School and Playfield	8	T08N, R21E, Section 14	6
371	Three Bridges Park	4	T07N, R21E, Section 36	28
372	Thurston Woods Campus	8	T08N, R21E, Section 25	3
373	Tippencanoe School	8	T06N, R22E, Section 21	1
374	Townsend School	8	T07N, R21E, Section 12	2
375	Trowbridge School	8	T06N, R22E, Section 10	1
376	Uncas Playground	4	T06N, R22E, Section 32	3
377	Urban Park	4	T07N, R22E, Section 28	6
378	Urban Waldorf School	8	T07N, R22E, Section 19	3
379	Victory School and Playfield	8	T06N, R22E, Section 31	3
380	Vieau School	8	T07N, R22E, Section 32	1
381	Vincent High School and Playfield	8	T08N, R21E, Section 17	39
382	Walker Middle School	8	T06N, R21E, Section 01	2
383	Warnimont Playground	4	T06N, R22E, Section 17	4
384	Washington High School	8	T07N, R21E, Section 14	5
385	Webster Middle School	8	T08N, R21E, Section 23	17
386	Westlawn Park	4	T08N, R21E, Section 34	3
387	Westside Academy I School	8	T07N, R21E, Section 24	2
388	Westside Academy II School	8	T07N, R21E, Section 24	1
389	Wheatley School	8	T07N, R22E, Section 18	2
390	Whitman School and Playfield	8	T06N, R21E, Section 23	8
391	Whittier School and Playfield	8	T06N, R22E, Section 20	6
392	Wick Playfield	4	T07N, R21E, Section 23	30
393	Wisconsin Conservancy of Life Long Learning	8	T06N, R21E, Section 36	5
394	Witkowiak Play Area	4	T06N, R22E, Section 05	1
395	Zablocki School	8	T06N, R22E, Section 08	2
396	Zillman Park	4	T06N, R22E, Section 04	1
397	Abendschein Park	4	T05N, R22E, Section 16	76
	City of Oak Creek			
398	Carollton Elementary School and Park	8	T05N, R22E, Section 23	9
399	Cedar Hills School	8	T05N, R22E, Section 06	3
400	Chapel Hills Park	4	T05N, R22E, Section 03	12
401	City of Oak Creek Open Space	4	T05N, R22E, Section 17	22
402	Deerfield Elementary School	8	T05N, R22E, Section 35	6
403	Edgewood Elementary and Oak Creek High Schools	8	T05N, R22E, Section 16	36

Table continued on next page.

Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Oak Creek (continued)			
404	Emerald Reserve Park	4	T05N, R22E, Section 17	20
405	Greenlawn Park	4	T05N, R22E, Section 09	9
406	Haas Park	4	T05N, R22E, Section 36	7
407	Kickers Creek Park	4	T05N, R22E, Section 14	12
408	Lake Vista Park	4	T05N, R22E, Section 24	32
409	Little League Complex	4	T05N, R22E, Section 08	19
410	Manor Marquette Park	4	T05N, R22E, Section 09	9
411	Mardeand Park	4	T05N, R22E, Section 32	8
412	MATC South Campus	8	T05N, R22E, Section 05	53
413	Meadowview Elementary School and Park	8	T05N, R22E, Section 33	6
414	Miller Park	4	T05N, R22E, Section 16	8
415	Oak Creek (MMSD Conservation Plan)	4	T05N, R22E, Section 19	14
416	Oak Creek (MMSD Conservation Plan)	4	T05N, R22E, Section 27	9
417	Oak Creek (MMSD Conservation Plan)	4	T05N, R22E, Section 22	9
418	Oak Creek East Middle School	8	T05N, R22E, Section 21	41
419	Oak Creek West Middle School	8	T05N, R22E, Section 18	13
420	Oak Leaf Park	4	T05N, R22E, Section 20	11
421	Otjen Playground	4	T05N, R22E, Section 23	4
422	Shepard Hills Elementary School and Park	8	T05N, R22E, Section 28	8
423	South Hills Park	4	T05N, R22E, Section 19	12
424	Veterans Memorial Park	4	T05N, R22E, Section 05	1
425	Willow Heights Park	4	T05N, R22E, Section 17	8
426	Blakewood School	8	T05N, R22E, Section 15	15
	City of South Milwaukee			
427	E.W. Luther Elementary School	8	T05N, R22E, Section 02	5
428	Hickory Park	8	T05N, R22E, Section 03	5
429	Lakeshore Park	4	T05N, R22E, Section 13	19
430	Lakeview School	8	T05N, R22E, Section 11	6
431	Little League Park	4	T05N, R22E, Section 11	7
432	South Milwaukee Middle and High Schools and Rawson Elementary School	8	T05N, R22E, Section 02	43
433	South Milwaukee Yacht Club	4	T05N, R22E, Section 12	12
434	Bombay Tot Lot	4	T06N, R22E, Section 15	1
	City of St. Francis			
435	Citizens Municipal Park	4	T06N, R22E, Section 22	1
436	Deer Creek Elementary	8	T06N, R22E, Section 15	4
437	Milton Vretenar Municipal Park	4	T06N, R22E, Section 23	5
438	St. Francis High School	8	T06N, R22E, Section 23	20
439	Willow Glen School	8	T06N, R22E, Section 22	6
	City of Wauwatosa			
440	Fisher School and Athletic Field	8	T07N, R21E, Section 19	15
441	Hart Park	4	T07N, R21E, Section 22	34
442	Jefferson School	8	T07N, R21E, Section 27	1
443	Lincoln School	8	T07N, R21E, Section 21	1
444	Longfellow Middle School	8	T07N, R21E, Section 16	11
445	Madison School	8	T07N, R21E, Section 05	8
446	McKinley School	8	T07N, R21E, Section 16	2
447	Oak Ridge Subdivision Open Space	4	T07N, R21E, Section 18	1
448	Roosevelt School	8	T07N, R21E, Section 15	2
449	Underwood School	8	T07N, R21E, Section 30	7
450	Washington School	8	T07N, R21E, Section 22	1
451	Wauwatosa East High School	8	T07N, R21E, Section 22	7
452	Wauwatosa Pocket Park	4	T07N, R21E, Section 22	1

Table continued on next page.

Table 2.26 (Continued)

Number on Map 2.24	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Wauwatosa (continued)			
453	Wauwatosa West High and Eisenhower Schools	8	T07N, R21E, Section 18	19
454	Whitman Middle School	8	T07N, R21E, Section 18	15
455	Wilson School	8	T07N, R21E, Section 28	1
	City of West Allis			
456	58th and Beloit Mini-Park	4	T06N, R21E, Section 02	1
457	64th and Greenfield Mini-Park	4	T07N, R21E, Section 34	1
458	Frank Lloyd Wright Intermediate School	8	T06N, R21E, Section 04	2
459	Franklin School	8	T06N, R21E, Section 04	4
460	General Mitchell School	8	T06N, R21E, Section 08	4
461	Honey Creek Park	4	T06N, R21E, Section 04	4
462	Horace Mann Elementary School	8	T06N, R21E, Section 03	1
463	Irving School	8	T06N, R21E, Section 05	7
464	Jefferson School	8	T06N, R21E, Section 03	3
465	Klentz Park	4	T06N, R21E, Section 10	64
466	Kopperud Park	4	T07N, R21E, Section 34	3
467	Liberty Heights Park	4	T06N, R21E, Section 03	7
468	Longfellow Elementary School	8	T06N, R21E, Section 03	2
469	Madison School	8	T07N, R21E, Section 32	2
470	McKinley Playground	4	T07N, R21E, Section 34	5
471	Nathan Hale High School and Playfield	8	T06N, R21E, Section 07	37
472	Parkway School	8	T06N, R21E, Section 07	1
473	Radtke Park	4	T06N, R21E, Section 04	1
474	Railroad Park	4	T06N, R21E, Section 04	1
475	Reservoir Park	4	T06N, R21E, Section 05	13
476	Rogers Park	4	T06N, R21E, Section 03	1
477	Rogers Playground	4	T06N, R21E, Section 02	1
478	Roosevelt School	8	T07N, R21E, Section 35	1
479	Veterans Memorial Park	4	T06N, R21E, Section 03	2
480	Walker School	8	T07N, R21E, Section 31	4
481	West Allis Central High School	8	T06N, R21E, Section 04	3
482	West Allis School District	8	T07N, R21E, Section 31	1
483	West Allis/West Milwaukee Recreation Center	8	T06N, R21E, Section 10	5
484	Wilson School	8	T06N, R21E, Section 04	1
485	Wright Middle School	8	T06N, R21E, Section 08	9
	Total City-Owned Sites – 199 Sites	4	--	1,394
	Total Village-Owned Sites – 41 Sites	5	--	324
	Total Public School District-Owned Sites – 245 Sites	8	--	1,645
	Total Sites – 485 Sites	--	--	3,363

[a] *Codes signify ownership as follows: 4-City; 5-Village; 8-School District.*

[b] *Indicates the U.S. Public Land Survey Township, Range and Section in which the site is located.*

[c] *Leased to Milwaukee County.*

Source: SEWRPC

Table 2.27
Private Outdoor Recreation or Open Space Sites in Milwaukee County: 2020

Number on Map 2.26	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	Village of Bayside			
1	Schlitz Audubon Center	13	T08N, R22E, Section 9	167
	Village of Brown Deer			
2	Bethlehem Baptist Church	10	T08N, R21E, Section 12	3
3	Milwaukee River Revitalization Foundation	13	T08N, R21E, Section 12	2
4	St. Mark Lutheran School	10	T08N, R21E, Section 10	1
5	Tripoli Country Club	12	T08N, R21E, Section 14	152
6	YMCA Aquatic Center	10	T08N, R21E, Section 01	46
	Village of Fox Point			
7	St. Eugene School	10	T08N, R22E, Section 17	4
8	Town Club	12	T08N, R22E, Section 16	8
	Village of Greendale			
9	Greendale Baptist Academy	10	T06N, R21E, Section 35	1
10	Jaycee Park	10	T06N, R21E, Section 34	5
11	JCPenney Soccer Fields	11	T06N, R21E, Section 27	3
12	Martin Luther High School	10	T06N, R21E, Section 28	19
13	St. Alphonsus School	10	T06N, R21E, Section 34	3
14	Village Club	12	T06N, R21E, Section 34	10
	Village of Hales Corners			
15	Hales Corners Lutheran School	10	T06N, R21E, Section 30	1
16	Messiah Lutheran School	10	T06N, R21E, Section 30	1
17	St. Mary School	10	T06N, R21E, Section 29	9
	Village of River Hills			
18	Lynden Sculpture Garden	11	T08N, R22E, Section 07	39
19	Milwaukee Country Club	12	T08N, R22E, Section 07	202
20	National Audubon Society	13	T08N, R21E, Section 12	39
21	River Tennis Club	12	T08N, R21E, Section 12	5
22	University School	12	T08N, R22E, Section 06	30
	Village of Shorewood			
23	St. Robert School	10	T07N, R22E, Section 03	1
	Village of Whitefish Bay			
24	Harry and Rose Samson Family Jewish Community Center	10	T08N, R22E, Section 29	16
25	Holy Family Parish School	10	T08N, R22E, Section 33	2
26	St. Monica Elementary and Dominican High School	10	T08N, R22E, Section 29	4
	City of Cudahy			
27	Ladish Little League Park	10	T06N, R22E, Section 35	3
28	St. Frederick's School	10	T06N, R22E, Section 23	1
29	St. John Lutheran Church	10	T06N, R22E, Section 25	5
30	St. Joseph School	10	T06N, R22E, Section 26	1
31	St. Paul's Lutheran School	10	T06N, R22E, Section 23	1
32	YMCA	10	T06N, R22E, Section 35	13
	City of Franklin			
33	Christine Rathke Memorial Park	10	T05N, R21E, Section 10	5
34	Conservancy for Healing and Heritage	10	T05N, R21E, Section 03	36
35	Croatian Park	10	T05N, R21E, Section 22	29
36	Franklin Little League Complex	10	T05N, R21E, Section 22	24
37	House of Prayer Lutheran Church and Academy of Integrity	10	T05N, R21E, Section 24	3
38	Indian Community School	10	T05N, R21E, Section 17	80
39	Milwaukee Area Land Conservancy – Carity Prairie	13	T05N, R21E, Section 20	23

Table continued on next page.

Table 2.27 (Continued)

Number on Map 2.26	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Franklin (continued)			
40	Milwaukee Area Land Conservancy – Fitzsimmons Woods	13	T05N, R21E, Section 25	25
41	New Hope Church	10	T05N, R21E, Section 18	2
42	Polonia Club Park	10	T05N, R21E, Section 20	22
43	Risen Savior Lutheran Church	10	T05N, R21E, Section 08	7
44	St. James Catholic Church and Preschool	10	T05N, R21E, Section 12	19
45	St. Martin of Tours Parish School	10	T05N, R21E, Section 18	38
46	St. Paul's Lutheran Church and School	10	T05N, R21E, Section 02	4
47	Tuckaway Country Club	12	T05N, R21E, Section 15	175
	City of Glendale			
48	Bavarian Club Grounds	12	T08N, R22E, Section 32	16
49	Cardinal Stritch College	10	T08N, R22E, Section 20	16
50	Glendale Little League Park and City Hall Park	10	T08N, R22E, Section 30	22
51	River Glen	12	T08N, R22E, Section 19	9
52	St. John's Lutheran School	10	T08N, R22E, Section 17	4
	City of Greenfield			
53	Faith Bible Church	10	T06N, R21E, Section 19	10
54	Our Father Lutheran School	10	T06N, R21E, Section 36	4
55	River Falls Recreation	11	T06N, R21E, Section 26	5
56	St Jacobi Lutheran Church and School	10	T06N, R21E, Section 28	3
57	St. John's Catholic School	10	T06N, R21E, Section 21	13
58	YMCA-Southern Branch	10	T06N, R21E, Section 19	13
	City of Milwaukee			
59	Alverno College and Grade School	10	T06N, R21E, Section 13	22
60	Atlas Preparatory Academy	10	T06N, R21E, Section 12	1
61	Atonement Lutheran School	10	T07N, R21E, Section 01	2
62	Believers in Christ Christian Academy	10	T07N, R22E, Section 06	1
63	Berryland Playground	10	T08N, R21E, Section 25	2
64	Blessed Sacrament School	10	T06N, R21E, Section 13	1
65	Bowling Alley	11	T06N, R22E, Section 19	1
66	Burns Commons (southern portion)	10	T07N, R22E, Section 14	1
67	Christ Lutheran School	10	T06N, R22E, Section 06	1
68	Christ Memorial School	10	T08N, R21E, Section 25	1
69	COA Youth and Family Goldin Center	10	T07N, R22E, Section 07	3
70	Corpus Christi School	10	T08N, R21E, Section 33	4
71	Divine Savior\Holy Angels High School	10	T07N, R21E, Section 05	9
72	Downtown Montessori School	10	T06N, R22E, Section 09	1
73	Eastbrook Church/School and Long Island Drive Totlot	10	T08N, R22E, Section 31	2
74	Gloria Dei-Bethesda School	10	T07N, R21E, Section 05	1
75	Gospel School	10	T07N, R22E, Section 07	1
76	Greater Holy Temple Christian Academy	10	T08N, R21E, Section 33	8
77	Holy Cross School	10	T07N, R21E, Section 26	3
78	Holy Ghost Lutheran School	10	T07N, R22E, Section 08	1
79	Holy Redeemer School	10	T07N, R21E, Section 01	1
80	Holy Rosary School	10	T07N, R22E, Section 21	1
81	Hope Christian School-Fortis	10	T07N, R22E, Section 08	1
82	Immaculate Conception School	10	T06N, R22E, Section 09	1
83	Ism Community Center/Salem Elementary School	10	T06N, R22E, Section 29	2
84	Joy Farm Riding Club	11	T08N, R21E, Section 19	33
85	Joy House Playgrounds	10	T07N, R22E, Section 30	1
86	Marquette Stadium	10	T07N, R21E, Section 25	9
87	Marquette University Athletic Fields	10	T07N, R22E, Section 30	13
88	Marquette University High School	10	T07N, R21E, Section 25	2
89	Messmer High School	10	T07N, R22E, Section 05	2

Table continued on next page.

Table 2.27 (Continued)

Number on Map 2.26	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Milwaukee (continued)			
90	Messmer Preparatory School	10	T07N, R22E, Section 16	1
91	Milwaukee College Prep School – 36th St. Campus	10	T07N, R21E, Section 13	1
92	Milwaukee College Prep School – 38th St. Campus	10	T07N, R21E, Section 13	1
93	Milwaukee College Prep School – Lloyd St. Campus	10	T07N, R22E, Section 19	5
94	Milwaukee College Prep School - Lola Rowe North/YMCA	10	T07N, R22E, Section 18	4
95	Milwaukee Lutheran High School	10	T07N, R21E, Section 05	14
96	Milwaukee River Revitalization Foundation	13	T07N, R22E, Section 21	3
97	Milwaukee School of Engineering Athletic Field	10	T07N, R22E, Section 28	3
98	Mother of Good Counsel School	10	T07N, R21E, Section 15	3
99	Mother of Perpetual Help School	10	T08N, R21E, Section 35	2
100	Mount Mary College	10	T07N, R21E, Section 17	75
101	Mt. Lebanon School	10	T08N, R21E, Section 34	2
102	Nativity Jesuit Middle School	10	T06N, R21E, Section 01	1
103	New Testament Christian Academy	10	T08N, R21E, Section 17	1
104	North Ridge Lakes	12	T08N, R21E, Section 03	55
105	North Trinity Lutheran School	10	T08N, R21E, Section 25	2
106	Northwest Little League	10	T08N, R21E, Section 32	13
107	Northwest Lutheran School	10	T07N, R21E, Section 04	4
108	Oklahoma Avenue Lutheran School	10	T06N, R21E, Section 14	1
109	Our Lady of Good Hope School	10	T08N, R21E, Section 24	4
110	Our Lady of Sorrow School	10	T07N, R21E, Section 03	2
111	Our Lady Queen of Peace School	10	T06N, R21E, Section 13	1
112	Pius XI High School	10	T07N, R21E, Section 28	1
113	Rocketship Southside Community Prep	10	T06N, R21E, Section 12	1
114	Saints Peter and Paul School	10	T07N, R22E, Section 15	1
115	Salem Lutheran School	10	T08N, R21E, Section 20	5
116	Seventh-Day Adventist Church and School	10	T08N, R21E, Section 19	5
117	Siloah Lutheran School	10	T07N, R22E, Section 07	1
118	St. Adalbert School	10	T06N, R22E, Section 06	1
119	St. Aemilian, Rose, and Mary Schools	10	T07N, R21E, Section 09	10
120	St. Anthony School and St. Stanislaus Church	10	T06N, R22E, Section 05	1
121	St. Bernadette School	10	T08N, R21E, Section 21	10
122	St. Borromeo School	10	T06N, R21E, Section 36	2
123	St. Catherine Alexandria School	10	T08N, R21E, Section 10	10
124	St. Catherine School	10	T07N, R21E, Section 14	1
125	St. Gregory the Great Parish School	10	T06N, R21E, Section 15	4
126	St. John's Lutheran School	10	T06N, R21E, Section 22	5
127	St. Joseph Academy	10	T06N, R22E, Section 07	1
128	St. Matthew School	10	T07N, R21E, Section 09	1
129	St. Matthias School	10	T06N, R21E, Section 17	7
130	St. Peter's Lutheran School	10	T08N, R21E, Section 21	4
131	St. Philip Neri School	10	T08N, R21E, Section 34	4
132	St. Rafael the Archangel School	10	T06N, R21E, Section 01	1
133	St. Roman School	10	T06N, R22E, Section 19	3
134	St. Rose School	10	T07N, R21E, Section 25	1
135	St. Sava Orthodox School/United Serbian Soccer Club	10	T06N, R21E, Section 14	5
136	St. Sebastian School	10	T07N, R21E, Section 23	1
137	St. Thomas Aquinas Academy	10	T06N, R22E, Section 21	1
138	St. Vincent de Paul School	10	T06N, R22E, Section 06	1
139	St. Vincent of Pallotti Elementary School	10	T07N, R21E, Section 28	1
140	Urban Day School	10	T07N, R22E, Section 08	1
141	Walter Memorial Lutheran	10	T07N, R21E, Section 12	1
142	Wilson Park Youth Baseball	11	T06N, R22E, Section 29	5

Table continued on next page.

Table 2.27 (Continued)

Number on Map 2.26	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	City of Milwaukee (continued)			
143	Windlake Elementary (Seeds of Health)	10	T06N, R22E, Section 07	1
144	Wisconsin Club Country Club	12	T08N, R21E, Section 15	184
145	Wisconsin Lutheran High School	10	T07N, R21E, Section 28	7
146	Word of Life Lutheran School	10	T06N, R22E, Section 18	1
147	Young Minds Christian Preparatory School	10	T07N, R21E, Section 24	1
	City of Oak Creek			
148	American Legion Park	10	T05N, R22E, Section 21	20
149	Creative Explorers Learning Center	10	T05N, R22E, Section 16	1
150	Early Childhood Education	10	T05N, R22E, Section 36	2
151	Gastrau's Golf Center[d]	11	T05N, R22E, Section 04	50
152	Grace Lutheran School	10	T05N, R22E, Section 15	11
153	Oak Hills Golf Course	11	T05N, R22E, Section 33	35
154	Parkway Christian Academy	10	T05N, R22E, Section 34	5
155	St. John's Lutheran School	10	T05N, R22E, Section 31	6
156	St. Matthews School	10	T05N, R22E, Section 23	5
157	Storybook Farm	11	T05N, R22E, Section 31	6
158	Woodland Golf Course	11	T05N, R22E, Section 34	31
	City of South Milwaukee			
159	St. Sylvester School	10	T05N, R22E, Section 02	7
160	Zion School	10	T05N, R22E, Section 14	3
	City of St. Francis			
161	Atlas Preparatory Academy	10	T06N, R22E, Section 22	3
162	St. Francis de Sales College	10	T06N, R22E, Section 14	33
163	Thomas Moore High School	10	T06N, R22E, Section 15	12
	City of Wauwatosa			
164	Apple Croft Private Park-Washington Highlands	12	T07N, R21E, Section 22	1
165	Bluemound Country Club	12	T07N, R21E, Section 17	194
166	Christ King School	10	T07N, R21E, Section 16	1
167	Our Redeemer Lutheran School	10	T07N, R21E, Section 20	1
168	Pilgrim Lutheran School	10	T07N, R21E, Section 15	1
169	Revere Drive Park	12	T07N, R21E, Section 22	1
170	St. Bernard School	12	T07N, R21E, Section 22	1
171	St. Johns Evangelical Lutheran School	12	T07N, R21E, Section 21	1
172	St. Joseph's School	10	T07N, R21E, Section 18	6
173	St. Jude's School	10	T07N, R21E, Section 28	1
174	St. Pius X School	12	T07N, R21E, Section 15	2
175	Washington Highlands Parkway	12	T07N, R21E, Section 22	5
176	West Suburban YMCA	10	T07N, R21E, Section 18	9
177	Wisconsin Lutheran College Outdoor Athletic Complex	10	T07N, R21E, Section 20	27
	City of West Allis			
178	Good Shepherd School	10	T07N, R21E, Section 32	1
179	Holy Assumption School	10	T06N, R21E, Section 03	1
180	Holy Trinity Lutheran School	10	T06N, R21E, Section 07	2
181	Jordan Evangelical Lutheran School	10	T06N, R21E, Section 09	1
182	Jordan Lutheran School	10	T06N, R21E, Section 04	1
183	Mary Queen of Heaven School	10	T06N, R21E, Section 08	1
184	St. Aloysius School	10	T06N, R21E, Section 05	1
185	St. Augustine School	10	T06N, R21E, Section 03	2
186	St. Paul's Lutheran School	10	T06N, R21E, Section 04	1
187	St. Rita School	10	T06N, R21E, Section 10	1
188	Woodlawn Lutheran School	10	T06N, R21E, Section 05	1

Table continued on next page.

Table 2.27 (Continued)

Number on Map 2.26	Local Government and Site Name	Ownership[a]	Location[b]	Acreage
	Total Organizationally Owned Sites – 154 Sites	10	--	997
	Total Commercially Owned Sites – 10 Sites	11	--	208
	Total Privately Owned Sites – 18 Sites	12	--	1,051
	Total Private Nonprofit Owned Sites – 6 Sites	13	--	259
	Total Sites – 188 Sites	--	--	2,515

[a] *Codes signify ownership as follows: 10-Organizational; 11-Commercial; 12-Private.*

[b] *Indicates the U.S. Public Land Survey Township, Range and Section in which the site is located.*

[c] *Less than one acre.*

[d] *Leased from Milwaukee County.*

Source: SEWRPC

Table 2.28
Historical Population of Milwaukee County: 1850-2020

Year	Population	Change from Preceding Census	
		Number	Percent
1850	31,077	--	--
1860	62,518	31,441	101.2
1870	89,930	27,412	43.8
1880	138,538	48,608	54.1
1890	236,101	97,563	70.4
1900	330,017	93,916	39.8
1910	433,187	103,170	31.3
1920	539,449	106,262	24.5
1930	725,263	185,814	34.4
1940	766,885	41,622	5.7
1950	871,047	104,162	13.6
1960	1,036,041	164,994	18.9
1970	1,054,249	18,208	1.8
1980	964,249	-89,261	-8.5
1990	959,275	-5,713	-0.6
2000	940,164	-19,111	-2.0
2010	947,735	7,571	0.8
2020	939,489	-8,246	-0.9

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

Table 2.29
Land Uses in Milwaukee County: 2015

Land Use Category	Area (Acres)	Percent of Subtotal	Percent of County
Urban[a]			
Residential	51,869	44.1	33.4
Commercial	7,981	6.8	5.1
Industrial	6,993	5.9	4.5
Transportation, Communications, and Utilities	34,104	29.0	22.0
Governmental and Institutional[b]	8,719	7.4	5.6
Recreational[c]	8,000	6.8	5.1
Urban Subtotal	117,666	100.0	75.7
Nonurban			
Agricultural	8,507	22.6	5.5
Wetlands	7,440	19.8	4.8
Woodlands	5,691	15.1	3.7
Extractive, Landfills, and Other Open Lands	14,484	38.4	9.3
Surface Water	1,555	4.1	1.0
Nonurban Subtotal	37,677	100.0	24.3
Total	155,343	--	100.0

[a] *Off-street parking is included with the associated land use.*

[b] *Includes public and private schools, government offices, police and fire stations, libraries, cemeteries, religious institutions, hospitals, nursing homes, and similar facilities.*

[c] *Includes only land which is intensively used for recreational purposes.*

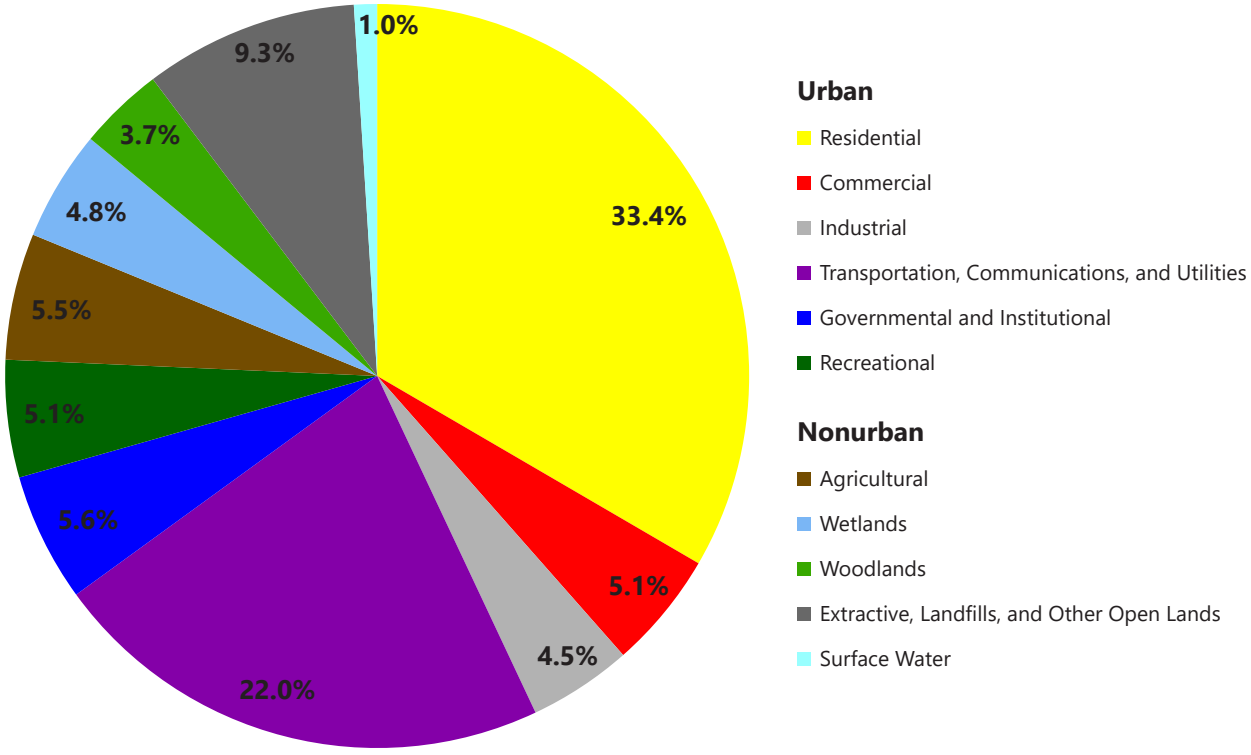
Source: SEWRPC

Chapter 2

RESOURCE ASSESSMENT

FIGURES

Figure 2.1
Land Uses in Milwaukee County: 2015



SEWRPC Community Assistance Planning Report No. 312 (2nd Edition)

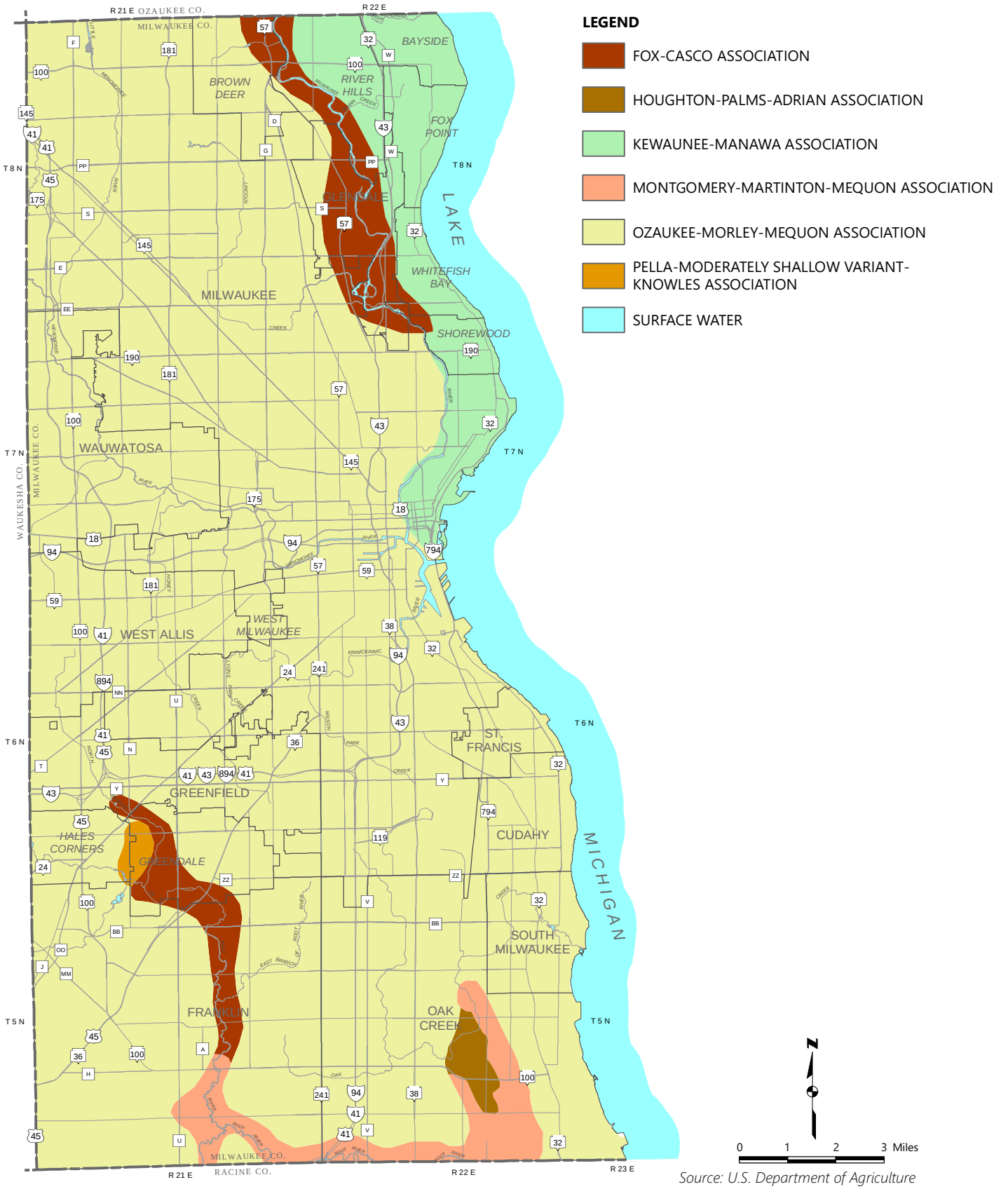
A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

Chapter 2

RESOURCE ASSESSMENT

MAPS

Map 2.1
General Soil Associations in Milwaukee County



Source: U.S. Department of Agriculture Natural Resources Conservation Service and SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.1.mxd)
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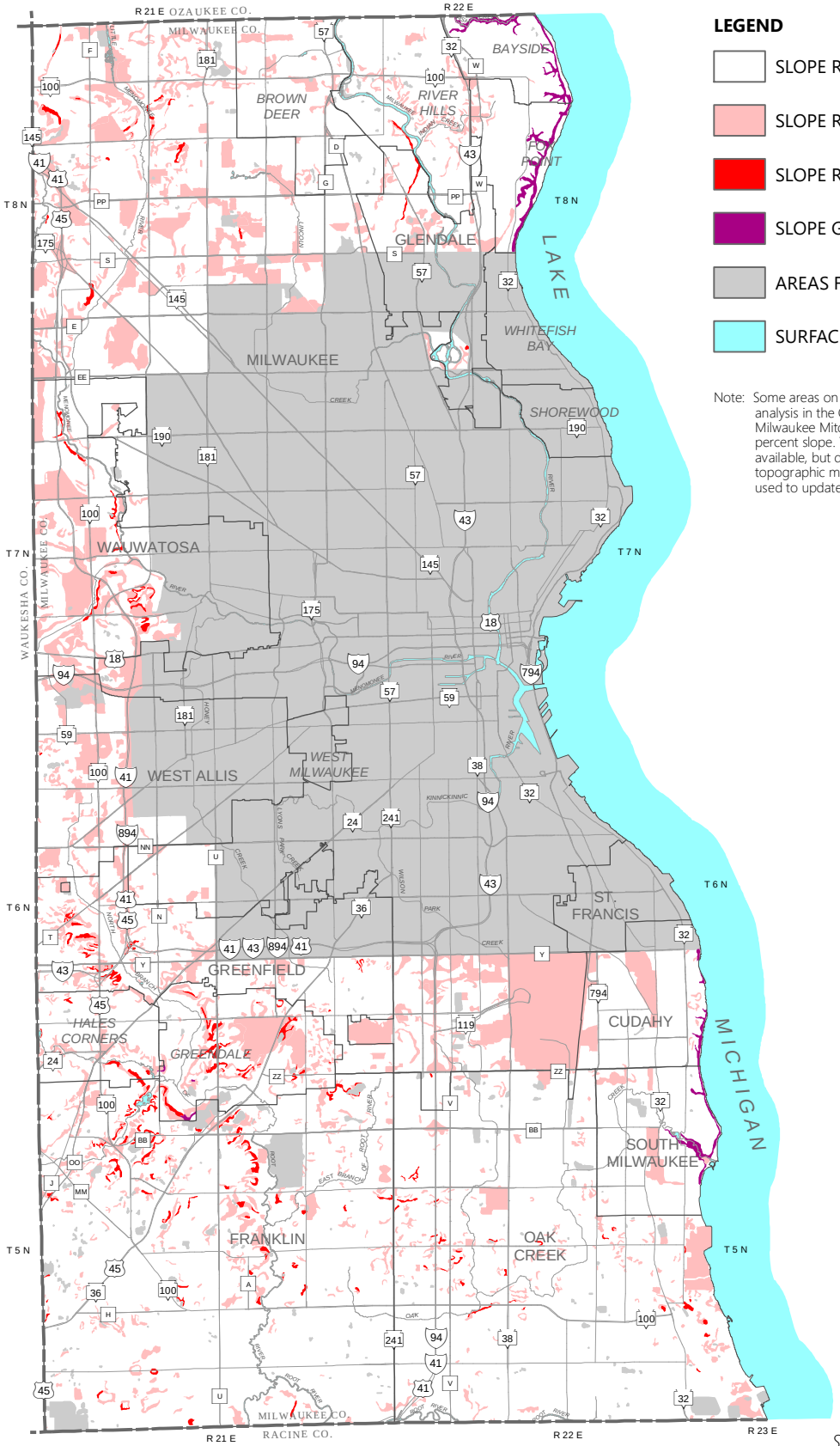
Map 2.2
Land Slope Analysis for Milwaukee County



LEGEND

- SLOPE RANGING FROM 0 TO 6 PERCENT
- SLOPE RANGING FROM 7 TO 12 PERCENT
- SLOPE RANGING FROM 13 TO 20 PERCENT
- SLOPE GREATER THAN 20 PERCENT
- AREAS FOR WHICH NO DATA ARE AVAILABLE
- SURFACE WATER

Note: Some areas on the map do not relect the accuracy of slope analysis in the County. An example of this inaccuracy is at Milwaukee Mitchell Airport, which indicates a 7 to 12 percent slope. This can be attributed to the best data available, but data that is historic and less detailed. Newer topographic mapping techniques and information should be used to update the slope data.

N

0 1 2 3 Miles

Source: U.S. Department of Agriculture Natural Resources Conservation Service and SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.2.mxd)
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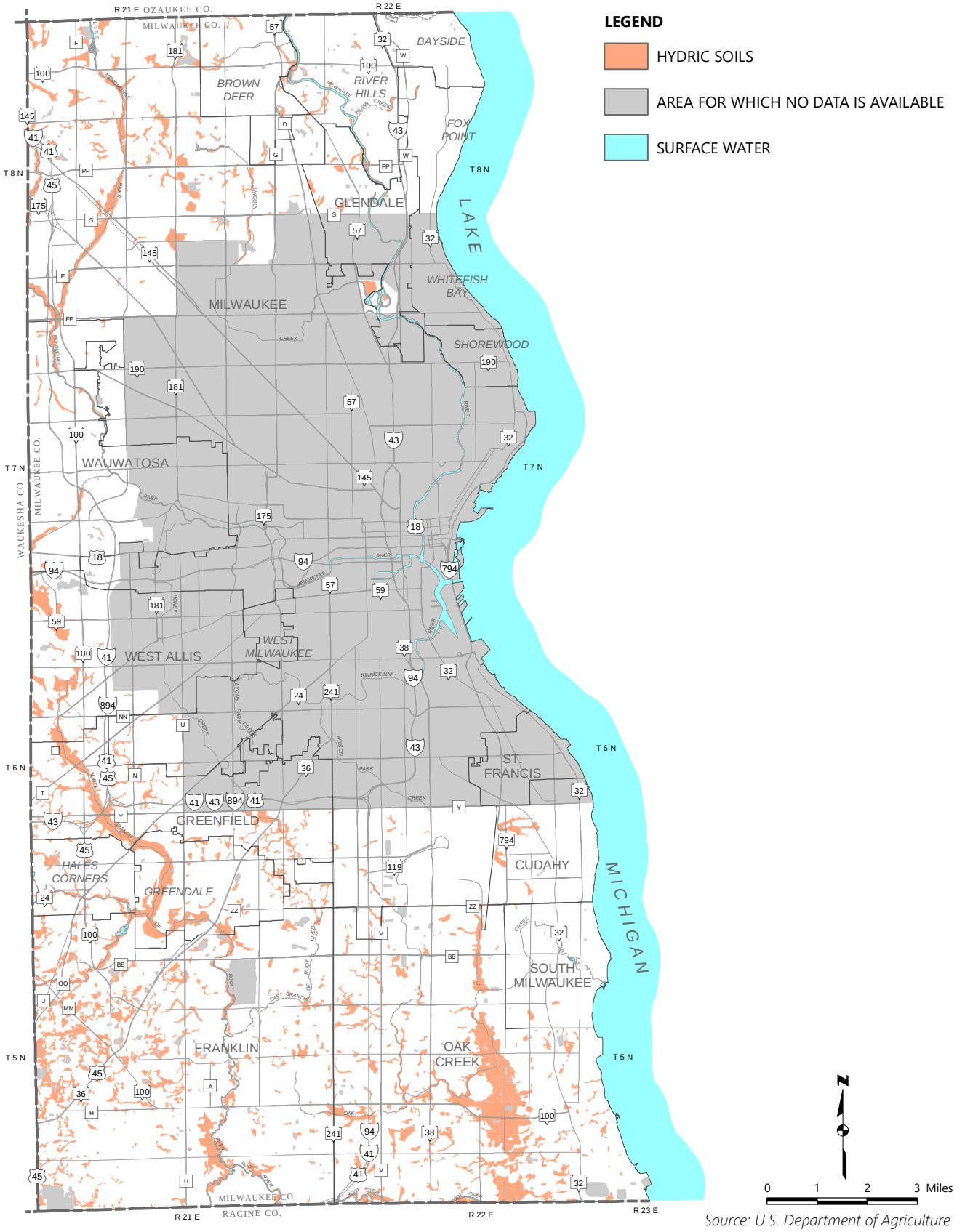
Map 2.3
Hydric Soils in Milwaukee County



Source: U.S. Department of Agriculture Natural Resources Conservation Service and SEWRPC

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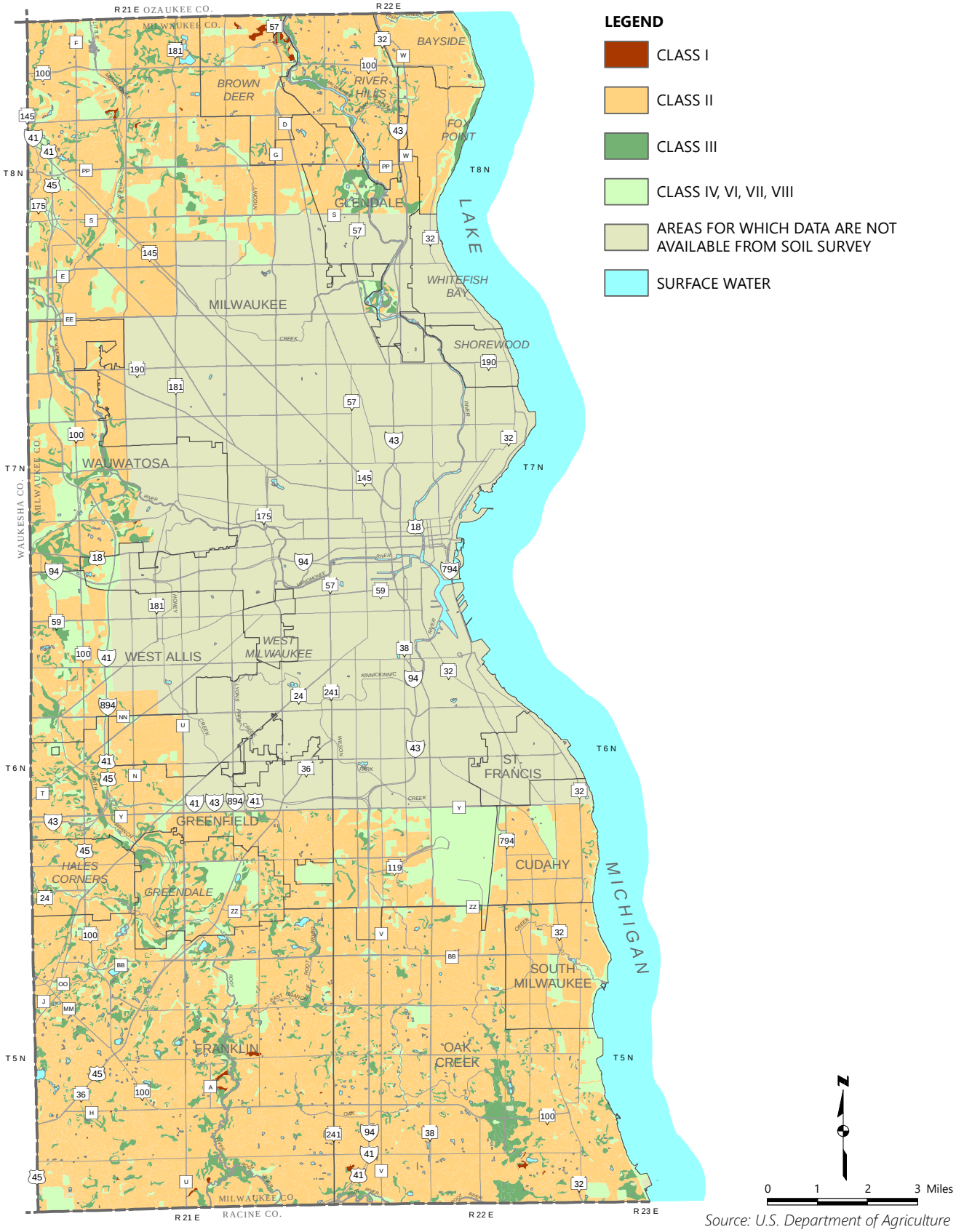
Map 2.4
Agricultural Soil Capability in Milwaukee County



Source: U.S. Department of Agriculture Natural Resources Conservation Service and SEWRPC

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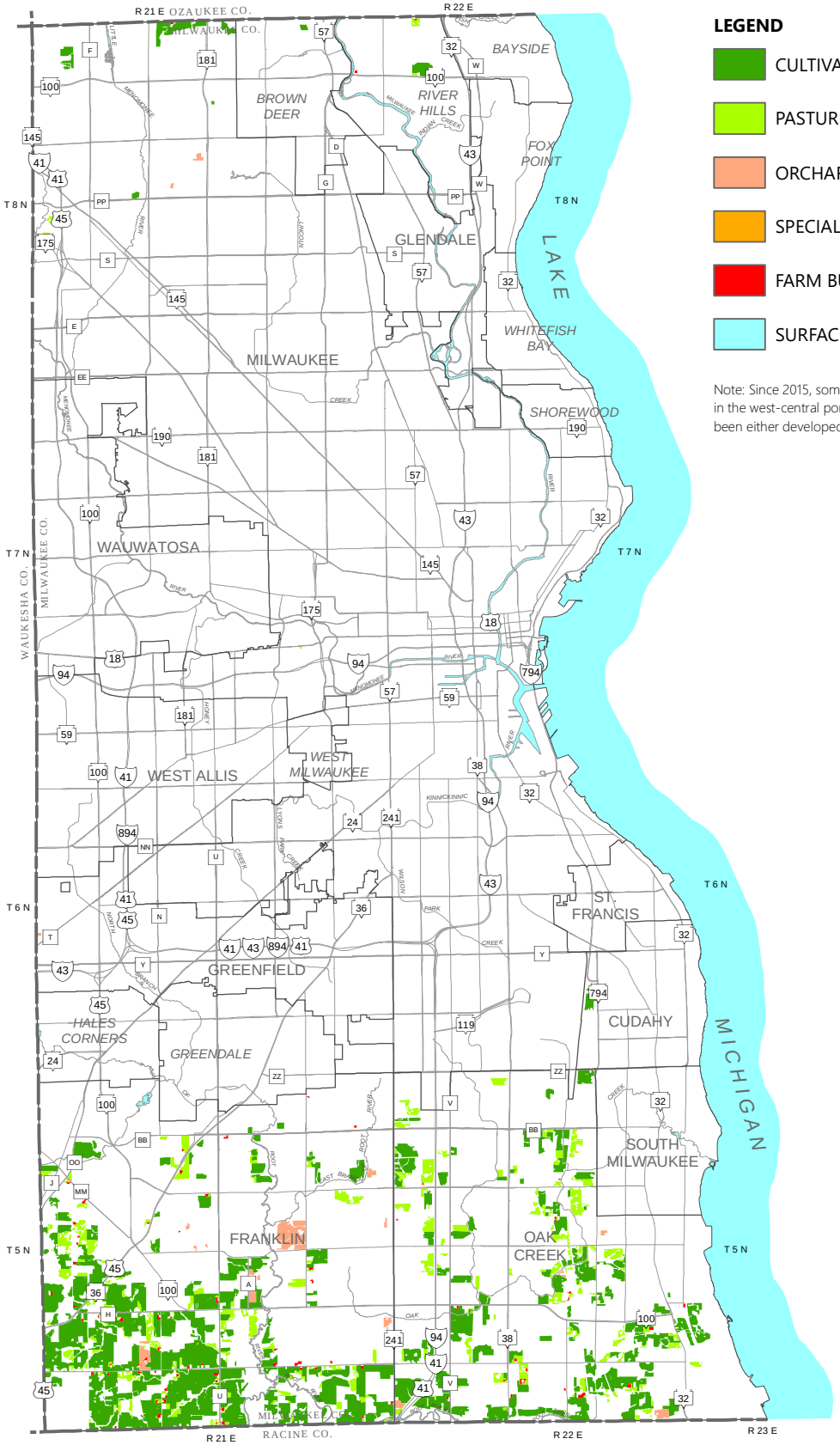
Map 2.5
Agricultural Lands in Milwaukee County: 2015



LEGEND

- CULTIVATED
- PASTURE AND UNUSED AGRICULTURE
- ORCHARDS AND NURSERY
- SPECIAL AGRICULTURE
- FARM BUILDING
- SURFACE WATER

Note: Since 2015, some agricultural lands near Falk Park in the west-central portion of the City of Oak Creek have been either developed or reforested.

