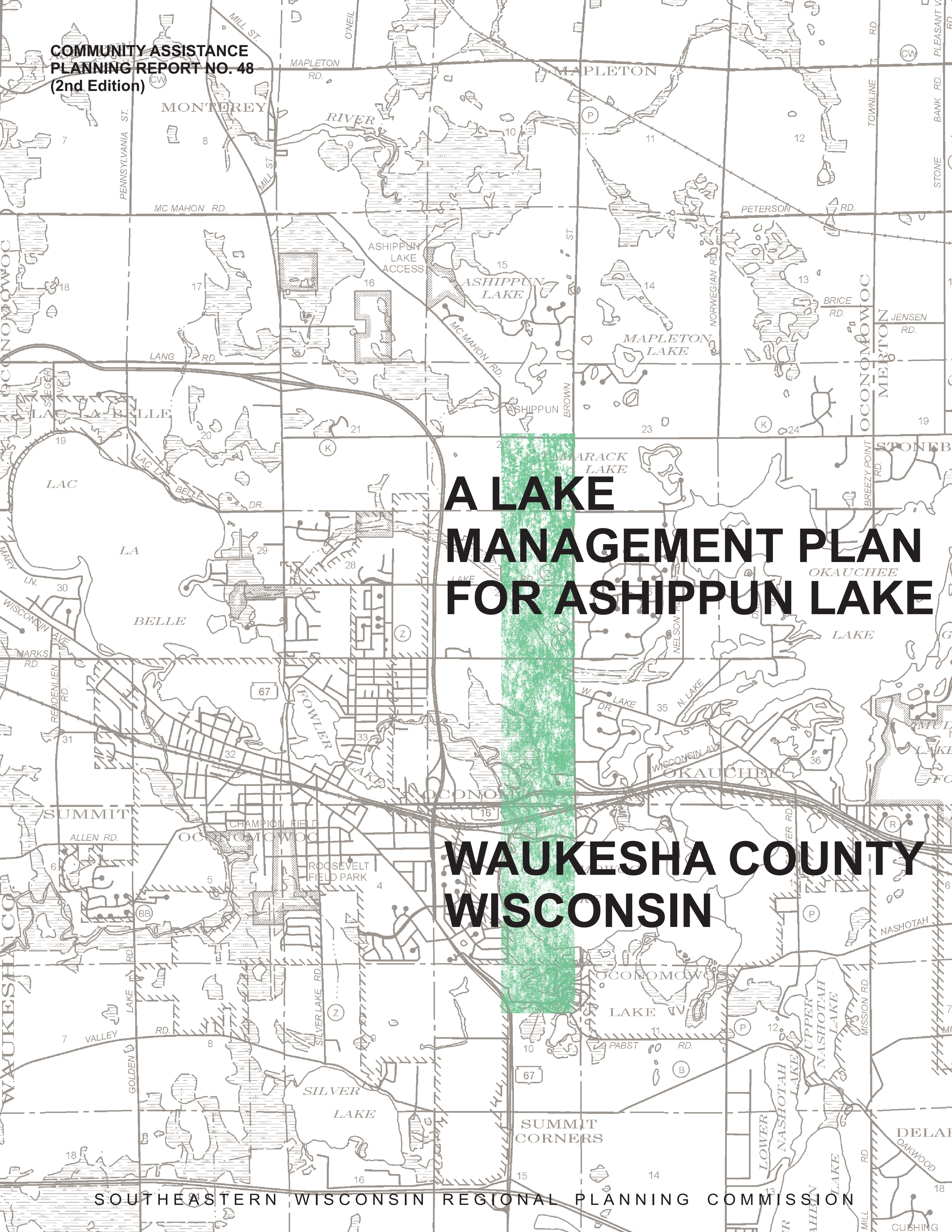
COMMUNITY ASSISTANCE PLANNING REPORT NO. 48
(2nd Edition)

# A LAKE MANAGEMENT PLAN FOR ASHIPPUN LAKE

# WAUKESHA COUNTY WISCONSIN




SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Special acknowledgement is made to Walter Baade, Commissioner emeritus, who provided comment on this plan during its formulation and as a draft.



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**COMMUNITY ASSISTANCE PLANNING REPORT**
**NUMBER 48, 2nd Edition**

# A LAKE MANAGEMENT PLAN FOR ASHIPPUN LAKE
# WAUKESHA COUNTY, WISCONSIN

Prepared by the


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## Chapter I

# INTRODUCTION

Ashippun Lake is an 84-acre lake located entirely within U.S. Public Land Survey Township 8 North, Range 17 East, Section 15, Town of Oconomowoc, in Waukesha County. The Lake drains, via an unnamed outlet stream, to the Ashippun River. The Lake is the focus of a small lake-oriented residential community surrounding a portion of the Lake. Ashippun Lake offers a variety of water-based recreational opportunities to the wider community through the public recreational boating access site located on its western shore. Proper management of the 791-acre area tributary to Ashippun Lake will be required in order to maintain the Lake as a valuable recreational resource for the residents of the County and the Southeastern Wisconsin Region of which the County is an integral part.

During 1976, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) entered into a cooperative agreement with the Wisconsin Department of Natural Resources (WDNR) to develop a water quality management plan for Ashippun Lake. This planning study reviewed the physical, chemical, and biological characteristics of the Lake, together with pertinent related characteristics of the tributary drainage area, as well as the feasibility of various water quality management alternatives to enhance water quality conditions in the Lake. As a consequence of these studies, the first water quality management plan for Ashippun Lake was published in 1982.[1] That plan included recommendations for zoning ordinance modifications, analysis of nonpoint source pollution, and a review of lake rehabilitation techniques.

This lake management plan forms a logical complement to the 1982 plan, and represents an ongoing commitment by the Ashippun Lake Protection and Rehabilitation District to sound environmental planning. It was prepared by SEWRPC in cooperation with the Ashippun Lake Protection and Rehabilitation District, and incorporates the data and analyses developed in the aforementioned lake management-related studies. This plan also documents water quality management actions, recommended in the initial plan, that have been implemented in and around Ashippun Lake. In addition, this plan incorporates pertinent water quality data collected subsequently by the WDNR, presents feasible alternative in-lake measures for enhancing the water quality conditions and providing opportunities for the safe and enjoyable use of the Lake, and addresses specific concerns expressed by residents. More specifically, this plan describes the current physical, chemical, and biological characteristics of the Lake, pertinent related characteristics of the tributary watershed, and forecast changes in the watershed likely to modify the Lake ecosystem as well as the feasibility of various watershed and in-lake management measures which may be applied to enhance the water quality conditions, biological communities, and recreational opportunities of the Lake.

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[1]*SEWRPC Community Assistance Planning Report No. 48,* A Water Quality Management Plan for Ashippun Lake, Waukesha County, Wisconsin, *January 1982*.

The primary water quality management objectives for Ashippun Lake include: 1) providing water quality suitable for the maintenance of fish and other aquatic life, 2) reducing the severity of existing nuisance problems resulting from excessive macrophyte and algal growth and limited water clarity which constrain or preclude intended water uses, and 3) improving opportunities for water based recreational activities. The recommended management plan for the Lake, presented herein, conforms to the requirements and standards set forth in the relevant *Wisconsin Administrative Codes*,[2] and, accordingly, should constitute a practical, as well as technically sound, guide for the management of Ashippun Lake and its tributary basin.

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[2]*This plan has been prepared pursuant to the standards and requirements set forth in the* Wisconsin Administrative Code*: Chapter NR 1, "Public Access Policy for Waterways;" Chapter NR 103, "Water Quality Standards for Wetlands;" and Chapter NR 107, "Aquatic Plant Management;" and Chapter NR 109, "Aquatic Plants Introduction, Manual Removal and Mechanical Control Regulations."*

## Chapter II

# PHYSICAL DESCRIPTION

## INTRODUCTION

The physical characteristics of a lake and its watershed are important factors in any evaluation of existing and likely future water quality conditions and lake uses, including recreational uses. Characteristics, such as watershed topography, lake morphometry, and local hydrology, ultimately influence water quality conditions and the composition of plant and fish communities within the lake. Therefore, these characteristics must be considered during the lake management planning process. Accordingly, this chapter provides pertinent information on the physical characteristics of Ashippun Lake and its watershed, and on the climate and hydrology of the Ashippun Lake area. Subsequent chapters deal with the land use conditions, and the chemical and biological environments of the Lake.

