

# **PRELIMINARY DRAFT**

# **A LAKE MANAGEMENT PLAN FOR ELIZABETH LAKE AND LAKE MARY**

# **KENOSHA COUNTY WISCONSIN**

volume two

ALTERNATIVE AND  
RECOMMENDED PLANS

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**COMMUNITY ASSISTANCE PLANNING REPORT  
NUMBER 302**

**A LAKE MANAGEMENT PLAN FOR  
ELIZABETH LAKE AND LAKE MARY**

**KENOSHA COUNTY, WISCONSIN**

Volume Two

**ALTERNATIVE AND RECOMMENDED PLANS**

Prepared by the

Southeastern Wisconsin Regional Planning Commission  
W239 N1812 Rockwood Drive  
P.O. Box 1607  
Waukesha, Wisconsin 53187-1607  
[www.sewrpc.org](http://www.sewrpc.org)

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**SEWRPC Community Assistance Planning Report No. 302  
Volume Two, Alternative and Recommended Plans**

**A LAKE MANAGEMENT PLAN FOR ELIZABETH LAKE AND LAKE MARY  
KENOSHA COUNTY, WISCONSIN**

**Chapter I**

**BACKGROUND AND SUMMARY  
OF INVENTORY FINDINGS**

**INTRODUCTION**

The Twin Lakes are comprised of two connected waterbodies, the upstream Lake Mary and Elizabeth Lake, both located within the civil division limits of the Village of Twin Lakes in Kenosha County. Lake Mary is a 297-acre waterbody located within U.S. Public Land Survey Section 21, Township 1 North, Range 19 East, Kenosha County. Elizabeth Lake is a 638-acre waterbody located within U.S. Public Land Survey Section 28, Township 1 North, Range 19 East, Kenosha County; the southernmost extreme of the Lake extends into McHenry County, Illinois. Both Lakes are augmented by weirs which serve to maintain water levels in the Lakes; however, under most conditions, the spillway weir at the Elizabeth Lake outlet controls the levels of both Lakes. The total tributary area draining to the Lakes is about 8.1 square miles in areal extent, with about 2.25 square miles of the tributary area draining only to Lake Mary. While the tributary basin has historically encompassed large tracts of agricultural land, increasing portions of the tributary area are in urban land usage and the trend toward urban development remains ongoing.

The Lakes provide a range of complementary recreational services to the lake-oriented neighborhoods and wider community within the Village of Twin Lakes, and are a popular destination for recreational users from both the Milwaukee and Chicago metroplexes. Continuing changes within the areas tributary to the Twin Lakes have created a range of current concerns among this lake-centered community, which include surface water use conflicts, siltation and sedimentation, especially of bays and adjacent to wetland areas, lake water levels, protection of environmentally valuable areas, and abundant aquatic plant growths in the shallower portions of the lake basins. In addition, present and future urban-density development within the areas tributary to the Lakes is perceived to have impacted the Lakes and their ecosystems, and remain a cause for concern within the community. Other issues raised by lake residents and users include concern over variable water quality conditions and potential contamination of lake waters by nonpoint source pollution, especially from stormwater runoff. These issues have been quantified to the extent possible and documented in the lake and tributary area inventory, comprising Volume One of this lake management plan for the Twin Lakes.

Based upon these documented issues, identified in the aforementioned inventory, this volume sets forth alternative and recommended management actions for the Lakes and their tributary areas. This plan represents an ongoing commitment of the Twin Lakes Protection and Rehabilitation District (TLPRD) and the Village of Twin Lakes to sound environmental planning with respect to the Lakes, and to the protection of their water quality and ecosystem integrity. This plan describes both tributary area management and in-lake management measures that may be applied to enhance the water quality conditions, biological communities, and recreational opportunities in the Lakes.

This plan is intended to provide the recommended means to achieve the following current water use objectives of the Twin Lakes:

1. Providing water quality suitable for full-body contact recreational use and the maintenance of a healthy fishery and other desirable forms of aquatic life;
2. Significantly reducing the severity of the nuisance problems associated with deposition of silt sediments, and excessive aquatic plant and algal growths which constrain or preclude intended water uses at sites throughout the Lakes;
3. Protecting and rehabilitating the aquatic flora and fauna;
4. Improving opportunities for both active and passive water-based recreation, navigation and human use; and
5. Maintaining and improving the hydrologic functioning of the Lakes to promote a healthy native flora and fauna and multiple human uses.