0 1 2 3 Miles

Source: SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.5.mxd)
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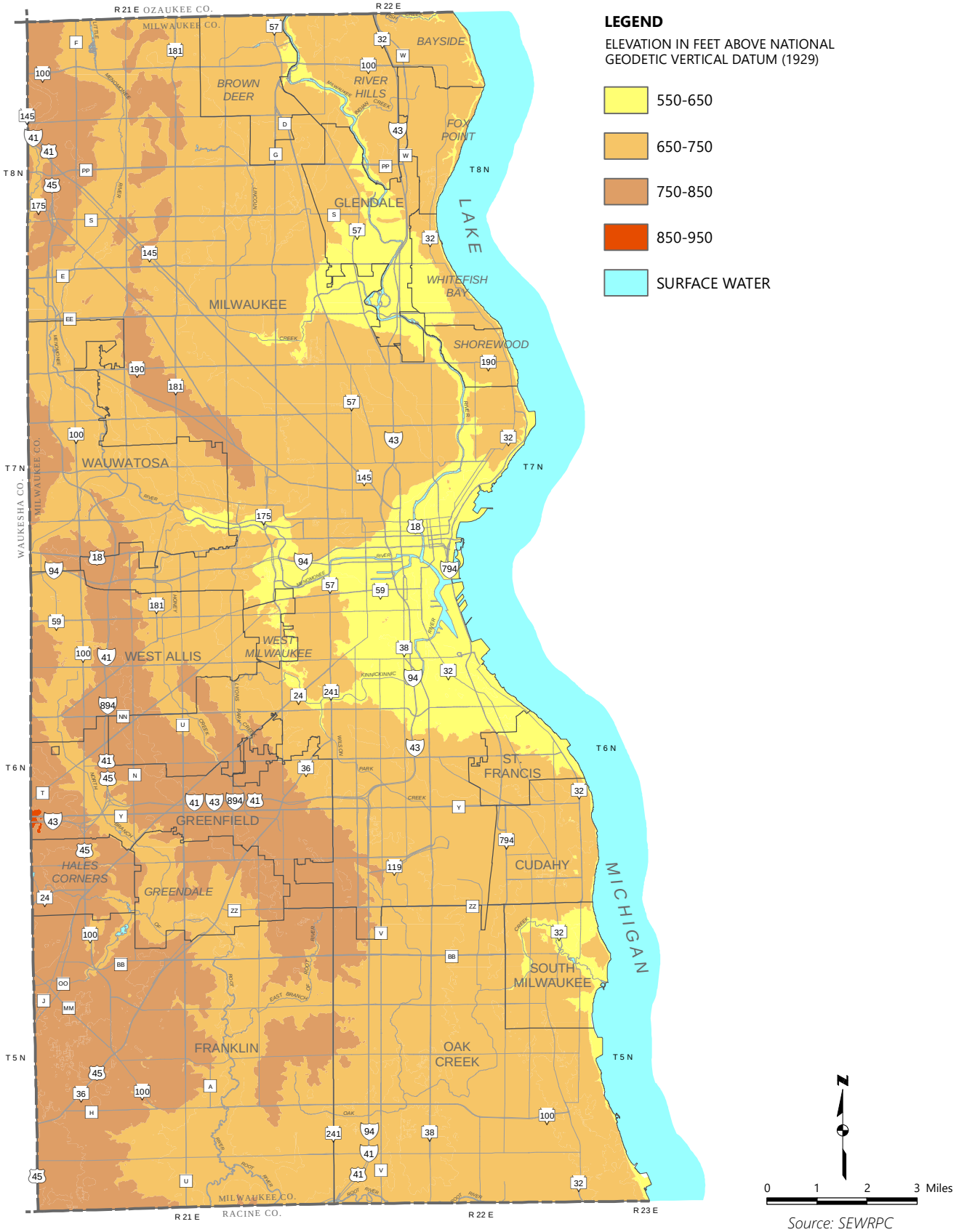
Map 2.6
Generalized Topographic Characteristics in Milwaukee County



Source: SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.6.mxd)
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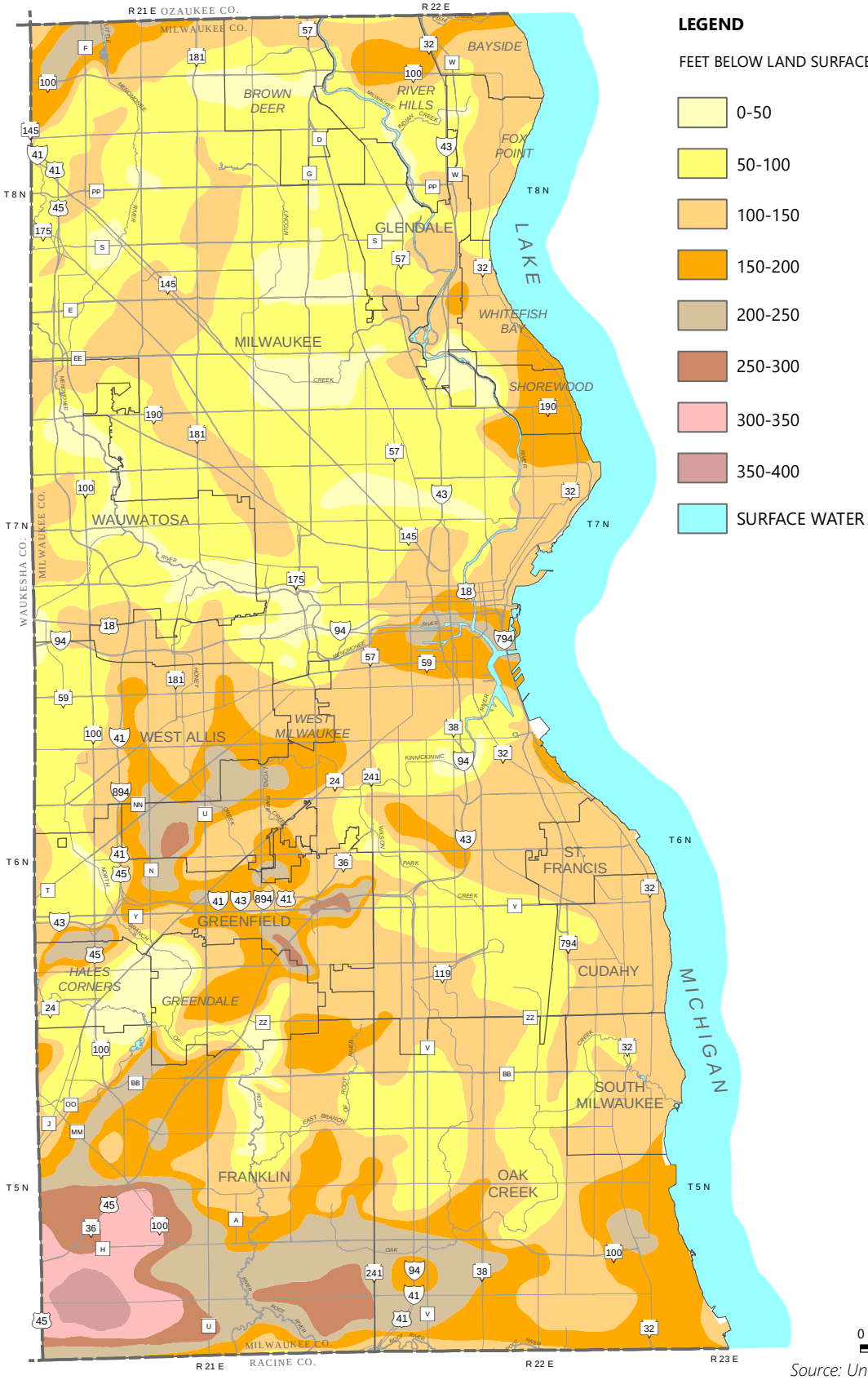
Map 2.7
Generalized Depth to Bedrock in Milwaukee County



LEGEND

FEET BELOW LAND SURFACE

- 0-50
- 50-100
- 100-150
- 150-200
- 200-250
- 250-300
- 300-350
- 350-400
- SURFACE WATER

N

0 1 2 3 Miles

Source: University of Wisconsin-Extension, Wisconsin Geological and Natural History Survey, and SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.7.mxd)
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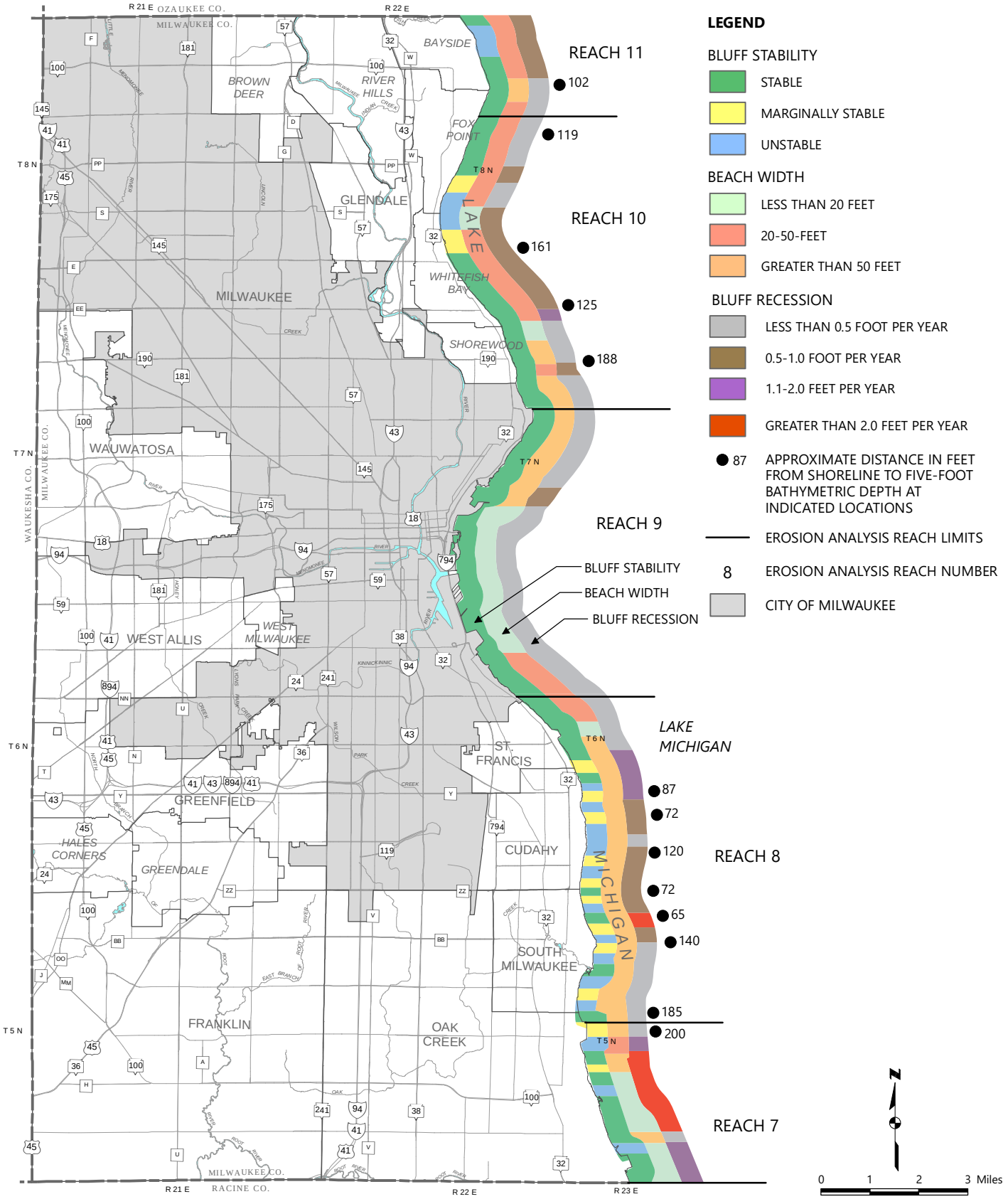
Map 2.8
Summary of Lake Michigan Shoreline Erosion and Bluff Stability Analyses in Milwaukee County: 1995



Source: T.B. Edil, D.M. Mickelson, J.A. Chapman, and SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.8.mxd)
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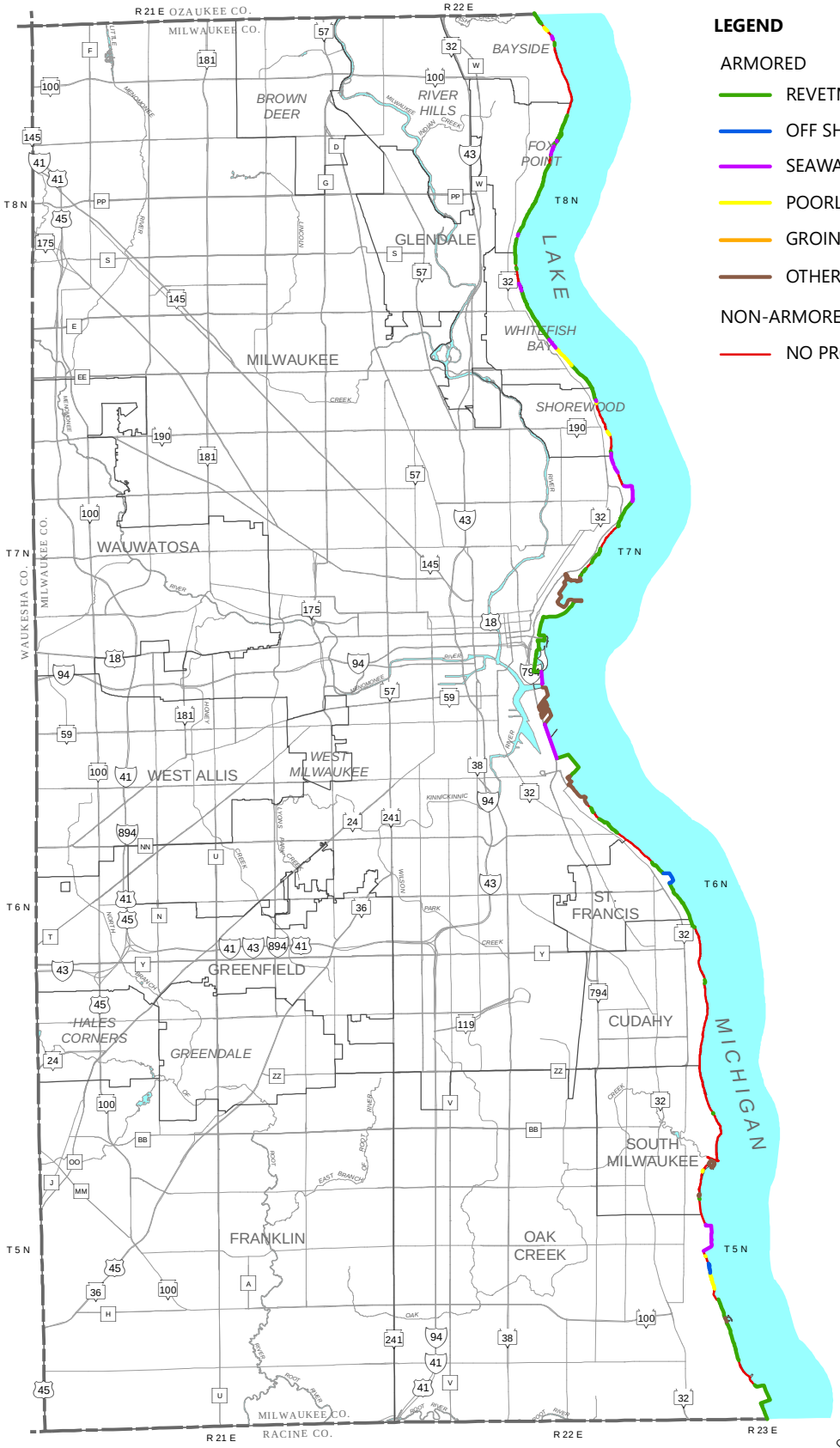
Map 2.9
Types of Shore Protection in Milwaukee County: 2018



LEGEND

ARMORED
- REVETMENT
- OFF SHORE BREAKWATER
- SEAWALL/BULKHEAD
- POORLY ORGANIZED RIP-RAP/RUBBLE
- GROIN/JETTY/OFF SHORE BREAKWATER
- OTHER (DOCKS AND MARINAS)

NON-ARMORED
- NO PROTECTION

N

0 1 2 3 Miles

Source: Wisconsin Shoreline Inventory and Oblique Viewer (Association of State Floodplain Managers, Geo-Professional Consultants, LLC, National Oceanic and Atmospheric Administration, Wisconsin Coastal Management Program) and SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.9.mxd)
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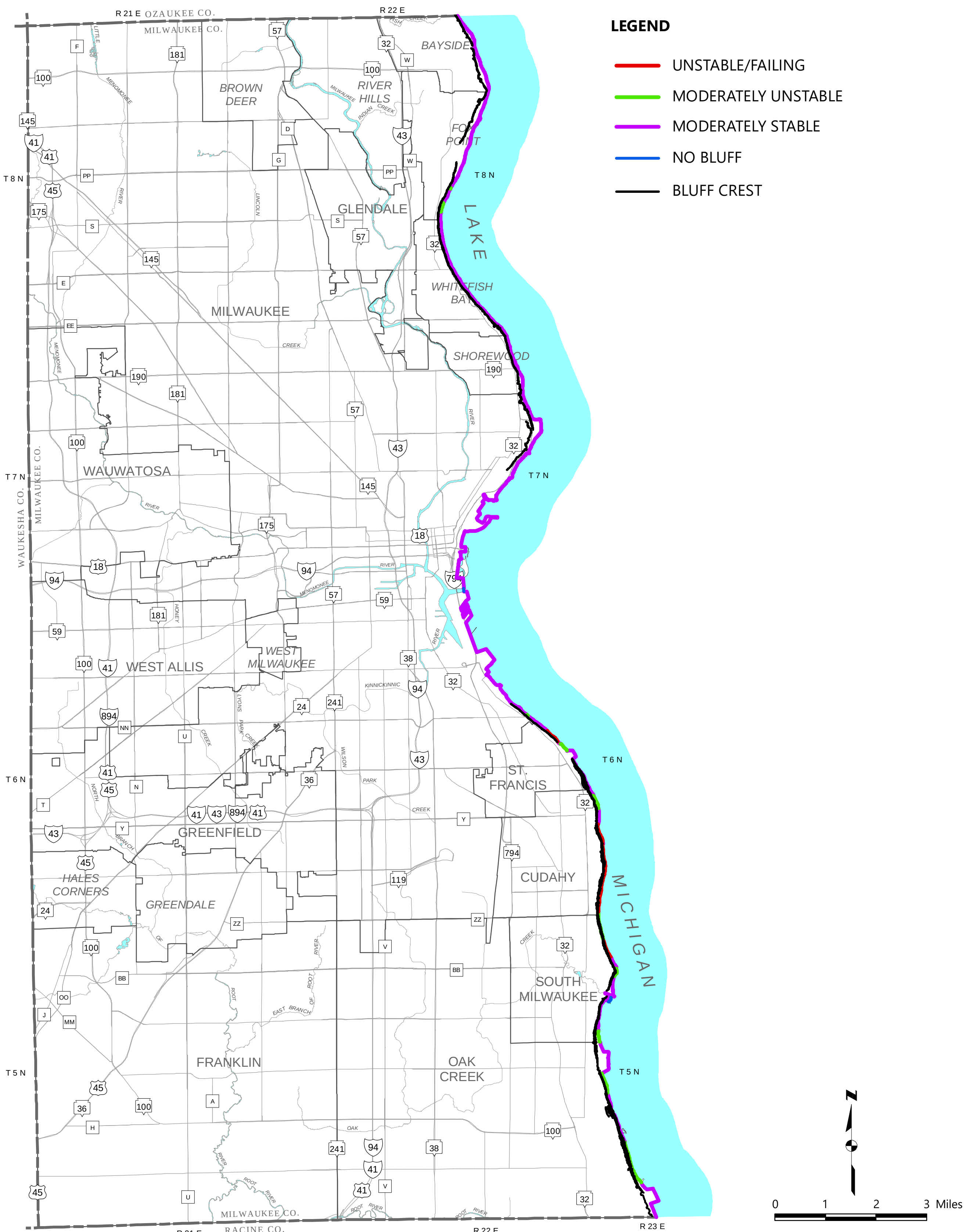
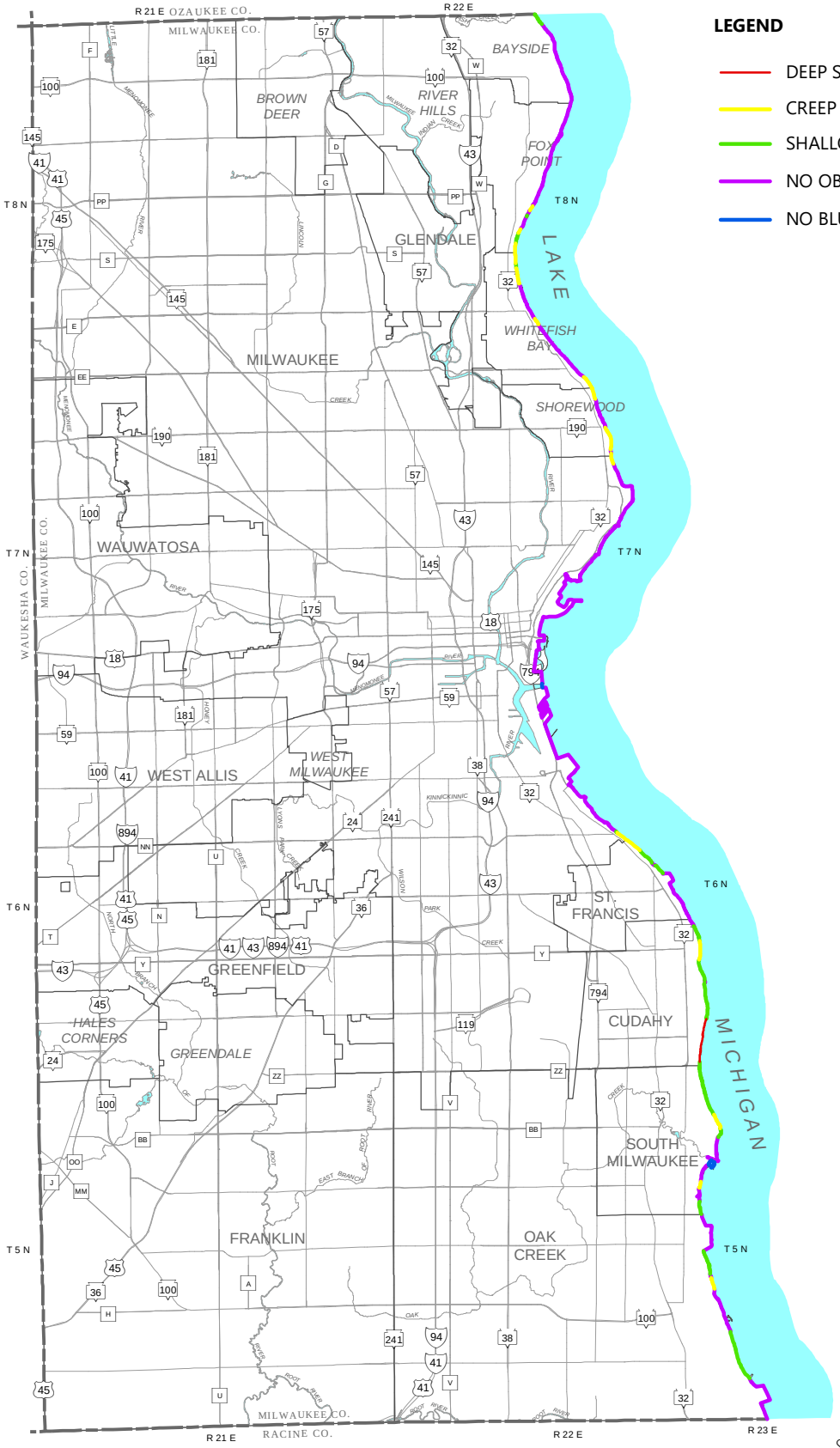
Map 2.10
General Bluff Conditions in Milwaukee County: 2018



Source: Wisconsin Shoreline Inventory and Oblique Viewer (Association of State Floodplain Managers, Geo-Professional Consultants, LLC, National Oceanic and Atmospheric Administration, Wisconsin Coastal Management Program) and SEWRPC

Map 2.11
Types of Bluff Failure in Milwaukee County: 2018



LEGEND

- DEEP SEATED SLUMP
- CREEP
- SHALLOW SLIDES
- NO OBVIOUS FAILURES
- NO BLUFF

N

0 1 2 3 Miles

Source: Wisconsin Shoreline Inventory and Oblique Viewer (Association of State Floodplain Managers, Geo-Professional Consultants, LLC, National Oceanic and Atmospheric Administration, Wisconsin Coastal Management Program) and SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.9.mxd)
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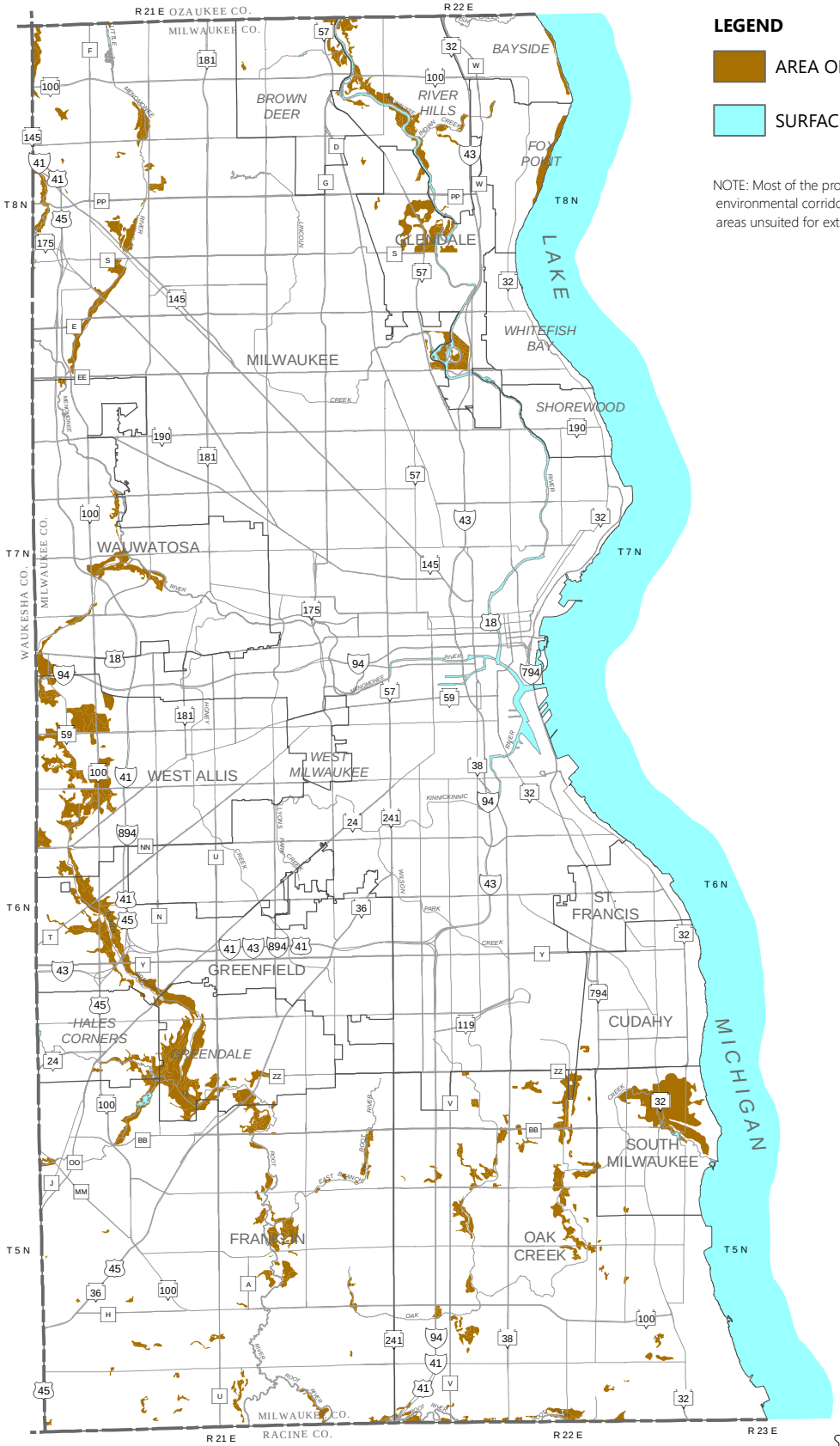
Map 2.12
Areas of Potential Commercially Workable Sand and Gravel Deposits in Milwaukee County

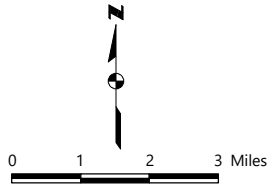


LEGEND

AREA OF POTENTIAL SAND AND GRAVEL DEPOSIT

SURFACE WATER

NOTE: Most of the probable deposits are located in floodplains, environmental corridors, or urbanized areas and are therefore in areas unsuited for extractive activities.



Source: U.S. Department of Agriculture Natural Resources Conservation Service and SEWRPC

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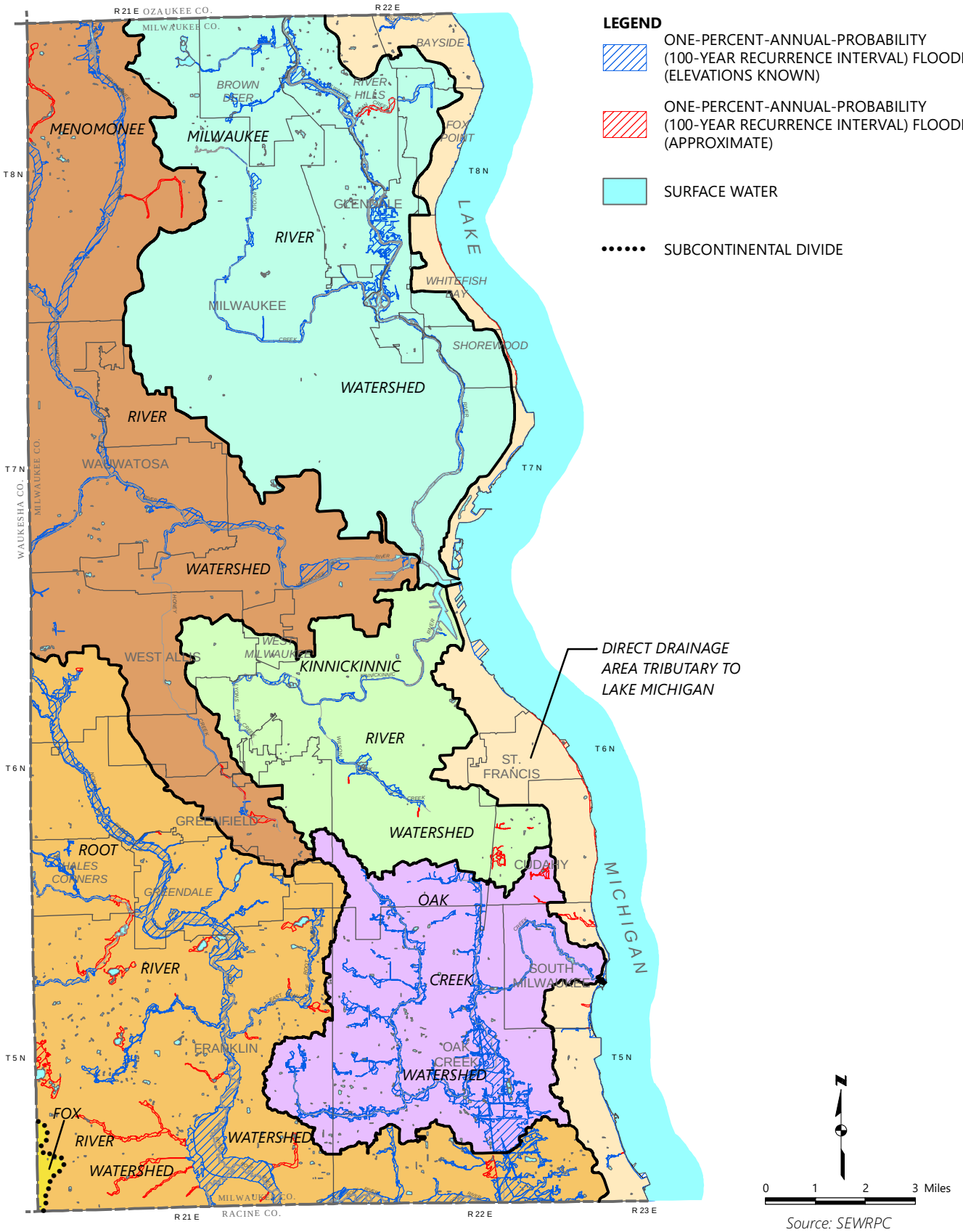
Map 2.13
Surface Waters, Floodplains, and Major Watersheds in Milwaukee County



Source: SEWRPC

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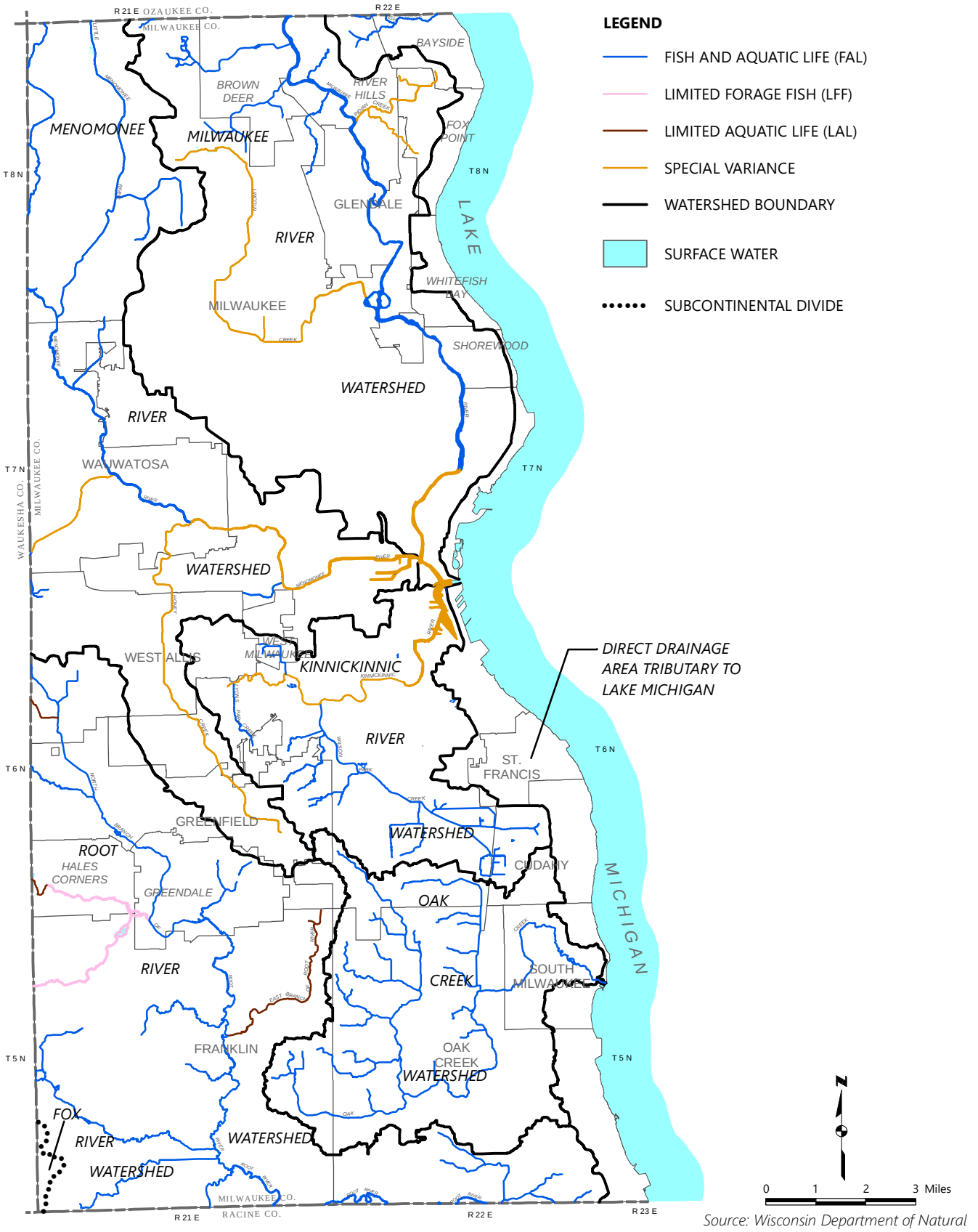
Map 2.14
Regulatory Water Use Classifications for Surface Waters within Milwaukee County



Source: Wisconsin Department of Natural Resources and SEWRPC

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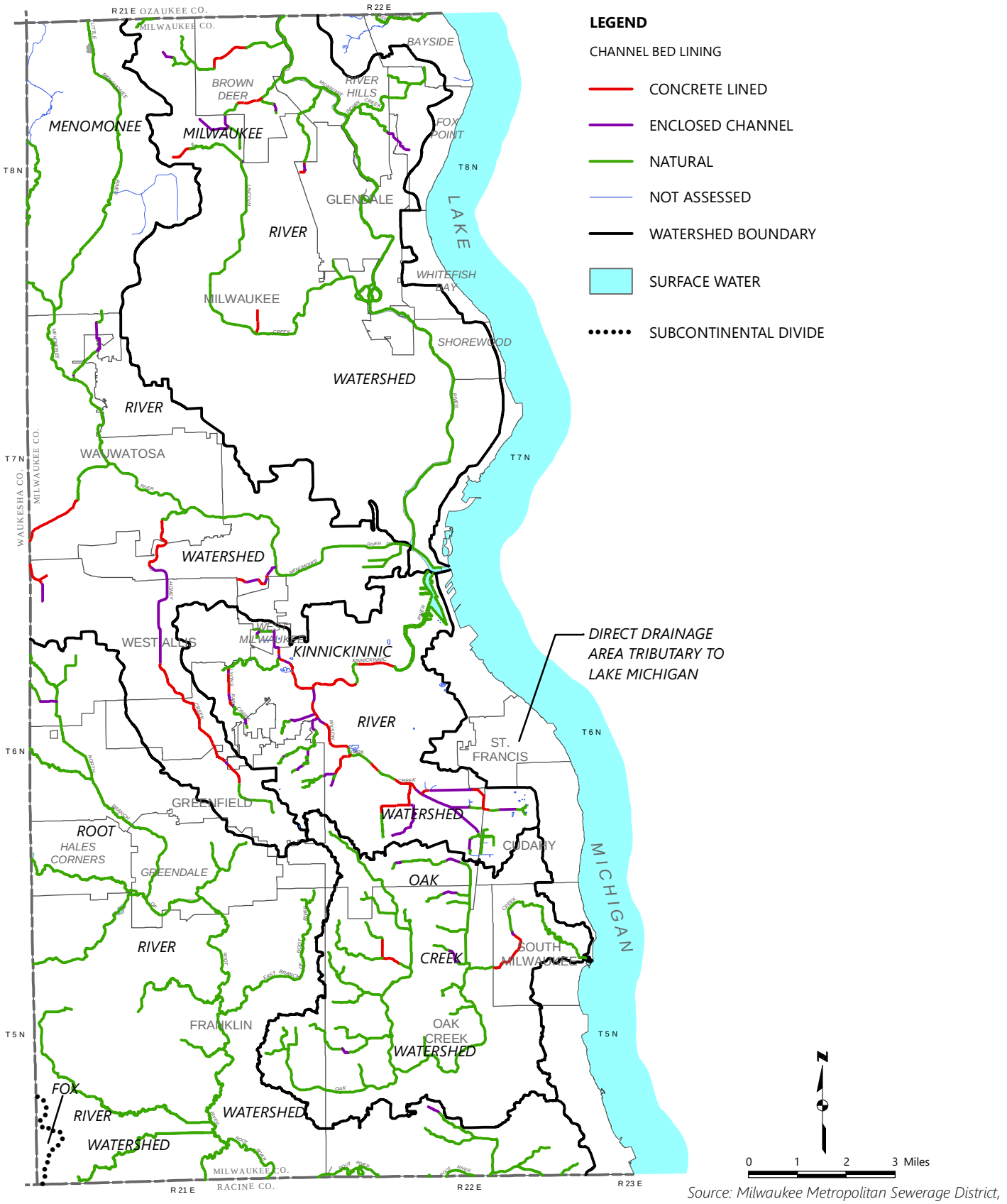
Map 2.15
Streambed Characteristics within Milwaukee County: 2019



Source: Milwaukee Metropolitan Sewerage District, Inter-Fluve, Inc., and SEWRPC

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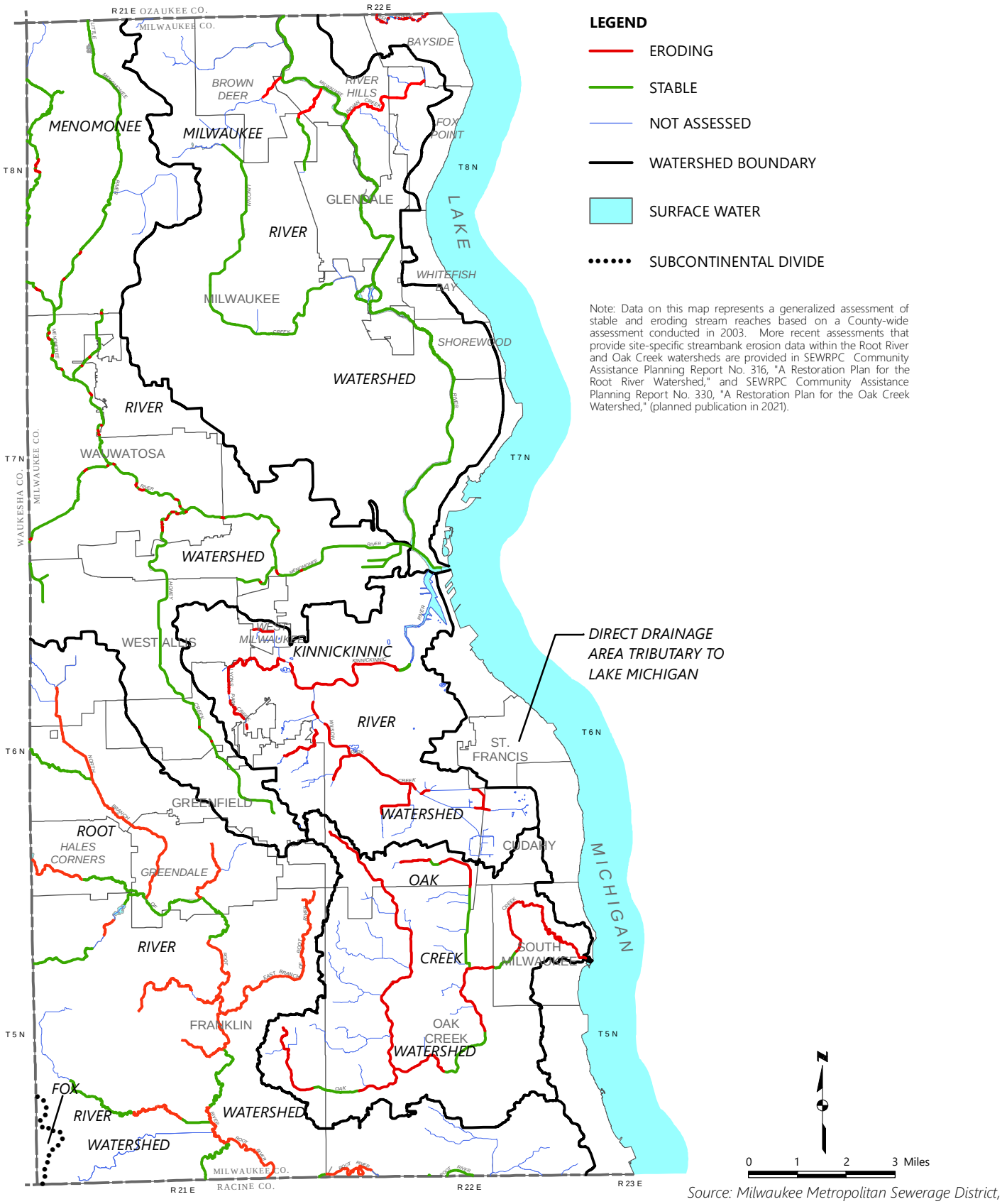
Map 2.16
Streambank Characteristics within Milwaukee County: 2003



Source: Milwaukee Metropolitan Sewerage District, Inter-Fluve, Inc., and SEWRPC

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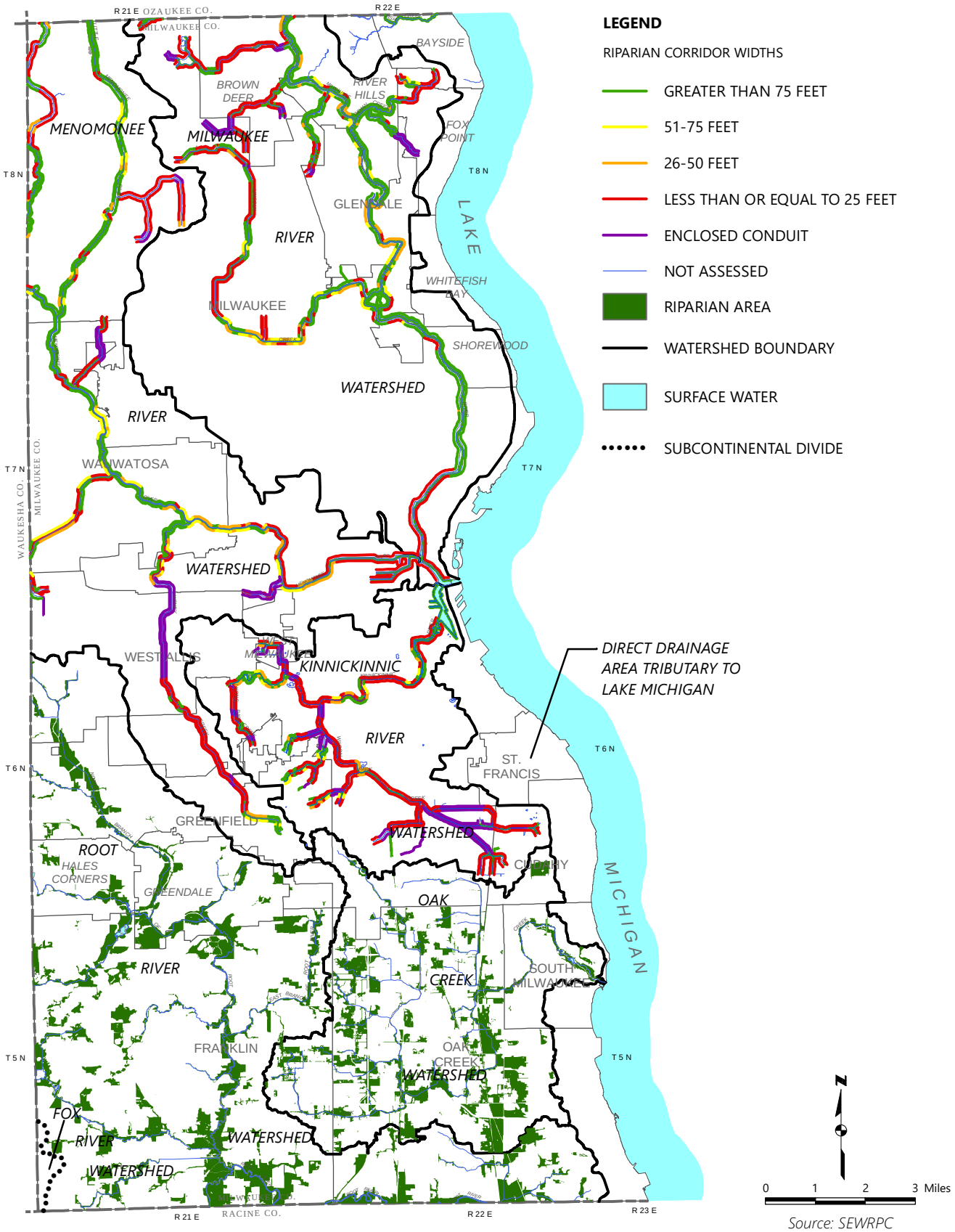
Map 2.17
Riparian Corridor Widths within Milwaukee County: 2015