## WATERBODY CHARACTERISTICS

Ashippun Lake is located in the Town of Oconomowoc, in Waukesha County. The entire area tributary to Ashippun Lake lies within the Town, as shown on Map 1.[1] Ashippun Lake is a drained lake which lies within a glacial terminal moraine. The Lake depends principally on precipitation falling directly on the Lake's surface and on groundwater flowing into the lake from both inside and outside the immediate surface tributary area. The outlet to Ashippun Lake, an unnamed creek, flows into the Ashippun River which, in turn, flows into the Rock River approximately seven miles downstream of its confluence with the unnamed creek.

Ashippun Lake has a surface area of about 84 acres, with a maximum depth of 40 feet and a mean depth of about 22 feet. Approximately 26 percent of the Lake is less than five feet deep, 29 percent has a water depth of between five and 20 feet, and about 45 percent of the Lake has a water depth of more than 20 feet. Ashippun Lake is approximately 0.5 mile long and 0.3 mile wide at its widest point. The major axis of the Lake lies in a northwesterly-southeasterly orientation. The Lake shoreline is 1.5 miles long, with a shoreline development factor of 1.7, indicating that the length of the shoreline is about 1.7 times longer than the circumference of a circular lake of the same area. The Lake has a total volume of approximately 1,400 acre-feet. Located immediately downstream of Ashippun Lake is a wetland area containing a smaller lake basin with an area of about 12 acres and a maximum depth of less than five feet. The outlet from this smaller basin drains to the Ashippun River.

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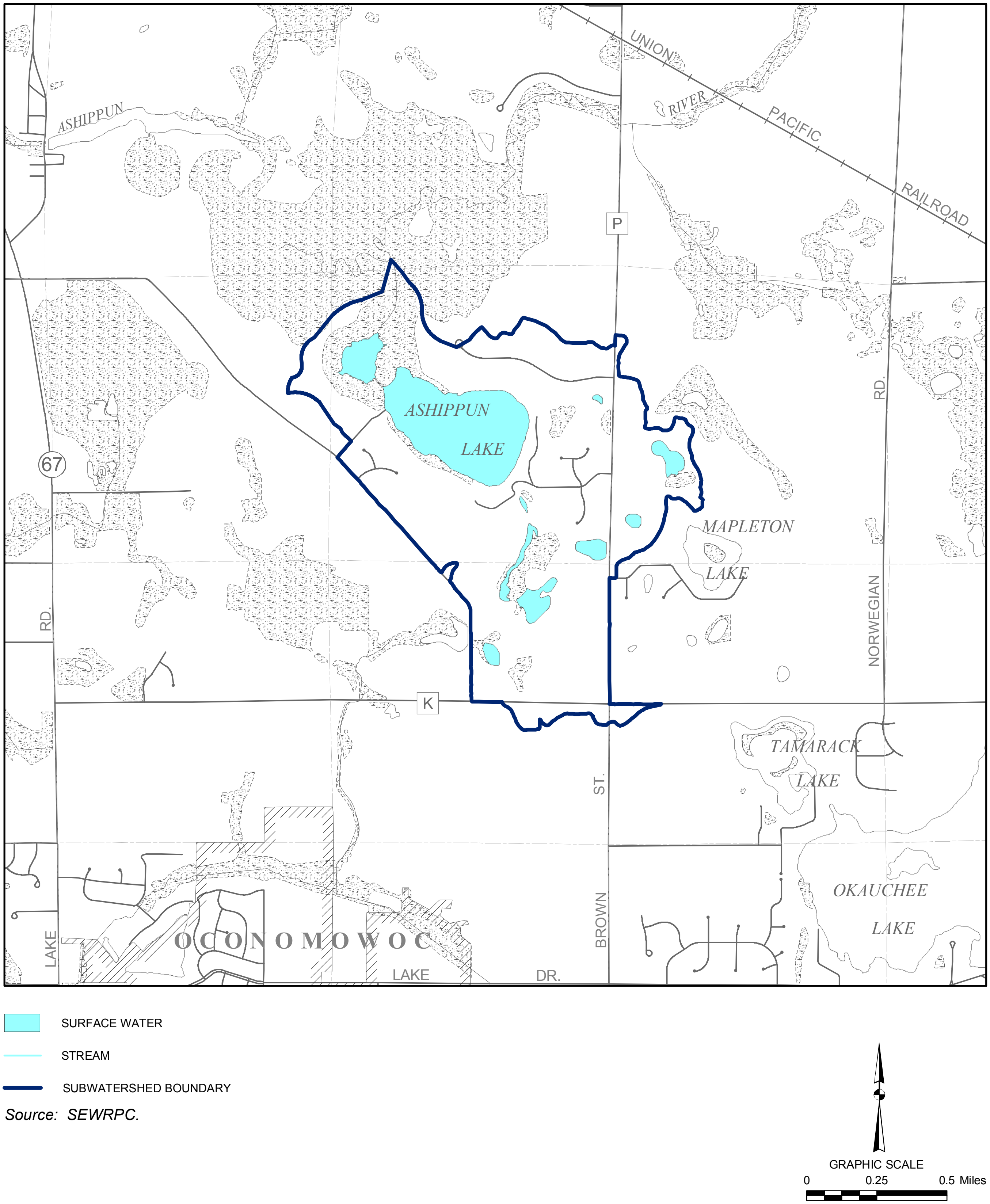
[1]*In the summer of 2003, Commission staff reestablished the boundaries of the area tributary to Ashippun Lake on the basis of onsite direct visual observations. Further adjustments to this area are anticipated due to the reconstruction of the CTH K and CTH P intersection in the vicinity of the Town of Oconomowoc Town Hall, and further commercial development along CTH P adjacent to the City of Oconomowoc.*

**Map 1**

**LOCATION OF ASHIPPUN LAKE**




*Source: SEWRPC.*

Hydrological and morphometric data on Ashippun Lake are presented in Table 1 and the bathymetry of the Lake is shown on Map 2.

About half of the shoreline of Ashippun Lake is developed for residential uses. A significant wetland area occupies most of the other half of the Lake's shoreline, beginning at about the midpoint of the northern shore and continuing around the west side of the Lake to a comparable location on the southwestern shore. The Wisconsin Department of Natural Resources (WDNR) owns a boat ramp and parking facility that is located on the northwestern shore. This recreational boating access facility is consistent with the requirements of Chapter NR 1 of the *Wisconsin Administrative Code*.

Erosion of shorelines results in the loss of land, damage to shoreline infrastructure, and interference with recreational access and lake use. Such erosion is usually caused by wind-wave erosion, ice movement, and motorized boat traffic. A survey of Ashippun Lake shoreline, conducted by Southeastern Wisconsin Regional Planning Commission (SEWRPC) staff, identified existing shoreline protection structures around the Lake, as shown on Map 3. Most were in a good state of repair. About half of the developed shoreland of Ashippun Lake had some form of shoreline protection in 2000. While improperly installed and failing shoreline protection structures, and the erosion of natural shorelines on Ashippun Lake, remain a limited cause for concern, SEWRPC staff did not identify any significant shoreland erosion problems on Ashippun Lake at the time of this survey.

Lake bottom sediment types are shown on Map 4. Silt and muck are the predominant lake bottom materials. Other bottom sediment types primarily along the shoreline consist of combinations of silt and sand.

## WATERSHED CHARACTERISTICS

The area tributary to Ashippun Lake is approximately 791 acres,[2] or 1.2 square miles, in areal extent, as shown on Map 1. Ashippun Lake has a watershed-to-lake area ratio of about 9.4:1. The lake outlet is an unnamed stream that discharges to the Ashippun River about one-half mile downstream of the Lake. The Ashippun River joins the Rock River at a point in Jefferson County about seven miles downstream of the confluence with the unnamed lake outlet stream.

### Soil Types and Conditions

Soil type, land slope, and land cover are among the more important factors determining lake water quality conditions. Soil type, land slope, and vegetative cover are also important factors affecting the rate, amount, and quality of stormwater runoff. Soil texture and soil particle structure influence the permeability, infiltration rate, and erodibility of soils. Land slopes are important determinants of stormwater runoff rates and of the susceptibility of soils to erosion. The erosivity of the runoff can be moderated or modified by vegetation.