This plan should serve as a practical guide over time for achieving these objectives in a technically sound manner.

## **INVENTORY AND ANALYSIS FINDINGS**

### **Physical Description**

- The Twin Lakes are comprised of two connected waterbodies: Lake Mary and Elizabeth Lake. Lake Mary is a drained lake that flows into Elizabeth Lake through a narrow outlet over a low concrete weir; Elizabeth Lake is a through-flow lake with both a defined inflow, from Lake Mary and outflow which drains across a concrete dam to the Elizabeth Lake Drain, which flows into the North Branch of Nippersink Creek.
- Lake bottom sediment types along the shoreline of Lake Mary consist of sand along about 32 percent of the shoreline, gravel and rubble along about 24 percent of the shoreline, and soft sediments along the remainder. In Elizabeth Lake, gravel is found along about 70 percent of the shoreline, sand along about 5 percent of the shoreline, and soft sediments along the remainder.
- The shoreline of Lake Mary is more than 90 percent developed for residential uses; about 60 percent of Elizabeth Lake shoreline is similarly developed, with the balance being comprised of extensive stretches of wetlands.
- The water levels of the Twin Lakes are influenced by local precipitation patterns, runoff conditions, and groundwater levels and rates of groundwater flow. Lake surface elevations in Lake Mary ranged from 793.2 feet above the National Geodetic Vertical Datum of 1929 (NGVD-29) to 795.1 feet NGVD-29. Lake surface elevations in Elizabeth Lake are maintained by a dam, which was reconstructed in 1984, and ranged between 793.0 and 795.1 feet NGVD-29.

### **Tributary Area**

- Less than 1 percent of the total land area tributary to the Twin Lakes is covered by well-drained soils; 86 percent of the tributary area is covered by moderately drained soils; and poorly- or very-poorly drained soils cover the remaining 14 percent of the combined tributary area.
- Nearly 45 percent of the lands within the total tributary area of the Twin Lakes are covered by soils categorized as having few limitations for onsite sewage disposal systems, which would suggest a limited likelihood of extensive nonpoint source pollution of the Lakes from land-based contaminant

sources. Currently, all of the shorelands of the Twin Lakes are served by public sanitary sewer services operated by the Village of Twin Lakes.

### **Water Budget**

- Long-term water budgets for the Twin Lakes were computed using U.S. Geological Survey (USGS) data, as well as long-term climatic data from the National Weather Service (NWS) and the National Oceanic and Atmospheric Administration (NOAA). It is estimated that, annually, about 2,155 acre-feet of water enter Lake Mary, about 45 percent of which enters through direct precipitation onto the lake surface, 32 percent as the result of surface runoff, and about 23 percent through groundwater inflow. In Elizabeth Lake, about 6,414 acre-feet enter the Lake annually, of which about 45 percent enters as surface runoff, 28 percent enters as direct precipitation, about 17 percent enters as groundwater inflow, and about 10 percent enters as inflow from Lake Mary.
- Of the inflows to Lake Mary, about 38 percent evaporates from the lake surface, 29 percent is discharged to Elizabeth Lake, and about 33 percent goes into groundwater recharge. In Elizabeth Lake, about 49 percent of the inflow leaves by way of evaporation, 20 percent is lost to groundwater recharge, and 31 percent flows out through the Elizabeth Lake Drain at the south end of the Lake.
- Due to the relatively short hydraulic residence times of waters in the Twin Lakes, it would be expected that the Twin Lakes would allow nutrients and pollutants to be flushed from the Lakes fairly rapidly and would, therefore, respond rapidly nutrient inputs are altered.

### **Population**

- The 2000 resident population in the area tributary to the Twin Lakes was estimated to be 7,182 persons. The population living within the tributary area within Wisconsin, estimated to be 3,774 persons, increased by about 23 percent over the 1990 population and by about four and one-half times the population living in the tributary area during 1963.
- The 2000 resident population occupied approximately 2,599 dwelling units within the area tributary to the Twin Lakes. The 1,430 dwelling units reported from the tributary area within Wisconsin during 2000 represent an increase of about 30 percent over the number of households reported in 1990.