Source: SEWRPC

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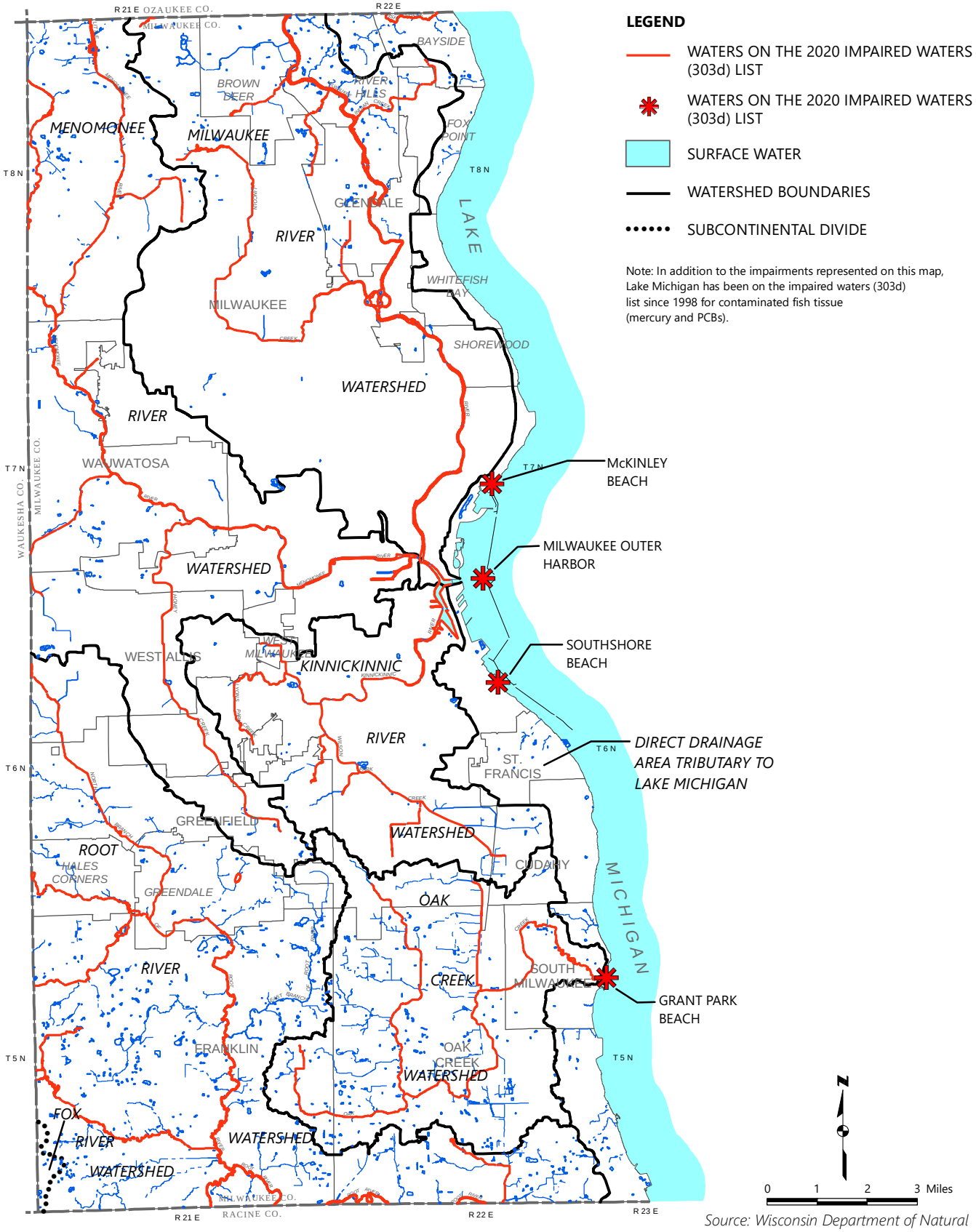
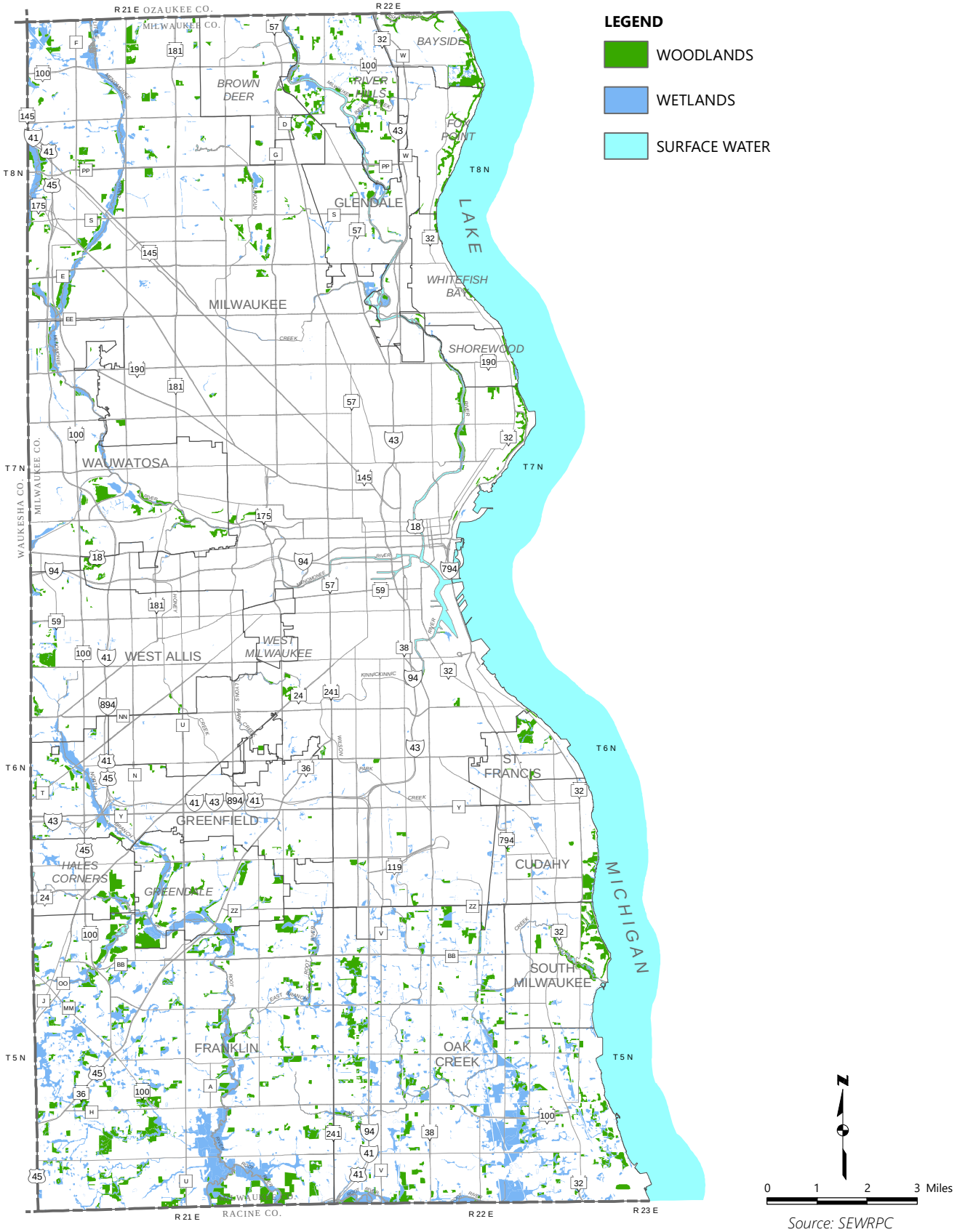
Map 2.18
Impaired Waters within Milwaukee County: 2020



Source: Wisconsin Department of Natural Resources and SEWRPC

Map 2.19
Woodlands and Wetlands in Milwaukee County: 2015



Source: SEWRPC

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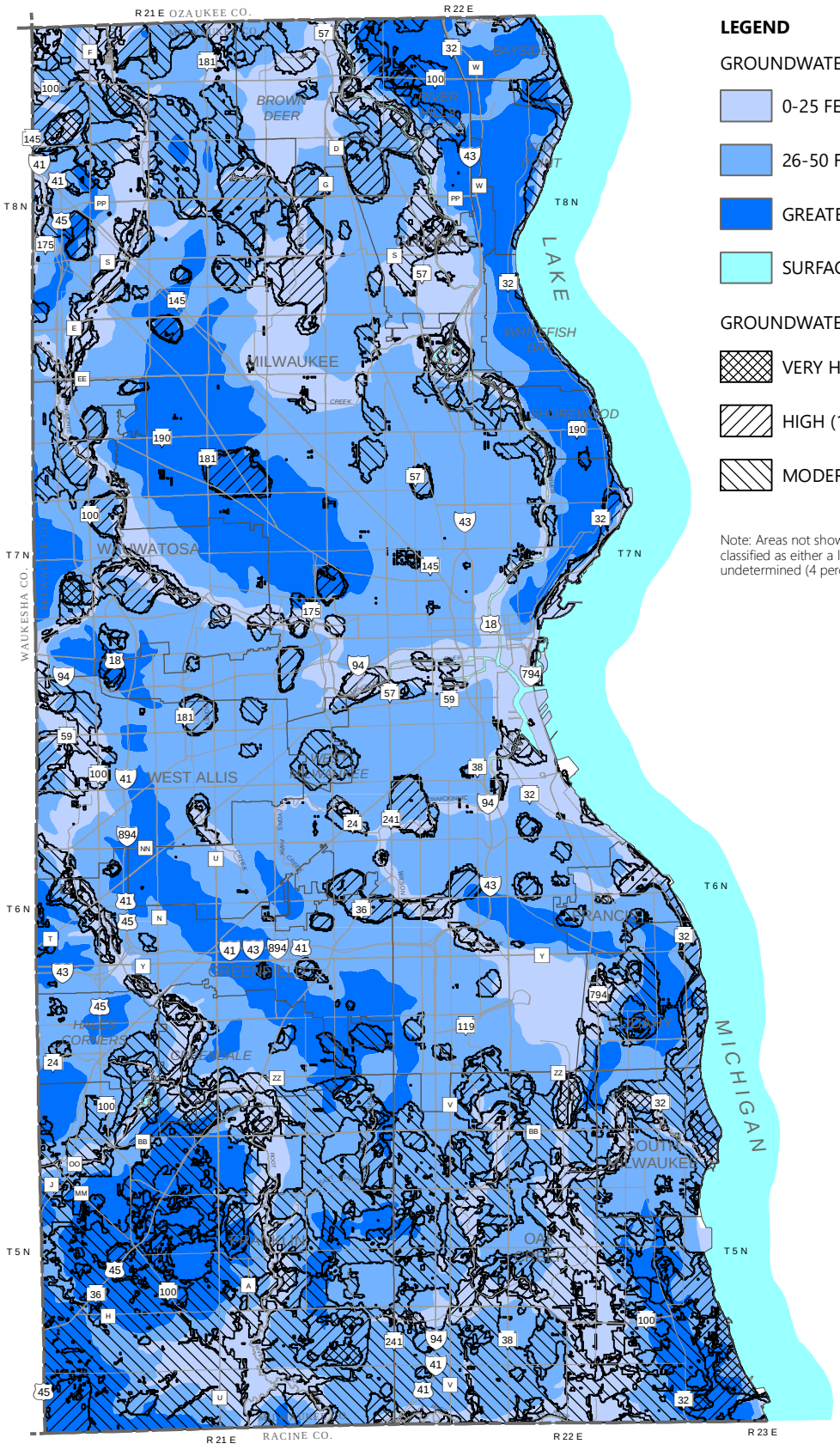
Map 2.20
Depth to Seasonal High Groundwater Table and Groundwater Recharge Areas in Milwaukee County



LEGEND

GROUNDWATER TABLE DEPTH

- 0-25 FEET (22 PERCENT OF COUNTY)
- 26-50 FEET (55 PERCENT OF COUNTY)
- GREATER THAN 50 FEET (23 PERCENT OF COUNTY)
- SURFACE WATER

GROUNDWATER RECHARGE AREA

- VERY HIGH (2 PERCENT OF COUNTY)
- HIGH (12 PERCENT OF COUNTY)
- MODERATE (25 PERCENT OF COUNTY)

Note: Areas not shown with a cross hatch or hatch pattern are classified as either a low recharge area (57 percent of County) or undetermined (4 percent of County)

N

0 1 2 3 Miles

Source: SEWRPC

Map Document: (I:\COMMON\LAND\MILW CO LWRMP 2020\Maps\Maps\New Maps for 2020\Map 2.18.mxd)
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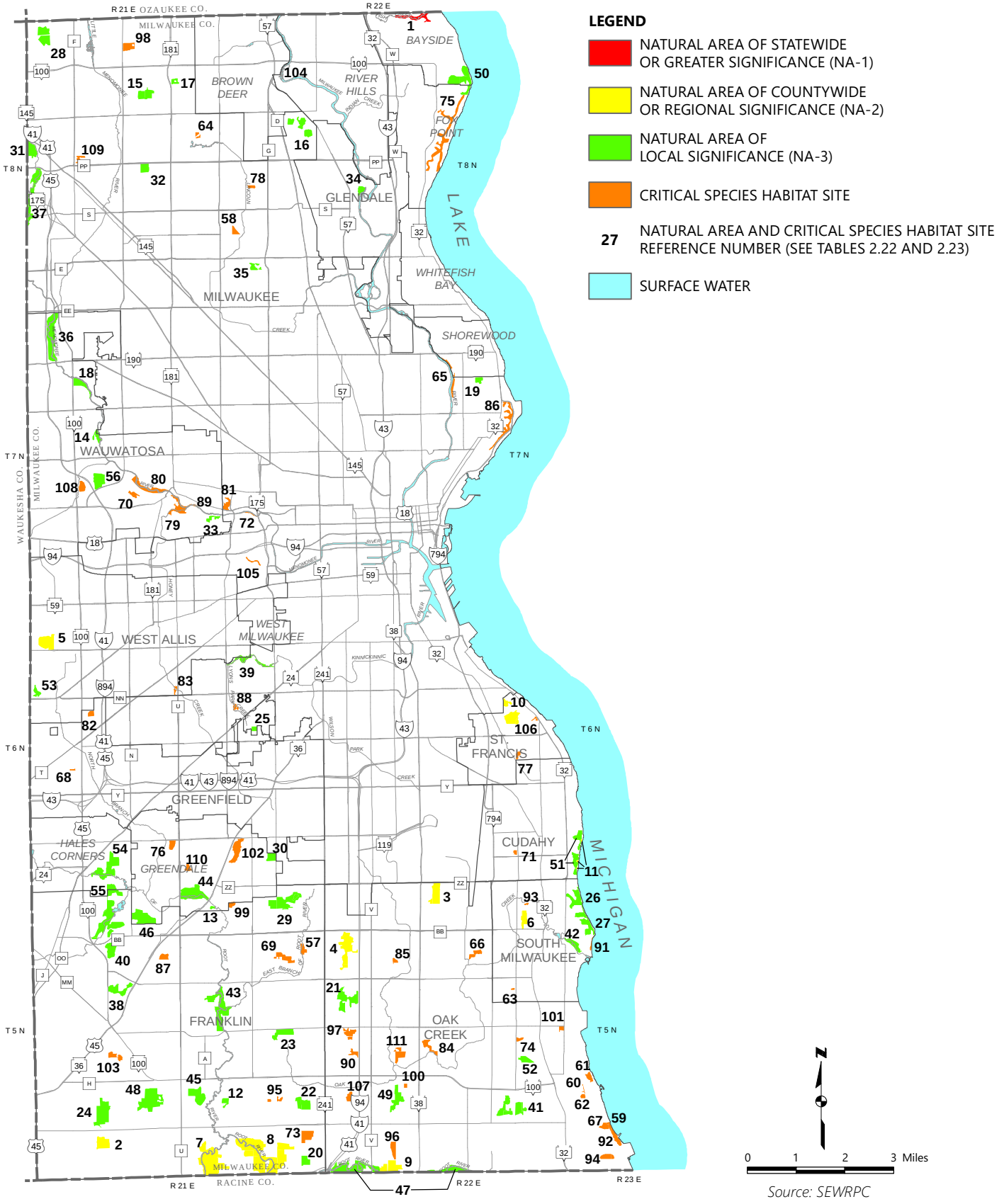
Map 2.21
Natural Areas and Critical Species Habitat Sites in Milwaukee County: 2009



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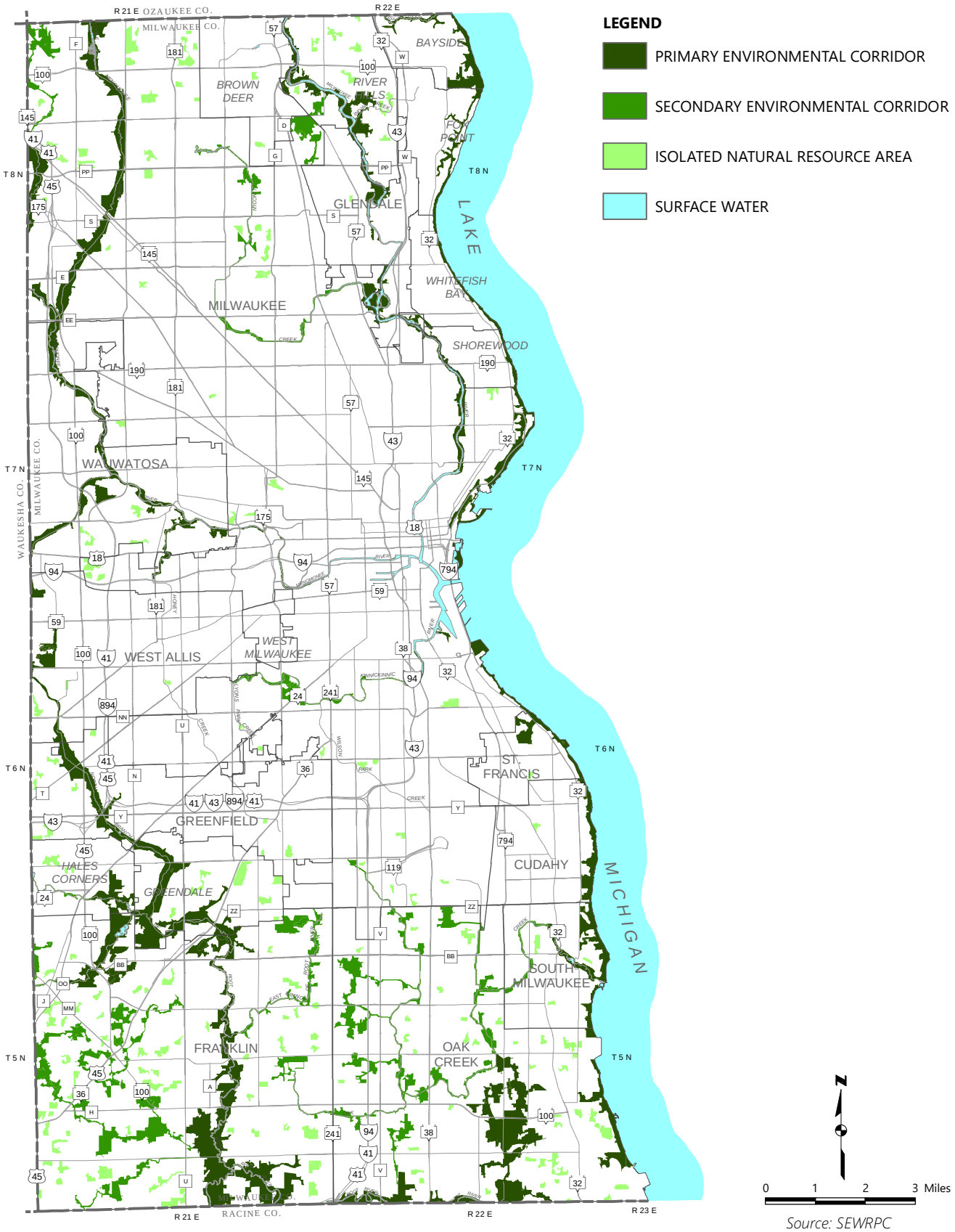
Map 2.22
Environmental Corridors and Isolated Natural Resource Areas in Milwaukee County: 2015



Source: SEWRPC

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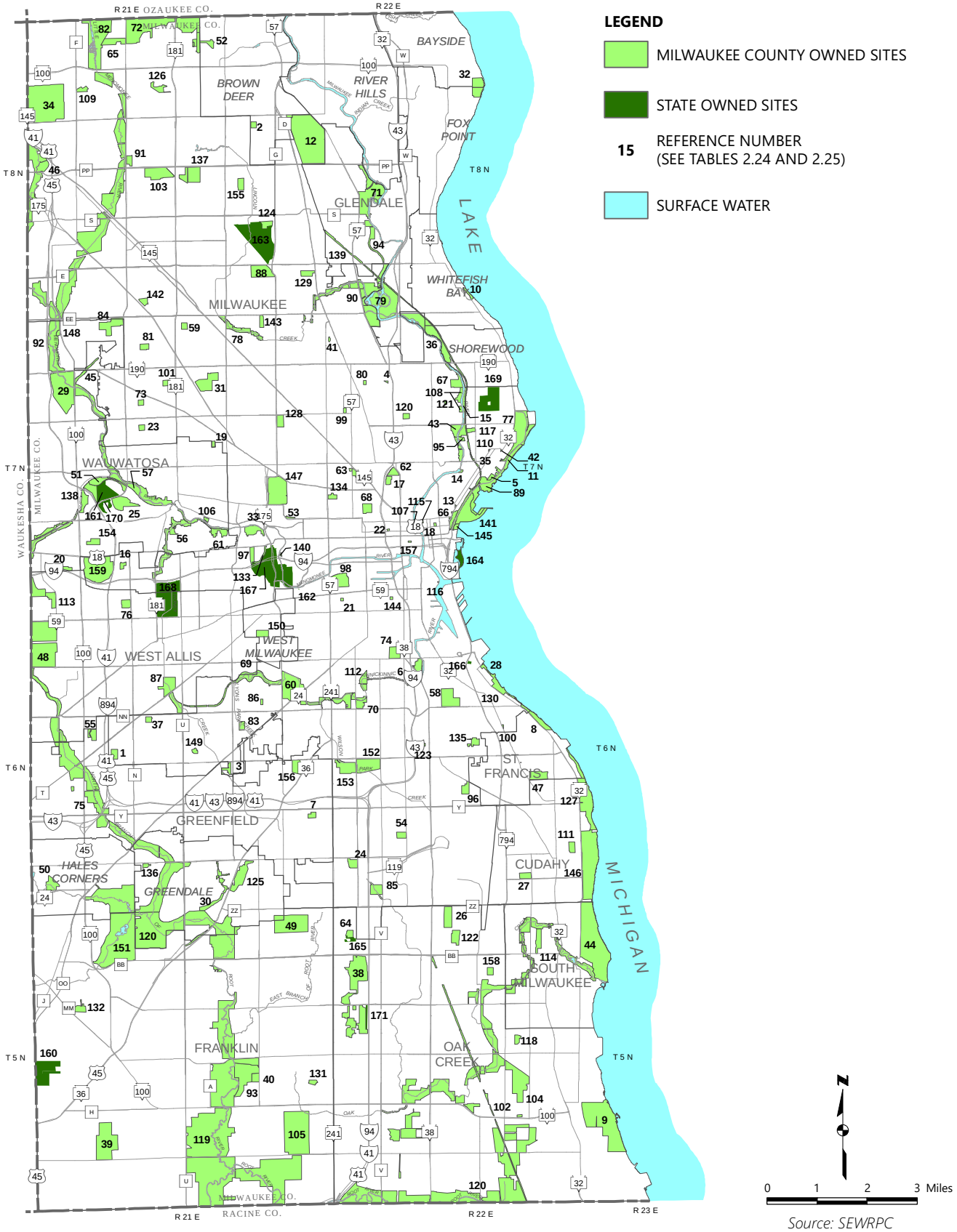
Map 2.23
Milwaukee County and State of Wisconsin Park and Open Space Sites: 2020



Source: SEWRPC

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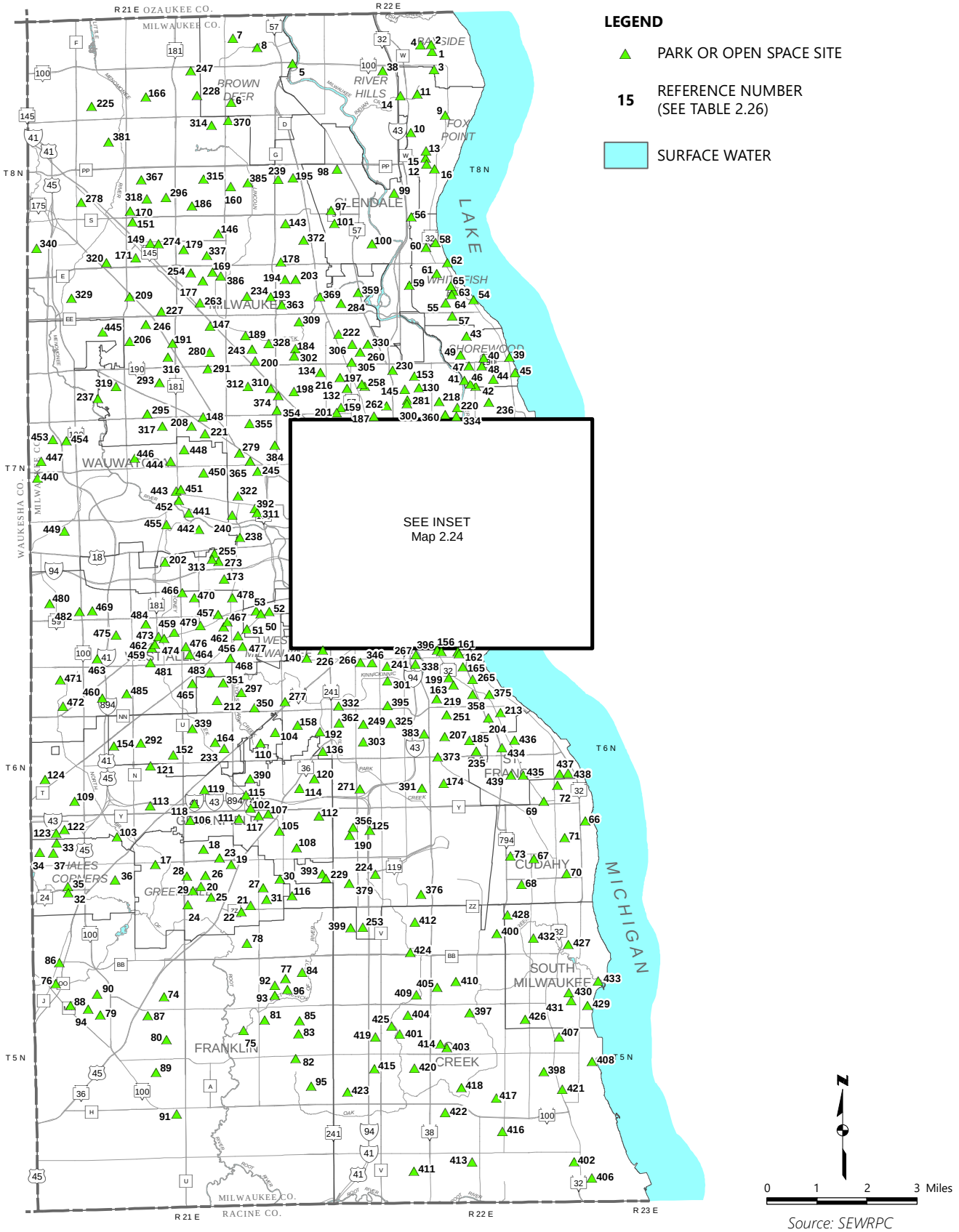
Map 2.24
Park and Open Space Sites owned by Cities, Villages, or School Districts in Milwaukee County: 2020



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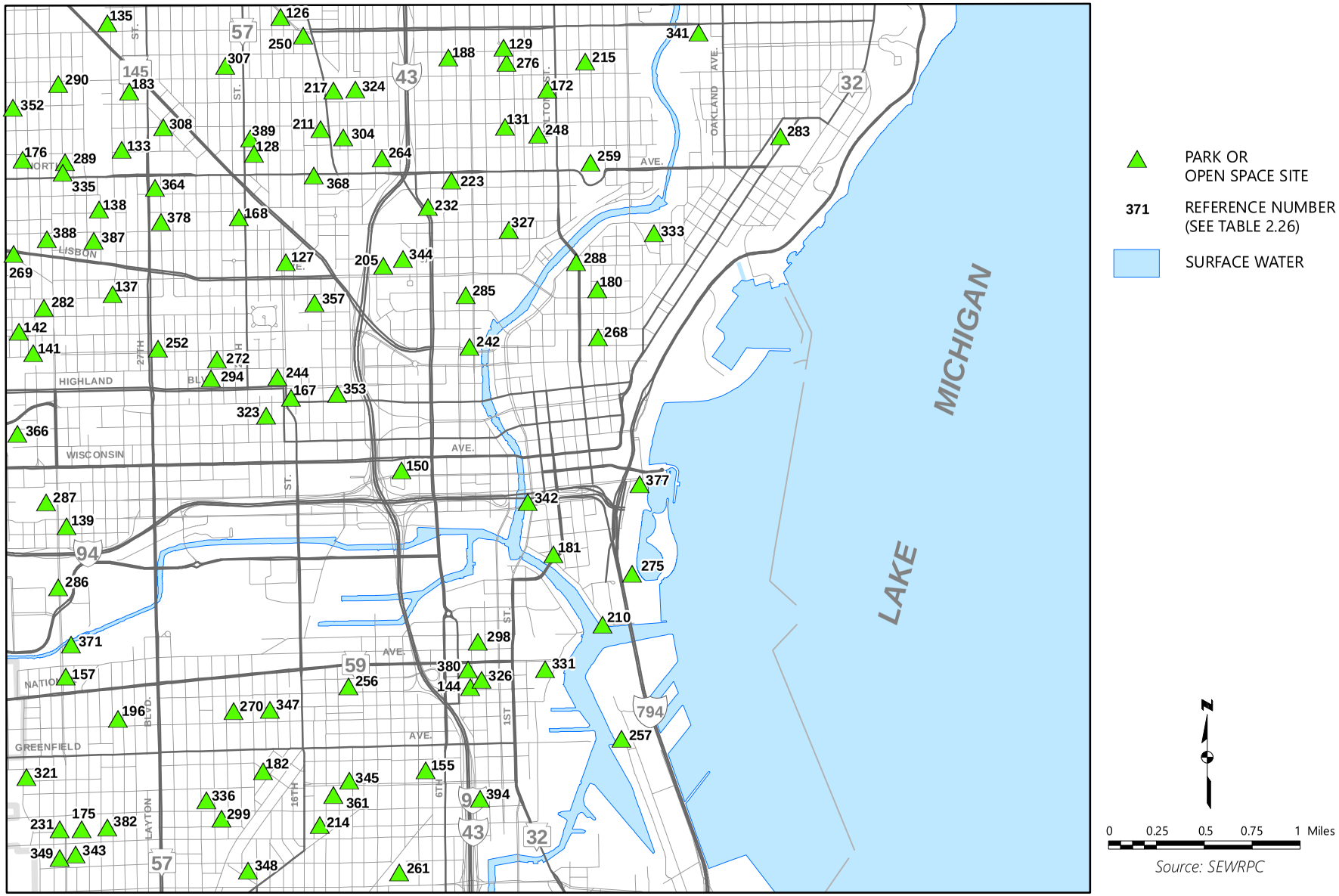
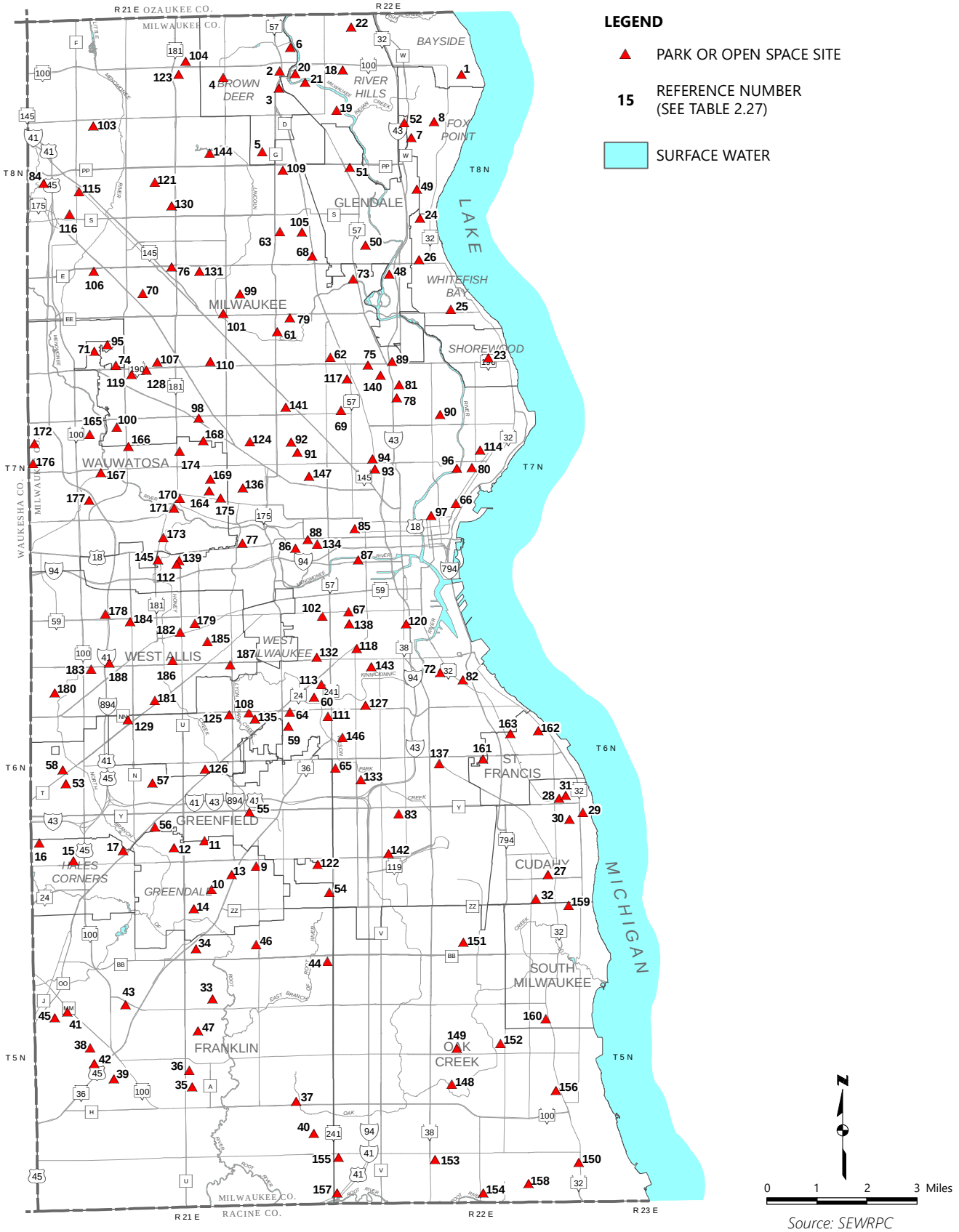
Inset to Map 2.24
Park and Open Space Sites owned by the City of Milwaukee or Public School Districts in Central Milwaukee Area: 2020



Map 2.25
Private Outdoor Recreation or Open Space Sites in Milwaukee County: 2020



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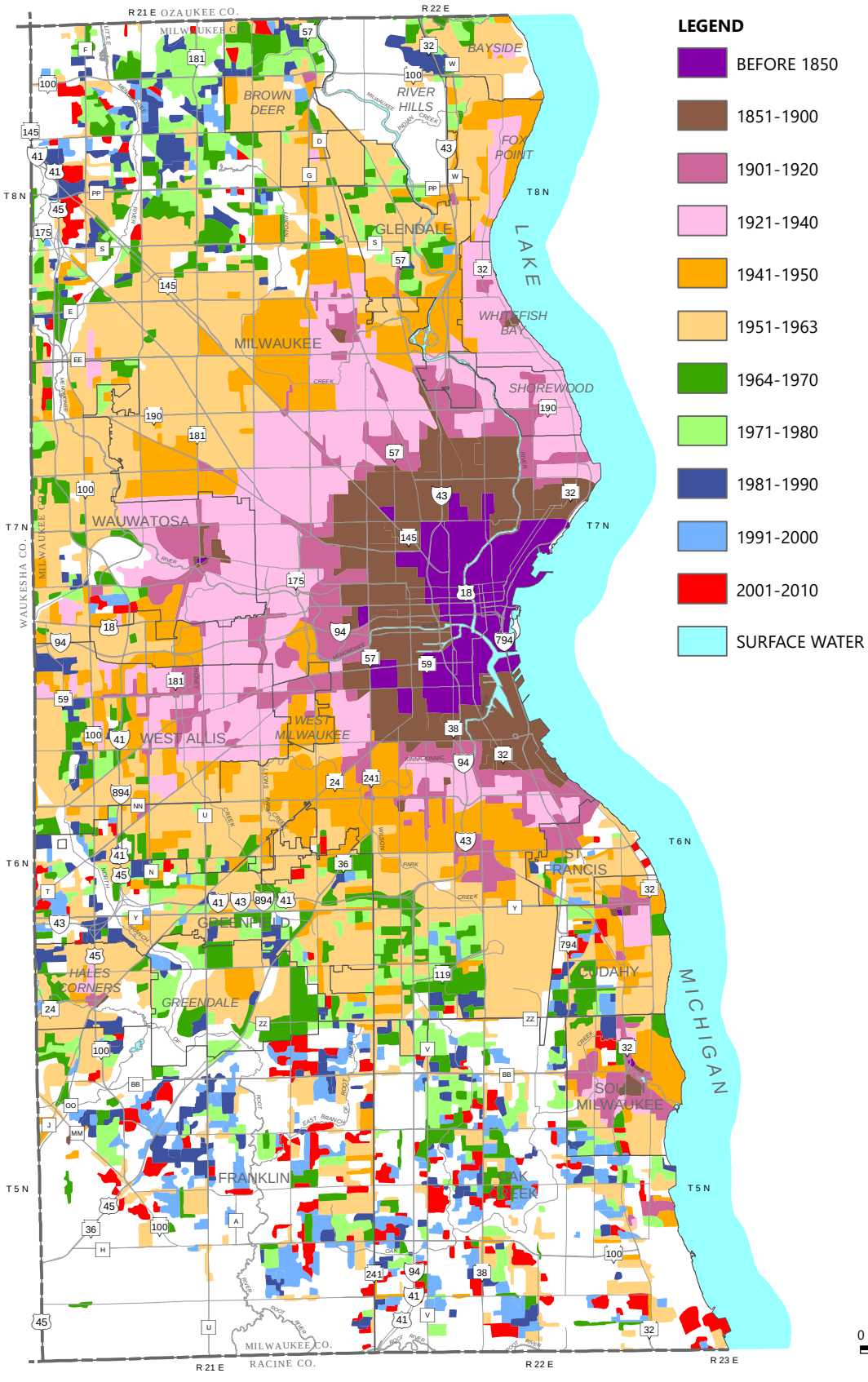
Map 2.26
Historic Urban Growth in Milwaukee County: 1830-2010



Source: SEWRPC

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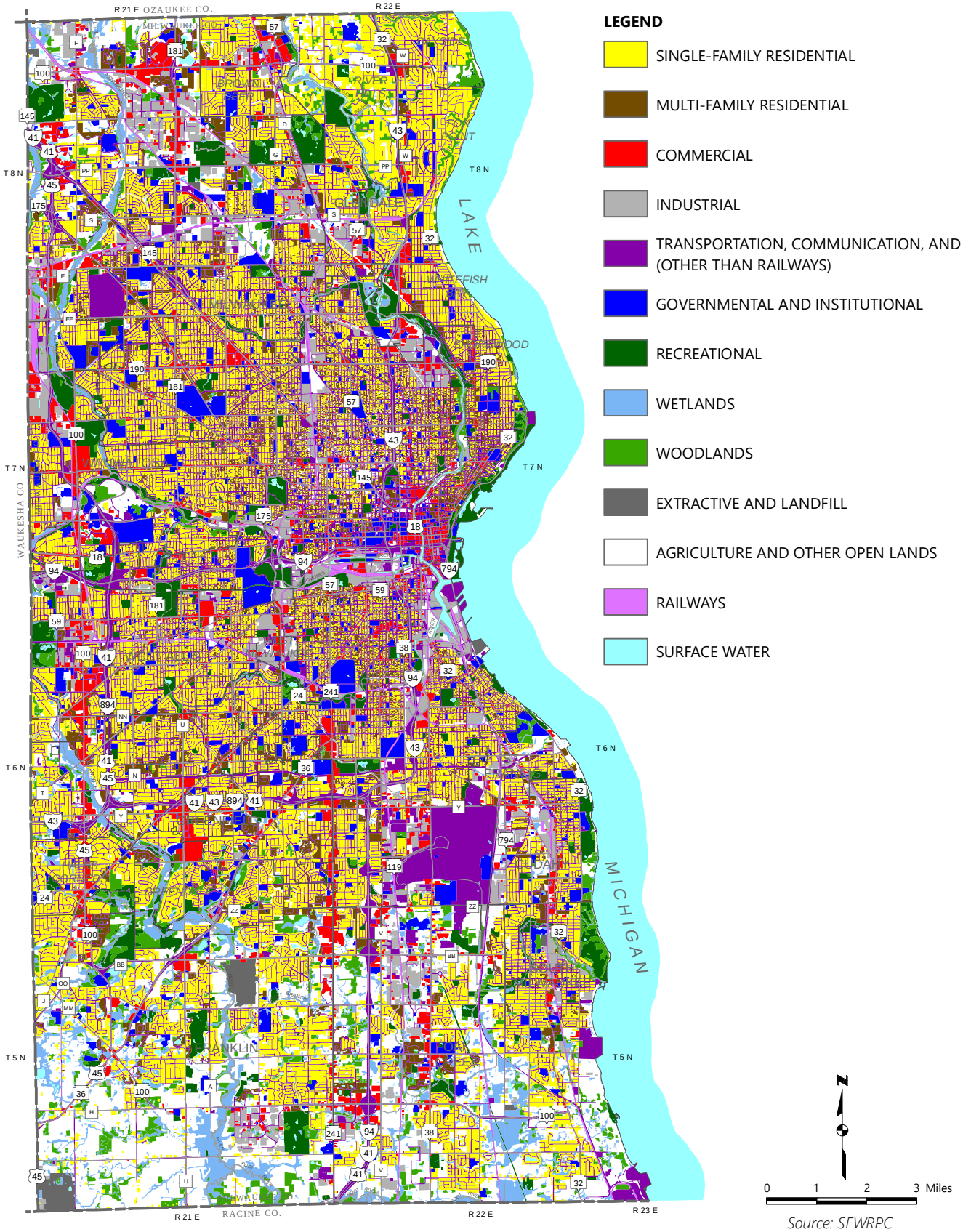
11/16/2020 -- 10:47:47 AM

Map 2.27
Existing Land Use in Milwaukee County: 2015



Source: SEWRPC

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SEWRPC Community Assistance Planning Report No. 312 (2nd Edition)

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

Chapter 3

RELATED PLANS, REGULATIONS, AND PROGRAMS

3.1 INTRODUCTION

The updated Milwaukee County land and water resource management plan is built upon the initial plan and its previous updates and complements other planning and resource management efforts and programs linking local level planning with regional and watershed level plans. The plan, therefore, provides an integrated framework within which Milwaukee County will conduct activities to protect and rehabilitate the land and water resource base of the County and contribute to the environmentally sound management of these valuable resources in a coordinated manner that is compatible with watershed-wide needs and resource management programs. One of the first steps to be undertaken in the land and water resource management planning program is the inventory, collation, and review of the recommendations of relevant previously prepared reports and plans.

There are a number of plans that focus on the natural resources of Milwaukee County. These plans include programs that address the interconnection of the natural resources of Milwaukee County with those of the related watersheds and the Southeastern Wisconsin Region, as well as the importance of natural resources at the County and community level. The plans collated and reviewed for input into this current planning program were generally most relevant to actions undertaken by the County or potentially to be undertaken by the County. In addition, selected plans prepared at the local level, including local land use plans, park and open space plans, lake and water quality management plans, and sewer service area plans prepared for individual communities or for special-purpose units of government were considered. All of these documents provide the basis for developing an integrated scheme for the sustainable management of the natural resources of Milwaukee County through the coordinated efforts of Federal, State, County, and local

governments, special-purpose units of government, and community groups. This land and water resource management plan provides an opportunity to promote detailed action at the local level while achieving strategic objectives within the boundaries of Milwaukee County, its watersheds, and the Southeastern Wisconsin Region. This plan takes into account planning objectives identified by local officials and also those reflected in locally adopted land use plans and ordinances. Accordingly, an important step in the planning process was a review of the existing framework of areawide and local plans and related land use regulations. This chapter presents a summary of that review.

3.2 REGIONAL PLANS

Regional Land Use and Transportation Plan (VISION 2050)

The regional land use and transportation plan, referred to as VISION 2050, recommends a long-range vision for land use and transportation in the seven-county Region. It makes recommendations to local and State government to shape and guide land use development and transportation improvement, including public transit, bicycle and pedestrian facilities, arterial streets and highways, and freight transportation to the year 2050. Map 3.1 shows the recommended regional land use development pattern as it relates[1] to Milwaukee County. The key recommendations of the plan as they pertain to land and water resource management include:

Environmental Corridors

VISION 2050 recommends limiting any new urban development within primary environmental corridors to essential transportation and utility facilities and/or compatible outdoor recreation facilities. To the extent possible, new urban development should also avoid secondary environmental corridors and isolated natural resource areas. Development considered compatible with environmental corridors is set forth in Table 3.1. VISION 2050 recommends preserving the remaining primary environmental corridors in essentially natural and open land uses. The plan further recommends that local governments consider preserving secondary environmental corridors and isolated natural resource areas in natural open space uses or for stormwater management and recreational purposes. For the most part, primary environmental corridors within Milwaukee County are protected through either public park and open space ownership by the State, County, local governments, or other public entities or through compatible zoning by local governments. Map 2.22 in Chapter 2 of this report shows the primary environmental corridors within Milwaukee County. Because of the many interacting relationships existing between living organisms and their environment, the

[1]*Documented in SEWRPC Planning Report No. 55,* VISION 2050: A Regional Land Use and Transportation Plan*, July 2017.*

destruction or deterioration of one important element of the environmental corridor may lead to a chain reaction of deterioration and destruction of other elements, therefore, any new developments or projects that may affect any environmental corridor should be subject to a review on a site-by-site basis. During some circumstances, it is recognized that minor compromises can be negotiated to achieve a greater or more reasonable protection goal for environmental corridors. A loss of a portion of an environmental corridor on small parcels may be the appropriate action to permanently preserve large adjoining land tracts, or losses to enable needed public projects can sometimes be mitigated or offset by gains at other locations.

Urban Development

VISION 2050 recommends focusing urban development within urban service areas that typically include public sanitary sewer and water supply, parks, schools, and shopping areas. Since the majority of Milwaukee County is highly urbanized, it is recommended that any new residential development would primarily occur as infill and redevelopment under the Small Lot Traditional Neighborhood, Mixed-Use Traditional Neighborhood, and Mixed-Use City Center land use categories. These residential developments encourage a compact development pattern that also support Transit-Oriented Development (TOD). These developments allow single-family homes on smaller lots (one-quarter acre or less) and multifamily housing, which tends to be more affordable to a wider range of households. In addition, these developments would encourage walkable neighborhoods with housing in proximity to a mix of uses, such as parks, schools, and businesses. Descriptions of the types of residential developments recommended to be developed in Milwaukee County include:

Mixed-Use City Center

A Mixed-Use City Center includes offices, stores, services, apartments, condominiums, and homes with small yards. Many of the offices, apartments, and condominiums may be in mid-rise buildings and high-rise towers (particularly in and around downtown Milwaukee). There may also be stores and services located on the ground floors of these buildings. The demand for common open space, such as a public park, is high due to many of the housing developments lacking private yards. Mixed-use developments typically include dwellings above the ground floor of commercial uses and residential structures intermixed with, or located adjacent to, compatible commercial, institutional, or other civic uses.

Mixed-Use Traditional Neighborhood Development

A Mixed-Use Traditional Neighborhood includes stores, services, offices, apartments, condominiums, and major employment centers. This development may also include homes with small yards. The offices, apartments, and condominiums may be in midrise and low-rise buildings with stores and services on the

ground floor. People are also able to walk to many everyday destinations from their homes. Although there may be homes with yards, there is still a high demand for public open space. This development, including the layout of streets and sidewalks, encourages walking and bicycling as alternatives to automobile transportation within the neighborhood.

Small Lot Traditional Neighborhood

A Small Lot Traditional Neighborhood includes a mix of housing types such as homes with small lots (less than a quarter-acre in size) and apartments and condominiums. Small Lot Traditional Neighborhood also includes a mix of stores, services, and offices; can also be served efficiently by public transit; and may contain major employment centers located adjacent to highways. People are also able to walk to many destinations from their homes.

Transit-Oriented Development (TOD)

A TOD is a compact, mixed-use development whose internal design is intended to maximize access to a transit stop located within or adjacent to the development. Within the development, commercial uses and higher-density residential uses are located near the transit stop. Residential development should occur in multifamily buildings or buildings with a mix of uses such as commercial-retail space on the ground floor and dwellings on upper floors. Some buildings may have a mix of commercial-retail space on the ground floor with office space on upper floors. Public plazas, parks, and other governmental and institutional uses may also be included. The layout of streets and sidewalks should provide convenient and safe walking and bicycling access to the transit stop. A TOD also supports healthy communities, mobility, and revitalization in highly urbanized areas.

In addition, detailed neighborhood plans should be prepared for mature neighborhoods or special-purpose districts showing signs of land use instability or deterioration. Such plans should identify areas recommended for redevelopment to a different use, areas recommended for rehabilitation, any local street re-alignments or improvements, and other public utility and facility improvements. Redevelopment plans should seek to preserve historic, cultural, and natural features and features of the urban landscape that provide for neighborhood identity within the larger urban complex. Major industrial centers and other economic activity centers in older urban areas should be maintained and redeveloped to moderate the historical loss in employment at these centers. Aging industrial centers should undertake strategic and physical planning efforts for each center.

Productive Agricultural Land

The compact development pattern recommended under VISION 2050 would minimize the impacts of new development on productive agricultural land, including highly productive Class I and II soils (prime agricultural land), as classified by the U.S. Natural Resources Conservation Service. Some Class I and II farmland located in the vicinity of existing urban service areas may be converted to urban use as a result of planned expansion of those urban service areas to accommodate efficient regional growth. VISION 2050 defers to county plans to identify productive agricultural land. VISION 2050 also recommends developing a regional food system that connects food producers, distributors, and consumers to ensure access to healthy foods throughout the entire Region. In addition, local governments should implement land use policies that would allow urban agriculture, such as vertical farming and community gardens on vacant lots.