The U.S. Natural Resources Conservation Service, formerly the U.S. Soil Conservation Service, under contract to SEWRPC, completed a detailed soil survey of the Ashippun Lake area in 1966.[3] The soil survey contained interpretations for planning and engineering applications, as well as for agricultural applications. Using the regional soil survey, an assessment was made of hydrologic characteristics of the soils in the area of Ashippun Lake. Soils within the Ashippun Lake watershed can be categorized into three main hydrologic groups as indicated in Table 2. Soils that could not be categorized were included in an "other" group. About two-thirds of the area tributary to Ashippun Lake is covered by moderately drained soils, with the balance being approximately equally covered by various soils and water. The areal extent of these soils and their locations within the watershed are shown on Map 5.

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[2]Ibid.

[3]*SEWRPC Planning Report No. 8,* Soils of Southeastern Wisconsin, *June 1966.*

**Table 1**

**HYDROLOGICAL AND MORPHOMETRIC CHARACTERISTICS OF ASHIPPUN LAKE: 2000**

| Parameter | Measurement |
|---|---|
| Size (total) | |
| Surface Area | 84 acres |
| Total Drainage Area | 791 acres |
| Volume | 1,411 acre-feet |
| Residence Time[a] | 2.3 years |
| Shape | |
| Maximum Length of Lake | 0.5 mile |
| Length of Shoreline | 1.5 miles |
| Maximum Width | 0.3 mile |
| Shoreline Development Factor[b] | 1.7 |
| Depth | |
| Area of Lake Less than f Feet | 26 percent |
| Area of Lake Five to 20 Feet | 29 percent |
| Area of Lake Greater than 20 Feet | 45 percent |
| Mean Depth | 22 feet |
| Maximum Depth | 40 feet |

[a]*Residence Time: Time required for a volume equivalent to the full volume of the lake to enter the lake from the tributary area.*

[b]*Shoreline Development Factor: Ratio of shoreline length to that of a circular lake of the same area.*

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

The major soil types present within the tributary area are: Casco loam, Casco-Rodman complex, Fox loam, Fox silt loam, St. Charles silt loam, Sebewa silt loam, Lamartine silt loam, Theresa silt loam, Houghton muck, and marsh soils.

Interpretations associated with the soil survey are such that they provide insights into the potential for land-based sources of pollution to affect the lake water quality either as a consequence of overland flows during storm events or through groundwater flows to the Lake. These interpretations are based upon ratings that reflected the requirements of Chapter Comm 83 of the *Wisconsin Administrative Code* governing onsite sewage disposal systems as they existed through the year 2000. During 2000, the Wisconsin Legislature amended Chapter Comm 83 and adopted new rules governing onsite sewage disposal systems. These new rules, which had an effective date of July 1, 2000, significantly altered the existing regulatory framework, and effectively increased the area in which onsite sewage disposal systems could be utilized. Insofar as these ratings reflect the potential for the transport of contaminants into lakes through groundwater inflows, these assessments are presented herein as an index of the likelihood of groundwater-sourced contaminants entering Ashippun Lake. It is useful to note that about 15 percent of the lands within the area tributary to Ashippun Lake are covered by soils that are categorized as being unsuitable for either conventional or mound type onsite sewage disposal systems, as indicated on Map 6, suggesting a potential sensitivity to disturbance and likelihood of being permeable to pollutants. The residential lands within the area tributary to Ashippun Lake currently are served by onsite sewage disposal systems.

## Climate and Hydrology

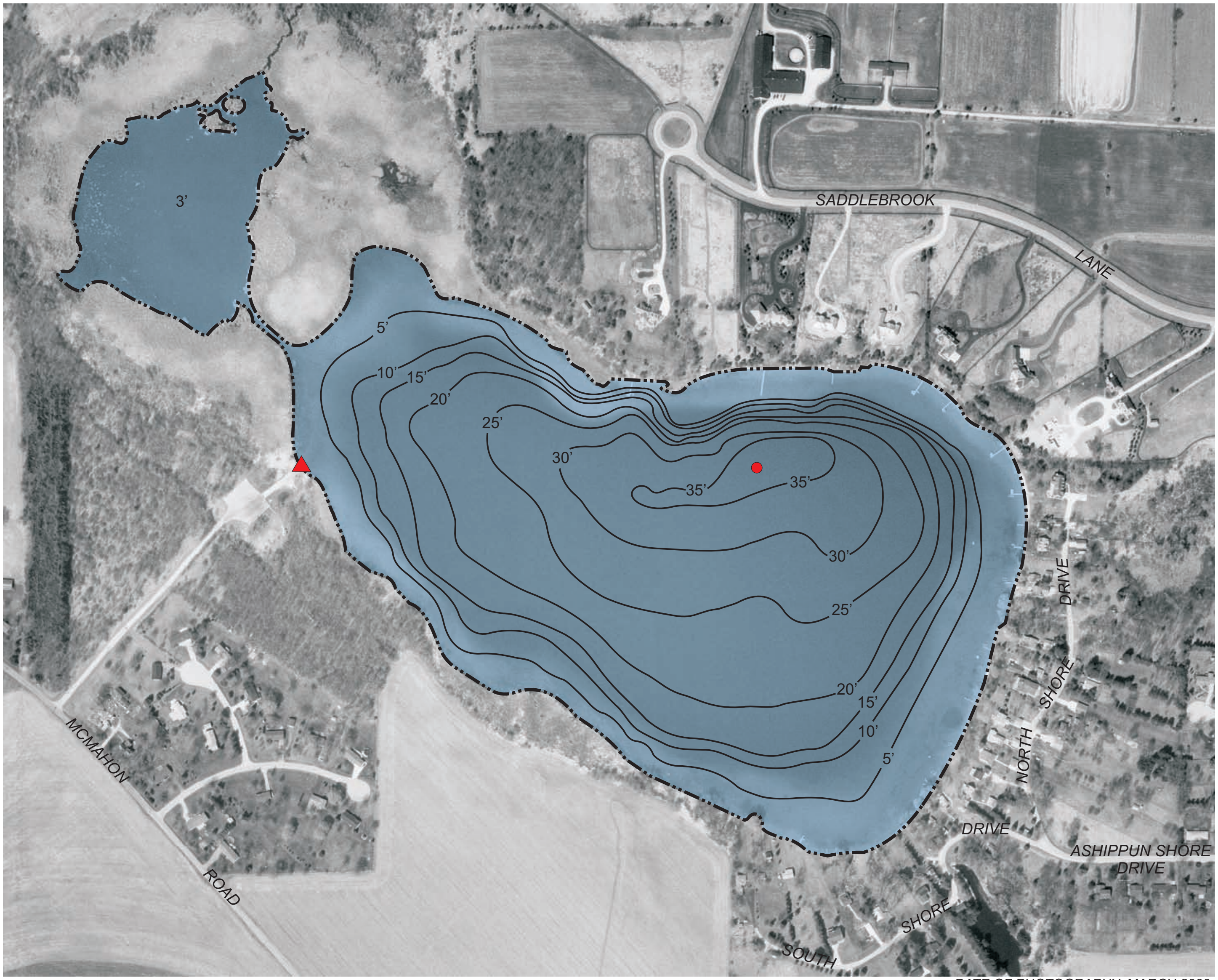
Long-term average monthly air temperature and precipitation values for the Ashippun Lake area are set forth in Table 3. These averages were taken from the National Oceanic and Atmospheric Administration (NOAA) records for the weather recording station at Oconomowoc, Wisconsin.

The records from this station may be considered typical of the lake area. The mean annual temperature of 48.2°F at Oconomowoc is similar to that reported from other recording locations in southeastern Wisconsin. The 12-month period for calendar year 2001, as indicated in Table 3, was a period during which temperatures were generally above normal. The mean annual precipitation at Oconomowoc is about 30.90 inches. Precipitation at Oconomowoc during the calendar year 2001 was about 38.44 inches, or about 25 percent, above normal, with the greatest increase from the average—2.21 inches—occurring during September. Eight of the 12 months experienced above normal amounts of precipitation.

Table 3 also sets forth stormwater runoff values derived from the U.S. Geological Survey (USGS) flow records for the Rock River at Watertown. More than half the normal yearly precipitation falls during the growing season, from May to September. Runoff rates are generally low during this period, since evapotranspiration rates are high, vegetative cover is good, and soils are not frozen. Normally, about 20 percent of the summer precipitation is expressed as surface runoff, but intense summer storms occasionally produce higher runoff fractions. In contrast, the approximately 45 percent of the annual precipitation occurs during the winter or early spring when the ground is frozen, and may result in high surface runoff during those seasons.