### **Land Use and Zoning**

- As of 2000, approximately 1,646 acres, or about 22 percent of the tributary area to the Twin Lakes, were in urban land uses, with the dominant urban land use being residential use, encompassing about 1,125 acres or about 68 percent of the urban land area in the watershed. Commercial, industrial, governmental and institutional, transportation, communications and utilities, and recreational lands comprised the balance of the urban lands.
- As of 2000, approximately 5,878 acres, or about 78 percent of the tributary area to the Twin Lakes, were in rural land uses, with the dominant rural land use being agricultural, encompassing about 4,288 acres or about 57 percent of the rural lands in the tributary area. Woodlands, wetlands, surface water, and open lands comprised the largest portion of the balance of the rural lands.
- Agricultural land uses are expected to continue to decline as urban-density residential and related development continues within the drainage area.

### **Water Quality**

- Physical and chemical characteristics of the Twin Lakes have been measured as part of the Wisconsin Department of Natural Resources (WDNR) Self-Help Monitoring Program periodically since 1987 and again from 1991 through 2006. These data continue to be collected under the auspices of the University of Wisconsin-Extension (UWEX) Citizen Lake Monitoring Network (CLMN). Additional

data have been acquired through the WDNR Base Line Monitoring Program, between 1999 and 2006, and through the USGS Trophic State Index (TSI) monitoring program, between 1995 and 1997.

- The Twin Lakes are dimictic, mixing completely twice per year during spring and fall, and exhibiting winter and summer stratification.
- Water clarity in Lake Mary, measured as Secchi-disk transparency during the period from 1995 through 1997, averaged 13.1 feet in spring, 11.5 feet in summer, and 8.2 feet in fall; Secchi-disk readings for Elizabeth Lake during the same time period averaged 8.2 feet in spring, 9.5 feet in summer, and 8.2 feet in late summer. These values are higher than those reported from other lakes in the Southeastern Wisconsin Region, which typically have average water clarity measurements that are below that of other lakes statewide.
- Chlorophyll-*a* concentrations in Lake Mary during the current study period ranged from 3.7 to 5.3 micrograms per liter ( $\mu\text{g/l}$ ), with an average of 4.3  $\mu\text{g/l}$ ; in Elizabeth Lake, concentrations ranged from 4.6 to 5.8  $\mu\text{g/l}$ , with an average of 5.4  $\mu\text{g/l}$ . Concentrations above 10  $\mu\text{g/l}$  generally result in a visible green coloration of the water, especially during spring when the maximum concentrations are recorded. The Twin Lakes measurements indicated good water quality.
- Total phosphorus concentrations reported by the USGS during spring overturn of the current study period averaged about 0.011 milligrams per liter (mg/l) in Lake Mary and 0.014 mg/l in Elizabeth Lake. The seasonal gradients of phosphorus concentration in the Twin Lakes indicate that there may be internal loading of phosphorus from the bottom sediments of the Lakes.
- Values for total phosphorus concentrations generally do not exceed the Southeastern Wisconsin Regional Planning Commission (SEWRPC)-recommended water quality guideline value of 0.020 mg/l for recreational use and maintenance of warmwater fish and aquatic life, indicating good water quality.
- Data for mean annual phosphorus concentrations, chlorophyll-*a* concentrations, and Secchi-disk readings indicate that the Twin Lakes should be classified as oligo-mesotrophic waterbodies. Mesotrophic lakes, being moderately fertile, are capable of supporting abundant aquatic plant growth and productive fisheries; mesotrophic conditions are typical of inland lakes in the Southeastern Wisconsin Region. Oligotrophic lakes, being nutrient-poor, characteristically support relatively few aquatic plants and often do not contain very productive fisheries, but provide excellent opportunities for swimming, boating, and waterskiing.

#### **Pollutant Loadings**

- Nonpoint sources of phosphorus and sediments to the Twin Lakes were dominated by inputs from rural, agricultural lands within the area tributary to the Lakes, which accounted for about one-half of the total phosphorus and sediment loads to the Lakes. Although agricultural land uses are a declining form of land use within the watersheds, it is anticipated that such land uses will remain the single largest contributor of sediments to the Lakes during the planning period, although the sources of the phosphorus loads to the Lakes under year 2035 land use conditions will shift to more urban sources.
- Urban land uses generated inputs of nonpoint source metals, as well as more than one-tenth of the nonpoint source phosphorus loads under year 2000 land use conditions and more than one-quarter of the phosphorus loads under forecast year 2035 conditions.
- Direct deposition of nutrients and particulates (sediment) onto the surfaces of Lake Mary and Elizabeth Lake accounted for the balance of the nonpoint source contaminant inputs to the Lakes.