Regional Transportation Component

The regional transportation component of VISION 2050 is intended to provide a vision for, and guide to, transportation system development in the Region. The transportation component of VISION 2050 includes the following six elements: public transit; bicycle and pedestrian; transportation systems management; travel demand management; arterial streets and highways; and freight transportation. VISION 2050 recommends improving or expanding the express bus service, local public transit, intercity transit, and the off-street bicycle network. VISION 2050 further recommends developing a rapid transit network consisting of eight rapid transit corridors (either bus rapid transit or light rail) with dedicated transit lanes and transit signal priority or preemption that are intended to provide travel times comparable to an automobile. Because major employment centers and job opportunities continue to develop in areas on the outskirts of Milwaukee County and in Counties adjacent to Milwaukee County, developing a rapid transit network will increase accessibility for County residents to activity centers, employment centers, neighborhoods, and other destinations within Milwaukee County and throughout the Region. The eight bus rapid transit or light rail corridors that are recommended for Milwaukee County include:

- From downtown Waukesha to downtown Milwaukee via the Milwaukee Regional Medical Center, predominately on E. Main Street, W. Blue Mound Road, and Wisconsin Avenue

- From Bayshore Town Center in Glendale to downtown Milwaukee via the University of Wisconsin-Milwaukee, predominately on N. Oakland Avenue, N. Prospect Avenue, and N. Farwell Avenue

- From the Park Place complex on the northwest edge of Milwaukee to downtown Milwaukee, predominately on W. Fond du Lac Avenue

- From the retail centers located around the intersection of S. 108th Street and W. Cleveland Avenue in West Allis to downtown Milwaukee, predominately on W. National Avenue

- From Northwestern Mutual's Franklin Campus on S. 27th Street to downtown Milwaukee via Milwaukee Mitchell International Airport, predominately along S. Howell Avenue and S. 1st Street

- From Bayshore Town Center in Glendale to W. Drexel Avenue, predominately on 27th Street

- From the Park Place Complex on the northwest edge of Milwaukee to the retail centers located around the intersection of S. 108th Street and Cleveland Avenue in West Allis via Mayfair Mall, predominately on N. Mayfair Road and S. 108th Street (STH 100)

- From Shoppers World of Brookfield at N. 124th Street and W. Capitol Drive to the University of Wisconsin-Milwaukee, predominately on Capitol Drive

VISION 2050 recommends additional express bus services within Milwaukee County, and improvements to the existing express bus services that would not be replaced by rapid transit lines. The express route serving 27th Street would be extended north to Brown Deer Road and south to Southridge Mall in Greendale along W. Forest Home Avenue. Additional express routes would be added on 76th Street and Oklahoma Avenue. Stops would be spaced at least one-half mile apart, and therefore, the services would provide better travel times than local bus routes. Express services in Milwaukee County would come at least every 15 minutes nearly the entire day.

Intercity rail and bus services will provide transit connections between Milwaukee County, the Region, and destinations outside Southeastern Wisconsin. VISION 2050 recommends developing two new intercity rail lines, one connecting Chicago to Minneapolis and St. Paul via Milwaukee and Madison, and another connecting Chicago to Green Bay via Milwaukee and the Fox Valley. Both services would be operated as extensions of the existing Amtrak Hiawatha service from Chicago, and all three lines would operate at speeds up to 110 miles per hour.

Future needs for transportation improvements are derived from the future growth proposed in VISION 2050.

2020 Review and Update

Every four years, the Regional Planning Commission conducts an interim review and update of the regional land use and transportation plan, in part to address Federal requirements. The 2020 Review and Update assessed implementation to date of VISION 2050, reviewed the year 2050 forecasts underlying the plan, and monitored current transportation system performance. The 2020 Review and Update examined whether it remains reasonable for the recommendations in VISION 2050 to be accomplished over the next 30 years, given the implementation of the plan to date and available and anticipated funding for the transportation component. Based on the implementation evaluation and public input, no changes were made to the land use component of the plan. VISION 2050 will continue to recommend: focusing new urban development in urban centers; a compact development pattern with a mix of housing types and uses; and preserving primary environmental corridors and agricultural land.

Regional Natural Areas Plan

Map 2.21 in Chapter 2 of this report presents the regional natural areas plan as it pertains to Milwaukee County. The natural areas plan[2] identifies the most significant remaining natural areas, critical species habitats, geological sites, and archaeological sites in the Region, and recommends means for their protection and management. Natural areas are tracts of land or water that contain plant and animal communities believed to be representative of the pre-European settlement landscape and critical species habitat sites are other areas that support endangered, threatened, or rare plant or animal species. The plan identifies potential sites for public or private protective ownership, and protection of other sites, insofar as it is possible, through zoning or other regulatory means without protective ownership. It also recommends preparing and implementing a detailed management plan for each site placed under protective ownership. The vast majority of natural areas and critical species habitat sites are located within environmental corridors and isolated natural resource areas. Tables 2.22 and 2.23 in Chapter 2 includes an inventory of natural areas and critical species habitat sites in the County. An update to the inventory of these areas and sites in Milwaukee County was underway as of the preparation of this plan update, and is expected to be completed in 2021. An update of Critical Species habitat sites identified by Milwaukee County Parks staff and SEWRPC staff between 2010 and 2021 are described in Chapter 4 of this report.

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[2]*SEWRPC Planning Report No. 42,* A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin*, September 1997, documents the 1994 inventory*. *SEWRPC Amendment to Planning Report No. 42,* Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin*, December 2010 documents the plan update*.

Regional Park and Open Space Plan

The regional park and open space plan consists of two basic elements: an open space preservation element and an outdoor recreation element.[3] The open space preservation element consists of recommendations for preserving primary environmental corridors within the Region. The outdoor recreation element consists of a resource-oriented outdoor recreation element that provides recommendations for the number and location of large parks, recreation corridors, and water-access facilities, and an urban outdoor recreation element that provides recommendations for the number and distribution of local parks and outdoor recreational facilities required in urban areas of the Region. The Milwaukee County park and open space plan[4] refines, details, and extends this regional plan. With the assistance of the Commission, Milwaukee County initiated work on an update to its park and open space plan in 2015, with the goal of extending the planning horizon to the year 2050. In Milwaukee County, the park and open space plan update recommends developing 14 undeveloped County-owned sites at five regional parks, two community parks, and seven neighborhood parks. The plan also recommends that the County develop additional trails within the Lake Michigan Corridor, the Little Menomonee River Corridor, the Menomonee River Corridor, and the Root River Corridor.

Regional Water Quality Management Plan

In 1979, SEWRPC completed and adopted a regionwide water quality management plan for Southeastern Wisconsin as a guide to achieving clean and healthy surface waters within the seven-county Region. The design of the plan is, in part, to meet the Congressional mandate that the waters of the United States be "fishable and swimmable" to the extent practical. It 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. Subsequently, SEWRPC completed a report documenting the updated content and implementation status of the regional water quality management plan: SEWRPC Memorandum Report No. 93, *A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995. This status report also documents the extent of progress made toward meeting the water use objectives and supporting water quality standards set forth in the regional plan.

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[3]*SEWRPC Planning Report No. 27,* A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000*, November 1977.*

[4]*SEWRPC Community Assistance Planning Report No. 132,* A Park and Open Space Plan for Milwaukee County*, November 1991.*

The 2007 regional water quality management plan update for the greater Milwaukee watersheds[5,6] addressed three major elements of the original regional water quality management plan: the land use element; the point source pollution abatement element; and the nonpoint source pollution abatement element, and it also included instream and riparian habitat considerations. The regional water quality management plan update was prepared in conjunction with the Milwaukee Metropolitan Sewerage District (MMSD) 2020 Facilities Plan. The 2013 amendment revisions were based on changes to the watershed water quality models necessitated by findings during additional modeling efforts conducted after the plan report was issued. The modeling efforts were conducted under a separate study directed toward evaluating the possible effects of climate change on water quality in the streams in the study area.

The original regional water quality management plan and its subsequent updates and status reports include specific recommendations for reducing nonpoint source pollutant levels. Evaluation of the degree to which the adopted water use objectives for rivers and streams could meet recommended plan conditions within the greater Milwaukee watersheds was based on detailed water quality modeling.

Regional Water Supply Plan

The Commission has conducted a regional water supply study and planning program for Southeastern Wisconsin.[7] The regional water supply plan together with past SEWRPC groundwater inventories and development of a ground water simulation model[8,9] form the basis of the SEWRPC regional water supply management program. These three elements were prepared in collaboration with the U.S. Geological Survey (USGS), the Wisconsin Geological and Natural History Survey, the University of Wisconsin-Milwaukee, the Wisconsin Department of Natural Resources (WDNR), and many of the area's water supply utilities.

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[5]*SEWRPC Planning Report No. 50,* A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds*, December 2007, amended May 2013*.

[6]*The greater Milwaukee watersheds are the Kinnickinnic, Menomonee, Milwaukee, and Root River watersheds, the Oak Creek watershed, and the Lake Michigan direct drainage area, of which portions of the Menomonee and Milwaukee River watersheds, and the Lake Michigan direct drainage area, are located in Ozaukee County.*

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

[8]*SEWRPC Technical Report No. 37,* Groundwater Resources of Southeastern Wisconsin*, June 2002.*

[9]*SEWRPC Technical Report No. 41,* A Regional Aquifer Simulation Model for Southeastern Wisconsin*, June 2005.*

The regional water supply plan includes the following major components:

- Identification of public utility water supply service areas

- Recommendations for source of water supply for identified service areas

- A recommendation for implementing comprehensive water conservation programs, including both supply side efficiency measures and demand side conservation measures with the scope and content of these programs to be determined on a utility-specific basis reflecting the type and sustainability of the source of supply and probable future water supply infrastructure requirements

- Identification of important groundwater recharge areas and recommendations for protecting and preserving recharge areas that have a high or very high recharge potential

- Recommendations for implementing various stormwater management practices, including state-of-the-art practices, which, to the extent practicable, will maintain the natural recharge of areas committed to urban land use development

- Recommendations related to siting new high-capacity wells

- Recommendations for installing enhanced rainfall infiltration systems[10] in areas where evaluations conducted in conjunction with the siting of high-capacity wells in the shallow aquifer indicate probable reductions in baseflow on nearby streams or water levels in nearby lakes and wetlands due to the installation and operation of these wells

The recommendations and guidance given in the plan should be considered by municipalities in Milwaukee County when evaluating the sustainability of proposed developments and in conducting local land use planning.

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[10]It should be noted that municipalities can only require infiltration that meets the standards set forth within NR 281.33(6)(a)1, which limits those stormwater quantity or peak flow standards to only those that address existing flooding problems or prevent future flooding problems; except that an ordinance under this subdivision may not require more than 90 percent of the difference between the pre-development annual runoff volume at a site and the post-development annual runoff volume at that site to be retained on the site.

Lake Michigan Water Diversion

Because the subcontinental divide between the Mississippi River and the Great Lakes-St. Lawrence River drainage basins traverses the Region, the use of Lake Michigan water as a source of supply within the Region is enticing to public utilities, especially those communities located west of the subcontinental divide and outside of the Lake Michigan drainage basin (Great Lakes Basin). In December 2005, Governors of the eight states bordering the Great Lakes signed the Great Lakes-St. Lawrence River Basin Water Resources Compact.[11] In 2007, the Compact was enacted into law by Wisconsin Act 227 and was subsequently formalized by a Congressional Consent Resolution signed by the President in October 2008. Under the Compact, all "diversions" outside the Great Lakes Basin would be prohibited with three exceptions—straddling communities, communities within straddling counties, and intra-basin transfers. A "diversion" is defined in the Compact to occur whenever water is transferred from the Great Lakes Basin into another basin or watershed by any means other than incorporation into a product.

A straddling community is any incorporated municipality, or equivalent, whose existing corporate boundaries lie partly within and partly outside the basin. To seek approval for a diversion from the State concerned, the community must prove that the water sought is to be used only for public water supply purposes and all water withdrawn from the basin will be returned to the source watershed less an allowance for consumptive use. In order to receive State approval of a diversion of over 100,000 gallons per day, the straddling community must demonstrate that: the need for the water cannot reasonably be avoided through the efficient use and conservation of existing water supplies; the withdrawal is limited to quantities considered reasonable for the purpose; the withdrawal will be implemented so as to ensure that it will result in no significant individual or cumulative adverse impacts to the waters and water dependent natural resources of the basin with consideration given to the potential cumulative impacts of any precedent-setting consequences associated with the proposal; and environmentally sound and economically feasible water conservation measures are to be implemented. The City of New Berlin is an example of this type of water diversion in the Region. In 2009, the WDNR approved a maximum diversion amount of 2.142 million gallons per day averaged over a calendar year. The City returns water to the Lake Michigan Basin through MMSD resulting in no net loss of water from the Great Lakes Basin.

A community within a straddling county is defined as any incorporated municipality, or equivalent, that is located totally outside the basin, but wholly within a county that lies partly within the basin. To seek approval for a diversion, the community must prove to the Great Lakes Governors that the water sought is to be used

[11]Great Lakes-St. Lawrence River Basin Water Resources Compact, *December 13, 2005*.

only for public water supply purposes within the straddling community, and all water withdrawn from the basin is to be returned to the source watershed less an allowance for consumptive use. In order to obtain approval from the Great Lakes Governors, the community within a straddling county must demonstrate that: the water sought will be used only for public water supply purposes within a community located within a straddling county that is without adequate supplies of potable water; there is no reasonable water supply alternative within the basin in which the community is located, including conservation of existing water supplies; and the proposal meets the standards applicable to straddling communities. Approval of a diversion of any size is granted only if the Governors of all eight Great Lakes states approve the application. The Compact further advises that a diversion should not be approved unless the community can demonstrate that the integrity of the basin ecosystem will not be endangered. The City of Waukesha is an example of this type of water diversion. The recently approved diversion affects the Root River watershed within Milwaukee County as the return flow of water to the Lake Michigan Basin is planned for the Root River in the City of Franklin.

The intra-basin transfer is defined as the transfer of water from the watershed of one of the Great Lakes into the watershed of another Great Lake. This type of diversion does not apply to Southeastern Wisconsin because Lake Michigan is the only Great Lake that is associated with this area.

To ensure the long-term protection of the natural resources associated with and affected by a water diversion project, either directly or indirectly, recommended cost estimates may be included during the evaluation or environmental impact study for a diversion project.

Regional Chloride Impact Study

In March 2016, SEWRPC completed a prospectus[12] for a comprehensive study of the environmental impacts of the use of chloride on the surface water and groundwater resources in the Region. SEWRPC is currently preparing the comprehensive study. The study will provide an inventory of the historical and present sources of chloride loads to surface and groundwater resources; assess the impacts of the loads on the environment; utilize a state-of-the-art component addressing current research and emerging technologies and policies related to mitigating the environmental effects of chloride from multiple sources; identify alternate means of achieving desired levels of managing sources of chloride; and provide general recommendations for reducing the undesirable environmental impacts of the use of chloride. The primary

[12]*Documented in a SEWRPC report titled,* Prospectus for Chloride Impact Study for the Southeastern Wisconsin Region*, March 2016.*

purpose of the study is to identify the relationship between significant sources of chloride to the environment and the chloride content of surface and groundwater within the Region.

Study work began in summer 2017 and included the installation of 37 conductance monitoring stream locations throughout the Region, which was completed in fall 2018. The intent is to monitor the streams for two winters from 2018 to 2020. Chloride loads entering surface and groundwater resources can potentially come from several significant sources, including road salt applied for anti-icing and deicing roads, sidewalks and parking lots; water softening systems and other systems that discharge to sanitary sewers or private onsite wastewater treatment systems; salt storage areas; large agricultural feed lots; fertilizers; landfills; chemical manufacturing; and food processing. However, salt applied to roads, parking lots, and public walkways are the most visible of the potential chloride sources, and thus, receives the most attention.

The negative environmental impacts regarding the use of chloride are significant because chloride introduced to surface water and groundwater resources is not treatable by the best management practices applicable to other forms of water pollution. There are no natural processes by which sodium and chloride concentrations contained in contaminated runoff or other discharges are broken down, metabolized, safely absorbed, or otherwise removed from the environment. Ultimately, chloride will accumulate over time in surface lakes and reservoirs and in groundwater, thereby constituting a significant threat to the future quality of life within the Region.

3.3 COUNTY AND MULTI-JURISDICTIONAL PLANS

Milwaukee County Park and Open Space Plan

The Milwaukee County park and open space plan was adopted in 1991 and is currently being updated.[13] The plan consists of both an open space preservation element and an outdoor recreation element, intended to, respectively, protect areas containing important natural resources and to provide major parks, areawide trails, and resource-oriented recreational facilities. Major or regional parks are defined as publicly owned parks at least 100 acres in size providing opportunities for such resource-oriented activities as camping, golfing, picnicking, and swimming. Map 2.23 in Chapter 2 of this report shows County- and State-owned park and open space sites in Milwaukee County as of 2020.

[13] *SEWRPC Community Assistance Planning Report No. 132,* op. cit.

The regional park and open space plan, as amended by the park and open space plan for Milwaukee County, contains recommendations which, if implemented, would provide residents of Milwaukee County with opportunities to participate in a wide range of resource-oriented outdoor recreation activities. Those recommendations are concerned with providing major or regional parks, which provide opportunities for intensive resource-oriented outdoor recreation activities, and recreation corridors, which provide opportunities for various trail-oriented activities. In addition, the plan contains recommendations for protecting and preserving open space lands, including natural resource features such as woodlands, wetlands, and floodplains, located within environmental corridors and isolated natural resource areas.

Milwaukee County Land and Water Resource Management Plan

The land and water resource management plan (LWRMP) was originally adopted by the County Board in 2001. A revised and updated version of the plan was approved in 2006. The second edition of the Milwaukee County LWRMP was adopted in 2011. The County submitted an interim plan to the Department of Agriculture, Trade and Consumer Protection (DATCP) in 2016 and DATCP extended approval through 2021. The 2011 plan identifies a set of five major goals related to County land and water resources. These goals include improving water quality by reducing sediment and nutrient delivery to surface waters in Milwaukee County; protecting, maintaining, and restoring land and water resources in Milwaukee County; enhancing Lake Michigan bluff protection initiatives; maintaining the existing information management network and land information web portal; and limiting the introduction and reducing the spread of invasive species in Milwaukee County. The plan identifies the natural resources and the current condition of those resources, the limitations of those resources, and sets forth a strategy that addresses the natural resource issues and problems. This plan also provides a means to educate the public about these issues and problems and include the public in the steps necessary to protect the natural resource base. The plan further defines a work plan, which sets forth the objectives and actions to be implemented in order to achieve the goals associated with each issue and identifies the agency or organization responsible for carrying out the listed actions.

Milwaukee County Pond and Lagoon Management Plan

Milwaukee County parklands include 68 lakes, ponds, and lagoons comprising over 120 acres of surface water. These waterbodies enhance park aesthetics while providing a variety of recreational opportunities, including fishing, boating, and ice skating. In addition, some of these lakes, ponds, and lagoons provide stormwater detention, which serves to improve water quality in receiving waters. Concerns about water quality and aesthetics have arisen as degraded conditions along some lagoon shorelines have become more apparent. Residents have also expressed concern over the impacts of poor water quality on fishing and on

the health implications to humans of exposure to the water in the ponds. In response to these concerns, Milwaukee County developed a park pond and lagoon management plan.[14] The objectives of this plan were to:

- Evaluate water quality conditions in representative lagoons
- Identify and prioritize lagoon needs and set long-term goals
- Identify water quality management objectives
- Compare observed conditions to water quality objectives
- Recommend long-term and short-term actions

The study identified several problem issues related to the lakes, ponds, and lagoons, including shoreline erosion; the presence of nuisance algae and aquatic plants, related to high nutrient loadings; elevated concentrations of fecal indicator bacteria, such as *E. coli*; litter; the presence of rough fish; and siltation. The plan made three general recommendations for all park lakes, ponds, and lagoons:

- Identify and deploy alternative management strategies to mowing grass to short lengths directly adjacent to these waterbodies
- Pursue grant funding for shoreline stabilization projects
- Continue water quality monitoring of these waterbodies in order to document conditions both before and after restoration projects

The plan also made specific project recommendations for ponds at Dineen, Humboldt, McGovern, Mitchell, Jacobus, and Washington Parks, and some of the project recommendations have been completed at certain parks. These recommendations were mostly concerned with shoreline stabilization and aquatic macrophyte management projects. In 2017, the County resampled various lakes, ponds, and lagoons to continue to evaluate the water quality issues at the sites, and updated and inventoried the data associated with those

[14] *Milwaukee County Environmental Services,* Milwaukee County Pond & Lagoon Management Plan, *June 2005.*

sites. In addition, between 2018 and 2020, UW-Milwaukee in coordination with Milwaukee County tested the Veterans Park Lagoon (also known as the Juneau Park Lagoon) water for cyanobacteria as well as other water quality parameters affecting harmful algal blooms. Testing for the site continues and is being funded largely through a grant that Milwaukee County Parks received from the Fund for Lake Michigan.

Milwaukee County Parks Ecological Restoration and Management Plans

The Milwaukee County Department of Parks Natural Areas Program is an inspiring use of partnerships to restore the ecology for the purposes of both science and beauty in Wisconsin's largest urbanized area. The program has developed over 75 community partnerships and a large volunteer corps to assist with managing the County Park's 10,000 acres of natural areas and agricultural lands. The Natural Areas Program also prepares Ecological Restoration and Management Plans for some of the County's natural areas. The primary goal of these plans is to restore and manage the natural resources within County parks, however, another goal of equal importance is connecting the citizens of the County to the publicly owned natural areas. The Ecological Restoration and Management Plans assist in prioritizing sites and management activities within natural areas and each plan serves as a comprehensive guide to manage the natural areas at each site in order to maintain a high level of ecological and aesthetic value.

These plans are not all-inclusive and may not provide every recommendation that could enhance the natural area or corridor ecologically, but these plans detail a number of progressive projects that will help stabilize the ecology of the natural areas. In most cases, the natural and biological diversity has persisted in these natural areas as evidenced by the various types of flora and fauna observed by the County Parks Department and SEWRPC. Some of the natural areas identified in these County plans may also be part of SEWRPC's regional natural areas inventory and these lands are recommended to be protected or preserved by any means necessary.

Ecological restoration and management plans prepared by the County Parks Department since 2010 include plans for: Grobschmidt Park, Franklin Savanna, Oak Creek Parkway Plan, Falk Park, Rawson Woods, Barloga Woods, Bender Park, Brown Deer, Doctors Park, Dretzka Golf Course, Grant Park, Greenfield Park, Kletzsch Park, Little Menomonee River Parkway, McGovern Park, Noyes Park, Warnimont Park, Whitnall Park, and Cudahy Nature Preserve. The primary goals identified in these plans include protecting existing high quality natural areas; maintaining and increasing native plant and wildlife diversity; reducing the negative impact of invasive species; providing passive recreational opportunities for the public; engaging the public as part of the restoration management process; conducting detailed flora and fauna inventories; and enhancing and maintaining the environmental corridor.

In addition, the City of Milwaukee consulted with TERRA Engineering to develop the Dineen Park Master Plan. The Dineen Park Master Plan provides a vision for long-term development that focuses on mitigating localized flooding and stormwater issues while continuing to serve the recreational and environmental needs of the residents of the surrounding neighborhood. Stormwater detention and park improvement projects included developing a seven-acre stormwater pond, improving walking paths, installing a new community playground, developing a picnic shelter, reconstructing the baseball field, redesigning the 18-hole disc golf course, improving the fishing overlook, updating pedestrian lighting, and adding native plantings and new trees throughout the park. Projects that have been completed or will be completed at the park through 2021 include lagoon dredging and channel stabilization; developing a detention basin and associated control structures; wetland and native planting areas; path and lighting updates; constructing a picnic shelter; and developing a new disc golf course and a baseball diamond.

Milwaukee County Coastal Resources Inventory

In 2019, Milwaukee County received a grant from the Wisconsin Coastal Management Program's (WCMP) Coastal Resilience Grant Program to undertake a comprehensive study to identify and address the vulnerability of its coastal resources, facilities, assets, and infrastructure to extreme weather. The report,[15] which was prepared by the Milwaukee County Environmental Services Unit in partnership with WCMP and GZA Environmental, Inc., inventories Milwaukee County's coastal resources and summarizes their current value, condition, and vulnerability. Milwaukee County has extensive property holdings along the Lake Michigan shoreline, primarily as part of the Milwaukee County Park System, and maintains a variety of recreational assets and facilities in its shoreline parks. Extreme weather and high lake levels have damaged Milwaukee County's coastal natural resources and associated recreational facilities and it is anticipated that damaging events will continue to occur in the future.

The report summarizes Milwaukee County's coastal resources and their vulnerability to weather driven damage and evaluates the resources from a resiliency perspective. Documenting the County's coastal resources vulnerability to extreme weather will also help in the pursuit of construction grants and potentially help stimulate greater investments in funding coastal protections by the State and Federal governments. In 2018, a Coastal Resilience Grant Self-Assessment was conducted and included ratings on coastal hazard issues such as shoreline recession and bluff failure; coastal flooding; shore protection damage; beach loss; beach impairment; and port, harbor, and marina damage and navigation impairment.

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[15]*Milwaukee County,* Milwaukee County Coastal Resources Inventory, *County Environmental Services Unit, October 7, 2020.*

Coastal assets inventoried in the report were provided condition, vulnerability, and valuation assessments, and those asset features included: athletic courts and fields, aquatic features, beaches, bluffs, bridges, buildings, golf courses, marina components, non-paved trails, open vegetated areas, paved areas, playgrounds, shore protection devices, storage tanks, and stormwater management features. A resiliency rating was also provided for each asset, and those assets were then grouped into three levels of total resiliency priority categories. An asset with a "high priority" designation signified a severe or permanent risk of damage. The report documents the 40 highest priority rated assets in Milwaukee County that have the most potential risk.

In addition, about 13 percent of the assets inventoried were categorized to be in poor condition and about 22 percent of the assets inventoried were considered highly vulnerable. Assets with the highest risks were beaches, groins (a shoreline protection device), and parking lots.

Milwaukee County Coastline Management Guidelines

In 2019, Milwaukee County requested that SEWRPC prepare a set of coastline management guidelines[16] to be used by County staff to evaluate projects affecting County-owned assets with respect to coastline area impacts. To develop the guidelines, an inventory of existing conditions was conducted, including natural resources and urban development along the Milwaukee County Lake Michigan coastline; a review of existing municipal, State, and Federal coastline management guidelines/policies and best management practices; and an examination of trends in the stability of the Lake Michigan bluffs within the County. Milwaukee County has always had a substantial interest in protecting County-owned assets along Lake Michigan. As Lake Michigan water levels approached the lake's highest measured level, sections of bluffs along Milwaukee County's coastline collapsed, and these properties and others along Milwaukee County's lakefront are becoming increasingly vulnerable to coastline impacts. Lakefront property may be best protected from future coastline impacts through the implementation of coastline management guidelines based upon best practices.

The guidelines offer a framework for promoting bluff slope stability within County-owned lands along the Lake Michigan coastline, and the County will seek to attain the following long-term management guidelines of the Lake Michigan Coastline Management Zone:

[16]*SEWRPC Memorandum Report No. 248,* Milwaukee County Coastline Management Guidelines*, February 2021.*

- Ensure appropriate public access to and recreational opportunities within the Lake Michigan Coastline Management Zone without compromising the stability of the Lake Michigan bluff slope or the integrity of the Lake Michigan shoreline

- Ensure access for the maintenance of stormwater facilities within the Lake Michigan Coastline Management Zone

- Limit land-disturbing activities within the Lake Michigan Coastline Management Zone that adversely impact natural functions of the land

- Prevent erosion and sedimentation that would alter the natural drainage system. In areas where erosion and sediment control practices may not be effective, activities that increase erosion should be severely limited

- Assess bluff conditions around existing facilities and infrastructure within the Lake Michigan Coastline Management Zone in order to identify both short- and long-term detrimental impacts

- Severely limit actions that may detrimentally alter natural and ecologically stable conditions characteristic of the Lake Michigan coastline

- Preserve or enhance the natural character and aesthetic values of the Lake Michigan viewshed in a sustainable way

- Preserve undeveloped areas within the Lake Michigan Coastline Management Zone that contain a unique or sensitive resource

Comprehensive Watershed and Basin Plans

SEWRPC has developed comprehensive plans for the Kinnickinnic River watershed,[17] the Menomonee River watershed,[18] the Milwaukee River watershed,[19] the Oak Creek watershed,[20] and the Root River watershed.[21] The Kinnickinnic River watershed encompasses 24.5 square miles, or about 10 percent of the total land area of Milwaukee County. Within the County, the Menomonee River watershed encompasses 55.3 square miles, or about 23 percent of the total land area of the County; the Milwaukee River watershed encompasses 57.7 square miles, or about 24 percent of the total land area of the County; the Oak Creek watershed encompasses 27.4 square miles, or about 11 percent of the total land area of the County; and the Root River watershed encompasses 57.7 square miles, or about 24 percent of the total land area of the County. Together these comprehensive watershed plans cover approximately 92 percent of the County's land area. These plans include delineations of floodplain boundaries along many streams in each watershed. Plan recommendations were developed for land use, park and open space needs, stormwater and floodland management, water quality management, and fisheries management. These watershed plans also recommend maintaining and preserving primary and secondary environmental corridors and isolated natural resource areas in open uses.

As part of its planning activities related to watershed management, the WDNR has prepared State of the Basin Reports for each basin within the County to provide an overview of land and water resource quality, identify challenges facing these resources, and outline future actions. The State of the Basin reports for Milwaukee County include the Milwaukee Basin, which encompasses the Kinnickinnic River, Menomonee River, and Milwaukee River watersheds and adjacent portions of the Lake Michigan direct drainage area,[22] and the Root-Pike basin, which in Milwaukee County encompasses the Root River and Oak Creek

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[17] *SEWRPC Planning Report No. 32,* A Comprehensive Plan for the Kinnickinnic River Watershed, *December 1978*.

[18] *SEWRPC Planning Report No. 26,* A Comprehensive Plan for the Menomonee River Watershed*, Volume One,* Inventory Findings and Forecasts, *October 1976; Volume Two,* Alternative Plans and Recommended Plan, *October 1976*.

[19] *SEWRPC Planning Report No. 13,* A Comprehensive Plan for the Milwaukee River Watershed*, Volume One,* Inventory Findings and Forecasts, *December 1970; Volume Two,* Alternative Plans and Recommended Plan, *October 1970*.

[20] *SEWRPC Planning Report No. 36,* A Comprehensive Plan for the Oak Creek Watershed, *August 1986*.

[21] *SEWRPC Planning Report No. 9,* A Comprehensive Plan for the Root River Watershed, *July 1966*.

[22] *Wisconsin Department of Natural Resources,* The State of the Milwaukee River Basin, *PUBL WT-704-2001, August 2001*.

watersheds and adjacent portions of the Lake Michigan direct drainage area.[23] The WDNR recently updated its water quality plan for the Oak Creek watershed.[24] The WDNR Basin reports identify the need to monitor and manage high priority issues and actions to restore and protect each basin's resources.

Nine-Key Element Watershed Plans

In 1987, Congress enacted Section 319 of the Clean Water Act (CWA), which established a national program to control nonpoint sources of water pollution. Section 319 grant funding is available to states, tribes, and territories for the restoration of impaired waters and to protect unimpaired and high-quality waters. Watershed plans funded by CWA Section 319 funds must address nine key elements that the USEPA has identified as critical for achieving improvements in water quality.[25] In addition, projects implemented using Federal funds provided under Section 319 must directly implement a watershed-based plan that USEPA has determined to be consistent with the nine elements. Thus, a finding of consistency with the nine elements is a significant benefit to implementing the plan because it makes projects recommended under the plan eligible for Federal funding. The nine elements from the USEPA Nonpoint Source Program and Grants Guidelines for States and Territories are as follows:

1. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. Sources that need to be controlled should be identified at the significant subcategory level along with estimates of the extent to which they are present in the watershed.

2. Estimates of the load reductions expected from management measures.

3. Descriptions of the nonpoint source management measures that will need to be implemented to achieve load reductions in element 2, and a description of the critical areas in which those measures will be needed to implement this plan.

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[23] *Wisconsin Department of Natural Resources,* The State of the Root-Pike River Basin, *PUBL WT-700-2002, May 2002.*

[24] *Wisconsin Department of Natural Resources,* Oak Creek Frontal Lake Michigan TWA WQM 2017, *September 2017.*

[25] *U.S. Environmental Protection Agency,* Handbook for Developing Watershed Plans to Restore and Protect Our Waters*, EPA 841-B-08-002, March 2008.*

4. Estimates of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

5. An information and education component used to enhance public understanding of the plan and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.

6. A reasonably expeditious schedule for implementing the nonpoint source management measures identified in this plan.

7. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.

8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.

9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under element eight.

Three nine-key element plans have been developed that encompass portions of Milwaukee County: the Kinnickinnic and Root River watershed restoration plans and the Wind Point watershed-based plan. These plans were reviewed by the WDNR and USEPA and found to be consistent with the nine key elements. Currently, the Menomonee River and the Oak Creek watershed restoration plans are being developed by Southeastern Wisconsin Watersheds Trust, Inc (Sweet Water) and SEWRPC, respectively, and both plans are being developed to comply with the USEPA's nine minimum elements of a watershed plan. A finding that the plan is consistent with the nine key elements provides eligibility for nonpoint source pollution funding through Section 319 of the Federal Clean Water Act for implementing projects in the plan's study area for a period of ten years.

The proceeding section identifies the watershed restoration plans that have been prepared or are being prepared within Milwaukee County, including those plans that are in compliance with or are being prepared to be in compliance with the USEPA's nine minimum elements of a watershed plan.

Watershed Restoration Plans

Kinnickinnic and Menomonee River Watershed Restoration Plans

The MMSD, in collaboration with Sweet Water, has developed watershed restoration plans for the Kinnickinnic and Menomonee River watersheds.[26] These plans were developed within the overall framework provided by the SEWRPC regional water quality management plan update for the greater Milwaukee watersheds, and their primary purpose is to identify specific short-term and long-term actions to improve water quality. The recommended actions were identified based upon consideration of many factors, including overall effectiveness, scientific underpinning, regulatory considerations, and stakeholder goals.

Through the stakeholder input of Sweet Water, three major focus areas emerged for these watershed restoration plans: bacteria/public health, habitat, and nutrients/phosphorous. These focus areas reflect the linkage between water quality parameters and water use in the Kinnickinnic and Menomonee River watersheds. Relative to these focus areas, the plans identify a set of targets to be achieved over the plan period.

These plans sought to identify management strategies that could be developed to meet the targets in a cost-effective manner. The approach used is predicated on the assumption that the existing regulations for point and nonpoint sources of pollution will be implemented. The analysis used in developing the plans assumes the management strategies recommended to meet these regulations, as identified in the regional water quality management plan update, are in place and would serve as the foundation upon which new management strategies are added to achieve the desired goals. The watershed restoration plans categorize these management strategies, comprised of facilities, policies, operational improvements, and programs into three categories: existing regulatory management strategies, other management strategies in various stages of implementation, and management strategies recommended for implementation under the regional water quality management plan update for the greater Milwaukee watersheds, but which have not yet been implemented.

The plans also prioritize the identified management strategies. As part of this prioritization, they identify as foundational actions those management strategies whose implementation is necessary for the full benefit of other strategies to be achieved.

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[26]*Milwaukee Metropolitan Sewerage District,* Kinnickinnic River Watershed Restoration Plan, *April 2010; Milwaukee Metropolitan Sewerage District,* Menomonee River Watershed Restoration Plan, *April 2010.*

In 2018, the Kinnickinnic River Watershed Restoration Plan was updated[27] by Sweet Water and was developed to comply with the USEPA's nine minimum elements of a watershed plan. The plan update was prepared to make watershed improvements through a comprehensive and collaborative implementation of priority projects and practices in four main categories: water quality, flood management and water quantity, habitat, and recreational use. The plan recognized that of the 25 stream miles in the Kinnickinnic River watershed, only five miles were meeting their designated uses, and the remaining segments were listed as impaired, and those impairments included: recreational use restrictions, habitat degradation, low dissolved oxygen, and chronic aquatic toxicity.

There have been improvements made at the municipal and regional level that have reduced combined sewer system overflows and other causes of poor water quality, but stressors continue to degrade water quality in the watershed. Urban and rural stormwater runoff were identified as the leading cause of TP, TSS, and FC pollutants. In addition, several related indicators of poor water quality in the Kinnickinnic River included a lack of riparian habitat, increasing frequency of flood events, a lack of widespread policy supporting water quality improvement efforts, and a growing disconnect between community members and their water resources. Impervious pavement in the Kinnickinnic River Watershed is also a large contributor to runoff and resulting pollutant loading of TSS and TP. In the hopes of reducing high volumes of untreated and pollutant heavy stormwater to runoff into waterways, the plan identified critical priority "hot spots" on impervious and commercial lots to target for green infrastructure implementation. These priority hotspots were determined by identifying areas with high densities of impervious pavement and the commercial lots within those areas with the goal of targeting clusters instead of individual sources.

The plan prioritizes projects that address numerous deficiencies in order to most concisely address the issues in the watershed. By identifying and evaluating past barriers to successful implementation of the multitude of prior plans in the area, the plan continued to use the adaptive process of "Plan, Do, Check, Act" presented in the 2010 Kinnickinnic River Watershed Restoration Plan.

An update to the Menomonee River Watershed Restoration Plan is currently being prepared by Sweet Water, in collaboration with SEWRPC. The plan will update the plan approved in 2010 by the WDNR and USEPA and is being developed to comply with the USEPA's nine minimum elements of a watershed plan.

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[27] *Southeastern Wisconsin Watersheds Trust, Inc.,* The Kinnickinnic River Watershed Updated Implementation Plan, A Comprehensive Watershed Restoration Plan, *November 2018*.

Root River Watershed Restoration Plan

SEWRPC, in collaboration with Root-Pike Watershed Initiative Network (Root-Pike WIN) and Sweet Water, developed a watershed restoration plan for the Root River watershed.[28] The Root River watershed restoration plan is a second-level plan for managing and restoring water resources in the Root River watershed. It was prepared in the context of the regional water quality management plan update for the greater Milwaukee watersheds, and the plan recommendations were for focused implementation from 2014 to 2019, but the plan is comprehensive in scope and implementation will continue well beyond 2019. The plan seeks to develop specific, targeted recommendations to preserve, restore, and improve the natural environment by focusing on four areas: water quality, recreational access and use, habitat conditions, and flooding. The water quality recommendations include measures to reduce the levels of phosphorus, bacteria, and pollutants.

The Root River watershed contains a mixture of urban and rural land uses, with urban development concentrated in Milwaukee and Waukesha Counties, the City of Racine, and the southeastern portion of the watershed. The remainder of the watershed, about 66 percent, is primarily influenced by rural land uses. Nonpoint source pollution contributed by urban and rural stormwater runoff is a major source of pollution in the Root River watershed. The plan provides numerous strategies to reduce pollution from both urban and rural runoff, and also recommends implementing strategies from MMSD's green infrastructure plan. The most important component to the existing and future economic, social, and recreational well-being of the Root River watershed is to preserve and develop riparian buffers, which are natural or relatively undisturbed lands located adjacent to waterbodies and to corridor lands in need of protection. Riparian buffers protect surface- and ground-water quality and recharge, help protect wildlife, allow native species to flourish while discouraging unwanted species, and provide natural areas for rivers. In addition to riparian buffers, the plan also recommends preserving and expanding open spaces through native landscaping and small wetlands, woodlands, and prairies.

The Root River Watershed Restoration Plan was developed to meet the requirements of the USEPA's nine elements for a Watershed Plan. However, when the plan was submitted to the WDNR and USEPA for their review, which assures plan consistency with the nine minimum elements of a watershed-based plan that USEPA considers critical for achieving improvements in water quality, both organizations requested several

[28]*Documented in SEWRPC Community Assistance Planning Report No. 316,* A Restoration Plan for the Root River Watershed*, July 2014.*

clarifications regarding the plan. A memorandum report[29] was subsequently prepared by SEWRPC that presented the Root River Watershed Restoration Plan supplemental information that the WDNR and USEPA specifically requested, and in addition, the plan provided additional quantification relative to implementing several specific recommendations. In 2015, the WDNR and USEPA determined that the Root River Watershed Restoration Plan, as supplemented by the Memorandum Report, is consistent with the USEPA nine minimum elements of a watershed-based plan, thus allowing projects recommended under the plan eligible for Federal and State funding.

Wind Point Watershed-Based Plan

Root-Pike Watershed Initiative Network (Root-Pike WIN) hired Applied Ecological Services, Inc. (AES) to conduct a watershed planning effort and produce a comprehensive watershed-based plan for the Wind Point watershed.[30] This plan meets the requirements of the USEPA to develop and implement a watershed-based plan designed to enable waterbodies within the watershed to achieve water quality standards/criteria (i.e., nine-key element watershed plan).

Within Milwaukee County, the watershed is located along Lake Michigan in the Cities of Oak Creek and South Milwaukee and is a direct drainage to Lake Michigan. The watershed planning process is a collaborative effort involving voluntary stakeholders whose primary intent is to provide a healthy watershed and lakefront by protecting, restoring, and managing the cultural and ecological aspects of green infrastructure through watershed plan implementation, education, and stewardship.

This plan defines green infrastructure as a network of connected systems that include natural areas (stream corridors, wetlands, floodplain, woodlands, and grasslands) and other open spaces or working lands (farms, parks/ball fields, golf courses, school grounds, detention basins, and large residential parcels). Protecting, restoring, and managing these areas within the watershed will help conserve natural ecosystem values and functions, sustain clean air and water, and provide a wide array of benefits to wildlife and people. Primary and secondary environmental corridors identified by SEWRPC will serve as the foundation of the green infrastructure network within the watershed.

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[29]*SEWRPC Memorandum Report No. 220,* Supplemental Information Developed for the Root River Watershed Restoration Plan, *April 2015*.

[30]*Documented in Root-Pike Watershed Initiative Network,* Wind Point Watershed-Based Plan, A Guide to Protecting and Restoring Watershed Health, Final Report*, May 2015, prepared by Applied Ecological Services, Inc.*

The Wind Point watershed-based plan focuses on programmatic and site-specific recommendations. Programmatic recommendations are general watershed-wide remedial, preventative, and regulatory actions and site-specific recommendations involve specific locations where projects can be implemented to improve surface and groundwater quality, green infrastructure, and aquatic and terrestrial habitats. Site-specific high priority critical area recommendations within the watershed include detention basin retrofits, wetland restoration, stream and ravine stabilization, riparian area restoration, green infrastructure protection areas, agricultural management practices, and bluff stabilization.

Having a watershed-based plan will allow Wind Point watershed stakeholders to access Federal and State grant funding and other funding for watershed improvement projects recommended in the plan.

Oak Creek Watershed Restoration Plan

The Commission, in collaboration with Milwaukee County, MMSD, and the City of South Milwaukee, is in the process of developing a watershed restoration plan for the Oak Creek watershed.[31] The Oak Creek watershed restoration plan will be a second-level plan for managing and restoring water resources in the Oak Creek watershed. It is being prepared in the context of the regional water quality management plan update for the greater Milwaukee watersheds, and will provide a guide for addressing the water quality impairments that have been identified in the watershed, and it will also include specific, targeted restoration and improvement recommendations to address four focus issues: water quality, recreational access and use, habitat conditions, and targeted stormwater drainage and flooding issues. The four focus issues were derived from the findings of the regional water quality management plan for the greater Milwaukee watersheds and from themes that emerged from a series of discussions by elected officials, State and local government staff, nongovernmental organizations, landowners, and residents. In addition, the plan will address the status of the Oak Creek Mill Pond and the associated dam, considering their relationship to multiple focus issues.

The plan is being prepared to meet the USEPA's nine minimum elements for a watershed-based plan, thus allowing projects recommended under the plan eligible for Federal and State funding.

[31]*Documented in SEWRPC Community Assistance Planning Report No. 330,* A Restoration Plan for the Oak Creek Watershed*. The plan is currently being prepared and is planned to be completed in late 2021.*

Remedial Action Plan for the Milwaukee Estuary Area of Concern (AOC)

The Great Lakes and the rivers that feed them have been historically important centers of trade and industry in Wisconsin. As cities grew around the economic hubs, river and harbor sediments were polluted by chemicals, which contributed to the loss of important fish and wildlife habitat. The Great Lakes rivers and harbors that have been most severely affected by pollution and habitat loss are known as "Areas of Concern," or AOCs. In 1987, as part of an international agreement (the Great Lakes Water Quality Agreement) between the United States and Canada, there were 31 U.S.-based AOCs identified across the Great Lakes, including five AOCs in the State of Wisconsin. The Milwaukee Estuary was designated an Area of Concern because of historical modifications and pollutant loads that contributed toxic contaminants to the AOC and Lake Michigan. Sediments contaminated with PCBs (polychlorinated biphenyls), PAHs (polycyclic aromatic hydrocarbons) and heavy metals contribute to the beneficial use impairments within the boundaries of the AOC. Eleven of the possible 14 beneficial uses identified by the International Joint Commission are impaired or suspected to be impaired for the Milwaukee Estuary AOC.

The original boundaries of the Milwaukee Estuary AOC included the Milwaukee River downstream from the former North Avenue Dam; the Menomonee River downstream from 35th Street; the Kinnickinnic River downstream from Chase Avenue; the inner and outer harbors; and the nearshore waters of Lake Michigan, bounded by a line extending north from Sheridan Park to the City of Milwaukee's Linnwood water intake. In July 2008, the EPA approved expanding the geographic boundaries for the Milwaukee Estuary Area of Concern due to evidence showing contributions of toxic substances from upstream sources that have accumulated since the boundaries were originally delineated in 1980. The expanded boundaries includes the Milwaukee River downstream from the confluence with Cedar Creek to the former North Avenue Dam, which also includes Lincoln Creek from Mill Road and Cedar Creek from Bridge Road to the confluence with the Milwaukee River, and the Menomonee River downstream from the confluence with the Little Menomonee River to 35th Street, which includes the Little Menomonee River downstream from Brown Deer Road to the confluence with the Menomonee River.

The WDNR has worked with community stakeholders to develop a Remedial Action Plan[32] since 1991. The Remedial Action Plan is updated regularly to summarize progress made in the AOC and share the progress with various partners and stakeholders. The plan includes a summary of the progress towards removing

[32]*The most recent updated WDNR plan is entitled,* Remedial Action Plan Update for the Milwaukee Estuary Area of Concern*, August 2020. A complete list of remedial action plans prepared since 1991 can be located at dnr.wisconsin.gov/topic/GreatLakes/Milwaukee.html.*

beneficial use impairments and tracks the progress of projects in the AOC which may delist or remove the Area of Concern designation. The plan updates continue to identify goals and actions necessary to address legacy contamination in the AOC. The main priorities for the Milwaukee Estuary AOC include:

- Remediating contaminated sediments in tributaries and nearshore waters of Lake Michigan
- Controlling nonpoint source pollution
- Improving water quality for recreation
- Enhancing fish and wildlife habitat and populations

The WDNR and various partners are working to clean up sediments, prevent excessive algal growth, control storm water pollution, improve beach water quality, enhance fish and wildlife populations, and restore habitat. Since 1991, approximately 300,000 cubic yards of sediment have been removed; the North Avenue, Falk, Estabrook, and Lime Kiln Dams have been removed; the Mequon-Thiensville fishway passage has been completed; concrete-lined river channels have been restored in portions of the Kinnickinnic River, Menomonee River, and Underwood Creek; and citizen monitoring of fish impediments in AOC tributaries are continually being conducted. The WDNR also continues to perform surface water and sediment sampling to determine if PFAS (per- and poly-fluoralkyl substances) are present in areas that are targeted for potential remedial dredging in the Milwaukee Estuary Area of Concern.

MMSD 2050 Facilities Plan

On March 30, 2021, the WDNR approved MMSD's 2050 Facilities Plan (2050 FP),[33] which identifies the projects and other actions required to meet regulatory and permit requirements through the 2020 to 2040 regulatory planning period and to address MMSD's 2050 Foundational Goals through 2050. The plan addresses long range planning through the year 2050 from an asset management perspective. Major asset areas addressed in the plan include the conveyance and storage system (the MMSD conveyance and deep tunnel system); the water reclamation facilities and biosolids system (the two MMSD water reclamation (wastewater treatment) facilities); the watercourse and flood management system (watercourses under MMSD jurisdiction); and the green infrastructure system. The plan also outlines social, economic, and

[33] *Milwaukee Metropolitan Sewerage District,* 2050 Facilities Plan, *March 2021.*

environmental aspects that will influence future facilities development and provides a plan to protect the quality of the Region's water resources as well as to reliably and sustainably meet the needs of growth and redevelopment in a cost-effective manner.

The asset management approach was selected for the 2050 FP to build upon the watershed approach used in MMSD's previous facilities plan, which has helped to improve the quality of area waterways and preserve Lake Michigan. During the planning process, MMSD assessed the condition of its systems and associated risks, established needs for improvement, evaluated options to address the system needs, and recommended the projects and other actions needed to continue to meet existing and anticipated permit requirements and projected future conditions.

The governing principles for developing MMSD's 2050 FP came from MMSD Commission direction, including MMSD's 2035 Vision and Strategic Objectives, which is composed of two key elements: integrated watershed management and climate change mitigation/adaptation with an emphasis on energy efficiency. Watershed management involves interjurisdictional opportunities and limitations related to wastewater conveyance and treatment, stormwater management, flood risk reduction, and regional water supply strategies. This approach focuses on the infrastructure of the watersheds, seeking a healthy balance between grey and green infrastructure.