**Map 2**

**BATHYMETRIC MAP OF ASHIPPUN LAKE**




DATE OF PHOTOGRAPHY: MARCH 2000

— 20’ — WATER DEPTH CONTOUR IN FEET

▲ PUBLIC BOAT ACCESS

● SAMPLING SITE

*Source: U.S. Geological Survey and SEWRPC.*

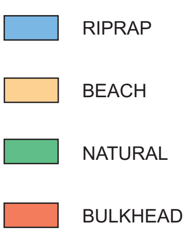
GRAPHIC SCALE

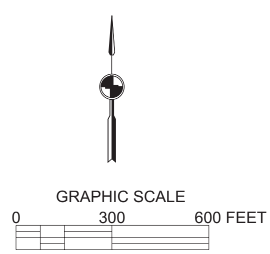
0 300 600 FEET

**Map 3**

**SHORELINE PROTECTION STRUCTURES ON ASHIPPUN LAKE: 2001**


DATE OF PHOTOGRAPHY: MARCH 2000

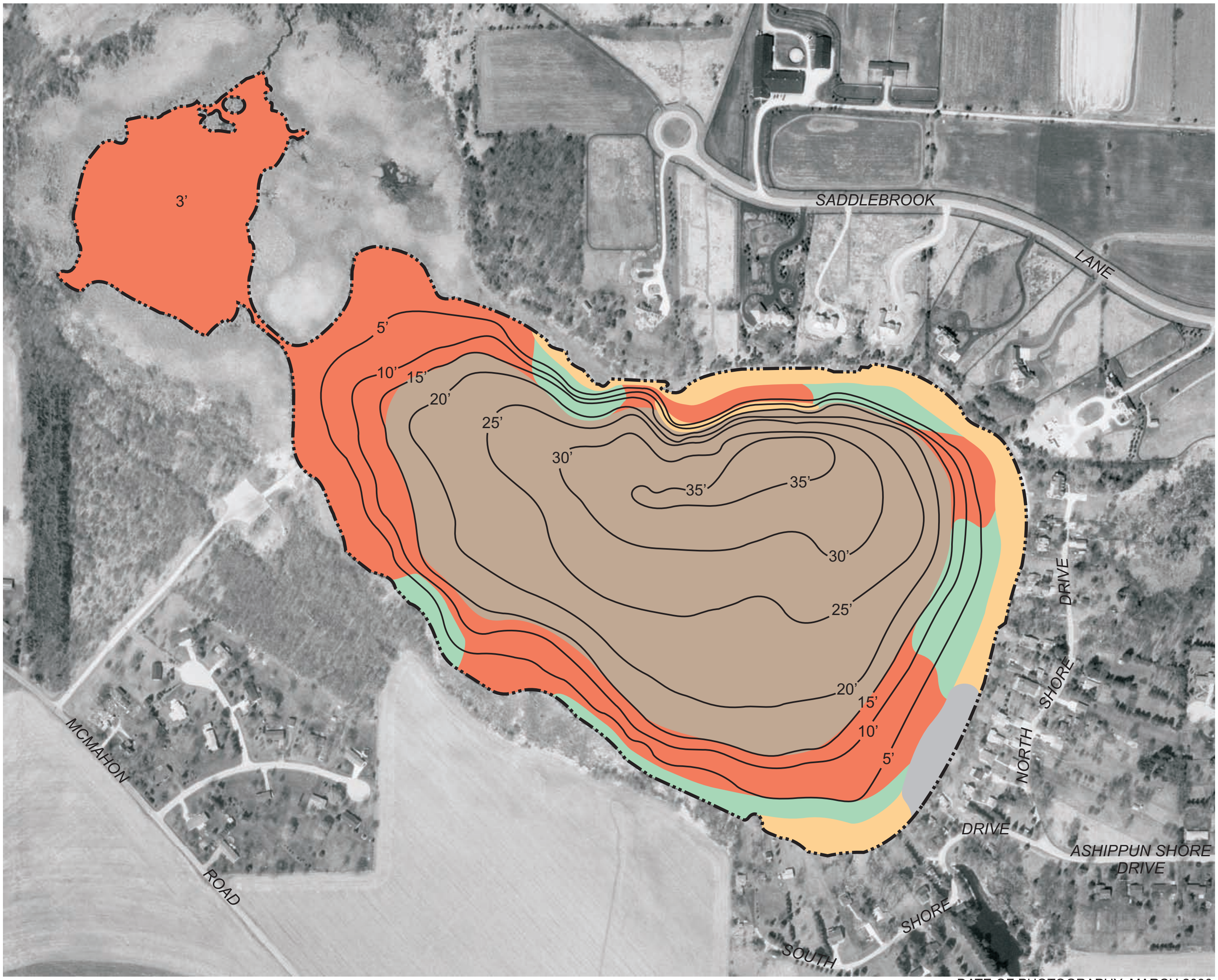



*Source: SEWRPC.*

**Map 4**

**SEDIMENT SUBSTRATE DISTRIBUTION IN ASHIPPUN LAKE: 2001**




DATE OF PHOTOGRAPHY: MARCH 2000

— 20' — WATER DEPTH CONTOUR IN FEET

SILT

SAND

MUCK

SAND AND SILT

SAND AND GRAVEL

GRAPHIC SCALE

0 300 600 FEET

*Source: SEWRPC.*

**Table 2**

**GENERAL HYDROLOGIC SOIL TYPES WITHIN THE TOTAL AREA TRIBUTARY TO ASHIPPUN LAKE**

| Group | Soil Characteristics | Total Tributary Area (acres) | Percent of Total |
|---|---|---|---|
| B | Moderately well drained; texture intermediate between coarse and fine; moderately rapid to moderate permeability; low to moderate shrink-swell potential | 548 | 69 |
| C | Poorly drained; high water table for part or most of the year; mottling, suggesting poor aeration and lack of drainage, generally present in A to C horizons | 26 | 3 |
| D | Very poorly drained; high water table for most of the year; organic or clay soils; clay soils having high shrink-swell potential | 77 | 10 |
| Other | Group not determined | 19 | 3 |
| Water | - - | 121 | 15 |
| - - | Total | 791 | 100 |

*Source: SEWRPC.*

**Lake Stage**

The water level of Ashippun Lake is nominally at an elevation of 868.5 feet above National Geodetic Vertical Datum of 1929 (NGVD29), although the actual surface level of the Lake varies with local weather and precipitation patterns since the lake depends primarily on groundwater level and precipitation as its primary sources of water. The initial water quality management plan for Ashippun Lake documented data for a 10 month period during the mid-1970s wherein Lake surface elevations fluctuated between 868.25 feet and 869.50 feet NGVD29. For the purposes of the current plan, however, it is assumed that over the long-term Lake levels will center around the 868.5 feet elevation.