### **Aquatic Plants**

- The Twin Lakes support healthy and diverse aquatic macrophyte communities, albeit relatively sparse, except in those portions of the lake basins having more of a wetland character. Over time, the dominant submerged macrophyte in the Twin Lakes has been muskgrass (*Chara* sp.).
- Eurasian water milfoil (*Myriophyllum spicatum*) is found in both the Twin Lakes, but is more abundant in Elizabeth Lake.
- Aquatic plant management in the Twin Lakes has historically been achieved through applications of chemical herbicides and manual control measures.

### **Fishery**

- WDNR fisheries surveys, conducted in Lake Mary in 2004, suggest a relatively diverse fish population in the Lake, with 17 species of fishes being recorded. Largemouth bass, smallmouth bass, walleye, and northern pike were important gamefish. A wide range of panfish, the most dominant species being bluegill, was also present.
- Stocking of smallmouth bass, walleye, and northern pike has taken place fairly regularly on Lake Mary since 1975 and on Elizabeth Lake since 1974.

### **Natural Resource Base**

- In 1985, wildlife habitat covered about 927 acres, or 18 percent of the area tributary to the Twin Lakes within Wisconsin. Of the current area of wildlife habitat, about 269 acres, or about 5 percent, of the area tributary to the Twin Lakes in Wisconsin were rated as high-value habitat capable of supporting a diverse population of wildlife, with adequate land area and appropriate vegetative cover for nesting, cover, and subsistence, and minimal levels of disturbance.
- Wetlands covered about 3 percent of the area tributary to the Twin Lakes; woodlands covered about 4 percent of the area tributary to the Twin Lakes.
- Within the immediate vicinity of the Twin Lakes, there are two specially designated natural areas and one area of critical species habitat recommended for protection in the adopted regional natural areas and critical species protection and management plan;<sup>1</sup> namely, the Elizabeth Lake Lowlands, the Twin Lakes themselves, and Hamilton Woods.
- Primary environmental corridors, or contiguous lands containing the majority of the high-value woodlands, wetlands, and wildlife habitat and surface waters delineated by SEWRPC, comprised about 6 percent of the area tributary to the Twin Lakes.

### **Recreational Use**

- As of 2008, there were three public recreational boating access sites on the Twin Lakes, providing each of the Twin Lakes with adequate public recreational boating access, pursuant to Chapter NR 1 of the *Wisconsin Administrative Code*.
- During September 2006, approximately 1,482 watercraft were observed to be docked, moored, or trailered on and around the Twin Lakes. Of these, about 467 were powerboats, about 346 craft were pontoon boats, about 89 were fishing boats, and 244 were personal watercraft. The balance was comprised of paddleboats, sailboats, rowboats, canoes, and similar nonmotorized watercraft. Lake

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<sup>1</sup>SEWRPC Planning Report No. 42, A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, September 1997.

Mary appears to be utilized more for power boating and associated uses such as water skiing; Elizabeth Lake tends to be utilized more by anglers.

- In a recreational rating system developed by the WDNR to characterize the recreational value of inland lakes, Lake Mary received 62 out of a possible total of 72 points and Elizabeth Lake received a total of 70 out of a possible 72 points. These scores indicate that the Lakes provide: a wide range of recreational opportunities, including angling; some areas of moderately good swimming substrate; boat launching sites supported by good water quality and adequate depth conditions for boating; and, aesthetic viewing opportunities.

Based upon these inventory findings, lake management actions appear warranted to maintain and preserve the aesthetic, recreational, and natural resource functions served by the Twin Lakes. Consequently, Chapter II of this volume presents an overview of alternative and recommended water quantity management measures from which feasible alternatives are identified, Chapter III presents an overview of alternative and recommended water quality management measures from which feasible alternatives are identified, and Chapter IV summarizes the recommended lake management plan.

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