Foundational goals identified in the 2050 plan include:

- Changing MMSD from an organization that impacts the environment to an organization that benefits the environment
- Incorporating new technologies and operational improvements to minimize MMSD's financial burden on ratepayers
- Integrating Green Infrastructure into all aspects of development and redevelopment
- Supporting urban biodiversity activities within the Region
- Providing adaptive leadership to climate change and the other goals listed above

Milwaukee Metropolitan Sewerage District Stormwater Drainage and Flood Control Plan

MMSD's responsibilities for stormwater management are carried out within explicit policy guidelines set forth by MMSD's Commission. A comprehensive stormwater drainage and flood control system plan consistent with those policies was originally adopted in 1986. This plan consists of two parts: a policy plan and a stormwater drainage and flood control systems plan.[34]

The policy plan discusses the District's stormwater management and flood control responsibilities. Major elements include:

- Identification of streams and watercourses for which the MMSD should assume jurisdiction for the resolution of drainage and flood control

- Recommendations regarding the types of improvements for which the MMSD should assume responsibility

- Recommendations regarding how costs are to be shared

The 1990 stormwater drainage and flood control systems plan identified the types, general locations, and horizontal and vertical alignments of needed drainage and flood control facilities within the MMSD's jurisdiction. Adopted in 2001, MMSD Rules Chapter 13, *Surface Water and Stormwater*, defined MMSD's flood management role and expanded the District's jurisdiction from 28 to 37 streams that are wholly or partially within Milwaukee County. These streams include:

- The mainstem of the Edgerton Channel, Wilson Park Creek, Villa Mann Creek, an unnamed tributary to Villa Mann Creek, Lyons Creek, the South 43rd Street Ditch, and the mainstem of the Kinnickinnic River in the Kinnickinnic River watershed

- The Little Menomonee River, Underwood Creek, the South Branch of Underwood Creek, Honey Creek, Woods Creek, Grantosa Creek, Schoonmaker Creek, Burnham Canal, South Menomonee Canal, and the mainstem of the Menomonee River in the Menomonee River watershed

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[34]*SEWRPC Community Assistance Planning Report No. 130,* A Stormwater Drainage and Flood Control Policy Plan for the Milwaukee Metropolitan Sewerage District*, March 1986; SEWRPC Community Assistance Planning Report No. 152,* A Stormwater Drainage and Flood Control System Plan for the Milwaukee Metropolitan Sewerage District*, December 1990.*

- Beaver Creek, Southbranch Creek, Brown Deer Park Creek, Indian Creek, Lincoln Creek, and the mainstem of the Milwaukee River in the Milwaukee River watershed

- The North Branch of Oak Creek, the Mitchell Field Drainage Ditch, and the mainstem of Oak Creek in the Oak Creek watershed

- An unnamed tributary to the Root River identified as the 104th Street Branch, Whitnall Park Creek, Tess Corners Creek, East Branch Root River, North Branch Root River, West Branch Root River, Hale Creek, Crayfish Creek, including Lower Crayfish Creek, and the mainstem of the Root River in the Root River watershed

- Fish Creek and an unnamed tributary to Fish Creek in the Lake Michigan direct drainage area

Milwaukee Metropolitan Sewerage District Watercourse System Planning Program

Identifying, analyzing, and recommending possible methods of mitigating flooding problems in Milwaukee County have been the subject of various planning efforts. Over the course of these planning efforts, it became clear to the MMSD and other responsible parties that the philosophy of flood control and accompanying engineering practices needed to evolve beyond just having public safety foremost in mind, but also having long lasting environmental and quality of life benefits connected with projects. This prompted MMSD in 1996 to invest in an environmentally responsible systemwide watershed planning program. The program goals were to reduce current flood risk while putting policies and programs in place to mitigate for future problems. This new program's philosophy was a shift from the old paradigm of flood "control" to flood "management." The shift in philosophy recognized that severe weather, extreme rainfalls, and resulting floods could only truly be managed to the extent possible and not controlled. The systemwide watershed planning program also provided an opportunity to reverse some adverse flood relief techniques utilized in the past, such as concrete channel lining. It was recognized that urban channels could be rehabilitated with proper planning to accommodate both flood flows and provide an environmental stream corridor that incorporates meandering channels with pools and riffle sections as habitat enhancements and have aesthetic, stable, and native species vegetated banks. All these features collectively provide an attractive community/neighborhood asset that can also stimulate economic benefits and increase surrounding property values. This planning effort updated and refined the 1990 MMSD watercourse system plan, which was built upon the findings of the comprehensive watershed system plans prepared by SEWRPC for the five major watersheds that are located within the County. MMSD's watercourse management plans are updated as needed and are used to determine what projects MMSD will develop. Like the earlier

planning efforts, the current planning program uses the watershed as the basic geographic unit for planning. Thus, the floodplain management elements set forth below are also presented by watershed in summary form. Additional plan details for each watershed are available in the referenced advanced planning reports prepared by various consultants for the MMSD.

Floodplain Management Plan for the Kinnickinnic River Watershed

The MMSD recently completed an advanced planning effort of its watercourse system plan for the Kinnickinnic River watershed. The planning effort is documented in the Kinnickinnic River Watershed Flood Management Plan.[35] This plan includes recommendations for flood mitigation for the mainstem of the Kinnickinnic River, Wilson Park Creek, Lyons Park Creek, Villa Mann Creek, an unnamed tributary to Villa Mann Creek, and the S. 43rd Street Ditch. The improvements along the mainstem of the Kinnickinnic River extend continuously for about 4.5 miles from S. 6th Street to S. 43rd Street.

- Recommended improvements for the section of the mainstem of the Kinnickinnic River between S. 6th Street and S. 27th Street consist of replacing the concrete channel lining with a more naturalized stream design, widening the stream corridor, acquiring and demolishing 83 structures between S. 6th Street and S. 16th Street to allow for the wider stream and replacing five vehicular and four pedestrian bridges. The plan also recommends acquiring and removing or floodproofing seven flood-prone residential structures that are expected to remain in the floodplain after the recommended improvements are implemented.

- Recommended improvements for the mainstem between S. 27th Street and the West Kinnickinnic River Parkway in Jackson Park consist of replacing the concrete channel lining and improvements to the West Kinnickinnic Parkway bridge that is located near S. 29th Street. In addition, the plan recommends acquiring and removing or floodproofing three flood-prone residential structures that are expected to remain in the floodplain following implementation of the recommended improvements.

- Recommended improvements for the mainstem in Jackson Park consist of lowering a portion of the park to provide flood storage to reduce flood risk to structures located on the Kinnickinnic River

[35] *Milwaukee Metropolitan Sewerage District,* Kinnickinnic River Watershed Flood Management Plan: Final Report, *May 4, 2017.*

mainstem, removing 700 feet of concrete lined channel, removing 700 feet of corrugated metal pipe culvert, and increasing the flow capacity under the S. 43rd Street Bridge.

Detailed recommended developments or improvements for Lyons Park Creek, Villa Mann Creek, a Villa Mann Creek tributary, Wilson Park Creek, and the 43rd Street Ditch are identified in the Kinnickinnic River floodplain management plan.

Floodplain Management Plan for the Menomonee River Watershed

The flood control plan for the Menomonee River watershed was developed through several planning efforts, which included a stormwater drainage and flood control system plan for the streams for which the MMSD has jurisdiction, a stormwater drainage and flood control system plan for Grantosa Creek[36] and Phase 1 and 2 watercourse management plans for the Menomonee River. Although some of the plan elements are located outside of Milwaukee County, they are integral to the design and function of those elements that are located in the County. Specifically, lowering the floodplain along Hart Park and the Milwaukee County Grounds detention basin serve to reduce downstream flood discharges, thus, reducing the size of the required plan elements in that area.

The stormwater drainage and flood control system plan for Grantosa Creek recommended developing flood storage to eliminate overland flooding to buildings immediately south of W. Hampton Avenue and to reduce surcharging in the Grantosa Creek enclosure along N. 100th Street and W. Grantosa Avenue. Several of the projects recommended in the Grantosa Creek flood control plan have been completed, including MMSD constructing a dry detention basin for Grantosa Creek at Timmerman Airport.

MMSD's Menomonee River Phase 1 Watercourse Management Plan called for a series of flood mitigation projects to be implemented along an 8.5-mile reach of the Menomonee River between the mouth of the river and W. North Avenue.[37] Additional Menomonee River projects were recommended in a second phase of planning by MMSD.[38] The projects recommended in these plans were designed to function as integrated, interdependent components of an overall system, with the design of some projects incorporating the flood

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[36]*SEWRPC Memorandum Report No. 53,* A Stormwater Drainage and Flood Control System Plan for Grantosa Creek, *February 1992*.

[37]*Milwaukee Metropolitan Sewerage District,* Menomonee River Phase 1 Watercourse Management Plan*, August 2000*.

[38]*Milwaukee Metropolitan Sewerage District,* Menomonee River Phase 2 Watercourse Management Plan*, July 2002*.

reduction benefit of the upstream Milwaukee County Grounds flood management basin. Several of the elements recommended in the Menomonee River Phase 1 and Phase 2 watercourse management plans have been completed, including two phases of the Western Milwaukee Flood Management Project.

Two elements recommended in the Menomonee River Phase 1 and 2 watercourse management plans have yet to be implemented. These plans recommend floodproofing a municipal structure in Hart Park and one in Jacobus Park in the City of Wauwatosa. Presently, it has been determined that the structure in Jacobus Park is no longer in the floodplain, and thus, would not need floodproofing, and the City of Wauwatosa has decided against floodproofing the structure at Hart Park. In addition, Phase 2B of the Western Milwaukee Flood Management Project has been designed and will include removing a structure, lowering a floodplain, and constructing an approximately 2,600-foot series of earthen levees and reinforced concrete floodwalls in the northern overbank located along a stretch of the Menomonee River in the City of Milwaukee.

Preventing flooding problems has been the major focus of stormwater and floodland management efforts in urban areas. This has led to channelization (both ditching and straightening), and placement of concrete (to promote conveyance of flood flows and to control flows as in the case of dams, drop structures, and enclosed channels) in portions of the Menomonee River watershed. Concrete-lined stream segments are particularly damaging, due to the creation of conditions that 1) fragment and limit linear and lateral connectivity with the stream and their corridor habitat and ecosystem; 2) limit or prevent fish and wildlife movement; 3) increase water temperature; 4) destroy fish, aquatic life and wildlife habitat; 5) limit recreational uses, including those attendant to navigation, fishing, and aesthetics; and 6) may actually increase flooding and decrease public safety if not designed as part of an overall system plan. Recognizing the value of lotic water resources and their multi-faceted contributions to the quality of life has led to programs to restore and recreate naturalized river systems that not only meet flood mitigation requirements, but also incorporate features related to habitat and maintenance of aquatic life.

MMSD also completed a number of concrete and drop structure removal projects throughout the greater Milwaukee watersheds since 2010. The Underwood Creek project involved removing both concrete lining and drop structures. Stream stabilization and flooding are important issues that must be addressed when removing concrete lining. Increased stream velocities within a concrete lined section can impact downstream “natural” channels and cause excessive streambed and streambank erosion, which is why streambed and streambanks must be protected after concrete lining is removed. To mitigate or offset the potential for increased flood risk, concrete removal needs to be associated with mitigative measures such as expanding the floodplain to the lands adjacent to the channel and lowering the ground elevation in the

overbanks outside the low- and moderate-flow channel to allow more room for attenuation and/or conveyance of flood flows. Such measures have the added benefit of decreasing instream velocities for multiple flood stages and reducing streambed and streambank erosion. Expanding the floodplain also allows for the opportunity to restore connectivity with the stream channel, restore native riparian vegetation, and allow space for a more naturally functioning stream channel, as well as providing stable instream habitat.

Full implementation of the floodplain management actions recommended for the subwatershed areas would eliminate structure flood damages in areas of the County due to direct overland flooding along the Menomonee River, Grantosa Creek, and the Little Menomonee River for floods up to, and including, the 1-percent-annual-probablity (100-year recurrence interval) flood event under planned land use and channel conditions.

Floodplain Management Plan for the Milwaukee River Watershed

In October of 2006, the MMSD assumed jurisdiction for the reach of the Milwaukee River mainstem in Milwaukee County from the upstream end of the Milwaukee Harbor Estuary to the Milwaukee-Ozaukee County line. A watercourse system plan[39] for the Milwaukee River was subsequently prepared by SEWRPC in 2010. The goal of the plan is to mitigate structural flood damages to 393 inhabited residential, commercial, or recreational structures resulting from overflow of the Milwaukee River within the 1-percent-annual-probablity (100-year recurrence interval) floodplain shown on the Milwaukee County effective Digital Flood Insurance Rate Maps. Three alternative plans were evaluated on the basis of cost, implementability, effectiveness of protection, special considerations related to levee systems, and local preferences as stated by the City of Glendale. Based off those factors, the floodproofing, elevation, or acquisition and demolition of buildings in the 1-percent-annual-probablity (100-year recurrence interval) floodplain was selected as the recommended plan. MMSD has since revised its floodproofing policy, so a revision to the watercourse management plan has been budgeted.

In 2018, MMSD removed the Estabrook Dam from the Milwaukee River during the spring of 2018. As part of this project, the streambank immediately adjacent to the dam was restored. The dam removal resulted in a lowering of water levels upstream of the dam, thus 50 of the 393 structures were no longer included in

[39]*SEWRPC Memorandum Report No. 172,* A Watercourse System Plan for the Milwaukee River in Milwaukee County Upstream of the Milwaukee Harbor Estuary*, December 2010.*

the floodplain. The City of Glendale, with assistance from MMSD, is currently preparing a revised floodplain delineation of the areas at and upstream of the former dam.

Flood mitigation projects have also been implemented by MMSD for Lincoln Creek, Beaver Creek, Indian Creek, and Southbranch Creek. The plans for the streams have been fully implemented, which should eliminate structure flood damages due to direct overland flooding along the streams for floods up to, and including, the 1-percent-annual-probablity (100-year recurrence interval) flood event under planned land use and existing channel conditions. Roadway flooding during such a flood event should also be eliminated. The MMSD Lincoln Creek flood mitigation and stream rehabilitation project resulted in many repetitive loss structures being removed from the 1-percent-annual-probablity (100-year recurrence interval) floodplain.

Floodplain Management Plan for the Oak Creek Watershed

In 2010, SEWRPC was authorized by MMSD to update the 2000 Phase 1 Oak Creek watercourse management plan.[40] The purpose of the study is to identify and categorize flooded structures located within the floodplain resulting from the 1-percent-annual-probablity (100-year recurrence interval) storm event, update structural damage estimates, and develop costs related to structure floodproofing or acquisition based on floodplain mapping developed by SEWRPC. The study draft report was completed in 2011, and then put on hold pending MMSD contact with identified floodplain property owners as well as a District policy revision regarding floodproofing. The report initially documented 23 structures in the Oak Creek regulatory floodplain. In 2018, Short Elliot Hendrickson, Inc. (SEH) prepared a technical memorandum at the request of MMSD to address conceptual floodproofing designs for structures within the Oak Creek Watershed.[41] Preliminary recommendations for Oak Creek and North Branch of Oak Creek consists of floodproofing nonresidential buildings or demolishing nonresidential buildings located within the 1-percent-annual-probablity (100-year recurrence interval). Final recommendations for flood mitigation are being formulated for streams for which structural flood damages have been identified in the watershed.

Stream flooding impacts to insurable structures were scattered throughout the Oak Creek watershed, thus large flood mitigation projects were not warranted. Nevertheless, stream flooding does impact roadways,

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[40]*SEWRPC Memorandum Report No. 198,* Oak Creek Updated Phase 1 Watercourse Management Plan*, December 2011, Revised May 2019.*

[41]*Short Elliot Hendrickson Inc.,* Oak Creek Watershed Conceptual Floodproofing Designs*, Technical Memorandum to MMSD, June 22, 2018.*

properties, and infrastructure in the watershed. FEMA flood profiles identify roadways that are flood-prone along Oak Creek, the North Branch of Oak Creek, and the Mitchell Field Drainage Ditch. Flood overtopping of roads is a concern for structure and roadway maintenance, safety, and emergency access.

In addition, the preliminary floodplain management recommendation for the Mitchell Field Drainage Ditch located within the Oak Creek watershed consists of constructing a floodwall and interior drainage facilities to protect structures located at Milwaukee Mitchell International Airport. The affected area is planned by Milwaukee County for redevelopment and structures in the floodplain will be addressed as part of the redevelopment plans. Determination of a final plan will be based upon coordination with all parties involved, including the MMSD, Milwaukee County, and local municipalities. Full implementation of the preliminary floodplain management actions recommended for the subwatershed areas involved would eliminate structure flood damages due to direct overland flooding along the North Branch of Oak Creek and the Mitchell Field Drainage Ditch for floods up to, and including, the 1-percent-annual-probablity (100-year recurrence interval) flood event under planned land use and channel conditions.

Floodplain Management Plan for the Root River Watershed

The MMSD has jurisdiction for developing and implementing flood mitigation activities in the Milwaukee County portion of the Root River watershed. Flooding problems in that portion of the watershed are being addressed through the MMSD watercourse planning program and the ongoing floodplain mapping that SEWRPC is conducting for the Milwaukee County Automated Mapping and Land Information System Steering Committee and MMSD.

The MMSD's responsibilities for floodplain management planning are executed within explicit policy guidelines set forth by the governing body of the District, as well as within the context of a watercourse management plan consistent with those policies. The MMSD program consists of two parts, a policy plan and watercourse management plans for the watersheds that include streams for which the District has jurisdiction. The policy plan identifies the streams and watercourses for which the MMSD has assumed jurisdiction for resolving drainage and flood control problems, makes recommendations regarding the types of improvements for which the MMSD should assume responsibility, and makes recommendations regarding how costs are to be shared. The watercourse system plan identifies the types, general locations, and horizontal and vertical configurations of needed flood mitigation and stream rehabilitation facilities

within the District's jurisdiction. The following streams and rivers in the Root River watershed[42] within Milwaukee County were studied under the MMSD watercourse planning program, and flood mitigation measures were identified for all but Tess Corners Creek and 104th Street Branch, neither of which has identified hazards to structures during floods with annual probabilities of occurrence of 1 percent or more:

- Upper North Branch of the Root River and Hale Creek
- Lower North Branch of the Root River
- East Branch of the Root River
- Whitnall Park Creek
- Crayfish Creek, including Lower Crayfish Creek
- Tess Corners Creek
- An unnamed tributary to the Root River identified as the 104th Street Branch

In addition, several local stormwater management plans cover portions of the Root River watershed. These plans contain specific recommendations regarding nonpoint source water pollution control and the collection, conveyance, and storage of stormwater. Furthermore, all four counties in the Root River watershed have developed multi-jurisdictional hazard mitigation plans. These plans include recommendations for mitigating the impacts of flooding.

Furthermore, flooding problems are relatively minimal in those portions of the Lake Michigan direct drainage area that are located within Milwaukee County. Fish Creek, which is located in the northeastern portion of the County and is the only stream that is located in the Lake Michigan direct drainage area in the County, does experience flooding issues in the Village of Bayside from rapid surface runoff during major precipitation events. As part of the Fish Creek Watercourse Flood Management Plan, MMSD has evaluated and recommended options to help reduce flooding and erosion issues along Fish Creek.

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[42]*Documented in SEWRPC Community Assistance Planning Report No. 316,* A Restoration Plan for the Root River Watershed*, July 2014.*

Great Lakes Coastal Flood Study: Milwaukee County

The Great Lakes Coastal Flood Study (GLCFS) is an ongoing collaboration of FEMA, the U.S. Army Corps of Engineers Engineering Research and Data Center (USACE-ERDC), State partners, the Association of State Floodplain Managers (ASFPM), and FEMA contractors. The GLCFS is FEMA's comprehensive storm and wind study of the Great Lakes basin for updating coastal flood hazard information and Digital Flood Insurance Rate Maps (DFIRMs) for Great Lakes coastal communities, including Milwaukee County. The purpose of the DFIRMs is to identify the areas in a community that are subject to flooding. One such area is the Special Flood Hazard Area (SFHA), or the 1-percent-annual-probablity (100-year recurrence interval) floodplain.

Included in the GLCFS was 50 years of historical wave and wind data, storm surge modelling, statistical wave and water level analyses, and response-based modelling to determine the coastal SFHA. The coastal SFHA was determined from water level and wave combinations that could potentially impact the coastline, including wave run-up.[43] As a part of the GLCFS coastal hazard analysis and mapping, FEMA used cross-sectional transects to determine near shore flood hazards. Transects represented coastal reaches with similar physical characteristics and are set perpendicular to the average shoreline. In addition to the coastal flooding concerns along the Milwaukee County shoreline, since there also numerous proportions of bluffs in Milwaukee County, the impact of wave run-up on the stability of the bluffs is also a major concern.

Milwaukee Metropolitan Sewerage District Conservation Plan

The MMSD, with the assistance of The Conservation Fund staff, completed and adopted a conservation plan that identifies land parcels that are recommended to be protected for multiple purposes, including flood reduction potential and stormwater management benefits, as well as wildlife habitat, water quality, and recreational benefits.[44] This plan identified 165 sites, including 42 high-priority sites, for protection through public acquisition or conservation easements, throughout the Menomonee River, Root River, and Oak Creek watersheds within the District. Many of these sites are located within Milwaukee County.

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[43] *Wave Run-up is the uprush of water from wave action on a beach, steep bluff, or coastal structure, typically caused by* a storm surge.

[44] *The Conservation Fund; Applied Ecological Services, Inc.; Heart Lake Conservation Associates; Velasco and Associates; and K. Singh and Associates,* Conservation Plan, Technical Report Submitted to the Milwaukee Metropolitan Sewerage District, *October 31, 2001.*

Many of the sites identified in the conservation plan consisted of isolated parcels. In order to provide greenway corridors connecting these parcels, the MMSD and SEWRPC staffs developed a greenway connection plan for the District.[45] The District later adopted a greenway connection plan that identified potential greenway corridors connecting, and typically downstream of, the isolated parcels identified in the MMSD Conservation Plan. It also synthesized the results of other related open space planning efforts undertaken in the MMSD area to date, resulting in a comprehensive Districtwide greenway connection plan having flood mitigation benefits as well as a wide range of other environmental benefits.

MMSD Green Infrastructure Plan

The MMSD has developed a green infrastructure plan[46] for the planning area. In developing the plan, the District undertook a detailed data analysis of the opportunities and constraints for implementing green infrastructure strategies. Extensive data collection and mapping were conducted as part of the planning effort. The analyses included quantifying the numbers of roads, buildings, and parking lots in the planning area that can be treated with green infrastructure. The objectives of the MMSD green infrastructure plan include:

1. Capturing the first 0.5 inch of rainfall from impervious surfaces with green infrastructure

2. Striving toward a rainwater harvest goal of capturing the first 0.25 gallon per square foot of area over the watershed for reuse

3. Complementing MMSD's Private Property Infiltration and Inflow Program and Integrated Regional Stormwater Management Program

4. Helping municipalities and other entities prioritize green infrastructure actions

5. Helping to meet receiving water quality standards by acknowledging watershed restoration plan recommendations

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[45] *SEWRPC Memorandum Report No. 152,* A Greenway Connection Plan for the Milwaukee Metropolitan Sewerage District, *December 2002.*

[46] *Milwaukee Metropolitan Sewerage District,* Regional Green Infrastructure Plan*, June 2013.*

6. Meeting MMSD's Wisconsin Pollutant Discharge Elimination System (WPDES) discharge permit goal for green infrastructure volume capture

As part of the approach to meeting these objectives, the plan developed watershed-specific recommendations for installing green infrastructure over the plan implementation period of 2014 through 2035. The recommendations were based on individual characteristics of each watershed.

Other MMSD Green Infrastructure Plans[47]

The regional MMSD Green infrastructure Plan was developed in 2013. From 2011 to 2020, numerous other green infrastructure plans were either prepared for or by MMSD. These plans provide supplemental information to the regional green infrastructure plan or provide green infrastructure strategies to specific areas. Plans were developed to help with water reclamation, flood management, and sewer overflows. MMSD has proposed to eliminate all sewer overflows by 2035. Green infrastructure will be a critical component in eliminating overflows by integrating a variety of practices to detain, evapotranspire, and infiltrate stormwater within the MMSD sewer service area. A study was conducted in three sewersheds to assess the abilities of the various green infrastructure practices. Potential benefits of green infrastructure were measured based on environmental outcomes such as overflow, peak stream flow, and pollutant loading reductions, and the analysis concluded that the potential of green infrastructure is an important component of improving environmental, economic, and social conditions within the three study areas.

Green infrastructure plans were also prepared for areas within the Kinnickinnic[48] and Menomonee River[49] watersheds. The Menomonee River plan focuses on raising green infrastructure planning and opportunities for street and parking lot projects within the MMSD service area. The plan identified the top two green infrastructure opportunities within 11 selected municipalities that were planned for a road or parking lot reconstruction. Each project within those 11 municipalities was provided information with developing the most impactful green infrastructure technique. The analysis for each project will enable the municipalities

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[47]*All MMSD green infrastructure plans and documents are located on MMSD's Fresh Coast Guardians website at: www.freshcoastguardians.com/resources/our-plans.*

[48]*Milwaukee Metropolitan Sewerage District*, Kinnickinnic River Watershed: Green Infrastructure Plan*, 2018, GRAEF, Stormwater Solutions Engineering, and Sixteenth Street Community Health Center.*

[49]*Milwaukee Metropolitan Sewerage District*, Green Infrastructure Identification and Prioritization in the Menomonee River Watershed*, August 2015, CH2M and Sweet Water.*

to plan for implementing green infrastructure and have the project information needed for funding opportunities. The Kinnickinnic River green infrastructure plan would work in conjunction with the Kinnickinnic River Flood Management Plan to reduce flooding risks and manage stormwater within the watershed, which is the most urbanized watershed in the MMSD planning area. Implementing green infrastructure would provide environmental benefits as such elements would act as resilient sponges that would absorb the shock from storms and smaller-scale flood events by slowing and filtering stormwater. Green infrastructure would also enhance natural aesthetics, improve water quality, and positively impact community health. Infiltration-based green infrastructure strategies are recommended with the focus on infiltrating more water upstream or away from impacted structures and improving the overall water quality by managing pollution, phosphorous, and runoff and identifying the locations of the highest levels of nonpoint source pollution.

The District's Green Infrastructure Standards Specifications and Plan Templates Report prepared in October 2016 by MMSD, following WDNR standards, where applicable, provides simplified planning and design tools to promote more widespread implementation of green infrastructure strategies throughout the District's service area. The intent is for the tools to be used initially by local municipalities served by the District to assist with capturing and reducing the quantity of stormwater runoff, while also improving municipal stormwater management and water quality consistent with Total Maximum Daily Load (TMDL) objectives. Such strategies include bioretention/bioswales, rain gardens, porous pavement, stormwater trees, native landscaping, and soil amendments. Because of the District's goal of widespread implementation of sustainable stormwater management throughout its service area, the report provides a brief description, site suitability considerations, design considerations, costs, plan templates/typical details, specifications, and inspection and maintenance of the strategies listed above. These tools can also be used to assist in meeting the District's vision for zero basement backups, zero overflows, reduced water quantity, and improved water quality. The report also includes tools and materials to provide information and guidance on planning, design, and construction/post-construction. The report should be utilized as a streamlined and user-friendly document with specifications and plan templates that can be adjusted to accommodate site-specific conditions and used as a reference document to supplement the green infrastructure sizing tool, typical details, and technical specifications.

MMSD, with the support of local stakeholders, also prepared a plan to help protect and restore native biodiversity within MMSD's planning area through applying green infrastructure. The plan defines green infrastructure as localized management approaches and technologies that infiltrate, evapotranspire, capture, and reuse stormwater to maintain or restore natural hydrology. While green infrastructure often

refers to landscape scale components such as forests, floodplains, and wetlands, that help maintain the natural water cycle, the focus of the report is on the potential biodiversity contributions of parcel- and street-level stormwater interventions. Promoting urban biodiversity is linked to MMSD's core mission to cost-effectively protect the region's water resources and is also consistent with MMSD's goal of using effective planning to allow the planning area and broader region to thrive economically and environmentally. MMSD recognizes that its activities to provide water reclamation and flood management services directly impact urban biodiversity.

Green infrastructure strategies promoted by MMSD and the benefits of urban agriculture were evaluated for their ability to enhance biodiversity. Direct benefits include the addition of new habitat (putting a green roof on an existing building), improvements to habitat quality (planting native species, removing concrete stream channels and dams), and pollination enhancement (planting wildflowers that are preferred by bees). Indirect benefits include improving aquatic biodiversity by returning instream flows to more natural conditions. More importantly, monitoring and evaluating the effectiveness of any urban biodiversity program will be necessary to make sure the activities are reducing the stressors they are designed to reduce. This includes evaluating the design, installation, and maintenance, as well as monitoring the performance of the practices in reducing runoff and pollutants. The plan further identifies goals and strategies for enhancing urban biodiversity in the MMSD planning area, identifies high priority conservation and rehabilitation areas, and provides suggestions for research, monitoring, and education/outreach in future areas.

A plan was also prepared for MMSD that provides information about lessons learned (successes and failures) of green infrastructure. The goal of the plan was to use experiences and realities to guide the practices of green infrastructure strategies, installations, and maintenance. Municipalities and other governmental agencies have encountered various barriers and successes regarding green infrastructure maintenance through project phases including planning, budgeting, design, construction, and post-construction. The plan focuses on these barriers and successes, summarizes the lessons learned, and prescribes recommendations about maintenance needs to both municipalities and MMSD.

In order to formulate the basis of the plan (lessons learned of green infrastructure), a survey was sent to 24 governmental units including 20 municipalities that received green infrastructure funding, three Milwaukee County agencies, and the University of Wisconsin-Milwaukee. The survey questions were relative to green infrastructure maintenance and mostly focused on the types of infrastructure that are most frequently installed, the level they are being maintained, and whether agencies have the correct equipment, personnel,

and/or training to maintain these features. Face-to-face interviews were then scheduled after an agency responded to the survey and most interviews were scheduled in groups of two to three with the intent of generating conversations and sharing experiences. Feedback from the survey and interviews mostly determined that communities do not have the time, expertise, or funding to maintain green infrastructure. About one-half of the respondents would be interested in a full-time commitment maintenance partnership with a neighboring community. Because of the demanding maintenance (time and resources) and rising costs of green infrastructure systems, some communities are not applying for or accepting potential funding and grants to install more infrastructure. Green infrastructure is an asset to assist with stormwater quality and control, meeting regulation requirements, and overall stormwater education. As more strategies are installed and require maintenance, more creative funding mechanisms for maintenance will need to be explored as well as increased training and education to all project phases because of concerns regarding future maintenance.

MMSD Urban Biodiversity Plan

The MMSD has developed an urban biodiversity plan[50] for its planning area. This plan is intended to help preserve and restore biodiversity in the MMSD planning area through the application of green infrastructure. The plan evaluates green infrastructure practices for their ability to enhance biodiversity. In addition, it identifies goals and strategies for enhancing urban biodiversity by making recommendations for incorporating biodiversity into green infrastructure and other projects; identifying high priority conservation and rehabilitation areas; and suggesting future areas for research, monitoring, education, and outreach.

TMDL Study for the Milwaukee River Basin

Under the Clean Water Act, States are required to develop Total Maximum Daily Loads (TMDLs) to address impaired waterbodies that are not meeting water quality standards and not achieving their designated uses. A TMDL includes both a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and an allocation of that load among the various sources of that pollutant. The TMDL must also account for seasonal variations in water quality and include a margin of safety to account for uncertainty in predicting how well pollutant reductions will result in meeting water quality standards.

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[50]*Milwaukee Metropolitan Sewerage District,* MMSD Planning Area Urban Biodiversity Plan: Draft for Ad Hoc Committee Review, *July 14, 2017.*

A TMDL allocates the allowable load between a wasteload allocation for point sources such as municipal wastewater treatment plants, industrial dischargers, concentrated animal feeding operations, and municipal separate storm sewer systems (MS4s); a load allocation for nonpoint sources such as agricultural sources, urban sources not covered under a discharge permit, and natural background loads; and a margin of safety. Wasteload allocations are implemented through limits established in discharge permits under the Wisconsin Pollutant Discharge Elimination System (WPDES). Load allocations are implemented through a wide variety of Federal, State, and local programs as well as voluntary action by citizens. These programs may include regulatory, non-regulatory, or incentive-based elements, depending on the program. Implementing load allocations is typically an adaptive process, requiring collaboration between diverse stakeholders and prioritizing and targeting available programmatic, regulatory, financial, and technical resources.

In 2018, CDM Smith, on behalf of the MMSD and the WDNR, completed a TMDL study[51], for the U.S. Environmental Protection Agency, Region 5, which included the Kinnickinnic River watershed and the Milwaukee Harbor Estuary within Milwaukee County and the entirety of the Menomonee River and Milwaukee River watersheds, including those portions of each watershed located outside of Milwaukee County. Elevated phosphorus, sediment, and bacteria levels in the Milwaukee River Basin have led to low dissolved oxygen concentrations, degraded habitat, excessive algal growth, turbidity, and recreational impairments. As a result, impairments to beneficial uses within the Basin, such as preserving and enhancing fish and other aquatic life and recreational use, have occurred. The purpose of this study is to describe the overall TMDL development process, the water quality impairments within the Basin, the technical approach and assumptions used to develop TMDLs for each impaired waterbody, the load and wasteload allocations by source that must be met to achieve water quality standards and targets, and the management practices that can be considered for TMDL implementation. This study also developed an implementation plan for the TMDLs, consisting of those programs and management measures needed to provide reasonable assurance toward achieving the load allocations developed for this TMDL study. The actual allowable load of pollutants for each TMDL reach is set forth in Appendix A of the study.

The Milwaukee River TMDL addresses impairments such as recreation restrictions, oxygen depletion, degraded biological communities, elevated water temperatures, high phosphorus, and degraded habitat resulting from high concentrations of fecal coliform bacteria, total phosphorus, and total suspended solids. It establishes wasteload allocations and load allocations for fecal coliform bacteria, total phosphorus, and

[51]*Milwaukee Metropolitan Sewerage District,* Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform, Milwaukee River Basin, Wisconsin*,* Final Report, *March 19, 2018, prepared by CDM Smith*.

total suspended solids in 55 TMDL basins of the Kinnickinnic River, Menomonee River, and Milwaukee River watersheds, including all seven basins in the Kinnickinnic River watershed, eight TMDL basins of the Menomonee River watershed and six TMDL basins of the Milwaukee River watershed that are wholly or partially located within Milwaukee County.

The developers of the Milwaukee River Basin TMDL used two models to simulate flow and calculate loads of fecal coliform bacteria, total phosphorus, and total suspended solids and predict associated water quality conditions under existing and anticipated future conditions for all the TMDL basins in the Milwaukee River Basin. The Hydrological Simulation Program-Fortran (HSPF) was used to model the TMDL basins within the Kinnickinnic and Menomonee River watersheds. The Loading Simulation Program in C++ (LSPC) was used to model the TMDL basins in the Milwaukee River watershed. LSPC includes HSPF algorithms but uses a different database structure.

For total phosphorus and total suspended solids, the Milwaukee River Basin TMDL expresses the load allocations for agricultural and non-permitted urban areas and the wasteload allocations for municipal separate storm sewer systems (MS4) as an average monthly percent reduction from the TMDL baseline loads. Within Milwaukee County, the Milwaukee River Basin TMDL does not contain any urban areas that are not required to be covered under a WPDES permit for the discharge of stormwater, thus no data were collected. In addition, since land uses in the Kinnickinnic River basins are highly urbanized, no agricultural load allocations were collected. Agricultural load allocations for the Milwaukee River Basin TMDL located wholly or partially within Milwaukee County were collected in four Milwaukee River basins and in five Menomonee River basins.

The reductions of total phosphorus loads for MS4 systems range between 38 percent and 88 percent in Kinnickinnic River basins, between 23 percent and 73 percent in Menomonee River basins, and between 14 percent and 87 percent in Milwaukee River basins. The reductions of total phosphorus loads for agricultural areas in the four Milwaukee River basins range between 12 percent and 70 percent and in the five Menomonee River basins range between 38 percent and 53 percent.

The reductions of total suspended solid loads for MS4 systems range between 69 percent and 80 percent in Kinnickinnic River basins, between 56 percent and 75 percent in Menomonee River basins, and between 48 percent and 66 percent in Milwaukee River basins. The reductions of total suspended solid loads for agricultural areas in the four Milwaukee River basins range between 26 percent and 45 percent and in the five Menomonee River basins range between 42 percent and 61 percent.

The Milwaukee River Basin TMDL also gives daily loading capacities and allocations that vary by month of the year. This reflects the fact that average total phosphorus and total suspended solids loading varies substantially by month. This variation is primarily driven by seasonal patterns in precipitation and vegetative cover that influence runoff and erosion rates. These same seasonal patterns also affect stream flow, which is the basis for pollutant assimilative capacity.

The Milwaukee River Basin TMDL used a load duration curve approach to develop allowable bacteria loads for each TMDL basin. This methodology considers how streamflow conditions relate to pollutant sources and makes rough determinations of what flow conditions result in exceedances of water quality standards. The TMDL is presented as a set of fecal coliform bacteria load duration curves that are given in Appendix D of the Milwaukee River Basin TMDL. Depending on the TMDL basin, the TMDL calls for reducing loads of fecal coliform bacteria by approximately one to three orders of magnitude under low flow and dry conditions, one to two orders of magnitude under mid-range flow and moist conditions, and one order of magnitude under high flow conditions.

Meeting the water quality targets set in the Milwaukee River TMDL will require substantial reductions in nonpoint source loading. The percent reductions goals from the TMDL should be used to help prioritize work in the Milwaukee River basins located in Milwaukee County.

Water Quality Improvement Plan

In 2017, Sweet Water was commissioned by MMSD to create a Water Quality Improvement Plan (WQIP) for the Greater Milwaukee Watersheds. This plan built on the technical strength of the Milwaukee River Basin TMDL Report, several nine-key element plans, MMSD's Regional Green Infrastructure and 2050 Facilities Plans, and various SEWRPC plans. The WQIP focuses on putting the goals and the recommendations in the other plans into action efficiently while also achieving important co-benefits. This relates directly to how work is funded and implemented, how work is prioritized, how collaboration can work, how to leverage the strengths of each sector, and how the impacts of watershed restoration efforts can be monitored and measured over time. It will achieve these goals through the use of integrated watershed management, which recognizes the need for collaboration among a range of stakeholders in an impaired watershed. The WQIP was submitted to the WDNR for approval in March of 2020. Sweet Water is gathering local experts that have knowledge on turning watershed planning into action in a series of workshops funded by a WDNR River Planning Grant. The goal is to develop "watershed playbooks."

3.4 CITY AND VILLAGE PLANS

Local Comprehensive Plans

Section 62.23 of the *Wisconsin Statutes* grants cities and villages the authority to prepare and adopt local master plans or plan elements, such as a community land use plan. In 1999, the Wisconsin Legislature enacted legislation that greatly expanded the scope and significance of comprehensive plans within the State. The legislation, often referred to as the State's "Smart Growth" law, provides a new framework for developing, adopting, and implementing comprehensive plans by regional planning commissions and by county, city, village, and town units of government. The law is set forth in Section 66.1001 of the *Wisconsin Statutes*. This section of the *Statutes* also defines elements that a comprehensive plan must contain. The law has been amended periodically, most recently in June 2010 through enactment of 2009 Wisconsin Act 372.

The law does not require the adoption of county and local comprehensive plans; however, Section 66.1001(3) of the *Statutes* requires that county and local general zoning ordinances; county, city, and village shoreland and floodplain zoning ordinances; county and local subdivision ordinances; and local official mapping ordinances enacted or amended on or after January 1, 2010, be consistent with the comprehensive plan adopted by the unit of government enacting or amending an ordinance.

All of the municipalities in Milwaukee County are incorporated as cities or villages. Because of this, the County has not prepared or adopted a comprehensive plan. All municipalities in Milwaukee County had prepared and adopted their own comprehensive plans. As of September 1, 2020, the Cities of South Milwaukee and St. Francis and Villages of Greendale, River Hills, West Milwaukee, and Whitefish Bay had adopted an update to their comprehensive plans and the Cities of Cudahy, Greenfield, and Oak Creek and the Villages of Fox Point and Shorewood are currently preparing updates to their plans.

City of Milwaukee Sustainability Plan

In 2013, the City of Milwaukee Office of Environmental Collaboration developed a sustainability plan titled ReFresh Milwaukee.[52] One goal set forth in this plan is reducing the amount of stormwater runoff and clearwater entering the sewer system. The plan established several targets related to this goal, including establishing a baseline measure through assessing existing amounts of impervious surface and green infrastructure within the City, developing a green infrastructure policy plan for the City, and increasing the volume of stormwater runoff captured by green infrastructure by 10 percent annually. The plan also outlined

[52] *City of Milwaukee,* ReFresh Milwaukee: City of Milwaukee Sustainability Plan: 2013-2023*, July 2013*.

elements that should be included in the recommended green infrastructure policy plan. Other recommendations of the sustainability plan that relate to stormwater management include recommendations that the City collaborate with Milwaukee County Parks and local land trusts to maximize the use of green space for stormwater management, replace and maintain City sewers, and work with private property owners to maintain private laterals. The City's HOME GR/OWN program, a program that repurposes foreclosed properties and vacant lots in order to increase the availability of healthy foods, implements the City's sustainability plan. The plan also provides opportunities for stormwater management through installing green infrastructure and other stormwater best management practices. Since the development of the HOME GR/OWN program, several projects in the City have included stormwater management features such as porous pavement, cisterns, rain gardens, and bioswales.

City of Milwaukee Baseline Green Infrastructure Inventory

In 2015, the City of Milwaukee conducted a baseline inventory[53] of green infrastructure within the City. The objectives of this inventory included:

- Determining the total amount of impervious area within the City
- Establishing the length of shoreline along rivers, streams, and Lake Michigan within the City
- Assessing the amount of shoreline within the City possessing properly maintained vegetative buffers
- Identifying, cataloging, and quantifying existing green infrastructure sites in the City and estimating the volume of water captured by these sites
- Identifying areas within the City that are prone to surface flooding, basement water infiltration, and/or basement backups due to topography
- Calculating the City's annual targets for stormwater runoff reductions through the implementation of green infrastructure practices

The findings of the inventory were used to determine the highest priority locations in the City to implement green infrastructure practices and to support development of a City green infrastructure plan.

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[53] *City of Milwaukee,* Green Infrastructure Baseline Inventory*, April 2015*.

City of Milwaukee Green Infrastructure Plan

In October 2017, the Milwaukee Common Council directed the City's Environmental Collaboration Office (ECO) to develop a comprehensive green infrastructure plan for Milwaukee's combined sewer area. After consulting with the MMSD, the City of Milwaukee Departments of Public Works and City Development, and community stakeholders, ECO proposed a green infrastructure plan framework.[54] This framework serves to guide development of the City's green infrastructure plan and was approved by the Common Council in September 2018. The City's green infrastructure plan[55] was subsequently adopted in June 2019.

The plan envisions that the City of Milwaukee will add approximately 36 million gallons of stormwater storage through green infrastructure implementation by 2030, and based on data analysis, is the equivalent of adding 143 acres of green space throughout the City. The plan will provide strategic and comprehensive strategies for implementing green infrastructure and prioritizing projects and should also help the City adapt to climate change. The plan further identifies various green infrastructure practices and potential financing mechanisms, prioritizes sub-basins and locations, formalizes policy changes within the City, and recognizes stakeholders within City, County, private, and nonprofit organizations that may offer a partnership to accomplish these goals. In addition, the Green Infrastructure Plan supplements the targets outlined in the City's Sustainability Plan.

In October 2018, a companion Common Council resolution was approved that will revise City ordinances to require green infrastructure on all large developments and redevelopments and explicitly outlines green infrastructure as a climate adaptation strategy in Chapter 120 of the City of Milwaukee Code of Ordinances.

City of Milwaukee Green Streets Stormwater Management Plan

The City of Milwaukee developed a green streets plan[56] to reduce stormwater quantity and improve stormwater quality through implementing green street stormwater strategies in conjunction with street and alley repaving or reconstruction projects. The plan provides and evaluates a menu of strategies to manage stormwater runoff in street rights-of-way without sacrificing roadway function. This menu includes practices that can be installed in vegetated areas such as medians, street terraces, and adjacent open spaces and

[54] *City of Milwaukee,* Framework for Green Infrastructure Plan*, September 2018.*

[55] *City of Milwaukee,* Green Infrastructure Plan*, June 2019.*

[56] *City of Milwaukee,* Green Streets Stormwater Management Plan*, March 2013, prepared by CH2MHill.*

paved areas such as streets, alleys, and parking lanes. The strategies also include the use of trees as drainage components. Implementing these strategies can be integrated into the design of street or alley repaving or reconstruction projects. The plan provides a mechanism for incorporating the installation of green street features into the City's standard process for planning and designing street and alley repaving and reconstruction projects. The City estimates that implementing such strategies during repaving and reconstruction projects can provide a cost savings of 20 to 40 percent over the cost of green street installation as a retrofit.

3.5 COUNTY AND LOCAL ORDINANCES

Good community development depends not only on quality planning at all levels of government, but on practical implementation measures as well. Land use and development regulations affect the type of uses allowed, as well as the detailed design and site layout of proposed developments. Because Milwaukee County has no unincorporated areas, many of these regulations are promulgated and enforced by the cities and villages in the County. The following presents a summary of regulations adopted by the County and local governments.

General Zoning

Zoning is a tool used to regulate the use of land in Milwaukee County in a manner that serves to promote the general welfare of its citizens, the quality of the environment, and conserving its resources. Zoning also is used to implement a comprehensive plan. Zoning involves delineating areas or zones into specific districts, which provides uniform regulations and requirements that govern the use, placement, spacing, and size of land and buildings. As, the County has no unincorporated areas, and as each city and village in the County has adopted and enforces its own zoning ordinance, general zoning has not been adopted nor administered by Milwaukee County.

Floodland Zoning Ordinance

Section 87.30 of the *Wisconsin Statutes* requires that cities and villages (and counties, with respect to their unincorporated areas), adopt floodland zoning to preserve the floodwater conveyance and storage capacity of the floodplain areas and to prevent the location of new flood damage-prone development in flood hazard areas. The minimum standards that such ordinances must meet are set forth in Chapter NR 116 of the *Wisconsin Administrative Code*. The required regulations govern filling and development within a regulatory floodplain, which is defined as the area subject to inundation by the 1-percent-annual-probablity (100-year recurrence interval) flood event. Under Chapter NR 116, local floodland zoning regulations must

prohibit nearly all forms of development within the floodway, which is that portion of the floodplain required to convey the 1-percent-annual-probablity (100-year recurrence interval) peak flood flow. Local regulations must also restrict filling and development within the flood fringe, which is that portion of the floodplain located outside of the floodway that would be covered by floodwater during the 1-percent-annual-probablity (100-year recurrence interval) flood. Permitting the filling and development of the flood fringe area, however, reduces the floodwater storage capacity of the natural floodplain, and may thereby increase downstream flood flows and stages. As all cities and villages in the County have adopted floodland zoning ordinances (except for the Village of West Milwaukee, which has no officially identified flood hazard areas within its boundaries), Milwaukee County has not adopted, nor administers, its own floodland zoning ordinance. The existing floodplains in the County are illustrated on Map 2.13 in Chapter 2 of this report.

Shoreland-Wetland Zoning

Under Sections 62.231 and 61.351, respectively, of the *Wisconsin Statutes*, cities and villages in Wisconsin are required to place wetlands five acres or larger and located in statutory shorelands into a shoreland-wetland conservancy zoning district to ensure their preservation. Minimum standards for city and village shoreland-wetland zoning ordinances are set forth in Chapter NR 117 of the *Wisconsin Administrative Code*.

It should be noted that the basis for identifying wetlands to be protected under Chapter NR 117 of the *Wisconsin Administrative Code* is the Wisconsin Wetlands Inventory. Mandated by the State Legislature in 1978, the Wisconsin Wetlands Inventory resulted in preparing wetland maps covering each U.S. Public Land Survey Township in the State. The inventory was completed for counties in Southeastern Wisconsin in 1982, the wetlands being delineated by SEWRPC in 1980, on one-inch equals 2,000 feet scale, aerial photographs. The Wisconsin Wetlands Inventory was last updated by SEWRPC in 2015.

The Cities of Cudahy, Franklin, Glendale, Greenfield, Milwaukee, Oak Creek, South Milwaukee, Wauwatosa, and West Allis and the Villages of Greendale, Hales Corners, and River Hills have adopted their own shoreland-wetland zoning ordinances pursuant to Sections 62.231 and 61.351, respectively, of the *Wisconsin Statutes*. The City of St. Francis and the Villages of Bayside, Brown Deer, Fox Point, Shorewood, West Milwaukee, and Whitefish Bay did not have any shoreland wetlands and were thus not required to adopt such ordinances.

Subdivision Regulations

Chapter 236 of the *Wisconsin Statutes* requires preparing a subdivision plat whenever five or more lots of 1.5 acres or less in area are created either at one time or by successive divisions within a period of five years.

The *Statutes* set forth requirements for surveying lots and streets, for plat review and approval by State and local agencies, and for recording approved plats. Section 236.45 of the *Statutes* allows any city, village, town, or county that has established a planning agency to adopt a land division ordinance, provided the local ordinance is at least as restrictive as the State platting requirements. Local land division ordinances may include the review of other land divisions not defined as "subdivisions" under Chapter 236, such as when fewer than five lots are created or when lots larger than 1.5 acres are created.

With the exception of the Village of Whitefish Bay, each of the municipalities in Milwaukee County has adopted its own subdivision control ordinance.

Official Mapping Ordinance

Section 62.23(6) of the *Wisconsin Statutes* allows the Common Council of any City to establish an official map for precisely identifying right-of-way lines and boundaries of streets, highways, waterways,[57] and parkways and the location and extent of railroad rights-of-way, public transit facilities, parks, and playgrounds. An official map is intended to be used as a precise planning tool for implementing master and comprehensive plans and for insuring the availability of land for the above features. Section 61.35 of the *Statutes* applies the authority provided cities under Section 62.23 to develop an official map to villages.