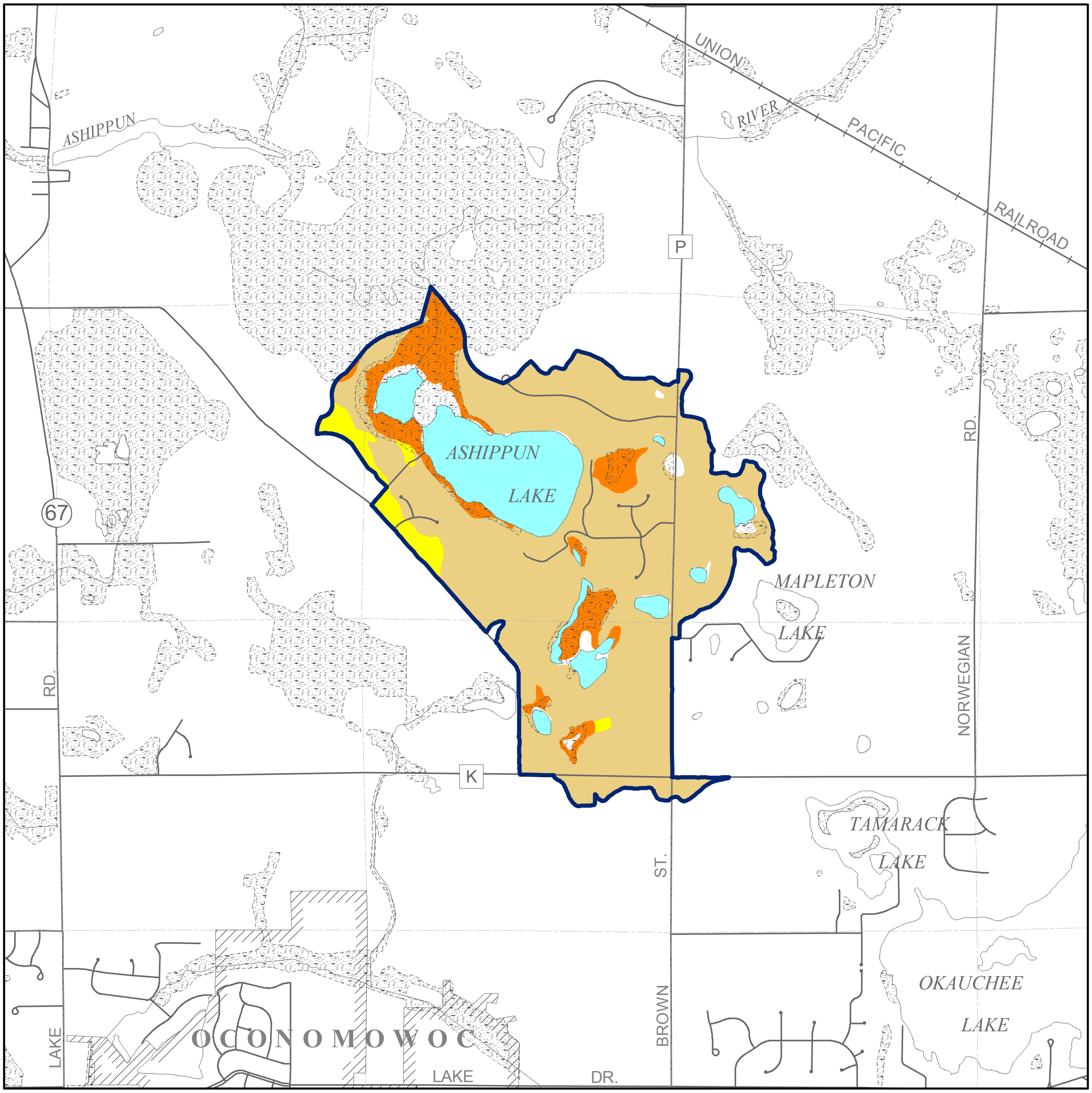
As documented in the initial water quality management plan for Ashippun Lake, as of 1982, an abandoned concrete dam, which historically provided hydropower for a mill, was located downstream of Ashippun Lake on the Ashippun River in the unincorporated community of Monterey, about one and one-half miles downstream of the Ashippun Lake outlet. The level of that dam, at the time of drafting of the initial plan, was controlled by flashboards and, under normal operating conditions, was expected to maintain water levels in the Monterey Mill Pond that were between 1.1 and 3.0 feet lower than the normal water surface elevation of Ashippun Lake.[4] Analyses conducted by SEWRPC staff at the time indicated that, during normal to low-flow periods, the Monterey Dam would not affect water levels in Ashippun Lake, if the dam were operated in accordance with WDNR permit requirements. Consequently, the long-term water budget shown in Figure 1 does not reflect any backflow to Ashippun Lake from the Ashippun River.

Notwithstanding, riparian residents have, in the past, reported perceived backflow occurrences to the Lake from the Ashippun River following unusually high precipitation events. These events coincided with extreme precipitation events moving across the Region from northwest to southeast, sequentially discharging runoff into

[4] *Monterey Mill Pond has a maximum depth of about eight feet and a surface area of about 28 acres. Wisconsin Department of Natural Resources Publication No. PUBL-WT-668-2002,* The State of the Rock River Basin, *April 2002, recommended that WDNR staff consider the feasibility of removing this structure. See also Wisconsin Department of Natural Resources Publication No. PUBL-WR-190-95REV,* Upper Rock River Basin Water Quality Management Plan, *December 1995.*

**Map 5**

**HYDROLOGIC SOIL GROUPS WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE**




GROUP B: MODERATELY DRAINED SOIL

GROUP C: POORLY DRAINED SOIL

GROUP D: VERY POORLY DRAINED SOIL

SURFACE WATER

TRIBUTARY AREA BOUNDARY

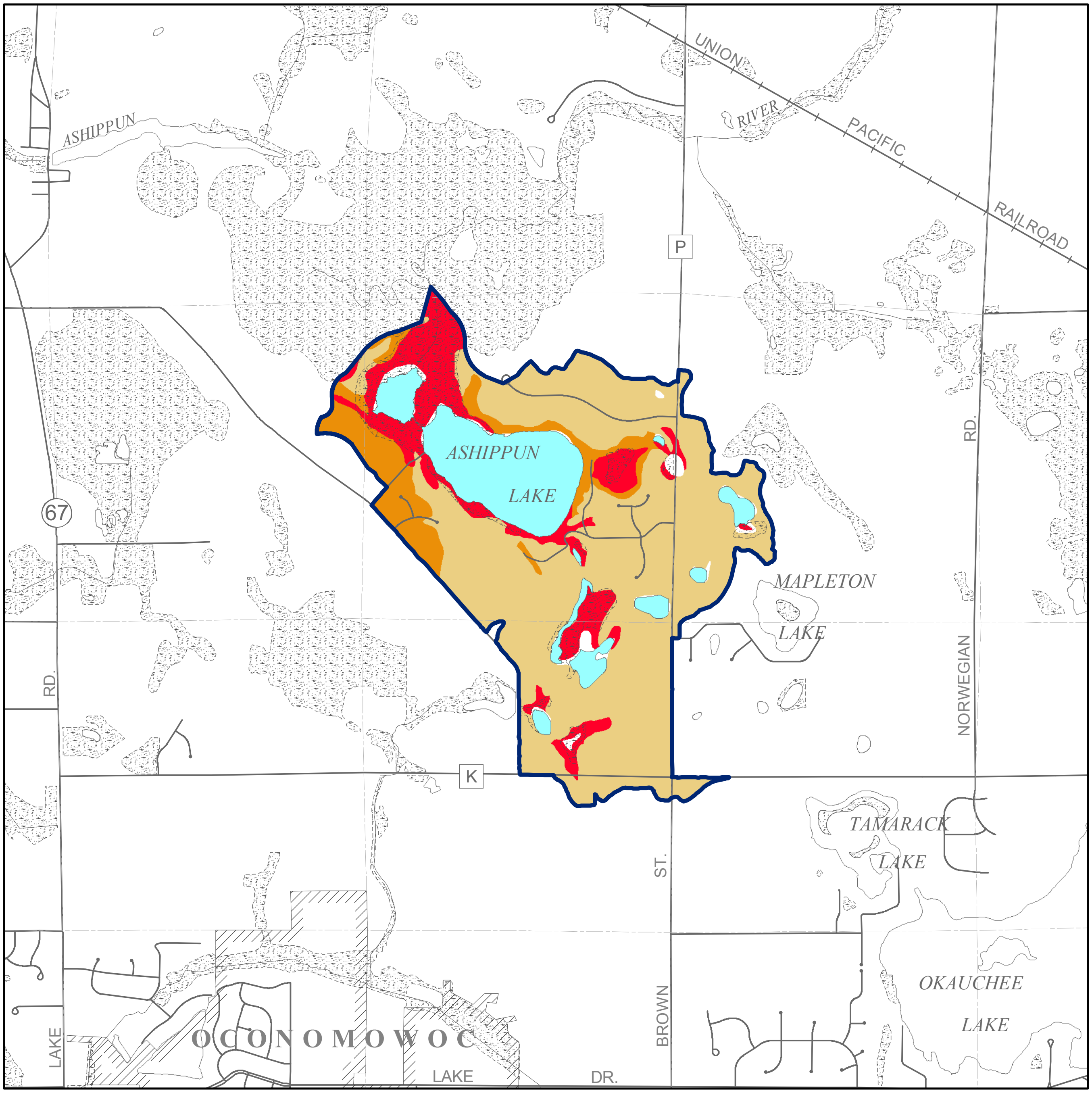
GRAPHIC SCALE

0 0.25 0.5 Miles

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

Map 6

GROUNDWATER CONTAMINATION POTENTIAL WITHIN THE DRAINAGE AREA TRIBUTARY TO ASHIPPUN LAKE




UNSUITABLE: Areas covered by soils which have a high probability of not meeting the June 2000 criteria of Chapter Comm 83 of the *Wisconsin Administrative Code* governing conventional onsite sewage disposal systems

UNDETERMINED: Areas covered by soils having a range of characteristics and or slopes which span the June 2000 criteria of Chapter Comm 83 of the *Wisconsin Administrative Code* governing conventional onsite sewage disposal systems so that no classification can be assigned