One of the basic purposes of the official map is to discourage constructing structures and their associated improvements on land that has been designated for future public use. Local government subdivision ordinances can also require land shown on the official map to be dedicated for street, park, or other public use at the time land is subdivided. The official map is a plan implementation device that operates on a communitywide basis in advance of land development and can thereby effectively assure the integrated development of the street and highway system. Unlike subdivision control, which operates on a plat-by-plat basis, the official map can operate over the entire community in advance of development proposals. All communities in Milwaukee County have an adopted official map, except the Villages of Fox Point and Whitefish Bay.

[57]*Waterways may be placed on the map only if included within a comprehensive surface water drainage plan.*

Prioritizing Codes and Ordinances in the Menomonee, Kinnickinnic, and Milwaukee River Watersheds and the Lake Michigan Coastal Watershed for Green Infrastructure

With a grant from the Fund for Lake Michigan, 1000 Friends of Wisconsin prepared a green infrastructure plan[58] that reviewed local codes and ordinances and identified the laws that created barriers to implementing green infrastructure. The project addresses the concern in which municipal codes and ordinances limit the implementation of green infrastructure. The project focused on municipalities within the Menomonee River watershed, but also helped to develop strategic code and ordinance revisions in other communities within watersheds draining to Lake Michigan. The three objectives of the project included:

1. Clearly outlining barriers to green infrastructure that existed in current codes and ordinances that either prohibited or inhibited greater adoption of green infrastructure

2. Increasing the potential for revisions of green infrastructure-friendly codes by prioritizing codes for municipalities

3. Further enhancing the ability of the municipalities to advance codes/ordinance revisions by providing new language for the revisions tailored to their needs

From 2012 to 2016, 1000 Friends of Wisconsin worked with municipalities in Southeastern Wisconsin to audit, revise, and prioritize codes and ordinances that prohibit or inhibit more widespread use of green infrastructure (www.1kfriends.org/what-we-do/watershed-protection/). From 2016 to 2018, the Fund for Lake Michigan, Clean Wisconsin, and Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water) worked with multiple municipalities within Milwaukee County to successfully adopt the recommended changes.

3.6 STATE NONPOINT SOURCE POLLUTION CONTROL STANDARDS AND PROHIBITIONS

Construction Site Erosion Control and Stormwater Management

Stormwater management and construction site erosion control ordinances act to protect water quality and protect and promote health, safety, and general welfare by minimizing the amount of sediment and other pollutants carried to lakes, streams, and wetlands by stormwater and runoff discharged from construction sites or land disturbing activities. Sections 62.234 and 61.354 of the *Statutes* grant authority to cities and

[58] *1000 Friends of Wisconsin,* Tackling Barriers to Green Infrastructure, An Audit of Local Codes and Ordinances.

villages, respectively, to adopt ordinances for preventing erosion from construction sites and the management of stormwater runoff from lands within their jurisdiction. While Milwaukee County does not have a construction site erosion control and stormwater management ordinance, all of the municipalities within the County have adopted such ordinances.

Chapter NR 216 of the *Wisconsin Administrative Code*, which intends to reduce the discharge of pollutants carried by stormwater, requires county and local governments in urbanized areas, which are based on population and density, to obtain a Wisconsin Pollutant Discharge Elimination System (WPDES) Stormwater Discharge Permit. The code requires that the designated county or local government meet State standards to control pollution that enters a municipal storm sewer system and develop a storm sewer system map, a public information and education program, a stormwater and erosion control ordinance, an illicit discharge detection program, and a plan to reduce suspended solids. The designated county or local government must then submit an annual report on progress in meeting the requirements to the WDNR.

Chapter NR 151 of the *Wisconsin Administrative Code* required that municipalities with a WPDES permit reduce the amount of total suspended solids in stormwater runoff by 20 percent by 2008 and by 40 percent by 2013, with respect to stormwater runoff from areas of existing development with no controls as of October 2004. In 2011, the Wisconsin Legislature amended Section 281.16 (2)(am) 2 of the *Wisconsin Statutes* which prohibited the enforcement of the 40 percent TSS reduction contained in NR 151.13 of the *Wisconsin Administrative Code*. Therefore, the applicable standards are the 20 percent TSS reduction or the TMDL reduction goals. All of the communities in Milwaukee County, including Milwaukee County, have received a WPDES Stormwater Discharge Permit. Fifteen Milwaukee County communities and Milwaukee County are covered under a group permit (either the Menomonee River Watershed Based Municipal Stormwater Discharge Group, the North Shore Group, or the Root River Group) and four Milwaukee County communities are covered under individual permits.

In addition, regardless of whether a municipality is required to have a stormwater discharge permit under Chapter NR 216, Chapter NR 151 requires that all construction sites that have one acre or more of land disturbance must achieve an 80 percent reduction in the amount of sediment that runs off the site. With certain limited exceptions, those sites required to have construction erosion control permits must also have post-development stormwater management practices to reduce the total suspended solids (sediment) that would otherwise run off the site by 80 percent for new development, 40 percent for redevelopment, and 80 percent for infill development. If it can be demonstrated that the solids reduction standard cannot be met for a specific site, total suspended solids must be controlled to the maximum extent practicable.

Under the requirements of Chapter NR 151, beginning March 10, 2008, incorporated municipalities with average population densities of 1,000 people or more per square mile that are not required to obtain municipal stormwater discharge permits must implement public information and education programs relative to specific aspects of nonpoint source pollution control; municipal programs for management of leaf and grass clippings; and site specific programs for application of lawn and garden fertilizers on municipally-owned properties with over five acres of pervious surface. This requirement applies to virtually all cities and villages.

The MMSD also promulgates stormwater management regulations as set forth in MMSD Rules Chapter 13, Surface Water and Stormwater. The purpose of Chapter 13, which applies to all users of the sewerage system and all governmental units in the sewer service area, is to:

- Reduce the unsafe conditions, property damage, economic losses, and adverse health effects caused by flooding

- Maximize the effectiveness of flood abatement facilities and watercourse improvements

- Reduce the number and magnitude of releases of sewage to the environment from sanitary and combined sewers and to protect sewage collection and treatment facilities from high flows

- Promote comprehensive watershed planning and intergovernmental cooperation

- Restore and enhance opportunities to use and enjoy watercourses

Runoff management is required for any development or redevelopment in the ultimate sewer service area (planning area) that meets all of the criteria set forth in Subchapter III – Stormwater Runoff Management Requirements, and applies to all cities, villages, and other governmental units (including counties, special districts, and state agencies if the other governmental unit asserts exemption from local land development requirements and receives sewer service from the District).

State Standards and Regulations for Control of Nonpoint Source Pollution

Through 1997 Wisconsin Act 27, the State Legislature required the WDNR and DATCP to develop performance standards for controlling nonpoint source pollution from agricultural and nonagricultural land

and from transportation facilities.[59] The performance standards are set forth in Chapter NR 151, "Runoff Management," of the *Wisconsin Administrative Code*, which became effective on October 1, 2002, and was revised in 2004, 2010, and 2018. Below is a summary of the standards and prohibitions that apply to the Milwaukee County Land and Water Resource Management plan:

Agricultural Regulations, Performance Standards, and Prohibitions

Performance standards relate to four areas of agriculture: cropland soil erosion control, soil loss from riparian lands, manure management, and nutrient management.

The agricultural performance standards are:

- Sheet, rill and wind erosion: Maintain soil erosion rates on all cropland at or below "T" (Tolerable Soil Loss)

- Tillage setback: Allow no tillage within a five- to 20-foot setback from the top of a surface water channel in agricultural fields for the purpose of maintaining streambank integrity and avoiding soil deposits into State waters

- Phosphorus index: A limit on the amount of phosphorus (an average phosphorus index of 6 or less over the accounting period and which may not exceed a phosphorus index of 12 in any individual year) that may run off croplands as measured by the Wisconsin Phosphorus Index

- Manure storage facilities: All new or substantially altered manure storage facilities must meet current engineering design standards to prevent surface or groundwater pollution

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[59]The State performance standards are set forth in the Chapter NR 151, "Runoff Management," of the Wisconsin Administrative Code. Additional code chapters that are related to the State nonpoint source pollution control program include: Chapter NR 152, "Model Ordinances for Construction Site Erosion Control and Storm Water Management;" Chapter NR 153, "Targeted Runoff Management and Notice of Discharge Grant Programs;" Chapter NR 154, "Best Management Practices, Technical Standards and Cost-Share Conditions;" Chapter NR 155, "Urban Nonpoint Source Water Pollution Abatement and Storm Water Management Grant Program;" and Chapter ATCP 50, "Soil and Water Resource Management." Those chapters of the Wisconsin Administrative Code became effective in October 2002. Chapter NR 120, "Priority Watershed and Priority Lake Program;" and Chapter NR 243, "Animal Feeding Operations" were repealed and recreated in October 2002.

- Process wastewater handling: A prohibition against significant discharge of process water from milk houses, feedlots, and other similar sources

- Clean water diversion: Divert clean water runoff away from contacting feedlots, manure storage facilities, and barnyards in water quality management areas (areas within 300 feet of a stream, 1,000 feet from a lake, or areas susceptible to groundwater contamination)

- Nutrient management: Application of manure or other nutrients to croplands must be done in accordance with a nutrient management plan, designed to meet State standards for limiting the entry of nutrients into groundwater or surface water resources. This standard does not apply to applications of industrial waste, municipal sludge, or septage regulated under other WDNR programs, provided that the material is not comingled with manure prior to application

- Silurian bedrock (this performance standard was added to NR 151 in 2018): To address land spreading of manure on soils in sensitive areas of the State – i.e. where depth to bedrock is shallow and the bedrock is fractured (also described as karst topography), mechanical manure application may not cause fecal contamination of water in a well, or be applied on areas of cropland or pastures that have 24 inches or less of separation between the ground surface and apparent water table, and must be applied in conformance with a nutrient management plan that is consistent with all applicable standards

- Manure management: Prohibitions include no direct runoff from animal feedlots to "waters of the state", no overflow of manure storage facilities, no unconfined manure piles in shoreland areas (areas within 300 of a stream, 1,000 feet from lakes), and no unlimited livestock access to "waters of the state" where the livestock prevent sustaining an adequate vegetative cover

- TMDL: A crop or livestock producer shall reduce discharges of pollutants from a livestock facility or cropland to surface waters if necessary, to meet a load allocation in a US EPA and state approved TMDL

In general, only if cost share funds are made available via a bona fide offer of cost sharing do those lands that do not meet the NR 151 standards (and were cropped or enrolled in the U.S. Department of Agriculture Conservation Reserve or Conservation Reserve Enhancement Programs as of October 1, 2002), need to meet these agricultural performance standards. Existing cropland that met the standards as of October 1, 2002,

must continue to meet the standards. New cropland must meet the standards, regardless of whether cost share funds are available.

Chapter NR 243, "Animal Feeding Operations," of the *Wisconsin Administrative Code* sets forth rules for concentrated animal feeding operations and other animal feeding operations for the purpose of controlling the discharge of pollutants to waters of the State. The definition of concentrated animal feeding operations is any livestock and poultry operations with more than 1,000 animal units. Calculation of animal units depends upon each different type and size class of livestock and poultry. For example, facilities with 1,000 beef cattle, 700 milking cows, or 200,000 chickens each would be the equivalent of 1,000 animal units. All concentrated animal feeding operations and certain types of other animal feeding operations must obtain WPDES permits. In general, the definition of animal feeding operations is any feedlot or facility, other than pasture, where feeding of animals for a total of 45 days in any 12-month period occurs. While none of these operations are located in Milwaukee County, upstream portions of the Milwaukee River and its tributaries located in Dodge, Fond du Lac, Ozaukee, Sheboygan, and Washington Counties may contain these operations which could have an effect on the water quality downstream in Milwaukee County.

Under Chapter NR 216, "Stormwater Discharge Permits" of the *Wisconsin Administrative Code,* agriculture is not exempt from the requirement to submit a notice of intent (NOI) for one or more acres of land disturbance for the construction of structures such as barns, manure storage facilities or barnyard runoff control systems. Construction of an agricultural building or facility must follow an erosion and sediment control plan consistent with Section NR 216.46, *Wisconsin Administrative Code*, including meeting the performance standards of Section NR 151.11, *Wisconsin Administrative Code*. Agriculture is exempt from this requirement for activities such as planting, growing, cultivating and harvesting crops for human or livestock consumption and pasturing of livestock as well as for sod farms and tree nurseries. NR 216 establishes the criteria and procedure for issuance of stormwater discharge permits to limit the discharge of pollutants carried by stormwater runoff into waters of the State.

Nonagricultural (Urban) Performance Standards and Stormwater Discharge Permits

The nonagricultural performance standards set forth in Chapter NR 151 encompass two major types of land management. The first includes standards for areas of new development and redevelopment and the second includes standards for developed urban areas. The performance standards address the following areas:

- Construction sites for new development and redevelopment

- Post construction stormwater runoff for new development and redevelopment

- Developed urban areas

- Nonmunicipal property fertilizing

Chapter NR 151 requires counties and local units of government in urbanized areas to obtain a WPDES stormwater discharge permit as required under Chapter NR 216.[60] All of the communities in Milwaukee County have applied for and been issued these permits.

Chapter NR 151 requires permit holders to reduce the amount of total suspended solids in stormwater runoff from areas of existing development that is in place as of October 2004 to the maximum extent practicable, according to the following standards:

- By March 10, 2008, the NR 151 standards call for a 20 percent reduction

- By October 1, 2013, the standards call for a 40 percent reduction

However, in 2011, the Wisconsin Legislature amended Section 281.16 (2)(am) 2 of the *Wisconsin Statutes* which prohibited the enforcement of the 40 percent TSS reduction contained in NR 151.13 of the *Wisconsin Administrative Code*. Therefore, the applicable standards are the 20 percent TSS reduction or the TMDL reduction goals.

Permitted municipalities are required to implement the following 1) public information and education programs relative to specific aspects of nonpoint source pollution control; 2) municipal programs for collection and management of leaf and grass clippings; and 3) site-specific programs for application of lawn and garden fertilizers on municipally controlled properties with over five acres of pervious surface. The requirements of Chapter NR 151 (as of March 10, 2008) do not require incorporated municipalities with average population densities of 1,000 people or more per square mile to obtain municipal stormwater discharge permits, however, they must still implement the three programs noted above.

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[60]Chapter NR 216 of the Wisconsin Administrative Code, "Storm Water Discharge Permits," sets forth requirements for construction site erosion control and for industrial, municipal, and transportation-related stormwater discharge permits.

Section NR 151.12 of the *Wisconsin Administrative Code* requires infiltration of post-development runoff from areas developed on or after October 1, 2004, subject to specific exclusions and exemptions as set forth in Sections 151.12(5)(c)5 and 151.12(5)(c)6, respectively. In residential areas, Section NR 151.12 requires infiltration of either 90 percent of the annual predevelopment infiltration volume or 25 percent of the post-development runoff volume from a two-year recurrence interval, 24-hour storm. However, Section NR 151.12 requires use of no more than 1 percent of the area of the project site as an effective infiltration area. In commercial, industrial and institutional areas, NR 151.12 requires infiltration of 60 percent of the annual predevelopment infiltration volume or 10 percent of the post-development runoff volume from a two-year recurrence interval, 24-hour storm. In this case, NR 151.12 requires use of no more than 2 percent of the project site as an effective infiltration area.

3.7 CLIMATE AND CLIMATE CHANGE

Climate, which is the long-term weather conditions in an area, is an important element when assessing and planning for the future health of Milwaukee County and its water and terrestrial resources. Recent assessments have documented changes in Wisconsin's climate over the late 20th century.[61] Projections of Wisconsin's future climate based on downscaled data from 14 global climate models indicate that additional changes will occur through the 21st century.[62] The following sections describe the changes that have occurred in Wisconsin's climate since 1950 and the changes that are projected to occur by the middle of the 21st century.

Air Temperature

Based on the 30-year average temperature data during the period of 1981 to 2010 from the official NOAA National Weather Service records, the average annual temperature at Milwaukee's Mitchell International Airport was 47.8 degrees Fahrenheit. Average annual temperatures in Wisconsin increased over the last half

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[61] *For example, Christopher J. Kucharik, Shawn P. Serbin, Steve Vavrus, Edward J. Hopkins, and Melissa M. Motew, "Patterns of Climate Change across Wisconsin from 1950-2006," Physical Geography, Volume 31, pages 1-28, 2010.*

[62] *Wisconsin Initiative on Climate Change Impacts, Wisconsin's Changing Climate: Impacts and Adaptation, Nelson Institute for Environmental Studies, University of Wisconsin-Madison and Wisconsin Department of Natural Resources, 2011. Downscaling is an analysis approach that enables climatological data generated by Intergovernmental Panel on Climate Change general circulation models developed at a relatively coarse geographic scale (e.g., climate change data for several large regions in an entire state) to be modified to represent a finer geographic scale (e.g. at the scale of a county or watershed).*

of the 20th century. Between 1950 and 2006, average annual temperature in the State increased by 1.1°F.[63] In Milwaukee County, the increase was between 1.5 and 2.0°F. Much of this increase in average annual temperature occurred in the form of higher night-time low temperatures. For example, over the period 1950 through 2006, the average number of days in which the daily low temperature fell below 0°F decreased by about six days per year. The greatest increase in temperatures occurred during winter and spring months.

The consensus of downscaled results from climate models is that average annual temperatures will continue to increase through the 21st century.[64] Depending on location, the models project that average annual temperatures in Wisconsin will increase by between 4.0°F and 9.0°F over the period 1980 through 2055. The greatest changes are estimated to occur during the winter months, with average winter temperatures being projected to increase by about 7.5°F. By contrast, average temperatures in the County during the summer are projected to increase by about 5.5°F.

Changes in extreme temperatures will accompany these changes in average temperature. The frequency of extreme daily high temperatures is also predicted to increase based on modeling results. The average number of days per year with daily high temperatures greater than 90°F is currently about 12 in southern Wisconsin. This is likely to double to about 25 days per year by 2055. By contrast, the frequency of extreme daily low temperatures is expected to decrease. The average number of days per year with daily low temperatures below 0°F is currently about 15 in southern Wisconsin. This is projected to decrease to about nine days per year by 2055.

Precipitation

Based on the 30-year average precipitation data during the period of 1981 to 2010 from the official NOAA National Weather Service records, the average annual precipitation at Milwaukee's Mitchell International Airport was 34.8 inches. Average annual precipitation in Wisconsin increased over the last half of the 20th century. Between 1950 and 2006, average annual precipitation in the State increased by about 3.1 inches.[65] It should be noted that there was substantial variability in the change in average annual precipitation across the State, with some areas experiencing increases up to 7.0 inches, while areas in parts of northern Wisconsin experienced decreases in annual precipitation. Areas within the County experienced annual precipitation

[63] *Kucharik and others, 2010, op. cit.*

[64] *Wisconsin Initiative on Climate Change, 2011, op. cit.*

[65] *Kucharik and others, 2010, op. cit.*

increases over this period of between 4.5 and 6.0 inches. Much of the increase in average precipitation occurred during autumn months. In Milwaukee County, average precipitation during autumn months increased between 2.0 and 2.5 inches over the period from 1950 through 2006. Increases in precipitation also occurred to a lesser degree during winter, spring, and summer.

The frequency and magnitude of heavy precipitation events has also been increasing in Wisconsin. Extreme rainfall patterns in the City of Milwaukee illustrates this trend. In the decade between 2001 and 2010, there were 24 days in which 2.0 inches or more of precipitation fell in a single event. This is twice the previous maximum of 12 days with 2.0 inches or more of precipitation, which occurred in the decade between 1951 and 1960.

The consensus from downscaled results of climate models predict several changes in precipitation through the 21st century.[66] Most of the models project an increase in average annual precipitation in Southeastern Wisconsin of about 1.5 to 2.0 inches. The models indicate that the amount of precipitation falling during winter is likely to increase by about 25 percent. Due to the projected increase in temperatures, it is estimated that a greater amount of precipitation occurring during the winter will fall as rain rather than snow.[67] This will be accompanied by both an increase in the likelihood of freezing rain events and decreases in snow depth and snow cover. Model projections also show that Wisconsin will receive more precipitation and more frequent and intense precipitation events during the spring, especially during early spring. As in winter, it will become more likely for early spring precipitation to fall as rain rather than snow. The total amount of precipitation occurring during the summer is not projected to change much, but the models also indicate that the frequency of intense rainfall events will increase. In southern Wisconsin, the frequency of precipitation events in which two or more inches fall in a 24-hour period is expected to increase from about 12 events per decade to 15 events per decade by the middle of the 21st century. These changes will be concentrated in the spring and fall. The projections also indicate that the magnitude of the heaviest precipitation events will also increase. The shift to more heavy rainfall events but little change in total summertime precipitation implies that more dry days will occur in Wisconsin during the summer. More dry days, coupled with higher summer temperatures and the increases in evapotranspiration that may result from higher temperatures, may lead to an increase in the likelihood of summer droughts.

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[66] *Wisconsin Initiative on Climate Change Impacts, 2011, op. cit.*

[67] *Michael Notaro, David J. Lorenz, Daniel Vimont, Stephen Vavrus, Christopher Kucharik, and Kristie Franz, "21st Century Wisconsin Snow Projections Based on Operational Snow Model Driven by Statistically Downscaled Climate Data," International Journal of Climatology, Volume 31, pages 1615-1633, 2011.*

Effects of Climate Change on Water Resources

Climate directly affects water resources and such resources can serve as indicators of climate change at various temporal and spatial scales. The Wisconsin Initiative on Climate Change Impacts (WICCI) has concluded that projected future climate conditions may influence the quantity and quality of the State of Wisconsin's water resources. WICCI also found clear evidence from analysis of past trends and probable future climate projections that there will be different hydrologic responses to climate change in different geographic regions of the State. The differences may affect local variations in land use, soil type and surface deposits, groundwater characteristics, and runoff and seepage responses to precipitation which illustrates the importance of considering the potential climate change effects on local hydrologic conditions and as part of a watershed restoration plan strategy.

Climate change appears to be altering the availability of water (volume), the distribution of rainfall over time, and whether precipitation falls as rain or snow, each of which affects the water cycle. Most of the water entering the landscape arrives as precipitation (rain and snowfall) that falls directly on waterbodies; or runs off the land surface and enters streams, rivers, wetlands, and lakes; or percolates through the soil, recharging groundwater that flows underground and re-emerges as springs discharging into lakes, wetlands, and streams. Even in the absence of climate change, when one part of the system is affected, all other parts are impacted. For example, an overdrawn groundwater aquifer used to irrigate crops or to provide potable water supply can lead to a reduction or complete loss in discharge of a local stream. More importantly, climate change exposes the vulnerabilities of water availability within a given area, and this vulnerability is proportional to how much humans have altered how water moves through the water cycle (e.g. through reducing groundwater recharge potential during land development and/or withdrawals from aquifers). This vulnerability becomes particularly evident during periods of prolonged drought conditions.

As discussed above, downscaled climate models predict that there will be an increase in annual precipitation in southeastern Wisconsin, as well as an increase in precipitation falling as rain rather than snow due to higher temperatures. In addition, the frequency and magnitude of larger rainfall events is projected to increase. The combination of the above projections will likely lead to higher peak stream flows which can often lead to increased streambank erosion and sediment transport, as well as increases in nutrients and other pollutants entering the streams. While intense rainfall events are expected increase, there is projected to be little change in total summertime precipitation, implying that there will be longer stretches of dry weather. These periods of dry weather could lead to decreased summertime baseflows, and when combined with warmer air temperatures, may produce increased water temperatures which can have a harmful impact on fish and other aquatic life.

The WICCI Water Resources Working Group (WRWG) incorporated WICCI's 1980-2055 projections for temperature, precipitation (including occurrence of events), and changes in snowfall to guide their evaluation of potential impacts to hydrologic processes and resources.[68] The team of experts prioritized the highest potential climate change impacts on water resources and proposed adaptation strategies to address impacts across the State of Wisconsin as summarized below:

- Minimize threats to public health and safety by anticipating and managing for extreme events through effective planning;

- Increase resiliency of aquatic ecosystems to buffer the impacts of future climate changes by restoring or simulating natural processes, ensuring adequate habitat availability, and limiting human impacts on resources. Examples include limiting groundwater and surface water withdrawals, restoring or reconnecting floodplains and wetlands, and maintaining or providing migration corridors for fish and other aquatic organisms;

- Stabilize future variations in water quantity and availability by managing water as an integrated resource, keeping water "local," and supporting sustainable and efficient water use for humans and the environment; and

- Maintain, improve, or restore water quality under a changing climate regime by promoting actions to reduce nutrient and sediment loading.

Changing climatic conditions are significant elements to water quality conditions within Milwaukee County and these adaptive strategies are important to protecting surface water and groundwater quality and quantity within the County.

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[68]The Water Resources Working Group (WRWG) included 25 members representing the Federal government, State government, the University of Wisconsin System, the Great Lakes Indian Fish and Wildlife Commission, and the Wisconsin Wetlands Association. For more details on climate change, impacts, adaptation, and resources visit www.wicci.wisc.edu/water-resources-working-group.php.

Climate Change Strategies[69]

Responding to climate change involves two possible approaches; mitigation, which for the purposes of this plan is defined as an approach that focuses on reducing and stabilizing the levels of heat-trapping greenhouse gases in the atmosphere; and adaptation, which focuses on adjusting to or reducing the vulnerability to the actual or expected effects of climate change. Climate change effects and protective procedures are already factored into a variety of regional, County, and local plans, (such as County and City of Milwaukee Hazard Mitigation Plans)[70] which may focus on managing the increasingly extreme disasters and the associated risks; protecting coastlines and coping with increasing lake-level encroachment; utilizing best management practices for land and forests; managing and planning for a reduction in water availability; developing resilient food sources; and protecting energy and public infrastructure.

Mitigation strategies to be implemented may include developing or redeveloping urbanized areas more compactly and sustainably; retrofitting buildings to make them more energy efficient; adopting renewable energy sources such as solar, wind, and geothermal; developing more sustainable transportation options such as rapid transit, electric vehicles, and biofuels; and promoting more sustainable uses of land and forests.

Adaptation strategies to be implemented may include developing flood defenses during major flooding events, developing measures to prevent or limit coastline damages due to high lake levels and/or extreme weather events; installing water-permeable pavements to manage flooding, run-off, and stormwater issues, providing security for buildings, facilities, and infrastructure; restoring the natural landscape and reforestation; and improving water storage and use.

The latest available data and research[71] has indicated that some amount of increased warming and climate change has already occurred and will occur due to previously emitted carbon. However, the same data and research indicate that it is possible to avoid the greatest amounts of warming and climate change if actions are taken to reduce carbon emissions. Therefore, a combination of both strategies is necessary to combat

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[69]*Information detailed at www.climate.nasa.gov/solutions/adaptation-mitigation/ and in a report titled,* Climate Change 2014-Impacts, Adaptation, and Vulnerability, *prepared by the Intergovernmental Panel on Climate Change, 2014*.

[70]*www.sewrpc.org/SEWRPC/communityassistance/Hazard-Mitigation-Planning.htm*.

[71]*Documented in a report titled.* Climate Change 2021-The Physical Science Basis*, prepared by the Intergovernmental Panel on Climate Change, August 7, 2021*.

the effects of climate change. Mitigation addresses the causes of climate change, while adaptation addresses the impacts of climate change. Even with strong mitigation efforts, the climate would continue changing over time and adaptation to these changes is necessary. On the other hand, adaptation will not be able to eliminate all negative impacts and mitigation is crucial to limit changes in the climate system.

3.8 CONSERVATION PROGRAMS

Coordination with Federal, State, regional, and local agencies is paramount to protecting the land and water resources of Milwaukee County. The conservation programs mentioned below are vital to the successful implementation of this plan. The positive integration of programs and funding sources administered by the County and its cooperating agencies is essential to accomplishing the workplan objectives set forth in Chapter 4.

Federal Programs

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a voluntary conservation program that supports agriculture and environmental quality as compatible goals. Through EQIP, farmers may receive financial and technical help with structural and management conservation practices on agricultural land. EQIP offers contracts through the NRCS for conservation practice implementation for periods ranging from one to 10 years, and it pays up to 75 percent of the costs of eligible conservation practices. The program may also make incentive payments and cost share payments to encourage a farmer to adopt land management practices such as nutrient management, manure management, integrated pest management, or wildlife habitat management. Portions of the Wildlife Habitat Incentives Program (WHIP) were carried over into this program.

Conservation Stewardship Program

The Conservation Stewardship Program (CSP) helps agricultural producers maintain and improve their existing conservation systems and adopt additional conservation activities to address priority resources concerns. CSP contracts are for five years, but successfully fulfilling the initial contract (and agreeing to additional conservation objectives) allows the opportunity to compete for an additional five-year term. To meet the renewal stewardship threshold, the participant must agree to meet or exceed two additional priority resource concerns or agree to adopt or improve conservation activities to achieve higher levels of conservation on two existing priority resource concerns. Contract payments are based upon the existing level of conservation on the land uses included in the contract, an NRCS assessment of the existing

stewardship at the time of enrollment and implementing additional conservation activities. The program design is for working lands and is the largest conservation program in the United States with 70 million acres of productive agricultural and forest land enrolled.

Resource Conservation and Development

The Resource Conservation and Development (RC&D) program was established by the Federal Agricultural Act of 1962. This Act directs the USDA to help units of government conserve and properly utilize all resources in solving local issues. Wisconsin has seven RC&Ds, covering all Wisconsin counties. Milwaukee County is a member of the Town and Country RC&D area which was organized to cover 13 counties in southeastern Wisconsin. The Town and Country RC&D helps to facilitate the development and coordination of existing and innovative projects and will assist in finding funding to implement them. Town and Country RC&D has helped promote agricultural, energy, water quality, and educational projects and programs throughout the Region.

The Wildlife Restoration Program

The Wildlife Restoration Program, the nation's oldest wildlife restoration program, through the U.S. Fish and Wildlife Service provides grants to State fish and wildlife agencies for projects to restore, conserve, manage, and enhance wildlife and wildlife habitat. This program provides up to 75 percent Federal cost-share assistance for eligible projects and requires a 25 percent match from non-Federal sources. This program provides up to 100 percent Federal cost-share assistance for eligible insular projects. Eligible projects include identification, restoration, and improvement of areas of land or water adaptable as feeding, resting, or breeding places for wildlife.

The State Wildlife Grants Program

The U.S. Fish and Wildlife Service through the State Wildlife Grants Program provides Federal grant funds to State fish and wildlife agencies for the development and implementation of projects for the benefit of fish and wildlife and their habitats, including species that are not hunted or fished. Priority is placed on projects that protect species of greatest conservation concern. Two types of grants are made under this program: planning grants and implementation grants. Planning grants provide up to 75 percent Federal cost-share assistance for eligible projects and require a 25 percent match from non-Federal sources. Implementation grants under this program provide up to 65 percent Federal cost-share assistance for eligible projects and require a 35 percent match from non-Federal sources.

Healthy Forests Reserve Program

The Healthy Forests Reserve Program (HFRP) helps landowners restore, enhance, and protect forestland resources on private lands through easements and financial assistance. Through the program, landowners promote the recovery of endangered and threatened species under the Endangered Species Act, improve plant and animal diversity, and enhance carbon sequestration. The program provides landowners with 10-year restoration agreements and 30-year or permanent easements for specific conservation actions. Some landowners may avoid regulatory restrictions under the Endangered Species Act by restoring or improving habitat on their land for a specified period of time. Lands enrolled in the HFRP easements must be privately owned, and restore, enhance, or measurably increase the recovery of threatened or endangered species, improve biological diversity, or increase carbon storage.

Agricultural Conservation Easement Program

The Agricultural Conservation Easement Program (ACEP) helps landowners, land trusts, and other entities protect, restore, and enhance wetlands, grasslands, and working farms and ranches through conservation easements.

Under the Agricultural Land Easements component, the ACEP helps state and local governments, American Indian tribes, and non-governmental organizations protect working agricultural lands and limit non-agricultural uses of the land. The NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. In the case of working farms, the program helps farmers and ranchers keep their land in agriculture. Lands eligible for agricultural land easements includes cropland, rangeland, grassland, pastureland, and nonindustrial private forest land. The NRCS may contribute up to 50 percent of the fair market value of the agricultural land easement. When protecting grasslands of special environmental significance, the NRCS may contribute up to 75 percent of the fair market value of the agricultural land easement.

Under the Wetlands Reserve Easements component, the ACEP helps to restore, protect, and enhance enrolled wetlands. The NRCS provides technical and financial assistance directly to private landowners and Indian tribes to restore, protect, and enhance wetlands through the purchase of a wetland reserve easement. Lands eligible for wetland reserve easements includes farmed or converted wetlands that can be successfully and cost-effectively restored. This program offers landowners three options: permanent easements, 30-year easements, and term easements, with a minimum 10-year duration for each option. For permanent easements, the WRP pays 100 percent of the easement value for the purchase of the easement and between 75 to 100 percent of the restoration cost. For 30-year easements, the WRP pays 50 to 75 percent of the

easement value for the purchase of the easement. In addition, the program pays 50 to 75 percent of restoration costs. For term easements, the WRP pays 50 to 75 percent of the easement value for the purchase of the easement and between 50 to 75 percent of restoration costs. Term easements are easements that are for the maximum duration allowed under applicable State laws. Under the 2008 Federal Farm Bill, municipalities are no longer eligible for payments under WRP, but private landowners remain eligible.

The 2014 Farm Bill streamlines and consolidates the Wetlands Reserve Program and the Grasslands Reserve Program into this program.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program (RCPP) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS helps producers through partnership agreements and RCPP conservation program contracts. The program encourages partners to join in efforts with producers to increase the restoration and sustainable use of soil, water, wildlife, and related natural resources on regional or watershed scales. Eligible partners include agricultural or silvicultural producer associations, farmer cooperatives or other groups of producers, state or local governments, American Indian tribes, municipal water treatment entities, water and irrigation districts, conservation-driven non-governmental organizations, and institutions of higher education. Eligible participants may enter into conservation program contracts or easement agreements under the framework of a partnership agreement. In 2020, a current RCPP project in southeastern Wisconsin and Milwaukee County includes the Milwaukee River Watershed Conservation Partnership.

Emergency Watershed Protection Program

The Emergency Watershed Protection Program (EWP) was established by Congress to respond to emergencies created by natural disasters and to take emergency measures to safeguard lives and property after a natural occurrence has caused a sudden impairment of a watershed. Hazards include floods and the products of erosion created by floods, fire, windstorms, or other natural disasters. Local sponsors such as city, County, State, and Tribal governments sponsor Emergency Watershed Protection projects. Sponsors are responsible for 25 percent of the construction costs, which can be direct cash expenditures or in-kind materials or services. The NRCS works with the sponsors to identify watershed impairments that threaten life and/or property (and defines property as significant infrastructure such as dwellings, office buildings, utilities, bridges and roads, but not land). The program cannot utilize funds to solve problems or remedy conditions that existed before the disaster or event. Through the Floodplain Easement portion of the

program, the NRCS may purchase easements on any floodplain lands that have a history of repeated flooding.

Watershed Protection and Flood Prevention Program

The purpose of the Watershed Protection and Flood Prevention Program (including River Basin operations) is to assist Federal, State, local agencies, local governments, Tribal governments, and program participants to protect and restore watersheds from damage caused by erosion, floodwater, and sediment, to conserve and develop water and land resources, and solve natural resource and related economic problems on a watershed basis. The program provides technical and financial assistance to local landowners or project sponsors, builds partnerships, and requires local and state funding contributions. Project sponsors can propose land treatment solutions or structural solutions. An approved watershed plan must be in place prior to initiation of any corrective land treatment or structural solution. Under this program, cities and villages in Milwaukee County that have been affected by flooding issues have worked closely with the Wisconsin Division of Emergency Management to secure FEMA Hazard Mitigation Grant Program funds to purchase properties in the Kinnickinnic, Menomonee, Milwaukee, and Root River floodplains and the Oak Creek floodplain.

Great Lakes Restoration Initiative

The Great Lakes Restoration Initiative (GLRI) is a multiagency Federal effort that targets the most significant environmental problems affecting the Great Lakes. Federal agencies do the work of the GLRI guided by five-year Action Plans. Action Plan III includes input from states, tribes, local governments, universities, business, and others. It outlines priorities and goals for the GLRI for the fiscal years 2020 to 2024, working to accelerate environmental progress in five focus areas: toxic substances and Areas of Concern; invasive species; nonpoint source pollution impacts on nearshore health; habitats and species; and foundations for future restoration areas. Grant opportunities for restoration projects are available, primarily through the Environmental Protection Agency (EPA). Specifically, the EPA and its partner agencies agree on program and project priorities to implement the GLRI Action Plan. The EPA then appropriates money, which in turn provides funding to other Federal government agencies. Those agencies, and the EPA, use that money to fund restoration projects, which the Federal agencies themselves, or other entities such as states, tribes, local governments, universities, or nongovernmental organizations then undertake.

Conservation Reserve Program

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners that provides annual rental payments and cost-share assistance to establish long-term, resource-conserving covers on

eligible farmland. The program was originally authorized by the Food Security Act of 1985 and was reauthorized by the 2018 Farm Bill. The CRP goal is to reduce soil erosion, protect the nation's ability to produce food and fiber, reduce sedimentation in streams and lakes, improve water quality, establish wildlife habitat, and enhance forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as a prairie-compatible, noninvasive forage mix; wildlife plantings; trees; filter strips; or riparian buffers. Farmers receive an annual rental payment for the term of the 10- to 15- year contract based on the agriculture rental value of the land, and up to 50 percent Federal cost sharing to establish vegetative cover. The FSA, an agency of the USDA, administers the program with the NRCS providing technical assistance. NRCS works with landowners to develop their application, and to plan, design, and install the conservation practices on the land.

The Conservation Reserve Enhancement Program (CREP) is a part of the CRP. The CREP targets specific state or nationally significant conservation concerns. In exchange for removing environmentally sensitive land from production and establishing permanent resource conserving plant species, each CREP agreement pays farmers and ranchers an annual rental rate along with other Federal and non-Federal incentives as applicable. Participation is voluntary, and the contract period is typically 10 to 15 years. While both the CREP and the CRP focus on environmentally sensitive lands, CREP is a partnership between state governments and the Federal government. This partnership is in place to address high priority conservation concerns, and CREP cannot enroll land in the program if the state does not have a CREP agreement.[72]

Other programs that are also part of the CRP, or which the Farm Service Agency administers, include among others: the CRP Grasslands; the Emergency Conservation Program; and the Emergency Forest Restoration Program. Further information about these programs can be viewed at the Farm Service Agency website at www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index.

State and Local Programs

Soil and Water Resource Management Program

DATCP administers Wisconsin's soil and water resource management program (SWRM) under the provisions of Chapter 92 of the *Wisconsin Statutes* and Chapter ATCP 50 of the *Wisconsin Administrative Code*. The SWRM grant program supports locally led conservation efforts. Awarding of grant funds to counties pays for conservation staff and provide landowner cost-sharing to implement their LWRMP. The

[72]*Wisconsin's CREP agreement, in place since 2001, focuses on environmentally sensitive land next to rivers and streams and two designated geographic areas for wildlife habitat.*

current version of Chapter ATCP 50, revised in February 2018, relates specifically to agricultural programs and it establishes requirements and/or standards for:

- Soil and water conservation on farms
- County soil and water programs, including land and water resource management plans
- Grants to counties to support county conservation staff
- Cost-share grants to landowners for implementing conservation practices
- Design certifications by soil and water professionals
- Local regulations and ordinances
- Cost-share practice eligibility and design, construction, and maintenance

Targeted Runoff Management Grant Program

The Targeted Runoff Management (TRM) Grant Program, in operation since 1999, was significantly revised effective January 1, 2011. Administering Targeted Runoff Management Grants is through Chapter NR 153 and NR 154 of the *Wisconsin Administrative Code*. These grants provide technical and financial assistance to local governments for managing nonpoint source pollution. Most grants address agricultural problems. The agricultural project grants address many types of water resources, including impaired waters in areas with Total Maximum Daily Load (TMDL), impaired waters outside TMDL areas, high-quality surface waters threatened by degradation, and ground water protection and improvement. Agricultural projects can vary in scale, from small-scale projects addressing a single farm to larger-scale projects that address agricultural sources on a watershed basis. The program requires that projects outside a TMDL area must implement the State's agricultural nonpoint source performance standards and prohibitions set forth in Chapter NR 151. Projects designed to implement TMDLs may also implement practices that indirectly achieve State standards and prohibitions as long as the management practices require achievement of the goals of the TMDL. Targeted Runoff Management (TRM) Grants also provide funding for a limited number of urban storm water

construction projects but restrict the urban TRM projects to TMDL areas.[73] Only small-scale projects are available in urban areas.

All TRM grants provide 70 percent cost sharing for construction of management practices, with up to 90 percent cost sharing available for agricultural projects where the farmer qualities for economic hardship. Large scale TRM projects may also provide limited funding for staff support. Each year, the WDNR establishes caps on grant amounts consistent with available funding.

Chapter NR 153 also administers the Notice of Discharge Grants. Notices of Discharge are issued by the WDNR under Chapter NR 243, "Animal Feeding Operations." WDNR issues Notices of Discharge to small and medium livestock operations that fail to meet Federal point source discharge requirements or that are causing fecal contamination of a drinking water well. In many of these cases, this requires the farmer to fix the site regardless of cost sharing. However, the WDNR may decide to offer a grant to help facilitate site clean-up. Not cleaning up problem sites results in issuance of WPDES permits or referral to the Wisconsin Department of Justice for prosecution. The WDNR and DATCP work jointly to address these sites.

Urban Nonpoint Source and Storm Water Management Grant Program

The Urban Nonpoint Source and Storm Water Management Grant Program provides cost-share funds for planning or construction activities for controlling nonpoint source pollution from urban areas. Projects funded by this program are site-specific, serve areas smaller in size than a sub-watershed, and target high-priority problems. Eligible applicants include cities, villages, towns, counties, regional planning commissions, and special purpose districts such as lake districts, sewerage districts, and sanitary districts. In addition, an "urban project area" must meet at least one of the following criteria:

- The area has a residential population density of at least 1,000 people per square mile

- The area has a commercial land use

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[73]Chapters NR 154 and NR 155, which administer a companion grant program, the Urban Nonpoint Source Storm Water Management Grant Program, complements the TRM Program by making grants for urban areas available Statewide for a variety of planning and construction activities. These urban grants are available to address a wide range of water resources including impaired waters in TMDL areas, impaired waters outside TMDL areas, high quality waters that are threatened by stormwater runoff, and groundwater that is threatened or degraded by stormwater runoff.

- The area is a portion of a privately-owned industrial site not covered by a WPDES permit issued under Chapter NR 216 of the *Wisconsin Administrative Code*

- The area is a municipally owned industrial site

The maximum cost-share rate available for planning grants is 50 percent of eligible costs. The cap on the total State share for planning projects is $85,000. The maximum cost-share rate available for construction grants is 50 percent of eligible costs, with a total State share for a construction project of $150,000 and a potential grant of an additional $50,000 for land acquisition, where needed. Planning grants can pay for a variety of eligible activities, including stormwater management planning for existing and new development, related information and education activities, ordinance and utility district development, and enforcement. Construction grants can pay for construction of best management practices to control stormwater pollution from existing urban areas. Projects may be eligible for funding whether or not they are designed to meet the performance standards identified in Section NR 151.13 of the *Wisconsin Administrative Code*, but the highest priority in selecting projects under this program is given to projects that implement performance standards and prohibitions contained in Chapter NR 151 or that address waterbodies listed on the Federal Section 303(d) list of impaired waters.

Knowles-Nelson Stewardship Program

The Knowles-Nelson Stewardship Program preserves the State's most significant land and water resources for future generations and provides the land base and recreational facilities needed for quality outdoor experiences. The program achieves these goals by funding the acquisition of land and easements for conservation and recreation purposes, developing and improving recreational facilities, and restoring wildlife habitat. The administrative rules for the program are set forth in Chapter NR 50 and NR 51 of the *Wisconsin Administrative Code*. The program provides 50 percent matching grants to local units of government and qualified nonprofit conservation organizations for the acquisition of land and easements. To maintain eligibility to apply for and receive such funding, local units of government must prepare and periodically update a park and open space plan.

Lake Protection Grant and River Protection Grant Programs

The Lake Protection Grant program as set forth in Chapter NR 191 of the *Wisconsin Administrative Code* assists local governments, lake districts and associations, and other nonprofit organizations in improving and protecting water quality in lakes. A 75 percent State cost-share is available, with a 25 percent local match. Projects that are eligible for cost-share assistance include land acquisition for easement

establishment, wetland restoration, and various lake improvement projects such as those involving pollution prevention and control, diagnostic feasibility studies, and lake restoration.

The River Protection Grant program as set forth in Chapter NR 195 of the *Wisconsin Administrative Code* assists local governments, lake districts and associations, and other nonprofit organizations in improving and protecting water quality in rivers. A 75 percent State cost-share is available, with a 25 percent local match. Cost-share funding cannot exceed $50,000 for a management project. The types of projects that are eligible for cost-share assistance include management activities such as land acquisition, easement establishment, ordinance development, installation of nonpoint source pollution abatement projects, river restoration projects, and river plan implementation projects.

Municipal Flood Control Grant Program

Under Chapter NR 199, "Municipal Flood Control Grants," of the *Wisconsin Administrative Code* municipalities, including cities, villages, and towns, as well as metropolitan sewerage districts are eligible for cost-sharing grants from the State for projects to minimize flooding and flood-related damages. Projects may include acquisition and removal of structures; floodproofing of structures; riparian restoration projects, including removal of dams and other artificial obstructions, restoration of fish and native plant habitat, erosion control, and streambank restoration projects; acquiring vacant land to create open-space flood storage areas; constructing structures for collecting, retaining, storing, and transmitting stormwater and groundwater for flood control; and preparing flood insurance studies and other flood mapping projects. Municipalities and metropolitan sewerage districts are eligible for up to 70 percent State cost-share funding for eligible projects and have to provide at least a 30 percent local match.

Clean Water Fund Program

The State Clean Water Fund Program (CWFP) provides financial assistance to municipalities for the planning, design, and construction of projects to control and treat urban stormwater runoff. Eligible applicants include counties, cities, villages, towns, town sanitary districts, public inland lake protection and rehabilitation districts, and metropolitan sewerage districts. Eligible projects must relate to either a WPDES permit, a performance standard, or a plan approved by the WDNR. The primary purpose of an eligible urban runoff project must be to improve water quality. The program provides loans at an interest rate of 65 percent of the current CWFP market rate.

The CWFP also has a Small Loan Program that provides interest rate subsidies to municipalities that have a loan from the State Trust Fund Loan Program for the planning, design, and construction of urban runoff projects with total estimated costs of $1 million or less.

Wisconsin Coastal Management Program

The Department of Administration, Bureau of Intergovernmental Relations administers the Wisconsin Coastal Management Program (WCMP). The WCMP is a voluntary State-Federal partnership that works through a council appointed by the Governor to provide policy coordination among State agencies and to award Federal funds to local governments and other entities for implementing initiatives related to managing coastal zones in the State. The program has identified wetlands protection, habitat restoration, public access, land acquisition, nonpoint source pollution control, land use and community planning, natural hazards, and Great Lakes education projects as current priorities. The program also aids local governments in managing and protecting shorelands, wetlands, and floodplains through zoning and permitting.

Wisconsin Surface Water Grant Program

The WDNR is proposing to consolidate five related administrative code chapters governing three cost-sharing grant programs into one new administrative code chapter. This would create a comprehensive surface water grant program that provides financial assistance to nonprofit organizations and governmental units to protect and restore surface water and aquatic ecosystems and control aquatic invasive species. The Program's two primary activities include: planning projects to help communities understand the condition of aquatic ecosystems and watersheds, collect data, conduct studies, and develop management plans; and management projects to protect and improve water quality and aquatic habitat and prevent and control aquatic invasive species.

MMSD Greenseams Program

The Milwaukee Metropolitan Sewerage District's "Greenseams" Program identifies land that is recommended to be protected for multiple purposes, including flood reduction potential and stormwater management benefits, as well as wildlife habitat, water quality, and recreational benefits. The program identified sites throughout the watersheds within the District's planning area. The partnering between MMSD and public or private agencies and organizations may increase the prospects for funding assistance through the Wisconsin Stewardship program in support of land acquisition or the purchase of conservation easements. It is envisioned that the sites acquired by the MMSD would eventually be conveyed to the appropriate county or local unit of government or private nonprofit conservation organization, with MMSD

retaining a conservation easement on such lands. All land acquisitions or purchases of conservation easements by the MMSD or any other public agency would be on a willing-seller basis.

Producer-Led Watershed Protection Program

The Producer-Led Watershed Protection Program focuses on ways to increase farm participation in voluntary efforts by fostering locally led decision making by producers. A Producer-Led Group is located in the northern portion of Milwaukee County as part of the Milwaukee River watershed and is identified as the Milwaukee River Watershed Clean Farm Families. This group is focused on promoting soil health and water quality principles as well as providing funding to area farmers in the project area within the Milwaukee River watershed for implementing conservation practices such as No-Till, cover crops, and harvestable buffers; nutrient management planning; and low-disturbance manure injections. Grant funding is available through DATCP along with matching dollars from organizations such as the Fund for Lake Michigan help farmers address soil and water quality challengers of their local landscapes with innovative and collaborative approaches. It should be noted that the majority of the active farms and farmlands within the Milwaukee River watershed are located in Ozaukee County.

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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

Chapter 3

RELATED PLANS, REGULATIONS, AND PROGRAMS

TABLES

Table 3.1
Guidelines for Development Considered Compatible with Primary Environmental Corridors and Isolated Natural Resource Areas

Component Natural Resource and Related Features Within Environmental Corridors[a]	Permitted Development (see General Development Guidelines below)																
	Transportation and Utility Facilities				Recreational Facilities											Rural-Density Residential Development	Other Development
	Streets and Highways	Utility Lines and Related Facilities	Engineered Stormwater Management Facilities	Engineered Flood Control Facilities[b]	Trails[c]	Picnic Areas	Family Camping[d]	Swimming Beaches	Boat Access	Ski Hills	Golf	Playfields	Hard-Surface Courts	Parking	Buildings		
Lakes, Rivers, and Streams	--[e]	--[f,g]	--	--[h]	--[i]	--	--	X	X	--	--	--	--	--	--	--	--
Riparian Buffer[j]	X	X	X	X	X	X	--	X	X	--	X	--	--	X	X	--	--
Floodplain[k]	--[l]	X	X	X	X	X	--	X	X	--	X	X	--	X	X	--	--
Wetland[m]	--[l]	X	--	--	X[n]	--	--	--	X	--	--[o]	--	--	--	--	--	--
Wet Soils	X	X	X	X	X	--	--	X	X	--	X	--	--	X	--	--	--
Woodland	X	X	X[p]	--	X	X	X	--	X	X	X	X	X	X	X[q]	X	X
Wildlife Habitat	X	X	X	--	X	X	X	--	X	X	X	X	X	X	X	X	X
Steep Slope	X	X	--	--	--[r]	--	--	--	--	X[s]	X	--	--	--	--	--	--
Prairie	--	--[g]	--	--	--[r]	--	--	--	--	--	--	--	--	--	--	--	--
Park	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	--	--
Historic Site	--	--[g]	--	--	--[r]	--	--	--	--	--	--	--	--	X	--	--	--
Scenic Viewpoint	X	X	--	--	X	X	X	--	X	X	X	--	--	X	X	X	X
Natural Area or Critical Species Habitat Site	--	--	--	--	--[q]	--	--	--	--	--	--	--	--	--	--	--	--

Note: An "X" indicates that facility development is permitted within the specified natural resource feature. In those portions of the environmental corridors having more than one of the listed natural resource features, the natural resource feature with the most restrictive development limitation should take precedence.

APPLICABILITY

These guidelines indicate the types of development that can be accommodated within primary environmental corridors and isolated natural resource areas while maintaining the basic integrity of those areas. Throughout this table, the term "environmental corridors" refers to primary environmental corridors and isolated natural resource areas.

Under the regional plan:

- As regionally significant resource areas, primary environmental corridors should be preserved in essentially natural, open use in accordance with the guidelines in this table.
- Secondary environmental corridors and isolated natural resource areas warrant consideration for preservation in essentially natural open use, as determined in county and local plans and in a manner consistent with State and Federal regulations. County and local units of government may choose to apply the guidelines in this table to secondary environmental corridors and isolated natural resource areas.

Table continued on next page.

Table 3.1 (continued)

GENERAL DEVELOPMENT GUIDELINES

- Transportation and Utility Facilities: All transportation and utility facilities proposed to be located within the important natural resources should be evaluated on a case-by-case basis to consider alternative locations for such facilities. If it is determined that such facilities should be located within natural resources, development activities should be sensitive to, and minimize disturbance of, these resources, and, to the extent possible following construction, such resources should be restored to preconstruction conditions.

The above table presents development guidelines for major transportation and utility facilities. These guidelines may be extended to other similar facilities not specifically listed in the table.

- Recreational Facilities: In general, no more than 20 percent of the total environmental corridor area should be developed for recreational facilities. Furthermore, no more than 20 percent of the environmental corridor area consisting of upland wildlife habitat and woodlands should be developed for recreational facilities. It is recognized, however, that in certain cases these percentages may be exceeded in efforts to accommodate needed public recreational and game and fish management facilities within appropriate natural settings. In all cases however, the proposed recreational development should not threaten the integrity of the remaining corridor lands nor destroy particularly significant resource elements in that corridor. Each such proposal should be reviewed on a site-by-site basis.

  The above table presents development guidelines for major recreational facilities. These guidelines may be extended to other similar facilities not specifically listed in the table.

- Rural-Density Residential Development: Rural-density residential development may be accommodated in upland environmental corridors, provided that buildings are kept off steep slopes. The maximum number of housing units accommodated at a proposed development site within the environmental corridor should be limited to the number determined by dividing the total corridor acreage within the site, less the acreage covered by surface water and wetlands, by five. The permitted housing units may be in single-family or multifamily structures. When rural residential development is accommodated, cluster subdivision designs are strongly encouraged.

- Other Development: In lieu of recreational or rural-density residential development, up to 10 percent of the upland corridor area in a parcel may be disturbed in order to accommodate urban residential, commercial, or other urban development under the following conditions: 1) the area to be disturbed is compact rather than scattered in nature; 2) the disturbance area is located on the edge of a corridor or on marginal resources within a corridor; 3) the development does not threaten the integrity of the remaining corridor; 4) the development does not result in significant adverse water quality impacts; and 5) development of the remaining corridor lands is prohibited by a conservation easement or deed restriction. Each such proposal must be reviewed on a site-by-site basis.

  Under this arrangement, while the developed area would no longer be part of the environmental corridor, the entirety of the remaining corridor would be permanently preserved from disturbance. From a resource protection point of view, preserving a minimum of 90 percent of the environmental corridor in this manner may be preferable to accommodating scattered home sites and attendant access roads at an overall density of one dwelling unit per five acres throughout the upland corridor areas.

- Pre-Existing Lots: Single-family development on existing lots of record should be permitted as provided for under zoning at the time the Commission adopted the regional land use plan.

- All permitted development presumes that sound land and water management practices are utilized.

FOOTNOTES

[a] *The natural resource and related features are defined as follows:*

Lakes, Rivers, and Streams: Includes all lakes greater than five acres in area and all perennial and intermittent streams as shown on U.S. Geological Survey quadrangle maps.

Riparian Buffer: Includes a band 50 feet in depth along both sides of intermittent streams; a band 75 feet in depth along both sides of perennial streams; a band 75 feet in depth around lakes; and a band 200 feet in depth along the Lake Michigan shoreline.

Floodplain: Includes areas, excluding stream channels and lake beds, subject to inundation by the 1 percent annual probability flood event.

Wetlands: Includes areas that are inundated or saturated by surface water or groundwater at a frequency, and with a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wet Soils: Includes areas covered by wet, poorly drained, and organic soils.

Woodlands: Includes areas one acre or more in size having 17 or more deciduous trees per acre with at least a 50 percent canopy cover as well as coniferous tree plantations and reforestation projects; excludes lowland woodlands, such as tamarack swamps, which are classified as wetlands.

Wildlife Habitat: Includes areas devoted to natural open uses of a size and with a vegetative cover capable of supporting a balanced diversity of wildlife.

Steep Slope: Includes areas with land slopes of 12 percent or greater.

Prairies: Includes open, generally treeless areas which are dominated by native grasses; also includes savannas.

Park: Includes public and nonpublic park and open space sites.

Historic Site: Includes sites listed on the National Register of Historic Places. Most historic sites located within environmental corridors are archaeological features such as Native American settlements and effigy mounds and cultural features such as small, old cemeteries. On a limited basis, small historic buildings may also be encompassed within delineated corridors.

Scenic Viewpoint: Includes vantage points from which a diversity of natural features such as surface waters, wetlands, woodlands, and agricultural lands can be observed.

Natural Area and Critical Species Habitat Sites: Includes natural areas and critical species habitat sites as identified in the regional natural areas and critical species habitat protection and management plan.

Table continued on next page.

Table 3.1 (continued)

[b] *Includes such improvements as stream channel modifications and such facilities as dams*

[c] *Includes trails for such activities as hiking, bicycling, cross-country skiing, nature study, and horseback riding, and excludes all motorized trail activities. It should be recognized that trails for motorized activities such as snowmobiling that are located outside the environmental corridors may of necessity have to cross environmental corridor lands. Proposals for such crossings should be evaluated on a case-by-case basis, and if it is determined that they are necessary, such trail crossings should be designed to ensure minimum disturbance of the natural resources.*

[d] *Includes areas intended to accommodate camping in tents, trailers, or recreational vehicles which remain at the site for short periods of time, typically ranging from an overnight stay to a two week stay.*

[e] *Certain transportation facilities such as bridges may be constructed over such resources.*

[f] *Utility facilities such as sanitary sewers may be located in or under such resources.*

[g] *Electric power transmission lines and similar lines may be suspended over such resources.*

[h] *Certain flood control facilities such as dams and channel modifications may need to be provided in such resources to reduce or eliminate flood damage to existing development.*

[i] *Bridges for trail facilities may be constructed over such resources.*

[j] *Previous editions of these guidelines identified this category as "Shoreland," rather than "Riparian Buffer." Riparian buffers, as defined in footnote "a" of this table, typically would be located within a State-defined shoreland area (see Chapters NR 115 and NR 117 of the* Wisconsin Administrative Code*).*

[k] *Consistent with Chapter NR 116 of the* Wisconsin Administrative Code.

[l] *Streets and highways may cross such resources. Where this occurs, there should be no net loss of flood storage capacity or wetlands. Guidelines for mitigation of impacts on wetlands by Wisconsin Department of Transportation facility projects are set forth in Chapter Trans 400 of the* Wisconsin Administrative Code.

[m] *Any development affecting wetlands must adhere to the water quality standards for wetlands established under Chapter NR 103 of the* Wisconsin Administrative Code.

[n] *Only an appropriately designed boardwalk/trail should be permitted.*

[o] *Wetlands may be incorporated as part of a golf course, provided there is no disturbance of the wetlands.*

[p] *Generally excludes detention, retention, and infiltration basins. Such facilities should be permitted only if no reasonable alternative is available.*

[q] *Only if no alternative is available.*

[r] *Only appropriately designed and located hiking and cross-country ski trails should be permitted.*

[s] *Only an appropriately designed, vegetated, and maintained ski hill should be permitted.*

Source: SEWRPC

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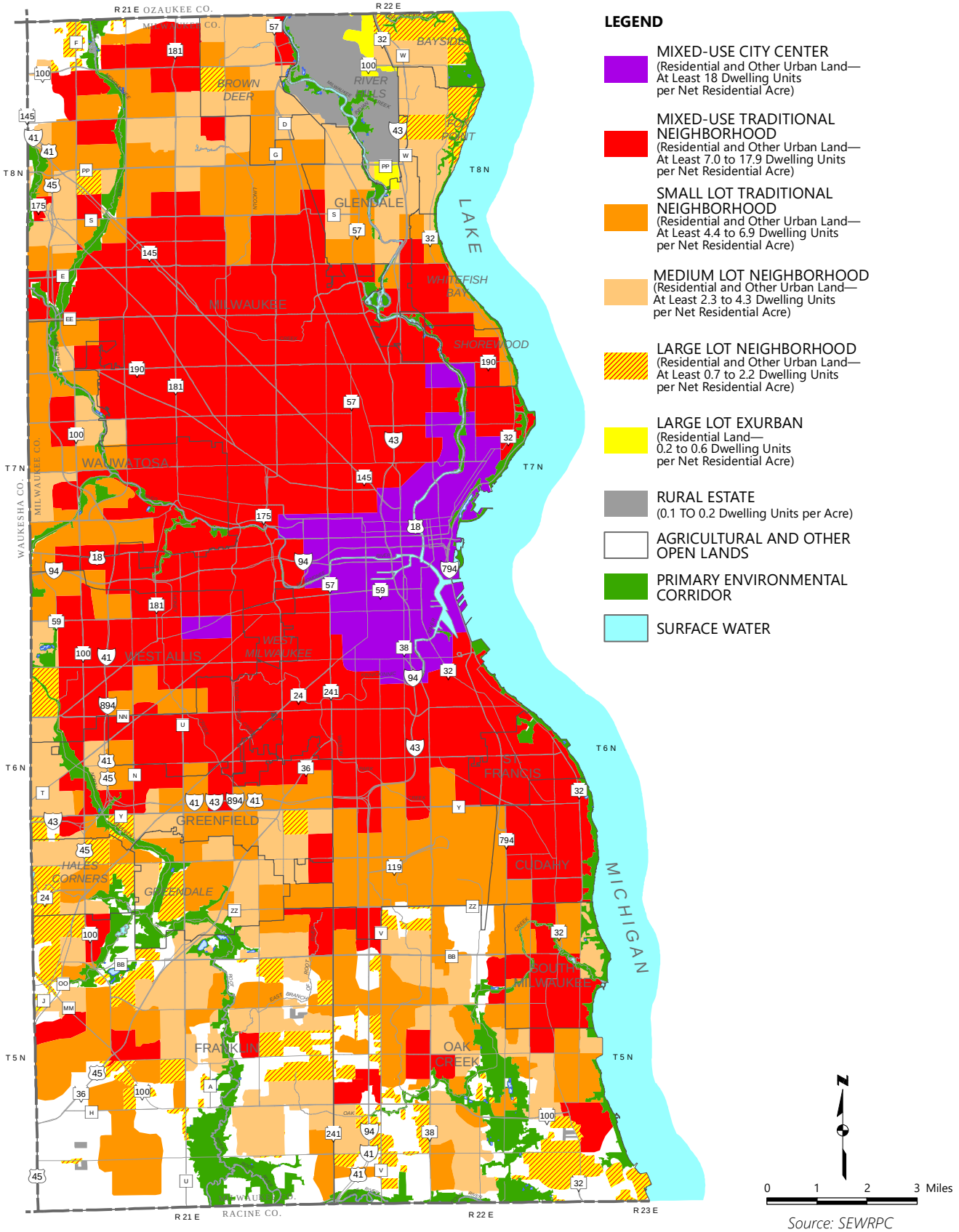
Chapter 3

RELATED PLANS, REGULATIONS, AND PROGRAMS

MAPS

Map 3.1
Regional Land Use Plan as it Pertains to Milwaukee County: 2050



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A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

Chapter 4

GOALS, OBJECTIVES, AND WORK PLAN

4.1 INTRODUCTION

The Milwaukee County land and water resource management plan incorporates inventory findings, including land use, natural resource data, soil and agricultural assets, and water quality data. Additionally, the plan addresses the principal land and water resource concerns and issues that were identified by the Advisory Committee and several other sources. During development of the land and water resource management plan adopted in 2011, the Milwaukee County Land Conservation Department and the County Department of Parks, Recreation and Culture gathered input from several sources. These sources included:

- The County Land Conservation Committee

- The Milwaukee Metropolitan Sewerage District (MMSD) and various water- and conservation-related documents and plans

- The Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water) and its watershed restoration plans

Based on input from the sources described above, five major issues were identified for the purpose of developing goals and objectives for the Milwaukee County land and water resource management plan adopted in 2011:

1. Improve water quality through the reduction of sediment and nutrient delivery to surface waters in Milwaukee County

2. Protect, maintain, and restore land and water resources in Milwaukee County

3. Enhance Lake Michigan bluff protection initiatives

4. Maintain the existing information management network and land information web portal

5. Limit the introduction and reduce the spread of invasive species in Milwaukee County

These issues were used as a basis for developing the goals, work plan objectives, and planned actions for the Milwaukee County Land and Water Resource Management Plan update. Based upon the identified issues, this plan has four goals for the period 2022 through 2031:

1. Improve water quality through the reduction of sediment and nutrient delivery to surface waters in Milwaukee County

2. Protect, maintain, and restore land and water resources in Milwaukee County

3. Enhance Lake Michigan coastline protection initiatives

4. Limit the introduction and reduce the spread of invasive species in Milwaukee County

To achieve these goals the Milwaukee County Land Conservation Department plans to partner with State and Federal agencies, the municipalities within the County, and other interested groups and organizations on a variety of projects and programs.

The recommended goals, work plan objectives, and planned actions for the years 2022 to 2031 are presented in Table 4.1. Milwaukee County's land and water resource management plan is a living document to plan conservation efforts over a ten-year period, therefore, the work plan activities may require amendment due to varying environmental conditions, local priorities and commitments, changing programs and policies, and funding considerations. The general goals of this plan, developed as a part of a public participation process and approved by the Wisconsin Department of Agriculture, Trade, and

Consumer Protection (DATCP), will not change and any necessary amendments to work plan activities would only be accomplished with proper approvals from the Milwaukee County Land Conservation Committee and DATCP.

4.2 EDUCATIONAL PROGRAMMING

Developing and implementing sound educational programming is an important component of a land and water resource management plan. Work plan objectives and action items related to educational programming have been integrated into the work plan set forth in Table 4.1. Work plan objectives related to educational programming include:

- Encourage public awareness of water quality problems and stormwater issues. Ensure that County staff is adequately trained to develop strategies and implement technologies to solve water quality problems (Goal 1)

- Engage and educate County residents about natural resource management (Goal 2)

- Ensure that mapping and the GIS infrastructure are updated on a regular basis (Goal 2)

- Provide information to County staff and residents about how to control invasive species (Goal 4)

In addition to the planned actions under these objectives, educational strategies are indicated by some planned actions related to other work plan objectives.

The planned actions presented in Table 4.1 that are related to educational programming form a framework within which a variety of educational strategies can be used to promote achievement of the goals of the land and water resource management plan. Specific strategies include developing, posting, and distributing reference and educational materials related to the natural resource issues facing the County and approaches to managing the resources and solving resource-related problems; sponsoring and participating in workshops and conferences related to water quality, stormwater, and land and water conservation issues; and responding to inquiries.

Two of the strategies in the work plan merit additional discussion. First, ensuring that mapping and the County's GIS infrastructure are updated regularly will allow the County to continue to provide the public

with access to the most current and extensive geographic data necessary for private landowners to design and implement management strategies. Second, by providing training to students and volunteers and involving them in the County's management of parks and natural areas as well as providing them information about the types of invasive species and the effects and proper eradication of these species, the plan will encourage a broader application of the skills developed that goes beyond just managing County-owned lands.

Much of the County's public educational programming is conducted in collaboration or cooperation with the County's partners in managing land and water resources. These partners include the local governments within the County; State agencies such as DATCP and WDNR; SEWRPC; MMSD; and private organizations, such as the Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water), the Southeastern Wisconsin Invasive Species Consortium (SEWISC), and local friends groups and partners to the Milwaukee County Parks.

4.3 PERFORMANCE STANDARDS IMPLEMENTATION STRATEGY

The goals, work plan objectives, and planned activities presented in this chapter represent part of the framework for an annual work plan that will be developed and carried out by the Milwaukee County Environmental Services Unit over the next ten years. Proposed planned activities were broadly defined to meet future changes in the environment, changes in programs and policies, changes in local priorities, and changes in available funding. As required by DATCP, a more detailed list of planned activities is set forth below as a strategy to implement the nonpoint pollution performance standards and prohibitions under NR 151. In addition, an estimate of the costs associated with plan implementation is provided.

Implementation Strategy (Agricultural)

To implement the previously noted standards and prohibitions in agricultural areas, a systematic and comprehensive approach is necessary. The strategy for implementation, detailed below, is a likely process for implementation with some need for flexibility as program experience develops and fiscal conditions may dictate. In the following sections, the term "landowner" is used broadly to describe the person responsible for compliance with the above-noted standards.

Conduct Information and Education Activities

Milwaukee County Environmental Services Unit will distribute information and educational material prepared by the WDNR and DATCP or others to appropriate landowners. The information will also be

distributed via the County website, public informational meetings, and individual contacts with landowners.

The educational materials will be designed to achieve the following objectives:

- Educate landowners about Wisconsin's agricultural performance standards and prohibitions, applicable conservation best management practices, and cost-share grant and technical assistance opportunities

- Promote voluntary implementation of conservation best management practices necessary to meet the performance standards and prohibitions by providing information through newsletters, brochures, mailings, and individual meetings

- Inform landowners of compliance procedures and agency roles to be used statewide and locally

- Make landowners aware of expectations for compliance and consequences for noncompliance

Identify and Evaluate Farms for Compliance with Standards and Prohibitions

Milwaukee County Environmental Services Unit will begin to use GIS as a tool to identify priority farms for compliance determinations, track progress on implementing performance standards, and meet reporting requirements. Color digital orthophotography taken in spring of 2020 will be used as a base map for initial screening. Water Quality Management Areas (WQMA) (300 feet from a stream or 1,000 feet from a lake or areas susceptible to groundwater contamination) will be delineated using County digital orthophotography and large-scale topographic maps and available GIS water resource layers. Digital land information from the U.S. Department of Agriculture Farm Service Agency will be used to identify field boundaries. Information from the NRCS soil survey may also be used to identify potential locations of runoff or groundwater problems. These data layers combined with a hydrologic data layer will help identify water resources and locate potential problem areas within the WQMA. Agricultural fields and livestock operations within this area can be identified and a list of owners generated from the Land Information System parcel maps. Once the list of landowners is created, Environmental Services staff can conduct a records inventory search for files related to conservation planning for these operations. This would be an initial review to determine potential compliance with the performance standards based on past or present program participation. If no records are found, or if the records are found to be out of date with existing farming operations, an onsite farm visit would be scheduled.

In the initial stages, implementation will focus on high priority areas, WQMA, livestock operations, highly erodible soil areas, and lands slated for development in the distant future. Landowners within these areas will be contacted for compliance evaluation based on initial screening data noted above. Additional onsite review may also be identified through complaints or staff observations. The number of compliance evaluations is limited by existing program efforts and staffing levels.

Work plan objectives in Table 4.1 related to agricultural performance compliance with standards and prohibitions include:

- Comply with the NR 151 Agricultural Performance Standards (Goal 1)

Document and Report Compliance Status

When the records review and onsite evaluations have been completed, an NR 151 Status Report will be prepared and issued to owners of the parcel evaluated. This report will include at a minimum:

- Compliance status of individual parcels with each of the performance standards and prohibitions
- Corrective measure options and an approximate cost estimate to comply with each of the performance standards and prohibitions for which a parcel is not in compliance
- Status of eligibility for available cost-share funding
- Grant funding and technical assistance available from Federal, State, and local government sources and third-party service providers
- An explanation of conditions that apply if public cost share funds are used
- A timeline for completing corrective measures, if necessary
- Signature lines indicating landowner agreement or disagreement with report findings
- Process and procedures for contesting evaluation results to the County
- A copy of performance standards, prohibitions, and technical design standards

All evaluations and compliance status reports will be kept as public record in the office of Milwaukee County Environmental Services. If a landowner agrees with the initial compliance determination and no corrective actions are required, a Letter of NR 151 Compliance would be issued, and the site mapped appropriately on the Milwaukee County Land Information System. If a landowner disagrees with the initial compliance determination, the landowner may meet and discuss concerns with Environmental Services staff regarding the compliance determination process and results. The landowner may choose to follow the local appeals process if there is still a disagreement about the conclusions after the meeting.

Offer Technical Assistance and Available Cost-Share Funding to Implement Appropriate Best Management Practices

If a site is determined to be out of compliance with the State standards, technical assistance and cost-sharing may be offered to the landowner to bring them into compliance. A list of conservation practices likely to be utilized to meet State performance standards and potential sources of cost-share funding is set forth in Appendix D. Since 2010, the Milwaukee County Conservation Department made several mailings to State or Federally listed farmers within the County which informed them of the available funding that is allocated to the County annually.

State law requires that cost sharing be made available to bring older livestock facilities and cropland practices into compliance with standards and prohibitions. Cost-sharing is not required for new livestock facilities or cropland practices. In addition, once a livestock facility or cropland is brought into compliance with a standard or prohibition, the landowner and all future landowners of those parcels are required to maintain compliance in perpetuity regardless of future cost share availability. When cost sharing is required, a landowner would not be required to comply until such time that cost-sharing becomes available. However, if cost-share funding is offered as part of a formal notice meeting the requirements of sections NR 151.09 or NR 151.09 of the *Wisconsin Administrative Code*, and a landowner refuses to make the corrective actions needed to bring the site into compliance, the landowner will be required to achieve compliance through stepped enforcement and will lose eligibility under some programs to get additional cost sharing to fix the standards violation. In these cases, the landowner will be required to fix the site at the landowner's expense.

Administer Funding and Technical Assistance

Once a landowner agrees to implement the corrective actions to bring the site into compliance with the State standards, and if cost-sharing is involved, the cost-share agreement and schedule for

implementation will be executed. If technical assistance is required, it will be arranged through appropriate agencies/staff with the proper engineering credentials or conservation planning certifications.

After the corrective measures are applied, the site will be re-evaluated to determine if the parcel has been brought into compliance with the relevant performance standards or prohibitions. If the site is in compliance, the NR 151 Status Report would be updated to include a Letter of NR 151 Compliance. This would serve as official notification that the site complies with applicable performance standards and prohibitions. Under NR 151, once a site is in compliance, it is required that the site remain in compliance for perpetuity without additional cost sharing being required.

Issue Required Notices and Enforcement Activities

Following compliance status notification and issuance of any notices required by State law, enforcement action may commence if appropriate action is not taken by the landowner/operator according to deadlines set forth in the notice.

Generally, a NR 151 Violation Letter would be sent via certified mail to notify the landowner of the violation and explain possible enforcement action that may follow. It is anticipated that the Environmental Services Unit would refer certain cases to the WDNR for further enforcement, depending on site-specific circumstances and whether the performance standard violation is also a violation of Milwaukee County ordinances.

Compliance Monitoring and Annual Reporting

Milwaukee County Environmental Services Unit will use GIS and develop a spreadsheet database to track the status of agricultural fields and operations and to record progress on implementing performance standards and meet reporting requirements. Compliance monitoring may be done as random spot checks or through scheduled inspections of sites previously cost-shared. Annual reports of monitored active and inactive agricultural fields will be compiled to evaluate the progress of administering performance standards and prohibitions and submitted to the WDNR and DATCP.

Implementation Strategy (Nonagricultural)

To implement the standards and prohibitions described in Chapter 3 of this report to the nonagricultural areas, a systematic and comprehensive approach will be necessary. Runoff pollution from urban lands can be the leading cause of water quality problems in some areas. As in rural areas, the main pollutant is sediment, or small bits of soil particles washed into streams and lakes. Attached to the soil particles are

nutrients such as phosphorus that fuel the growth of algae and weeds in bodies of water. Other pollutants from urban areas include flakes of metal from vehicles, particles from vehicle exhaust, bits of tire and brake linings, soot from smokestacks, lead, zinc, pet waste, leaves, grass clippings, and a variety of chemical compounds.

Because all the municipalities in the County are incorporated, those communities have continued to administer stormwater management, general erosion control, and the erosion control measures for development within the shoreland zone, except in those areas addressed by the County municipal separate storm sewer discharge permit. Information on the relevant local ordinances for the municipalities within Milwaukee County was presented in Chapter 3 of this report. All the cities and villages in the County have stormwater management and construction site erosion control plans or ordinances. All the municipalities in the County with shoreland wetlands have adopted shoreland-wetland zoning ordinances. All the municipalities in the County with identified flood hazard areas have adopted floodland zoning ordinances.

It should be noted that local erosion control ordinances do not apply to single-family home construction as these are regulated under Comm 21 *Wisconsin Administrative Code*. By State *Statute*, Comm 21 supersedes all local ordinances.

Work plan objectives in Table 4.1 related to nonagricultural performance implementation strategies include:

- Implement NR 216 Stormwater Requirements and Comply with the WPDES NR 216 Permit (Goal 1)
- Minimize Introductions of Chloride into Surface Waters of the County (Goal 1)
- Manage Contaminated Sediments for Water Quality Benefit (Goal 2)

4.4 STATUS OF 2012-2021 WORKPLAN

When County staff and the plan committee reviewed and evaluated the goals and objectives for this plan update's workplan (Table 4.1), most of the updates were slight modifications to the goals and objectives from the County land and water resource management plan adopted in 2011. However, this plan update includes four goals, a reduction of one goal from the 2011 plan. Goal #4 from the 2011 plan, *Maintain the*

Existing Information Network and Land Information Web Portal, was not included for this plan update because the County is confident of the technological advances and security measures that are currently in place for the network. The County Land Information Office, which operates the County land information network and web portal and develops and maintains the data, has received considerable funding to vastly improve the technological hardware and security of the data, thus the risk of losing the existing data or having the compiled data compromised is extremely minimal. Increased funding for the County land information network was necessary due to the surge in public use of the web portal over the last decade.

Most of the objectives in the workplan (Table 4.1) for the plan update had minor modifications that still reflected the same intent and content from the 2011 plan. However, three new objectives were added to Goal #2 and include:

- Ensuring that mapping and the Geographical Information System (GIS) infrastructure be updated regularly

- Implement Countywide and Regional Restoration Plans

- Wildlife Management Program

Most of the modifications to the plan update's workplan (Table 4.1) were to the planned actions. Slight modifications were made to planned actions identified in Goals #1 and #3. Modifications to planned actions in Goal #1 were primarily related to implementing NR 216 requirements and Goal #3 to Lake Michigan shoreline protection measures and recreational use and access. The majority of the modifications to the workplan were to planned actions in Goal #2. Besides the addition of planned actions to the new objectives listed above, other planned actions were refined and updated due to their corresponding objectives being refined to reflect the current conditions or forthcoming conditions in the County.

4.5 PARTNERSHIP EFFORTS

Milwaukee County has conducted many of its land and water resource conservation activities in cooperation and collaboration with a variety of partners. Notable partners in these efforts during the years 2012 through 2021 are listed in Table 1.1 in Chapter 1 of this report. As indicated in the work plan set forth in Table 4.1, and identified in previous chapters of this report, particularly the partners listed in Table

1.1 of this report, the County will continue to maintain and expand these partnerships, as appropriate. The work plan identifies land and water conservation activities that will require partnership efforts to help minimize the harmful effects to land and water resources in the County and provide a safe and healthy use of those resources by County residents. Those partnerships include, but are not limited to, preventing beach closures due to bacterial contamination; identifying, acquiring, and protecting Natural Areas and other significant natural resource areas; conducting and promoting bluff, shoreline, and streambank stabilization projects to reduce erosion; improving public access to Lake Michigan, rivers, and river corridors; implementing conservation plans and programs; and providing various educational references.

As discussed in Chapter 3 of this report, nine-key element plans have been developed or are currently being developed within portions of Milwaukee County to comply with the USEPA's nine minimum elements of a watershed plan. The Kinnickinnic and Root River watershed restoration plans have been developed and the Menomonee River and the Oak Creek watershed restoration plans are currently being developed. These plans were or are currently being developed as collaborative efforts with various public and private environmental entities that focus on improving water quality and applying conservation techniques in the County.

In 2010, the Milwaukee Metropolitan Sewerage District, in collaboration with the Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water), developed watershed restoration plans for the Kinnickinnic and Menomonee River watersheds. Sweet Water updated the Kinnickinnic watershed restoration plan in 2018 to comply with the USEPA's nine-key elements. Sweet Water developed Kinnickinnic River watershed improvements through a comprehensive and collaborative implementation of priority projects and practices in four main categories: water quality, flood management and water quantity, habitat, and recreational use.

In the Menomonee River watershed, Sweet Water, in collaboration with SEWRPC, is currently preparing an update to the watershed restoration plan with the focus of developing potential projects related to agricultural runoff, stormwater management, riparian buffer installation, nutrient load reduction, streambank stabilization, and educational outreach related to the management of pet waste.

Sweet Water, in collaboration with the Root-Pike Watershed Initiative Network (Root-Pike WIN) and SEWRPC, also developed a watershed restoration plan for the Root River watershed. The plan seeks to develop specific, targeted recommendations to preserve, restore, and improve the natural environment by focusing on four areas: water quality, recreational access and use, habitat conditions, and flooding. The

plan recommendations were targeted for implementation from 2014 to 2019, but since the plan is comprehensive in scope, implementation will continue well beyond 2019.

SEWRPC is currently preparing an update to the Oak Creek watershed restoration plan, including collaborative efforts with stakeholders from Milwaukee County and MMSD. The plan will identify projects to manage and restore water resources in the Oak Creek watershed and will provide a guide for addressing the water quality impairments identified in the watershed. The plan will also include specific, targeted restoration and improvement recommendations to address four focus issues: water quality, recreational access and use, habitat conditions, and targeted stormwater drainage and flooding issues.

In addition, Milwaukee County Parks staff and SEWRPC staff have collaborated to identify new Critical Species Habitat sites throughout the County, and ultimately, the new Critical Species Habitat sites will be included in an amendment of the Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, which is currently being prepared by SEWRPC. County Parks staff has meticulously inventoried wildlife populations throughout the Parks system over several years and has resulted in the discovery of a number of previously undocumented State and Federally listed wildlife populations. County Staff provided locations to SEWRPC after confirming several Critical Species populations in the field throughout the County. SEWRPC staff mapped the Critical Species sites based on suitable habitat near a point location for each record provided by the County. The new Critical Species Habitat sites are listed in Table 4.2 and shown on Map 4.1. It should be noted that this information was collected following the publication of the 2010 Amendment to the Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, and thus, does not appear in any adopted plans.

These projects and other joint efforts may present opportunities for the County to engage in collaborative efforts to meet the goals and objectives of the Milwaukee County land and water resource management plan.

4.6 ESTIMATED COSTS OF PLAN IMPLEMENTATION

Since this plan does not have the authority to establish county budget items, the estimated costs provided below are solely intended to satisfy State LWRM planning requirements and do not in any way represent anticipated Milwaukee County Environmental Services Unit budgets. It is also assumed that no additional staff resources will be made available to implement this plan beyond what is currently allocated

to land and water conservation programs in the County (approximately three full time employees). The cost estimates contained in Table 4.3 are based on average annual costs to maintain existing program efforts and staffing levels. In addition, pursuant to the planned actions in Table 4.1, the estimated costs for plan implementation in Table 4.3 also take into account maintaining and enhancing existing partnerships and developing new partnerships.

The cost-sharing estimates in Table 4.3 are based on a statutory requirement of 70 percent cost-sharing and are dependent on the need for landowners to comply with the State performance standards described earlier in this chapter. Agricultural land uses comprise a small portion of the area in Milwaukee County. In addition, Milwaukee County has only a few livestock operations remaining. Therefore, compared to other Wisconsin counties, the costs to meet these requirements should be nominal. Portions of Milwaukee County have, however, been under intensive agriculture for over a hundred years and many of the County's streams have accumulated sediment throughout that period. If a new standard is established for stream buffers, and nutrient management standards are enforced, these costs could be greater. Average salary increases and inflationary costs are included in the increases shown each year. Currently, all cost-share funding is acquired from Federal and State sources, the Milwaukee County Environmental Services Unit will continue to apply for grants to supplement those funds. The table assumes that Milwaukee County's current budgeted staffing level of three full time employees is maintained, and it assumes stable segregated and bonding cost-share funds by the State. Conservation practices, such as diversions, riparian buffers, filter strips and building projects such as manure storage facilities, concrete barnyards, and roofed feedlots are considered "hard practices." Cropping practices, such as nutrient management and conservation tillage, are known as "soft practices." The projected cost-share needs for installing hard and soft best management practices over the next five years (2022 to 2026) is only an approximate estimate due to uncertain funding levels, changing land use and farm economy, and increasing practice installation costs.

Even though this updated plan is anticipated to be approved by DATCP for the next 10 years, through 2031, the projected costs associated with this plan update only include those through 2026, because DATCP requires that all County land and water resource management plans be reviewed and recertified by DATCP after five years, thus the projected costs for those remaining years (2027 to 2031) will be provided when the County submits and presents its five-year review and potential recertification of this plan.

The procedures and cost estimates outlined in this chapter represent the best estimates of the Milwaukee County Environmental Services Unit at the time the plan was prepared and are all subject to change. No attempt is made to identify the source of funding beyond the assumptions noted above. All the estimated costs are subject to the annual budget processes at the County, State, and Federal levels. Milwaukee County will make every attempt to take advantage of the wide array of grants and partnerships that may be available through public or private sources to implement this plan.

4.7 STAFFING

It is reasonable to assume that the existing staff will be able to provide a significant portion of the time required to implement this plan. If additional support is needed, it will be obtained through cooperative ventures with local universities, colleges, and volunteer groups; consultants, and limited-term or seasonal staff increases. As cited in various areas of this report, the County Land Conservation Department has been successful in its efforts to develop volunteers for its natural area management activities.

SEWRPC Community Assistance Planning Report No. 312 (2nd Edition)

A LAND AND WATER RESOURCE MANAGEMENT PLAN FOR MILWAUKEE COUNTY: 2022-2031

Chapter 4

GOALS, OBJECTIVES, AND WORK PLAN

TABLES

Table 4.1
Milwaukee County Workplan: 2022-2031

Workplan Objective	Planned Actions	Status of Planned Actions	Agencies[a]	Priority[b]	Progress Tracking
Goal 1: Improve Water Quality Through the Reduction of Sediment and Nutrient Delivery to Surface Waters in Milwaukee County					
Encourage Public Awareness of Water Quality Problems and Stormwater Issues. Ensure that County Staff is Adequately Trained to Develop Strategies and Implement Technologies to Solve Water Quality Problems	Work with local agencies and organizations to hold educational workshops and conferences designed to train consultants, inspectors, municipalities, developers, and County personnel about technologies and regulatory codes related to stormwater and water quality issues	Ongoing	ES, MCP, DATCP, WDNR, MMSD, SWWT	M	--
	Respond to walk in, telephone, and e-mail inquiries	Ongoing	ES, MCP	H	As needed
	As requested, give presentations to university classes, public groups, and others on stormwater and water quality issues	Ongoing	ES, MCP	M	--
Implement NR 216 Stormwater Requirements and Comply with the WPDES NR 216 Permit	Conduct dry weather screening at major and priority outfalls	Ongoing	ES	H	Screen all major outfalls annually
	Maintain stormwater pollution prevention plans (SWPPP) for applicable County facilities	Ongoing	ES, County departments	H	Maintain and meet requirements for all required plans
	Implement an Illicit Discharge Detection and Elimination Program for Milwaukee County	Ongoing	ES, County Departments	H	Program startup/number of outfalls inspected
	Disconnect illicit connections as they are discovered	Ongoing	ES, County departments	H	As needed
	Inspect and maintain County-owned, -operated, and -permitted structural stormwater facilities	Ongoing	ES	H	Inspect facilities once per year
	Update and maintain County storm sewer map	Ongoing	ES	H	Continually updated
	Assess/Maintain compliance with TMDL requirements	Ongoing	ES	H	Meet permit requirements
	Work with partners to provide pet litter management, supplies, and signage in high traffic areas within the park system	Ongoing	ES, MCP, Friends groups, SWWT	M	--
	Implement Winter Pavement Management Program	Ongoing	ES, County Departments	H	Meet permit requirements/amount of chlorides reduced
	Comply with WDNR Annual Reporting Requirements	Ongoing	ES	H	Meet permit requirements
Implement Countywide and Regional Restoration Plans	Referenced in Goal #2 under the Objective, "Implement Countywide and Regional Restoration Plans"	Ongoing	Several	M	--

Table continued on next page.

Table 4.1 (Continued)

Workplan Objective	Planned Actions	Status of Planned Actions	Agencies[a]	Priority[b]	Progress Tracking
Goal 1: Improve Water Quality Through the Reduction of Sediment and Nutrient Delivery to Surface Waters in Milwaukee County (continued)					
Work with Partners to Identify and Implement Measures to Prevent Future Beach Closings Resulting from Bacterial Contamination	Assist researchers working to identify sources of bacterial contamination by providing access to pertinent information on research findings	Ongoing	DAS, MMSD, UWM GLWI	H	Provide available information as requested
	Continue beach grading and grooming	Ongoing	MCP	H	Maintain established frequency
	Continue gull and goose abatement activities at selected locations with nuisance populations	Ongoing	MCP	H	Document nuisance conditions biannually at selected locations
Conduct and Promote Streambank Stabilization Projects and Projects Employing Best Management Practices (BMPs) to Reduce Erosion	Work with stakeholders to seek funding for streambank stabilization projects	Ongoing	ES, MCP, MMSD, SWWT	M	--
	Work with lessees of County lands and State agencies to install filter strips, riparian buffers, and other appropriate BMPs on agricultural parcels	Ongoing	MCP, ES, DATCP, WDNR, FSA, NRCS	M	--
	Install riparian buffers as a part of stormwater and streambank related projects	Ongoing	DAS, MCP, MMSD, WDNR, SWWT	M	--
	Complete high priority projects listed in the County Streambank Assessment Report	Ongoing	DAS, MCP, SWWT	M	--
	Work with stakeholders and project partners to increase public awareness of the causes of streambank erosion and the efforts to correct these problems through press releases, web pages, and/or educational displays	Ongoing	DAS, MCP, DATCP, WDNR, SWWT	M	--
	Implement recommendations relating to soil erosion and water quality outlined in the updated Milwaukee County Agricultural Lease Policy	Ongoing	MCP, ES, DATCP, NRCS, FSA	L	--
Implement the Recommendations Outlined in the County Pond and Lagoon Management Plan	Continue monitoring County park ponds and lagoons	Ongoing	MCP, ES	M	--
	Continue aquatic macrophyte management activities	Ongoing	MCP	M	--
	Conduct additional improvement projects recommended in the Pond and Lagoon Management Plan	Ongoing	MCP, ES	M	--
	Post multilingual educational signs at the sites of pond and lagoon projects to inform park visitors about problems at the lagoons and methods for improving water quality	Ongoing	MCP, ES	M	--
	Initiate consideration of a long-term program to address sediment deposition in County ponds and lagoons	Ongoing	MCP, ES	H	Program start up
Comply with the NR 151 Agricultural Performance Standards	Annually monitor agricultural fields to ensure compliance with NR 151 standards and prohibitions	Ongoing	ES	H	Annually monitor one field for compliance
	Develop and maintain a database for tracking the status of agricultural fields and operations	Ongoing	ES	H	Develop database for tracking compliance

Table continued on next page.

Table 4.1 (Continued)

Workplan Objective	Planned Actions	Status of Planned Actions	Agencies[a]	Priority[b]	Progress Tracking
Goal 1: Improve Water Quality Through the Reduction of Sediment and Nutrient Delivery to Surface Waters in Milwaukee County (continued)					
Comply with the NR 151 Agricultural Performance Standards (continued)	Conduct a soil loss survey during the plan period to determine whether the rate of soil loss is under "T," the tolerable rate of soil loss	Ongoing	ES, TSP	L	Conduct one soil survey every five years
	Identify priority farms and operations and notify noncompliant operators	Ongoing	ES, DATCP, NRCS, WDNR	H	Identify and inventory one priority farm per year
	Provide cost-share and technical assistance to priority farm landowners to implement BMPs. Information may be provided through newsletters, brochures, mailings, and one-on-one meetings	Ongoing	ES, DATCP, NRCS, WDNR	H	Use 100 percent of allotted cost-share funding
Minimize Introductions of Chloride into Surface Waters of the County	Use road deicing best practices in order to reduce introductions of chloride into the environment	Ongoing	DAS, MCP, County departments, local governments	H	Work with partners to develop best practices
Goal 2: Protect, Maintain, and Restore Land and Water Resources in Milwaukee County					
Restore and Maintain the Ecological Functionality of Milwaukee County Natural Areas	Continue to inventory and monitor ecological diversity (science-based flora and fauna surveys)	Ongoing	MCP, Local colleges, Friends groups	M	--
	Continue to convert Milwaukee County-owned farmland and underused mowed turf grass areas to native grasslands, forests, and wetlands	Ongoing	MCP, Local colleges, Friends groups	M	--
	Continue to undertake land management practices such as: oak woodland restoration, invasive species control, prescribed burning, etc. to restore and manage wildlife habitat	Ongoing	MCP, Local colleges, Friends groups	M	--
	Seek external funding to assist with ecological restoration and management activities	Ongoing	MCP	H	--
	Continue to develop site specific ecological restoration and management plans for MCP natural areas	Ongoing	MCP	H	Develop five management plans annually
Engage and Educate County Residents about Natural Resource Management	Conduct and/or support public and professional workshops on topics such as: invasive species management; human wildlife interactions; benefits of native plants for pollinators; bird conservation; etc.	Ongoing	MCP, SEWISC	M	--
	Continue the MCP Community-based Science Program that engages private citizens in scientific research (flora and fauna surveys) within the MCP natural areas	Ongoing	MCP	M	--
	Use social media to highlight important conservation projects or topics	Ongoing	MCP	H	Number of posts

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Table 4.1 (Continued)

Workplan Objective	Planned Actions	Status of Planned Actions	Agencies[a]	Priority[b]	Progress Tracking
Goal 2: Protect, Maintain, and Restore Land and Water Resources in Milwaukee County (continued)					
Engage and Educate County Residents about Natural Resource Management (continued)	Conduct ecological restoration work days that allows the public to learn hands-on restoration techniques from County staff	Ongoing	MCP	M	--
	Continue to provide natural resource presentations at community events, universities/colleges, and at professional conferences	Ongoing	MCP	M	--
	Work with nature centers within Milwaukee County (Wehr, Urban Ecology Center's three branches, and Schlitz Audubon) to further an ecological conscience amongst county residents	Ongoing	MCP	M	As needed
	Continue to provide hands-on field experience opportunities to seasonal staff and college interns in the Natural Sciences fields of study	Ongoing	MCP	M	--
Maintain and Acquire High-Quality Natural Areas in Accordance with the Milwaukee County Parks and Open Space Plan/Protect the Remaining Privately-Owned Natural Areas Located Within Milwaukee County	Maintain and expand partnerships with local conservation organizations and other municipalities to identify, protect, and manage Milwaukee County natural areas highlighted by the latest version of SEWRPC's Natural Areas Plan as: critical species habitat sites; natural areas of local and regional significance; and primary and secondary environmental corridors and isolated natural areas	Ongoing	MCP	H	As needed
	Work with private landowners and partner organizations to acquire and manage natural areas from willing sellers	Ongoing	MCP, ES, WDNR, SWWT	M	--
	Seek external funding (grants and donations) to acquire natural areas, or use creative and mutually beneficial land swaps with interested parties to exchange parkland of presently low ecological value for private natural areas of high ecological value	Ongoing	MCP, ES, WDNR	M	--
Maintain Land in River Corridors for Recreational Use and Access	Maintain and enhance facilities to provide and improve access to river corridors and rivers at appropriate locations	Ongoing	MCP, DAS, WDNR	M	--
	Pursue partnerships on projects to improve access to river corridors and rivers	Ongoing	MCP, DAS, WDNR, MMSD	M	--
	Seek grant opportunities for providing and improving access to river corridors and rivers	Ongoing	MCP, WDNR	M	--
Manage Contaminated Sediments for Water Quality Benefit	Support efforts to determine best strategies for managing contaminated sediments	Ongoing	USEPA, WDNR, MMSD	M	--
	Support efforts to implement best strategies for managing contaminated sediments	Ongoing	USEPA, WDNR, MMSD	M	--

Table continued on next page.

Table 4.1 (Continued)

Workplan Objective	Planned Actions	Status of Planned Actions	Agencies[a]	Priority[b]	Progress Tracking
Goal 2: Protect, Maintain, and Restore Land and Water Resources in Milwaukee County (continued)					
Ensure that Mapping and the GIS Infrastructure are Updated on a Regular Basis	Maintain partnerships with local governments, State agencies, and other organizations to share data	Ongoing	MCLIO, SEWRPC, WDNR, MMSD, Local governments	M	--
	Update GIS data and layers as new or updated data become available	Ongoing	MCLIO, ES	H	Updates as available
Implement Countywide and Regional Restoration Plans	Work to implement the recommendations and attempt to meet the milestones within SEWRPC's Watershed Restoration Plans for the Root River watershed and the Oak Creek watershed	Ongoing	ES, MCP, SEWRPC, WDNR, Local Group/ Municipalities, MMSD	M	--
	Work to implement the recommendations and attempt to meet the milestones within the WDNR-led Menomonee River Watershed Plan and the Kinnickinnic River Watershed Restoration Plan	Ongoing	ES, MCP, SEWRPC, WDNR, Local Group/ Municipalities, MMSD	M	--
	Work to implement the recommendations and attempt to meet the milestones of Root-Pike WIN's Wind Point Watershed-Based Restoration Plan	Ongoing	ES, Local Group/ Municipalities, MCP, SEWRPC, WDNR	M	--
	Work with the WDNR, USEPA, and partner organizations to implement the Milwaukee River Estuary Area of Concern Remedial Action Plan	Ongoing	EPA, ES, MCP, SEWRPC, WDNR, Local Group/ Municipalities, MMSD	M	--
	Work to implement SEWRPC's Natural Areas Management Plan for Southeastern Wisconsin	Ongoing	MCP, SEWRPC	M	--
	Continue to develop and/or refine internal natural resource management policies that guide everyday activities within the County Park System	Ongoing	MCP	M	--

Table continued on next page.

Table 4.1 (Continued)

Workplan Objective	Planned Actions	Status of Planned Actions	Agencies[a]	Priority[b]	Progress Tracking
Goal 2: Protect, Maintain, and Restore Land and Water Resources in Milwaukee County (continued)					
Wildlife Management Program	Work with partners to use the latest science to manage or reduce over-abundant populations of wildlife that are causing degradation or other damage, including threats to ecological health or human health and safety. Initial targeted species would include Canada geese, white-tailed deer, and American beavers	Ongoing	MCP	M	--
	Continue to implement Milwaukee County's Coyote Management Plan that was developed by the MCP, WDNR, and UW-Madison	Ongoing	MCP, WDNR	M	--
	Continue to monitor and mitigate for bird window strikes at Milwaukee County facilities/buildings	Ongoing	MCP, County Departments	M	--
Goal 3: Enhance Lake Michigan Coastline Protection Initiatives					
Continue to Improve and Maintain Lake Michigan Shoreline Protection Measures and Abate Shoreline Erosion Problems in Milwaukee County Parks	Conduct or partner on bluff stabilization and shoreline protection projects	Ongoing	MCP, DAS	H	Conduct or partner on one bluff stabilization or shoreline stabilization project
	Enforce the Milwaukee County Coastline Management Guidelines	Ongoing	MCP, ES	M	--
Maintain Lakefront Land for Recreational Use and Access	Seek partnerships on projects to improve lake access	Ongoing	MCP, DAS, WDNR	M	--
	Enhance facilities to provide and improve access	Ongoing	MCP, DAS, WDNR	M	--
	Promote and enforce lakebed protective trust guidelines (Protective Trust Doctrine)	Ongoing	Milwaukee County, MCP	M	--
Goal 4: Limit the Introduction and Reduce the Spread of Invasive Species in Milwaukee County					
Provide Information to County Staff and Residents About How to Control Invasive Species	Conduct invasive species training for Milwaukee County employees involved in land and water resource management	Ongoing	MCP, WDNR, SEWISC	H	One training annually
	Update MCP's invasive species management guide as new techniques and knowledge become available	Ongoing	MCP	M	--
	Conduct invasive species removal workdays in County parks and natural areas for community volunteers and university students	Ongoing	MCP, Friends groups, colleges and universities	H	Conduct 30 workdays annually
	Post and distribute materials related to invasive species identification and management and respond to direct inquiries and telephone and e-mail inquiries	Ongoing	MCP, WDNR, SEWISC	H	As needed
	Work with partners to develop reference and educational materials related to invasive species identification and management	Ongoing	MCP, MMSD, WDNR, SEWISC	M	--

Table continued on next page.