SUITABLE: Areas covered by soils having a high probability of meeting the June 2000 criteria of Chapter Comm 83 of the *Wisconsin Aministrative Code* governing conventional onsite sewage disposal systems

OTHER: Areas consisting for the most part of disturbed land for which no interpretive data are available

SURFACE WATER

GRAPHIC SCALE
0 0.25 0.5 Miles

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

**Table 3**

**LONG-TERM AND 2001 STUDY YEAR TEMPERATURE, PRECIPITATION, AND RUNOFF DATA FOR THE ASHIPPUN LAKE AREA**

| Temperature | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air Temperature Data (°F) | January | February | March | April | May | June | July | August | September | October | November | December | Mean |
| Long-Term Mean Monthly | 15.2 | 19.4 | 31.9 | 45.4 | 57.5 | 66.7 | 71.7 | 68.8 | 60.1 | 49.0 | 35.5 | 21.4 | 45.3 |
| 2001 Mean Monthly | 20.4 | 20.6 | 31.2 | 50.3 | 59.4 | 65.3 | 72.8 | 72.1 | 60.0 | 49.0 | 45.8 | 31.0 | 48.2 |
| Departure from Long-Term Mean | 5.2 | 1.2 | -0.7 | 4.9 | 1.9 | -1.4 | 1.1 | 3.3 | -0.1 | 0 | 10.3 | 9.6 | 2.9 |

| Precipitation | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Precipitation Data (inches) | January | February | March | April | May | June | July | August | September | October | November | December | Mean | Total |
| Long-Term Mean Monthly | 0.99 | 0.95 | 1.87 | 2.76 | 2.86 | 3.60 | 3.76 | 3.93 | 3.88 | 2.52 | 2.12 | 1.67 | 2.58 | 30.90 |
| 2001 Mean Monthly | 1.20 | 2.95 | 0.38 | 3.80 | 4.79 | 4.61 | 2.08 | 5.80 | 6.09 | 3.81 | 1.53 | 1.40 | 3.20 | 38.44 |
| Departure from Long-Term Mean | 0.21 | 2.01 | -1.49 | 1.04 | 1.93 | 1.01 | -1.68 | 1.87 | 2.21 | 1.29 | -0.59 | -0.27 | 0.63 | 7.54 |

| Runoff | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Runoff Data (inches) | January | February | March | April | May | June | July | August | September | October | November | December | Mean |
| Long-Term Mean Monthly | 0.34 | 0.39 | 1.14 | 1.50 | 0.87 | 0.54 | 0.42 | 0.31 | 0.30 | 0.41 | 0.48 | 0.40 | 0.59 |
| 2001 Mean Monthly | 0.21 | 0.58 | 1.30 | 2.08 | 1.52 | 1.68 | 0.49 | 0.29 | 0.83 | 0.70 | 0.71 | 0.68 | 0.92 |
| Departure from Mean Monthly | -0.13 | 0.19 | 0.16 | 0.58 | 0.65 | 1.14 | 0.07 | -0.02 | 0.53 | 0.29 | 0.23 | 0.28 | 0.33 |

*Source: National Oceanic and Atmospheric Administration and U.S. Geological Survey.*

the Rock River, the Ashippun River, and Ashippun Lake, respectively. These events tend to create hydraulic blockages which may result in the observed reverse flows from the Ashippun River to Ashippun Lake. Such occurrences are exacerbated by the relatively low gradients of the rivers in the vicinity of Ashippun Lake, although generally such phenomena are short-lived and of a temporary character. At the time of the initial planning program, the volume of water contributed to Ashippun Lake from the Ashippun River during these high flow events was estimated to be about 126 acre-feet,[5] or less than one-half the volume of direct precipitation onto the Lake surface, as noted below. During 2001, in an effort to limit the occurrence of such reverse flow events, the Ashippun Lake Protection and Rehabilitation District purchased and installed an inflatable temporary dam. This rubber-canvas, bladder-type device was installed on the downstream side of the culvert under the driveway to the Kellogg residence on the west side of the pond at the outlet of the Lake. This dam was locally designed and permitted by the WDNR. After several storms, and repeated maintenance, this temporary structure failed during a heavy rain event and was abandoned.

Of potentially greater concern is the presence of beaver in the drainage basin and, particularly, in the wetland and kettle area adjacent to the outlet of Ashippun Lake. As recently as 2004, beaver activity has resulted in the blockage of the outlet to Ashippun Lake and concern among riparian residents over possible flooding due to high

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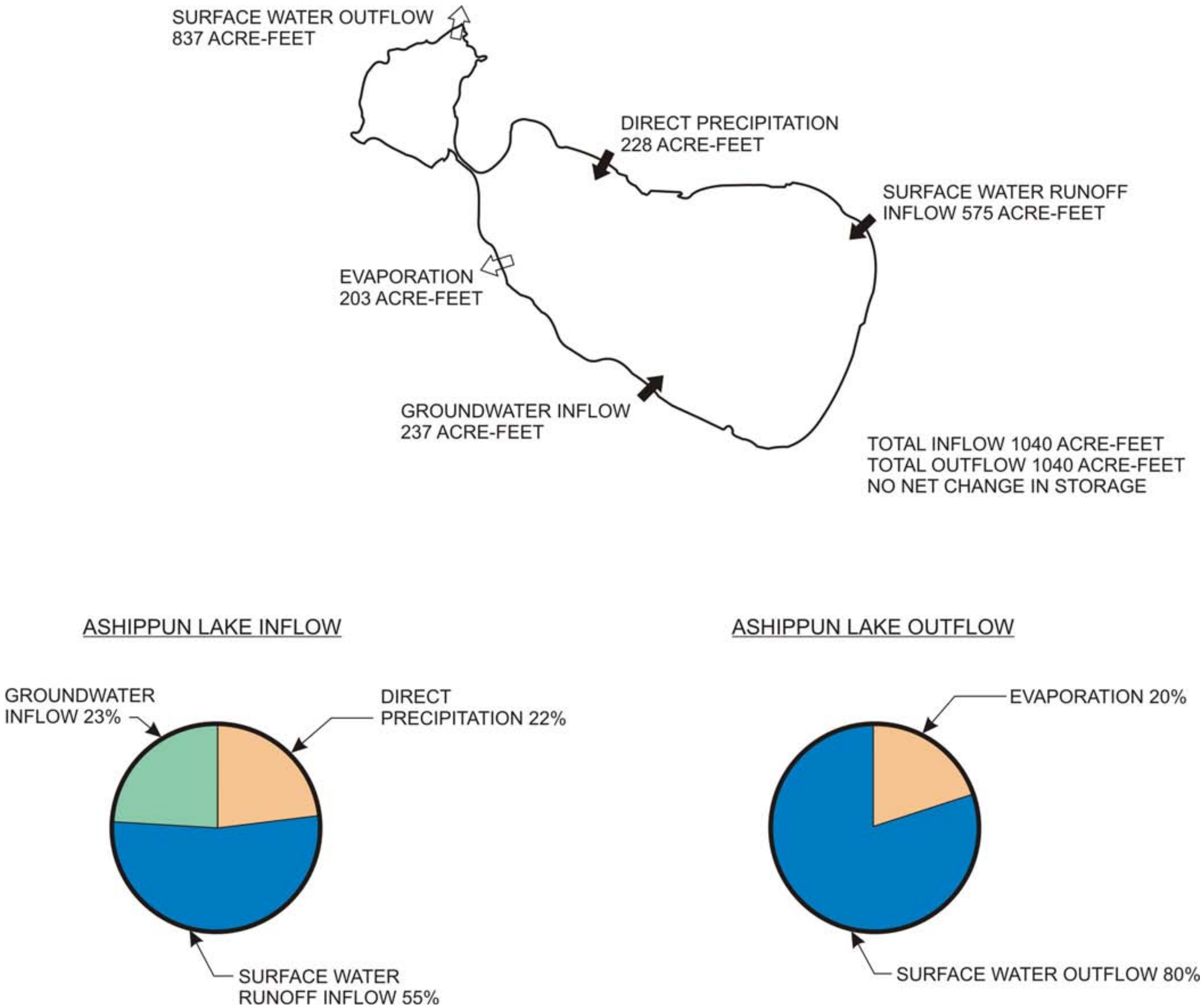
[5]*SEWRPC Community Assistance Planning Report No. 48,* A Water Quality Management Plan for Ashippun Lake, Waukesha County, Wisconsin, *January 1982.*

**Figure 1**

**LONG-TERM HYDROLOGIC BUDGET FOR ASHIPPUN LAKE**




*Source: U.S. Geological Survey and SEWRPC.*

water levels in the Lake. At such times, the animals are trapped and removed from the stream to allow the lake levels to return to more normal levels.