Table 4.1 (Continued)

Workplan Objective	Planned Actions	Status of Planned Actions	Agencies[a]	Priority[b]	Progress Tracking
Goal 4: Limit the Introduction and Reduce the Spread of Invasive Species in Milwaukee County (continued)					
Develop a Comprehensive and Coordinated Approach to the Management of Invasive Species in Milwaukee County	Inventory Milwaukee County-managed property for species listed as prohibited or restricted under NR 40	Ongoing	MCP	H	Inventory 40 sites
	Establish a task force from applicable County departments to develop an "umbrella" invasive species management policy to guide County invasive species management activities	Ongoing	MCP, County departments	H	Complete the policy
	Prioritize Milwaukee County-managed properties for the development of site-specific invasive species management plans	Ongoing	MCP	H	10 sites annually
	Develop site-specific invasive species management plans for Milwaukee County-managed properties	Ongoing	MCP	H	10 sites annually
	Update MCP's invasive species management guide as new techniques and knowledge become available	Ongoing	MCP	M	--
Manage Infestations of Invasive Species in Milwaukee County-Managed Properties	Conduct invasive species training for Milwaukee County employees involved in land and water resource management	Ongoing	MCP, WDNR, SEWISC	H	One training annually
	Restore native plant communities in infested sites	Ongoing	MCP	H	10 sites annually
	Conduct invasive species control efforts in accordance with the MCP quick reference guide	Ongoing	MCP, Friends groups	H	20 sites annually
	Manage ash trees on County lands in accordance with the MCP Emerald Ash Borer Preparedness Plan	Ongoing	MCP, WDNR	H	As needed

[a] *Agency acronyms used in this table are defined as follows:*

DAS = Milwaukee County Department of Administrative Services
DATCP = Wisconsin Department of Agriculture, Trade and Consumer Protection
ES = Milwaukee County Environmental Services
FSA = U.S. Department of Agriculture Farm Services Agency
MCLIO = Milwaukee County Land Information Office
MCP = Milwaukee County Parks
MMSD = Milwaukee Metropolitan Sewerage District
NRCS = U.S. Department of Agriculture Natural Resources Conservation Service
SEWISC = Southeast Wisconsin Invasive Species Consortium
SEWRPC = Southeastern Wisconsin Regional Planning Commission
SWWT = Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water)
TSP = Technical Services Provider
UWM GLWI = University of Wisconsin Great Lakes WATER Institute
USEPA = U.S. Environmental Protection Agency
WDNR = Wisconsin Department of Natural Resources

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Table 4.1 (Continued)

[b] *Priority symbols are defined as follows:*

H = High priority for implementation
M = Medium priority for implementation
L = Low priority for implementation

Source: Milwaukee County Environmental Services; Milwaukee County Parks Department; and SEWRPC

Table 4.2
Critical Species Habitat Sites Identified in Milwaukee County Between 2010 and 2021

Number on Map 4.1	Site Name	Location	Ownership	Size (acres)	Area/Species of Concern
1	Baran Park Woods	T6N R22E Section 8 City of Milwaukee	Milwaukee County	5	Dry-mesic woods along the eastern border of Baran Park supporting rare wildlife species
2	Bay View Clay Banks	T6N R22, Sections 14 and 15 City of Milwaukee and City of St. Francis	Milwaukee County	14	Clay bluffs along Lake Michigan supporting a State special concern plant species
3	Bender Habitat Area	T5N R22E Sections 24 and 25 City of Oak Creek	Milwaukee County	246[a]	A large undeveloped mix of restored and remnant natural communities supporting rare species
4	Big Bay Woods	T8N R22E Sections 33 and 34 Village of Whitefish Bay	Milwaukee County and Village of Whitefish Bay	6	Woodland bordering Lake Michigan supporting rare wildlife species
5	Brown Deer Park Pond	T8N R21E Section 13 City of Milwaukee	Milwaukee County	10	Pond supporting a State designated species of special concern
6	Caesar's Woods	T7N R22E Section 21 City of Milwaukee	Milwaukee County and private	3	Degraded woods supporting rare wildlife species overlooking the Milwaukee River
7	Camelot Park Woods	T5N R22E Section 10 City of Oak Creek	Milwaukee County and private	28[b]	Site contains the endangered plant species, Blue-stemmed goldenrod
8	County Grounds Park	T7N R21E Sections 20 and 21 City of Wauwatosa	Milwaukee County and private	87	Surrogate grassland and marsh supporting several rare animals
9	Currie Park	T7N R21E Section 7 City of Wauwatosa	Milwaukee County	76	Woodland and shrub thicket mosaic within a golf course supporting a State listed threatened mammal
10	Dretzka Park	T8N R21E Section 7 City of Milwaukee	Milwaukee County	177	Woodland and shrub thicket mosaic within a public park containing two State listed species
11	Estabrook Woods	T7N R22E Sections 4 and 5 City of Milwaukee, City of Glendale, Village of Shorewood, and Village of Whitefish Bay	Milwaukee County and State of Wisconsin	80	Woods and grassland supporting rare species along the Milwaukee River
12	Fox Point Clay Bluffs and Beach	T8N R22E Section 21 Village of Fox Point	Private	8	Clay seepage bluffs along Lake Michigan supporting a State threatened and special concern plant
13	Froemming Woods and Grasslands	T5N R21E Sections 22 and 23 City of Franklin	Milwaukee County	316	Grassland, woodlands, and wetlands along the Root River supporting several listed wildlife species
14	Grantosa Creek	T7N R21E Sections 5 and 8 City of Milwaukee and City of Wauwatosa	Milwaukee County	6	Wooded riparian area supporting rare wildlife species
15	Hart Park/Psychiatric Hospital Woods	T7N R21E Sections 21, 22, 27, and 28 City of Wauwatosa	Milwaukee County	49[c]	Site contains the threatened plant species, Forked aster, and five rare plant species; Golden seal, Twinleaf, Broad-leaved puccoon, Hoptree, and Black haw

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Table 4.2 (continued)

Number on Map 4.1	Site Name	Location	Ownership	Size (acres)	Area/Species of Concern
16	Harwood Avenue Woods	T7N R21E Section 21 City of Wauwatosa	Milwaukee County	49[d]	Site contains the threatened plant species, Forked aster, and two rare plant species, Twinleaf and Hoptree
17	Holler Park Woods	T6N R22E Section 29 City of Milwaukee	Milwaukee County	11	Small remnant dry-mesic forest supporting a rare insect species
18	Humboldt Park	T6N R22E Section 9 City of Milwaukee	Milwaukee County	27	Urban forested park containing a rare insect and bird population
19	Jackson Park Woods	T6N R21E Section 12 City of Milwaukee	Milwaukee County	26	Dry-mesic forest remnant within an urban park containing rare wildlife populations
20	Kohl Park Woods	T8N R21E Section 4 City of Milwaukee	Milwaukee County	103	Woodland, shrub thicket, and grasslands supporting wildlife listed as State special concern
21	Lincoln Creek Woods	T8N R21E Section 36 and T8N R22E Section 31 City of Milwaukee	Milwaukee County	20	Mesic forest and hardwood swamp along Lincoln Creek containing a species listed as special concern
22	Lincoln Park Woods	T8N R22E Section 32 City of Glendale and City of Milwaukee	Milwaukee County	63	Woods bordering the Milwaukee River in an urban park supporting several rare wildlife species
23	Little Menomonee River Habitat Area	T8N R21E Sections 5, 8, 17, 20, 29, and 31 City of Milwaukee	Milwaukee County and private	337	Disturbed habitat mosaic along the Little Menomonee River supporting many rare species
24	Melody View Preserve	T8N R21E Section 16 City of Milwaukee	Milwaukee County and private	18	Old field and shrub thicket containing a rare wildlife population
25	Menomonee River Habitat Area	T8N R21E Section 31 City of Milwaukee	Milwaukee County	80	Low woods and marsh along the Menomonee River containing rare plant and animal populations
26	Milwaukee River 1	T8N R22E Section 19 City of Glendale	Milwaukee County	13	Riparian woodland adjacent to the Milwaukee River containing a State Threatened wildlife population
27	Milwaukee River 2	T8N R22, Section 30 City of Glendale	Milwaukee County	10	Small woodland connected to the Milwaukee River containing rare wildlife species
28	Milwaukee River Habitat Area	T7N R22E Sections 9 and 16 City of Milwaukee	Milwaukee County and private	33	Wooded area along the banks of the Milwaukee River including open parkland, floodplain forest, and southern dry-mesic forest. The woods provide habitat for several State listed plant and animal populations
29	Mitchell Boulevard Park	T7N R21E Section 26 City of Milwaukee	Milwaukee County	4	A small woodland, shrub thicket, and old field supporting a State special concern insect
30	Mitchell Park Woods	T7N R22E Section 31 City of Milwaukee	Milwaukee County	8	Woods and shrub thicket in an urban park supporting a State special concern insect
31	Monarch Trail	T7N R21E Section 20 City of Wauwatosa	University of Wisconsin Milwaukee	20	Prairie planting, old field, and oak savanna containing rare insect populations
32	Oak Creek 14	T5N R22E Section 34 City of Oak Creek	Milwaukee County and private	54	Marsh and woods along a tributary to the Root River containing a rare species of wildlife

Table continued on next page.

Table 4.2 (continued)

Number on Map 4.1	Site Name	Location	Ownership	Size (acres)	Area/Species of Concern
33	Oak Creek 15	T5N R22E Section 34 City of Oak Creek	Milwaukee County and private	146	Large wetland complex along a tributary to the Root River supporting several rare wildlife species
34	Riverton Meadows	T5N R22E Section 15 City of Oak Creek	Milwaukee County	4	Upland and lowland woods containing a state special concern crustacean
35	Root River Habitat Area	T6N R21E Sections 7 and 18 City of West Allis	Milwaukee County	39	Floodplain woods and marsh bordering the Root River containing rare plant and animal species
36	Root River Habitat - South	T5N R21E Sections 4 and 5 City of Franklin and Village of Greendale T6N R21E Sections 32 and 33 Village of Greendale and Village of Hales Corners	Milwaukee County and private	344	Extensive degraded floodplain forest along the Root River containing rare plant and animal species
37	Scout Lake Park Woods	T6N R21E Section 35 Village of Greendale	Milwaukee County	61[e]	Site contains the rare plant species, Broad-leaved puccoon
38	Servite Park	T8N R21E Section 9 City of Milwaukee	Milwaukee County and private	20	Upland thicket and grassland containing a State listed special concern snake
39	South Shore Park	T6N R22E Section 10 City of Milwaukee	Milwaukee County	5	Mature hardwoods and open grassy area at an urban park containing two rare wildlife species
40	Springbrook Woods	T5N R22E Section 17 City of Milwaukee	Private	3	Woods and wetlands supporting a State designated special concern bird
41	Uihlein Park	T8N R21E Section 22 City of Milwaukee	Milwaukee County,	16	Shrub thicket and old field supporting two species listed by the State as special concern
42	Underwood Creek Habitat Area	T7N R21E Sections 19, 20, and 30 City of Wauwatosa	Milwaukee County, Milwaukee Metropolitan Sewerage District, and private	86	Floodplain forest and upland thicket containing a State listed special concern snake
43	Underwood Parkway Thicket	T7N R21E Section 20 City of Wauwatosa	Milwaukee County, State of Wisconsin, and Milwaukee Metropolitan Sewerage District	40	Shrub thicket and woods along underwood creek supporting rare plants and animals
44	Veterans Park	T7N R22E Sections 21 and 28 City of Milwaukee	Milwaukee County	7	Woodland and thicket in an urban park containing populations of two State listed species
45	Washington Park	T7N R21E Sections 23 and 24 City of Milwaukee	Milwaukee County	16	Urban park with a variety of wooded and aquatic habitats supporting several rare species
46	Wilson Park	T6N R22E Section 19 City of Milwaukee	Milwaukee County	30	Woods buffering pond and stream support a State listed special concern bird species
			Total: 46 Sites	2,804	--

[a] *Site also includes three critical species habitat sites inventoried in the 2010 Natural Areas Plan update; Bender Park Stream and Meadow (two acres), Bender Park Woods North (11 acres), and Bender Park Woods South (five acres).*

[b] *Site was expanded by 13 acres. The site inventoried in the 2010 Natural Areas Plan update encompassed 15 acres.*

[c] *Site was expanded by eight acres. The site inventoried in the 2010 Natural Areas Plan update encompassed 41 acres.*

[d] *Site was expanded by three acres. The site inventoried in the 2010 Natural Areas Plan update encompassed 46 acres.*

[e] *Site was expanded by 18 acres. The site inventoried in the 2010 Natural Areas Plan update encompassed 43 acres.*

Source: Milwaukee County and SEWRPC

Table 4.3
Estimated Total Costs for Plan Implementation: 2022-2026

Cost Category	2022 ($)	2023 ($)	2024 ($)	2025 ($)	2026 ($)	Five-Year Total Cost ($)
Salary and Benefits[a]	493,800	503,676	513,750	524,025	534,505	2,569,756
Operating Expenses[a]	75,000	75,000	75,000	75,000	75,000	375,000
Landowner Cost-Share Hard Practices[b]	20,000	20,000	20,000	20,000	20,000	100,000
Landowner Cost-Share Soft Practices[b]	5,000	5,000	5,000	5,000	5,000	25,000
Total Annual Costs	593,800	603,676	613,750	624,025	634,505	3,069,756

[a] *Anticipate 2 percent annual increases for salary, benefits, and operating expenses.*

[b] *The costs provided by landowners and other grant recipients would be approximately $7,500 annually.*

Source: Milwaukee County and SEWRPC

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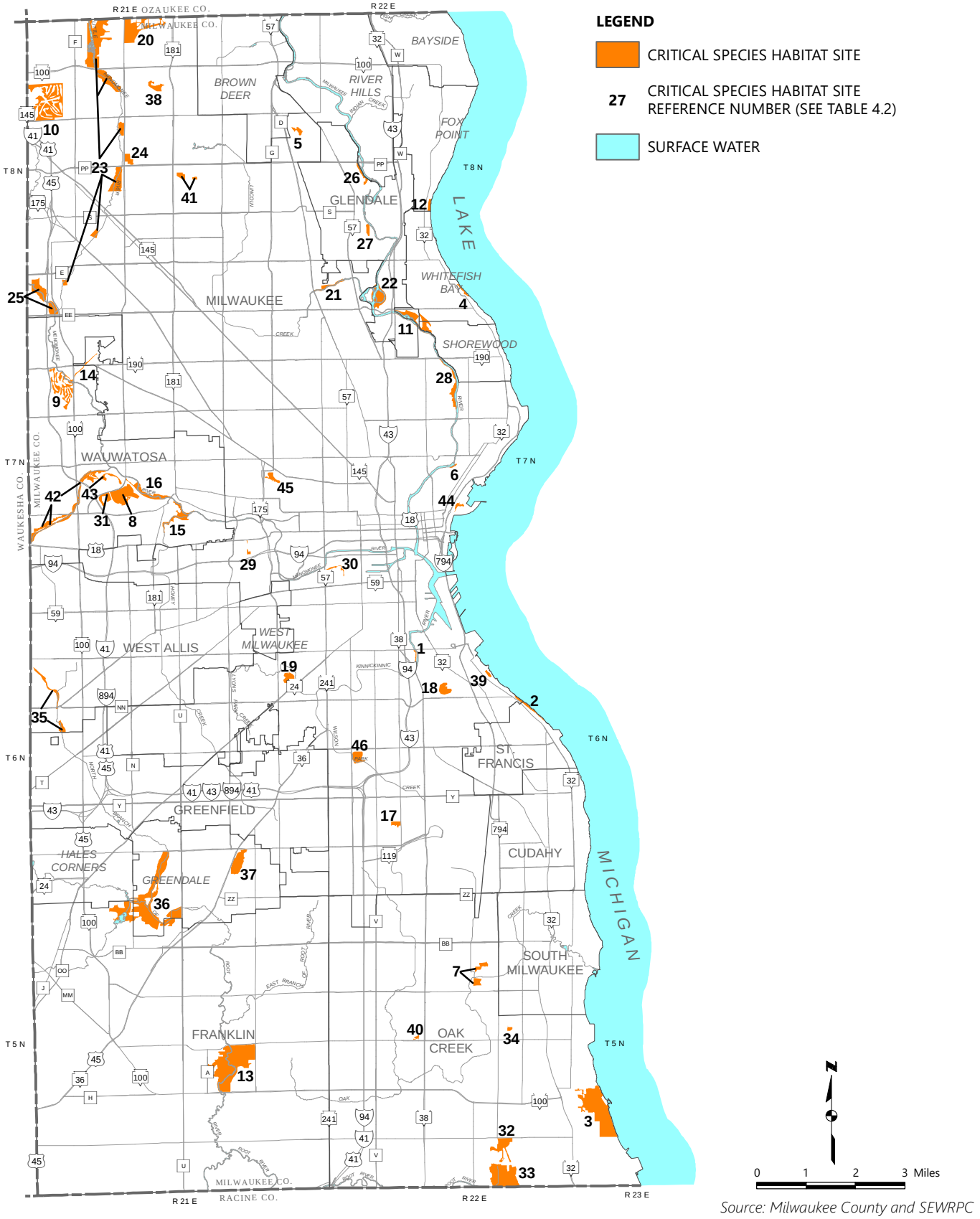
Chapter 4

GOALS, OBJECTIVES, AND WORK PLAN

MAPS

Map 4.1
Critical Species Habitat Sites Identified in Milwaukee County Between 2010 and 2021



Source: Milwaukee County and SEWRPC

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Chapter 5

PROGRESS MONITORING AND EVALUATION

5.1 MONITORING AND EVALUATION

Monitoring and evaluating program efforts is important to ensure the effectiveness of the planned activities described in Chapter 4 and Table 4.1 of this plan. The Milwaukee County Land Conservation Department currently employs and plans to expand a variety of methods to monitor and evaluate the progress of program efforts. Those methods include the geographic information system (GIS) database and the land information web portal, advisory committees, annual progress reports, and water quality monitoring. Monitoring program effectiveness will be carried out through analyses and quantifying soil erosion and sediment delivery, bluff stability and erosion analyses, priority farm compliance, tracking the status and amount of environmentally sensitive lands protection, inventorying the abatement of invasive species, and analyzing water quality data. This chapter describes some of these efforts in more detail and how they will be used to monitor and evaluate the success in implementing planned activities.

GIS/Database Tracking System

Milwaukee County's priority farms strategy will involve identifying and evaluating farmland for compliance with performance standards and prohibitions. Milwaukee County will use GIS as a tool to identify priority farms for compliance determinations, track progress on implementing performance standards, and meet reporting requirements. This database will be designed to inventory parcel ownership, track notices sent to landowners, and record conservation measures installed and cost-share funds awarded. In addition, the Environmental Services Division Unit will be able to track progress and compliance of riparian buffer and other best management practice installation achieved through the U.S. Department of Agriculture Conservation Reserve Program or other programs.

Progress Reporting

Regular meetings are currently held to report progress to the Milwaukee County Land Conservation Committee (LLC) regarding conservation plans and nutrient management plans, implementing vegetated buffers, contacts made, and educational activities. The meetings are used to evaluate the effectiveness of current practices, to approve and review cost-share contracts, and to change or modify programs to better address current conditions and local priorities.

Water Quality Monitoring

Water quality monitoring is an important means to assess the present condition of water resources and to gauge the effectiveness and progress of land conservation-related activities and best management practices. Unfortunately, it is often difficult to interpret the water quality data. This is due to the high number of variables involved in monitoring water quality, nonstandardized parameters and sampling techniques, and the broad spatial and temporal sampling effort. As a result of ongoing monitoring efforts by a variety of agencies and groups, considerable water quality monitoring information is available for some streams in Milwaukee County, as described below. Much of the recent data were summarized in Chapter 2 of this report. Milwaukee County supports citizen-based monitoring programs such as Water Action Volunteers. The County also plans to continue to work on collecting water quality data in cooperation with conservancy and environmental organizations, State and Federal Agencies, school districts, utility companies, local governments, the Milwaukee Metropolitan Sewerage District (MMSD), and adjacent County and local governments and other groups such as the Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water), Milwaukee Riverkeeper, Root-Pike Watershed Initiative Network (Root-Pike WIN), and SEWRPC. All of these groups work directly or indirectly, through project funding, to collect water quality data on a regular basis.

Wisconsin Department of Natural Resources (WDNR) Water Quality Monitoring

The WDNR conducts baseline monitoring of streams in Milwaukee County. The Department staff conducts fish collections and habitat assessments and examines macroinvertebrates at a number of locations throughout the County. This information is summarized in periodic State of the Basin reports.

U.S. Geological Survey Monitoring

The U.S. Geological Survey (USGS) is actively collecting surface water resources data at several locations in Milwaukee County and at numerous locations around Wisconsin. Streamflow is monitored at 17 locations in the County that continuously record water-stage and/or record crest stages of larger individual floods. These stations include sites along the mainstem of the Kinnickinnic River, Wilson Park Creek, and a

tributary to Holmes Avenue Creek in the Kinnickinnic River watershed; the mainstem of the Menomonee River, the Little Menomonee River, Underwood Creek, and Honey Creek in the Menomonee River watershed; the mainstem of the Milwaukee River and Lincoln Creek in the Milwaukee River watershed; the mainstem of Oak Creek in the Oak Creek watershed; and the mainstem of the Root River in the Root River watershed.

The USGS also monitors water quality by continuously recording probes and by collecting and analyzing water samples. Many of these stations are also located at the sites of streamflow gages. In 2020 through March 2021, continuous data were collected at six stations and water quality samples were collected at 16 stations. These stations include sites along the mainstem of the Kinnickinnic River, Wilson Park Creek, and a tributary to Holmes Avenue Creek in the Kinnickinnic River watershed; the mainstem of the Menomonee River, the Little Menomonee River, Underwood Creek, and Honey Creek in the Menomonee River watershed; the mainstem of the Milwaukee River and Lincoln Creek in the Milwaukee River watershed; a tributary to Oak Creek in the Oak Creek watershed; and the mainstem of the Root River and a tributary to the Root River in the Root River watershed. The type of data collected in the USGS sampling varies depending on program and project scope, but available data include historical and current streamflow on selected waterbodies and water quality.

The USGS regularly partners with WDNR, MMSD, SEWRPC, Milwaukee County, and other agencies and local interest groups to collect information on the condition of surface and groundwater resources. The USGS partners directly with Milwaukee County at four stations; three stations are near the Milwaukee Mitchell International Airport along Wilson Park Creek and a tributary to Holmes Avenue Creek and the other station is near St. Luke's Medical Center along Wilson Park Creek. More information on the variety of data collected by the USGS and the ability to view real-time stream gage data can be found at the USGS website (waterdata.usgs.gov/wi/nwis/nwis).

MMSD Water Quality Monitoring

The MMSD is actively collecting surface water quality data at nearly 100 sampling stations along streams within its service area and the associated nearshore areas of Lake Michigan, including over 30 sampling stations within Lake Michigan waters. Most of the sampling stations located along streams in the service area are within Milwaukee County. Those sampling stations that are not located in Milwaukee County are located in upstream reaches of streams which flow into the County. MMSD analyzes samples for about 41 different water quality parameters, including chemical parameters, suspended material, nutrients, and metals. Field measurements and grab samples are collected one to two times per month at all the

sampling sites totaling over 60,000 data points per year. Interactive reports and directions to view the water quality data collected can be found on MMSD's website (www.mmsd.com/what-we-do/water-quality/monitoring-data. Data are uploaded annually to USEPA's data warehouse and can be viewed or downloaded on the National Water Quality Monitoring Council Water Quality Portal (www.waterqualitydata.us). Streams that are currently monitored in Milwaukee County include the mainstem of the Kinnickinnic River, the 43rd Street Ditch, and Wilson Park Creek in the Kinnickinnic River watershed; the mainstem of the Menomonee River, the Little Menomonee River, Underwood Creek, Honey Creek, and Burnham Canal in the Menomonee River watershed; the mainstem of the Milwaukee River, Southbranch Creek, Indian Creek, and Lincoln Creek in the Milwaukee River watershed; the mainstem of Oak Creek in the Oak Creek watershed; the mainstem of the Root River in the Root River watershed; and Fish Creek in the Lake Michigan Direct drainage area. MMSD also collects continuous water quality monitoring data along streams within its service area. This data can be accessed by making a request to the MMSD Records Department with an email (recordsrequest@mmsd.com) or on their website (www.mmsd.com/about-us/contact-us). In partnership with the USGS, the District has also established 10 continuous water quality monitoring stations along streams within its service area. Eight of these stations are located in Milwaukee County, including six stations that are also partnered with SEWRPC.

Milwaukee Riverkeeper/Water Action Volunteers Water Quality Monitoring

Since 2006, Milwaukee Riverkeeper has conducted a volunteer monitoring program under which trained citizen volunteers monitor streams and rivers within the Milwaukee River basin. In Milwaukee County, this program conducts monitoring annually from May to October on the mainstems and tributary streams of the Kinnickinnic, Menomonee, and Milwaukee River watersheds. In the Menomonee and Milwaukee River watersheds, this program also monitors at sites upstream from Milwaukee County. The program trains two levels of volunteers. Level 1 volunteers learn to measure dissolved oxygen, air and water temperature, turbidity, flow, macroinvertebrates, stream habitat, and streamflow velocity on a monthly basis. Level 2 volunteers monitor water quality using calibrated sensors and equipment as required by the WDNR. This monitoring includes measurements of pH, dissolved oxygen (DO), turbidity, conductivity, and temperature using automated data loggers. Data that is collected by all volunteers and Riverkeeper staff is entered in the WDNR's Surface Water Integrated Monitoring System (SWIMS) database. In addition to baseline water quality, a subset of volunteers test for bacteria (*E. coli* and total coliform), chloride, total phosphorus, and emerging contaminants. The program also provided illicit discharge monitoring along sections of the Menomonee and Kinnickinnic Rivers in Milwaukee County from 2008 to 2016.

Lake Michigan Beach Monitoring

The Federal Beach Act was passed in October of 2000, requiring States that border coastal or Great Lakes waters to develop beach monitoring and public notification programs. The Beach Act also authorized the U.S. Environmental Protection Agency (USEPA) to provide grants to States that have beaches bordering these coastal waters for the purpose of developing and implementing monitoring and public notification programs. The WDNR and its partners have participated in this grant program since the 2002 swimming season. The Wisconsin Beach Monitoring Program was developed in accordance with USEPA performance criteria. Several health departments within Milwaukee County adhere to the performance criteria for monitoring, public notification, and reporting. These include the City of Milwaukee Health Department, the North Shore Health Department, the City of Oak Creek Health Department, the City of St. Francis Health Department, the Shorewood/Whitefish Bay Health Department, and the City of South Milwaukee Health Department. Beaches that are tested regularly within Milwaukee County include: Atwater Park Beach, Bay View Park Beach, Bender Beach, Bradford Beach, Grant Park Beach, Klode Park Beach, Lakeshore State Park Beach, McKinley Beach, South Shore Beach, and Tietjen Beach (Doctors Park Beach), and Watercraft Beach. Water quality data are posted daily from Memorial Day to Labor Day. Water quality conditions at the monitored beaches are posted at the beaches, at the Milwaukee County Parks website, and at the State of Wisconsin beach condition website. The State beach condition website is updated daily and, therefore, has the latest available advisories. The State of Wisconsin beach website is: www.wibeaches.us.

5.2 SUMMARY

Consistent and thorough evaluation and monitoring of conservation efforts is essential to ensure the effectiveness of the Milwaukee County Land and Water Resource Management Plan. An annual progress report will be the primary method used to evaluate progress of implementing the planned activities outlined in Chapter 4 and Table 4.1 of this plan. The progress report will use the standardized units of measurement for conservation practices and information and education activities prescribed by DATCP. The progress report will consist of a summary of the annual outcomes and accomplishments of planned activities outlined in the work plan. This summary may include but is not limited to: completed information and education activities, landowners contacted, BMPs designed and installed, conservation and nutrient management plans written or revised, cost-share agreements developed, compliance monitoring and status, and other planned program results. These annual progress reports will be compiled and forwarded to the Department of Agriculture, Trade and Consumer Protection (DATCP) and the Department of Natural Resources (WDNR). The results of the monitoring and evaluations described in

this chapter, and conducted over the term of this plan (2022 to 2031), will be used to improve the subsequent land and water resource management plan.

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Appendix A

MEMBERS OF THE MILWAUKEE COUNTY LAND AND WATER RESOURCE MANAGEMENT PLAN ADVISORY COMMITTEE

Timothy Detzer, Chairperson ..... Senior Environmental Engineer, Milwaukee County Department of Administrative Services-Facilities Management-Architecture, Engineering and Environmental Services

Joel Dietl, Secretary ..... Chief Land Use Planner, Southeastern Wisconsin Regional Planning Commission

Jessiah Bennett ..... Water Resources Management Specialist, Wisconsin Department of Natural Resources

Emilie Burmeister ..... Assistant Natural Areas Coordinator, Milwaukee County Department of Parks

Susan Coyle ..... Senior Project Manager, Milwaukee Metropolitan Sewerage District

Jacob Fincher ..... Executive Director, Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water)

Stevan Keith ..... Principal Environmental Engineer, Milwaukee County Department of Administrative Services-Facilities Management-Architecture, Engineering and Environmental Services

Brandi Richter ..... District Conservationist, USDA Natural Resources Conservation Service

Robbie Robinson ..... Senior Planner, Southeastern Wisconsin Regional Planning Commission

Brian Russart ..... Natural Areas Coordinator, Milwaukee County Department of Parks

Kurt Sprangers ..... Stormwater Manager, City of Milwaukee Department of Public Works

Sarah Toomsen ..... Manager of Planning and Development, Milwaukee County Department of Parks

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Appendix B

OBJECTIVES, ACTIONS, AND PROGRESS TRACKING MEASURES FROM THE MILWAUKEE COUNTY LAND AND WATER RESOURCE MANAGEMENT PLAN: 2012-2021

Table B.1
Objectives, Actions, and Progress Tracking Related to Goal #1:
Improve Water Quality Through the Reduction of Sediment and Nutrient Delivery to Surface Waters in Milwaukee County

Objective	Action	Progress Tracking
Encourage Public Awareness of Water Quality Problems and Stormwater Issues. Ensure that County Staff is Adequately Trained to Develop Strategies to Implement Technologies to Solve Water Quality Problems	Work with local agencies and organizations to hold educational workshops and conferences designed to train consultants, inspectors, municipalities, developers, and County personnel about the latest technologies and regulatory codes relating to stormwater and water quality issues	--
	Respond to walk in, telephone, and e-mail inquiries	As needed
	As requested, give presentations to university classes, public groups, and others on stormwater and water quality issues	--
	Cooperate with efforts to develop a watershed restoration plan for the Root River Watershed	--
Implement NR 216 Stormwater Requirements	Comply with conditions of WPDES NR 216 permit	Compliance with permit
	Conduct dry weather screening at major outfalls	Screen all major outfalls annually
	Maintain stormwater pollution prevention plans (SWPPP) for applicable County facilities	Maintain and meet requirements for all required plans
	Inspect for illicit connections in conjunction with SWPPP maintenance activities and other projects	Twice per year for SWPPPs/as needed for other projects
	Disconnect illicit connections as they are discovered	As needed
	Inspect and maintain County owned, operated, and permitted structural stormwater facilities	Inspect twice per year
	Update and maintain County storm sewer map	Continually updated
	Assess compliance with 40 percent reduction in total suspended solids required for 2013	Assess compliance by modeling once in the planning period
	Work with partners to provide pet litter management supplies and signage in high traffic areas within the park system	Install five to 10 new signs in high pet traffic areas
Work with Partners to Identify and Implement Measures to Prevent Future Beach Closings Resulting from Bacterial Contamination	Assist researchers working to identify sources of bacterial contamination by providing access to pertinent information on research findings	Provide available information as requested
	Continue beach grading and grooming	Maintain established frequency
	Continue gull and goose abatement activities at selected locations with nuisance populations	Document nuisance conditions biannually at selected locations
	Complete projects recommended by Lake Michigan storm sewer evaluation conducted as required by the County's WPDES NR 216 permit	Complete projects as required by permit within permit period
	Comply with conditions of WPDES NR 216 permit	Compliance with permit

Table continued on next page.

Table B.1 (Continued)

Objective	Action	Progress Tracking
Conduct and Promote Streambank Stabilization Projects and Projects Employing Best Management Practices (BMPs) to Reduce Erosion	Work with stakeholders to seek funding for streambank stabilization projects	--
	Work with lessees of County lands and State agencies to install filter strips, riparian buffers, and other appropriate BMPs on agricultural parcels	Install one buffer per year
	Install riparian buffers as a part of stormwater and streambank related projects	Install one buffer per year
	Complete high priority projects listed in the County Streambank Assessment Report	--
	Work with stakeholders and project partners to increase public awareness of the causes of streambank erosion and the efforts to correct these problems through press releases, web pages, and /or educational displays	--
	Implement recommendations relating to soil erosion and water quality outlined in the updated Milwaukee County Agricultural Lease Policy	--
Implement the Recommendations Outlined in the County Pond and Lagoon Management Plan	Continue monitoring of County park ponds and lagoons	Complete at least annual monitoring of recent projects
	Continue aquatic macrophyte management activities	Monitor at present level, control as needed
	Conduct additional improvement projects recommended in the Pond and Lagoon Management Plan	Complete two projects per planning period
	Post multilingual educational signs at the sites of pond and lagoon projects to inform Park visitors about problems at the lagoons and methods for improving water quality	--
	Initiate consideration of a long-term program to address sediment deposition in County ponds and lagoons	Program start up
Comply with the NR 151 Agricultural Performance Standards	Annually monitor agricultural fields to ensure compliance with NR 151 standards and prohibitions	Annually monitor one field for compliance
	Develop and maintain a database for tracking the status of agricultural fields and operations	Develop database for tracking compliance
	Conduct a soil loss survey during the plan period to determine whether the rate of soil loss is under "T," the tolerable rate of soil loss	Conduct one soil survey every five years
	Identify priority farms and operations and notify noncompliant operators	Identify and inventory one priority farm per year
	Provide cost-share and technical assistance to priority farm landowners to implement BMPs. Information may be provided through newsletters, brochures, mailings, and one-on-one meetings	Use 100 percent of allotted cost-share funding
Minimize Introductions of Chloride into Surface Waters of the County	Use road deicing best practices in order to reduce introductions of chloride into the environment	Work with partners to develop best practices

Source: Milwaukee County Environmental Services, Milwaukee County Department of Parks, Recreation and Culture, and SEWRPC

Table B.2
Objectives, Actions, and Progress Tracking Related to Goal #2: Protect, Maintain, and Restore Land and Water Resources in Milwaukee County

Objective	Action	Progress Tracking
Continue to Manage the Milwaukee County-Owned Natural Areas Using the Latest Advancements in Restoration Ecology	Establish new, and maintain existing, partnerships with local colleges and universities, and community groups	Work with two universities or colleges annually
	Encourage volunteer efforts by holding volunteer workdays in Milwaukee County natural areas	Hold at least two volunteer workdays per year
	Working with partner organizations and volunteers, continue to inventory and monitor the Milwaukee County natural resource base	--
	Develop natural resource management policies to guide future management	Develop one natural resource guide annually
	Develop site-specific management plans for DPRC natural areas	Develop five management plans annually
	Analyze the existing publicly generated hiking trails to determine the most ecologically sustainable trails and stabilize those trails	Analyze 40 miles during the planning period
	Identify areas in which to minimize mowing adjacent to waterbodies, giving consideration to the control of invasive plants and restoration of native plant communities called for under Goal 5 and accommodating active recreational use of some park lands	Identify and create the non-mowing zones in 20-acre units
Increase Public Awareness of the Value of Land and Water Resources in Milwaukee County	Develop and update as necessary natural resource management reference material that can be used by partner organizations and private individuals to manage natural resources under their control	--
	Conduct and assist in conducting workshops, lectures, community presentations, and professional publications on Milwaukee County's natural resource management efforts and the value of natural resource management projects to the community	--
	Expand partnerships with local universities and colleges to provide training opportunities for natural resource management students	Work with two universities or colleges annually
	Develop volunteer resources and provide training for volunteers	--
	Post and distribute multilingual informational materials on land and water resource conservation issues and approaches	--
	Respond to walk in, telephone, and e-mail inquiries	As needed
	Report on activities through written reports, short talks, lectures, press releases, and other activities	--

Table continued on next page.

Table B.2 (Continued)

Objective	Action	Progress Tracking
Maintain and Acquire High-Quality Natural Areas in Accordance with the Milwaukee County Parks and Open Space Plan	Maintain partnerships with local conservation groups and municipalities for identification and maintenance of high-quality natural areas that should be protected	As needed
	Work with stakeholders and landowners to acquire natural areas from willing sellers	--
	Seek grant opportunities to for acquiring natural area parcels from willing sellers	--
Maintain Land in River Corridors for Recreational Use and Access	Maintain and enhance facilities to provide and improve access to river corridors and rivers at appropriate locations	--
	Pursue partnerships on projects to improve access to river corridors and rivers	--
	Seek grant opportunities for providing and improving access to river corridors and rivers	--
Manage Contaminated Sediments for Water Quality Benefit	Support efforts to determine best strategies for managing contaminated sediments	--
	Support efforts to implement best strategies for managing contaminated sediments	--

Source: Milwaukee County Environmental Services, Milwaukee County Department of Parks, Recreation and Culture, and SEWRPC

Table B.3
Objectives, Actions, and Progress Tracking Related to Goal #3: Enhance Lake Michigan Bluff Protection Initiatives

Objective	Action	Progress Tracking
Continue to Improve and Maintain Lake Michigan Shoreline Protection Measures and Abate Shoreline Erosion Problems in Milwaukee County Parks	Conduct or partner on bluff stabilization and shoreline protection projects	Conduct or partner on one bluff stabilization or shoreline stabilization project
Maintain Lakefront Land for Recreational Use and Access	Seek partnerships on projects to improve lake access	--
	Enhance facilities to provide and improve access	--

Source: Milwaukee County Environmental Services, Milwaukee County Department of Parks, Recreation and Culture, and SEWRPC

Table B.4
Objectives, Actions, and Progress Tracking Related to Goal #4: Maintain the Existing Information Management Network and Land Information Web Portal

Objective	Action	Progress Tracking
Ensure that Mapping and the GIS Infrastructure are Updated on a Regular Basis	Maintain partnerships with local and State governments to share data	Meet with at least three local municipal staffs per year
	Update GIS data and layers as new or updated data become available	Updates as available
Promote Effective Use of GIS by County Staff, Natural Resource Professionals, Developers, and Citizens	Conduct GIS training sessions for County staff	--
	Present training related to the County's GIS, available layers, and land information web portal at local workshops and conferences	--

Source: Milwaukee County Environmental Services, Milwaukee County Department of Parks, Recreation and Culture, and SEWRPC

Table B.5
Objectives, Actions, and Progress Tracking Related to Goal #5: Limit the Introduction and Reduce the Spread of Invasive Species in Milwaukee County

Objective	Action	Progress Tracking
Provide Information to County Staff and Residents About How to Control Invasive Species	Conduct invasive species training for Milwaukee County employees involved in land and water resource management	One training annually
	Update DPRC's invasive species management guide as new techniques and knowledge become available	--
	Conduct invasive species removal workdays in County parks and natural areas for community volunteers and university students	Conduct 30 workdays annually
	Post and distribute materials related to invasive species identification and management and respond to direct inquiries and telephone and e-mail inquiries	As needed
	Work with partners to develop reference and educational materials related to invasive species identification and management	--
Develop a Comprehensive and Coordinated Approach to the Management of the Invasive Species in Milwaukee County	Inventory Milwaukee County-managed property for species listed as prohibited or restricted under NR 40	Inventory 40 sites
	Establish a task force from applicable County departments to develop an "umbrella" invasive species management policy to guide County invasive species management activities	Complete the policy
	Prioritize Milwaukee County-managed properties for the development of site-specific invasive species management plans	10 sites annually
	Develop site-specific invasive species management plans for Milwaukee County-managed properties	10 sites annually
	Update DPRC's invasive species management guide as new techniques and knowledge become available	--
Manage Infestations of Invasive Species in Milwaukee County-Managed Properties	Conduct invasive species training for Milwaukee County employees involved in land and water resource management	One training annually
	Restore native plant communities in infested sites	10 sites annually
	Conduct invasive species control efforts in accordance with the DPRC quick reference guide	20 sites annually
	Continue gypsy moth suppression activities in partnership with the WDNR	Once annually
	Monitor for emerald ash borer and manage ash trees on County lands in accordance with the DPRC Emerald Ash Borer Preparedness Plan	As needed

Source: Milwaukee County Environmental Services, Milwaukee County Department of Parks, Recreation and Culture, and SEWRPC

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Appendix C

MILWAUKEE COUNTY BEST MANAGEMENT PRACTICES (BMPS) AND PROJECTS TO IMPLEMENT NR 216 REQUIREMENTS BETWEEN 2012 AND 2021

- Permeable pavers and a subsurface flow wetland were created as part of the redesign of CTH F between Brown Deer and County Line Roads.

- A stormwater pond on College Avenue will have liner repairs and vegetation established along the banks where there was previously bare soil.

- Grant Park Beach parking lot rain gardens were installed.

- Permeable pavers, permeable concrete, and a rain garden were installed in Dineen Park.

- Bioretention cells were installed at Mitchell Park (Journey House Hudson Center Practice field).

- Cistern/bioretention was installed at Mitchell Park Greenhouse.

- Stormwater ponds developed at the County Sheriff Department Training Academy.

- Rawson Avenue and Forest Home Avenue permeable pavers were installed (8,800 square feet).

- 35th Street and Layton Avenue permeable pavers were installed (3,675 square feet in three sections).

- Behavioral Health Division installed a permeable paver parking lot (8,000 square feet of pavers in a 14,000 square foot parking lot).

- Pulaski Park a rain garden/cistern was installed. The facilities have since been removed due to a lack of maintenance and poor condition.

- Milwaukee County Zoo installed permeable pavement in Parking Lot #1.

- The Menomonee River Parkway Lagoon was converted from a treatment pond to a stormwater treatment wetland. The wetland receives stormwater from a 100-acre area. The project also involved the removal of a small dam.

- The construction of a new water quality/quantity stormwater pond near 76th Street and Drexel Avenue.

- Milwaukee River Parkway - three biofiltration basins were developed.

- Pervious pavement installed at Milwaukee Area Technical College parking lot.

- Reduced impervious surface (reduced asphalt walks) and replaced with turf at Smith and Martin Luther King Parks.

- Zablocki Park basketball courts will be rebuilt with reduced impervious area.

- Barnard Park basketball courts reconstructed with reduced impervious area.

- Reduced impervious surface (reduced asphalt) and replace with turf at Dineen Tennis Courts.

- Rain gardens installed at Moody Park.

- The Milwaukee County Sports Complex parking lot was reconstructed and includes a large two-acre area of permeable pavers to reduce the amount of polluted storm water runoff from the site that flows into the nearby Root River.

- Doctors Park parking lot reconstruction included a sedimentation chamber to reduce polluted runoff and a 30 percent reduction in total impervious area.

- A green roof and pervious pavement were installed at the Milwaukee County Domes.

- The Milwaukee County Zoo installed two cisterns that collect roof runoff. The water is used for washing pavement.

- General Mitchell International Airport (now known as Milwaukee Mitchell International Airport) installed a green roof on the new baggage claim building.

- A dewatering building was installed at Fleet Management to dry materials removed from catch basin cleaning. This facility allows more catch basin cleaning by reducing disposal costs without increasing budgets.

- General Mitchell International Airport (now known as Milwaukee Mitchell International Airport) Deicier Pads were installed to contain fluids from deicing activities.

- Boerner Botanical Gardens Rainwater Harvesting System was installed.

- Rain gardens, permeable pavers, and a green roof were installed at the Milwaukee County Zoo.

- Permeable Pavers installed at the Milwaukee County Research Park.

- Performed required Illicit Discharge Detection and Elimination (IDDE) permit sampling of major outfalls and suspected outfalls from 2016 to 2019. The County can provide analytical data or WDNR submittals.

- Between 2017 and 2019, County staff developed and implemented stormwater pollution prevention plans for the Milwaukee County Zoo (revision), Timmerman Airport (revision), and McKinley Marina (revision) and at four County maintenance facilities: the Parks Maintenance Facility, the County North Shop (revision), the County Highway South Maintenance Facility and Fleet Management Facility (revision).

- Installed a rain garden at Lake Park in 2017.

- Performed pavement reduction at Kletzsch Park in 2016.

- Developed two bioretention ponds at Baran Park in 2020.
- Installed pervious pavers at the Fond du Lac Bus Garage in 2019.
- Developed three bioinfiltration basins and installed pervious pavement at McKinley Marina in 2019.
- Developed eight bioinfiltration basins, two infiltration swales, and 24 rain gardens along the Menomonee River Parkway in 2017.
- Installed three microporous paver areas and two cisterns at the Milwaukee Public Museum in 2017.
- Reconstructed a stormwater pond to a wet retention pond along College Avenue. Repaired the eroded pond inlet and planted turf and native plants to prevent erosion at the site in 2016.
- Installed permeable pavers and a regenerative stormwater conveyance system at Lake Park in 2016.
- Developed three infiltration basins along the Milwaukee River Parkway in 2016.
- Developed two bioswales and six infiltration basins at South Shore Park in 2016.
- Performed pavement reduction during the Thurner Hangar Demolition in 2016.
- Performed pavement reduction and installed permeable asphalt at General Mitchell International Airport (now Milwaukee Mitchell International Airport) in 2016.
- Constructed a deicing pad on runway 7R at General Mitchell International Airport (now Milwaukee Mitchell International Airport) between 2016 and 2018. The deicing pad serves as a wash area when deicing fluids are applied to the aircraft and the fluids can be collected more easily for environmental compliance.
- Installed two portable snow melters at General Mitchell International Airport (now Milwaukee Mitchell International Airport) in 2016. The two snow melters help reduce the size of snow stockpiles on the airfield and are particularly important during winters of large snow accumulations. The melted snow is released into a field inlet and then eventually into the storm sewer system.
- Reconfigured the floor drains at the Fleet Management Facility to drain to the sanitary sewer system instead of the storm sewer system and surface waters and installed an oil/water separator between 2016 and 2017.

- Performed a condition assessment and mapping project of all the storm sewers at the Milwaukee County Grounds between 2016 and 2017.

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Appendix D

CONSERVATION PRACTICES

This table lists the current technical standards and potential sources of cost-share funding for the conservation practices likely to be used in Milwaukee County to meet the agricultural nonpoint pollution performance standards.

Conservation Practice	Practice Code[a]	Potential Funding Source[b]	Standard
Access Road	560	SWRM, EQIP, WHIP	ATCP 50.65
Animal Trails and Walkways	575	SWRM, EQIP	ATCP 50.66
Barnyard Runoff Control Systems	Various	SWRM, EQIP	ATCP 50.64
Contour Farming	330	EQIP	ATCP 50.67
Critical Area Stabilization	342	SWRM, EQIP	ATCP 50.69
Diversion	362	SWRM, EQIP	ATCP 50.70
Field Windbreak	612	EQIP, WHIP	ATCP 50.71
Filter Strips	393	SWRM, EQIP, WHIP, CRP	ATCP 50.72
Grade Stabilization Structure	468	SWRM, EQIP	ATCP 50.73
Heavy Use Area Protection	561	SWRM, EQIP	ATCP 50.74
Livestock Fencing	382	SWRM, EQIP, WHIP	ATCP 50.75
Livestock Watering Facilities	614	SWRM, EQIP	ATCP 50.76
Manure Storage System	313	SWRM, EQIP, TRM	ATCP 50.62
Manure Storage System Closure	360	SWRM	ATCP 50.63
Milking Center Waste Control Systems	Various	SWRM, EQIP	ATCP 50.77
Nutrient Management	590	EQIP	ATCP 50.78
Pesticide Management	595	EQIP	ATCP 50.79
Prescribed Grazing	Various	EQIP	ATCP 50.80
Riparian Buffer	391	SWRM, EQIP, CRP	ATCP 50.83
Roof Runoff System	558	SWRM, EQIP	ATCP 50.85
Roofs	Various	SWRM	ATCP 50.84
Sediment Basin	350	SWRM, EQIP	ATCP 50.86
Sinkhole Treatment	725	SWRM	ATCP 50.87
Streambank and Shoreline Protection	580	SWRM, EQIP, WHIP, TRM	ATCP 50.88
Subsurface Drain	606	SWRM, EQIP	ATCP 50.90
Terrace System	600	SWRM	ATCP 50.91
Underground Outlet	620	EQIP	ATCP 50.92
Wastewater Treatment Strip	635	SWRM, EQIP, TRM	ATCP 50.94
Water and Sediment Control Basin	638	SWRM, EQIP, TRM	ATCP 50.95
Waterways Systems	412	SWRM, EQIP, CRP	ATCP 50.96
Well Decommissioning	351	SWRM, EQIP	ATCP 50.97
Wetland Development or Restoration	657	SWRM, EQIP, WRP, CRP, TRM	ATCP 50.98

Table continued on next page.

[a] *Practice codes refer to NRCS field office technical guides available at efotg.nrcs.usda.gov.*

[b] *Potential funding sources:*

CRP-Conservation Reserve Program
EQIP-Environmental Quality Incentives Program
SWRM-Soil and Water Management Program
TRM-Targeted Runoff Management Program
WHIP-Wildlife Habitat Incentives Program
WRP-Conservation Reserve Program

Source: SEWRPC