## Water Budget

The long-term water budget for Ashippun Lake was computed using estimated groundwater inflows combined with inflows from direct precipitation and surface water runoff from the surrounding land. Groundwater levels, based upon data from five pairs of observation wells located around the Lake, indicated that groundwater flows were toward the Lake around the entire perimeter of the Lake, and it was therefore assumed that no significant groundwater outflows occur from Ashippun Lake. Estimated outflows due to evaporation from the Lake's surface as well as to surface water outflow through the unnamed creek at the northeast end of the Lake were assumed to balance the inflows during this period. Flow data were estimated based upon data collected by the USGS at Watertown, Wisconsin. This long-term water budget is set forth in Figure 1. An average of about 575 acre-feet, or about 55 percent, of the water entering the Lake, is contributed by surface runoff, about 237 acre-feet, or 23 percent, is contributed by groundwater inflow,[6] and about 228 acre-feet, or 22 percent, is contributed by precipitation directly onto the lake surface.[7] Of this total long-term annual inflow of 1,040 acre-feet, it is estimated that 837 acre-feet, or about 80 percent, is lost due to outflow through the unnamed creek, and 203 acre-feet, or about 20 percent, is lost due to evaporation from the lake surface.

A water budget for Ashippun Lake for the year 2001 was computed in like manner to the long-term water budget, from estimated inflows and outflows. For the year 2001, it is estimated that 660 acre-feet of water, or 57 percent of the inflow, entered the Lake by surface runoff; 261 acre-feet, or 23 percent, entered the Lake by direct precipitation on the lake surface; and, 237 acre-feet, or 20 percent, entered the Lake by groundwater inflow. During 2001, therefore, a total of approximately 1,158 acre-feet of water entered Ashippun Lake. Of this amount, about 203 acre-feet, or about 18 percent of the outflow, were calculated to have been lost due to evaporation from the Lake surface and 955 acre-feet, or about 82 percent, were estimated to have flowed out through the unnamed creek and have been discharged from the Lake as surface outflow. The total amount of 1,158 acre-feet of water flowing into and out of Ashippun Lake during 2001 represents an approximate increase of 11 percent over the amounts determined for long-term inflow and outflow, the increase due, in part, to the aforementioned increase in precipitation during 2001.

The long-term hydraulic residence time for Ashippun Lake, likely to be applicable during years of average precipitation, was determined to be approximately 1.3 years. The hydraulic residence time for years of greater than normal precipitation is expected to be shorter, as reflected in the 2001 water residence time estimate of 1.2 years. The hydraulic residence time is important in determining the expected response time of the Lake to increased or reduced nutrient and other pollutant loadings.

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[6]*Groundwater inflows to Ashippun Lake are principally through the numerous springs that exist around the perimeter of the Lake.*

[7]*Backflow occurrences to the Lake from the Ashippun River following unusually high precipitation events were estimated during the initial planning program to amount to about 126 acre-feet, or about 12 percent of the long-term total water inflow to the Lake from all sources. Given the periodic and intermittent nature of this occurrence, however, this volume is not reflected as inflow to the Lake from the River, but is subsumed into the net water budget reported herein through the assumption of no net change in storage within the Lake.*

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# Chapter III

# HISTORICAL, EXISTING, AND FORECAST LAND USE AND POPULATION

## INTRODUCTION

Water pollution problems, recreational use conflicts, and deterioration of the natural environment are all primarily a function of the human activities within the area tributary to a waterbody, as are the ultimate solutions to these problems. This is especially true with respect to lakes, which are highly susceptible to deterioration from human activities because of their relatively long pollutant retention times, and because of the variety of often conflicting uses to which lakes are subjected. Furthermore, urban development is often concentrated in the direct tributary areas, especially around the shorelines of lakes, where there are no intermediate stream segments to attenuate pollutant runoff and loadings. This type of lake degradation is more likely to interfere with desired water uses and is often more difficult and costly to correct than degradation arising from clearly identifiable point sources of pollution in the watershed. Accordingly, the land uses and attendant population levels in the area directly tributary to a lake must be important considerations in any lake management planning effort. In the case of Ashippun Lake, which is situated at the headwaters of a larger drainage system, the importance of nonpoint source pollutants in determining lake water quality and in influencing downstream water quality is paramount. For this reason, land use and population distributions are summarized in this chapter, together with a review of jurisdictional issues relevant to water quality and lake management.

## CIVIL DIVISIONS

The geographic extent and functional responsibilities of civil divisions and special-purpose units of government are important factors related to land use and management, since these local units of government provide the basic structure of the decision-making framework within which land use development and redevelopment must be addressed. The entire area tributary to Ashippun Lake is located within the Town of Oconomowoc, Waukesha County, adjacent to and northeast of the City of Oconomowoc. About 0.23 square mile, or 18 percent of the area tributary to the Lake, is within the Ashippun Lake Protection and Rehabilitation District, a special-purpose unit of government with responsibilities for lake management.

## POPULATION

As set forth in Table 4, the resident population within the area tributary to Ashippun Lake increased between 1963 and 1970, but has remained relatively static since then. The 1970 resident population of the tributary area, estimated at 290 persons, was nearly one and one-half times the estimated 1963 population level. The population remained at approximately this level through the latter part of the 20th Century, but decreased slightly, to about

**Table 4**

**HISTORIC AND FORECAST RESIDENT POPULATION AND HOUSEHOLD LEVELS WITHIN THE DRAINAGE AREA TRIBUTARY TO ASHIPPUN LAKE: 1963-2000[a]**

| Year | Number of Residents | Number of Households |
|---|---|---|
| 1963 | 191 | 47 |
| 1970 | 290 | 64 |
| 1980 | 289 | 81 |
| 1990 | 294 | 91 |
| 2000 | 244 | 95 |

[a]*Study area approximated using whole U.S. Public Land Survey one-quarter sections, U.S. Bureau of Census data and onsite determination of the boundary of the area directly tributary to Ashippun Lake.*

*Source: SEWRPC.*

240 persons, as of 2000. Comparison of historic, existing, and forecast population levels for the Ashippun Lake tributary area, Waukesha County, and the Southeastern Wisconsin Region, presented in the initial plan, showed that the population growth rate in the Ashippun Lake area since 1950 has been lower than the growth rate for Waukesha County.

While the population has remained essentially static in recent years, Table 4 shows that the numbers of housing units have continued to increase. The total number of housing units has almost doubled since 1963, with the numbers of dwelling units increasing from about 50 units in 1963 to about 95 units in 2000. This demand for housing units may be expected to place a continued stress on the natural resource base of the lake tributary area. Consequent to this, water resource demands and water quality concerns may be expected to increase as new households modify the demand for potable water, alter wastewater discharge regimes, and contribute to nonpoint source pollution.

## LAND USE

The type, intensity, and spatial distribution of the various land uses within the area tributary to Ashippun Lake are important determinants of lake water quality and recreational use demands. The current and planned land use patterns placed in the context of the historical development of the area are, therefore, important considerations in any lake management planning effort for Ashippun Lake.

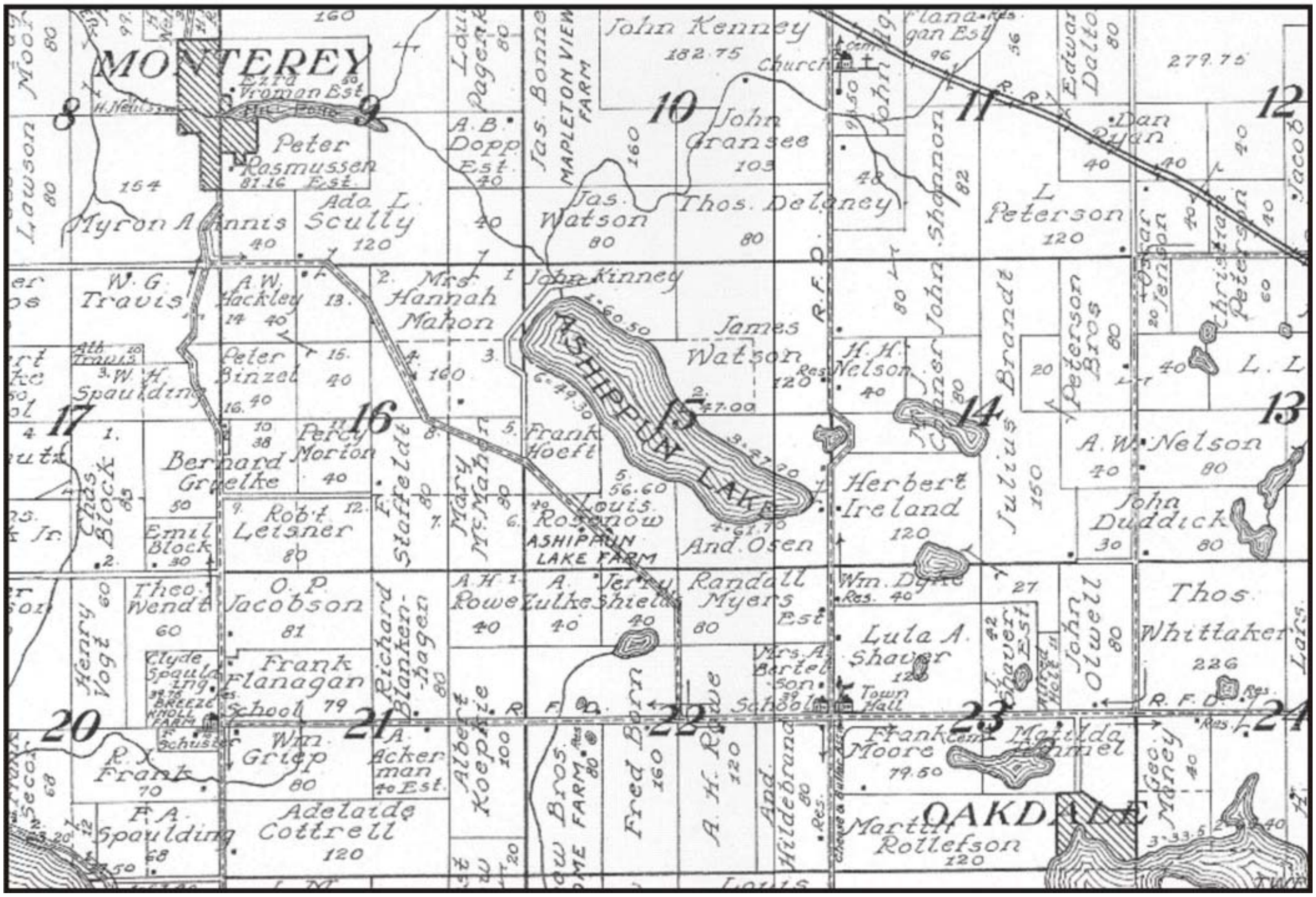
The movement of European settlers into the Southeastern Wisconsin Region began about 1830. Completion, within southeastern Wisconsin, of the U.S. Public Land Survey in 1836, and the subsequent sale of public lands in Wisconsin, brought a rapid influx of settlers into the area. Map 7 shows a 1914 historic plat for the Ashippun Lake area.

The division of rural lands within the area tributary to Ashippun Lake began during the 1830s. There were two periods of significant urban growth, primarily in the form of urban-density residential development. The first, during the 1940s, occurred primarily on lands adjacent to the lake shoreline. Later, from about 1963 to 1975, residential development took place primarily in the outlying areas away from the lake shoreline, along the major roadways in and adjacent to the Ashippun Lake area. Historic urban growth patterns are shown in Table 5 and displayed graphically on Map 8.

The existing land use pattern, as of 2000, in the Ashippun Lake tributary area is shown on Map 9, and is quantified in Table 6. As indicated in Table 6, as of 2000, about 178 acres, or 23 percent, of the total area tributary to Ashippun Lake were devoted to urban land uses. The dominant urban land use was residential, encompassing about 119 acres, or 67 percent of the area in urban use. As of 2000, about 613 acres, or 77 percent of the area tributary to Ashippun Lake, were still devoted to rural land uses. About 385 acres, or about 63 percent of the rural area, were in agricultural land uses. Woodlands, wetlands, and surface waters, including the surface area of Ashippun Lake, accounted for approximately 228 acres, or 37 percent, of the area in rural uses.

**Map 7**

**HISTORIC PLAT MAP OF THE ASHIPPUN LAKE AREA: 1914**




*Source: Geo. A. Ogle & Company, Chicago, Illinois.*

Under 2020 conditions, the trend toward more intensive urban land use being observed in Waukesha County is also expected to be reflected in the area tributary to the Lake.[1] As noted above, much of this development is expected to occur as agricultural lands are converted to urban lands, primarily for residential uses, as shown on Map 10. However, some redevelopment of existing properties and the reconstruction of existing single-family homes may be expected to occur, especially on lakeshore properties. By 2020, urban land uses within the area directly tributary to Ashippun Lake are expected to increase in areal extent to about 295 acres, or to about 37 percent of the area tributary to the Lake, as shown in Table 6. Urban residential uses are expected to increase from about 119 acres, as of 2000, to about 169 acres by the year 2020. Much of this development is expected to occur on the periphery of the area, along the major roadways, and not adjacent to the Lake, given that the extent of the wetlands in the vicinity of the Lake limits the area of land available for urban development. Agricultural lands in the area, consequently, are expected to decrease in areal extent from about 385 acres, as of 2000, to less than 268 acres in the year 2020. Recent surveillance indicates that such changes in land use appear to be due to

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[1]*SEWRPC Planning Report No. 45,* A Regional Land Use Plan for Southeastern Wisconsin: 2020, *December 1997, as refined for the year 2035; SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin, *August 1996.*

**Table 5**

**EXTENT OF URBAN GROWTH WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE: 1950-2000**

| | Direct Drainage Area | |
|---|---|---|
| Year | Extent of New Urban Development Occurring Since Previous Year (acres)[a] | Cumulative Extent of Urban Development (acres)[a] |
| 1950 | - - | 15 |
| 1970 | 47 | 62 |
| 1975 | 19 | 81 |
| 1980 | 3 | 84 |
| 2000 | 94 | 178 |

[a]*Urban development, as defined for the purposes of this discussion, includes those areas within which houses or other buildings have been constructed in relatively compact groups, thereby indicating a concentration of urban land uses. Scattered residential developments were not considered in this analysis.*

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

large-lot residential development. If this trend continues, some of the open space areas remaining in the tributary area are likely to be replaced with large-lot urban residential development, resulting in the potential for increased pollutant loadings to the Lake. This development could occur in the form of residential clusters on smaller lots within conservation subdivisions, thereby preserving portions of the remaining open space and, thus, reducing the impacts on the Lake.[2]

## LAND USE REGULATIONS

The comprehensive zoning ordinance represents one of the most important and significant tools available to local units of government in directing the proper use of lands within their area of jurisdiction. Local zoning regulations include general, or comprehensive, zoning regulations and special-purpose regulations governing floodland and shoreland areas. General zoning and special-purpose zoning regulations may be adopted as a single ordinance or as separate ordinances; they may or may not be contained in the same document. Any analysis of locally proposed land use changes must take into consideration the provisions of both general and special-purpose zoning ordinances. As noted, the area tributary to Ashippun Lake lies wholly within the Town of Oconomowoc, an unincorporated area of Waukesha County, adjacent to the northeastern boundary of the City of Oconomowoc. The ordinances administered by these units of government are summarized in Table 7.

### General Zoning

Cities in Wisconsin are granted comprehensive, or general, zoning powers under Section 62.23 of the *Wisconsin Statutes*.[3] Counties are granted general zoning powers within their unincorporated areas under Section 59.69 of the *Statutes*. County zoning ordinances become effective only in those towns that ratify the county ordinance. Towns that have not adopted a county zoning ordinance may adopt village powers, and subsequently utilize the city and village zoning authority conferred in Section 62.23, subject, however, to county board approval where a general-purpose county zoning ordinance exists. Alternatively, a town may adopt a zoning ordinance under Section 60.61 of the *Wisconsin Statutes* where a general-purpose county zoning ordinance has not been adopted, but only after the county board fails to adopt a county ordinance at the petition of the governing body of the town concerned.

General zoning is in effect in all communities in Waukesha County and within the area tributary to Ashippun Lake. Within the tributary area to Ashippun Lake, the Town of Oconomowoc has adopted the County ordinance, as shown in Table 7.

### Floodland Zoning

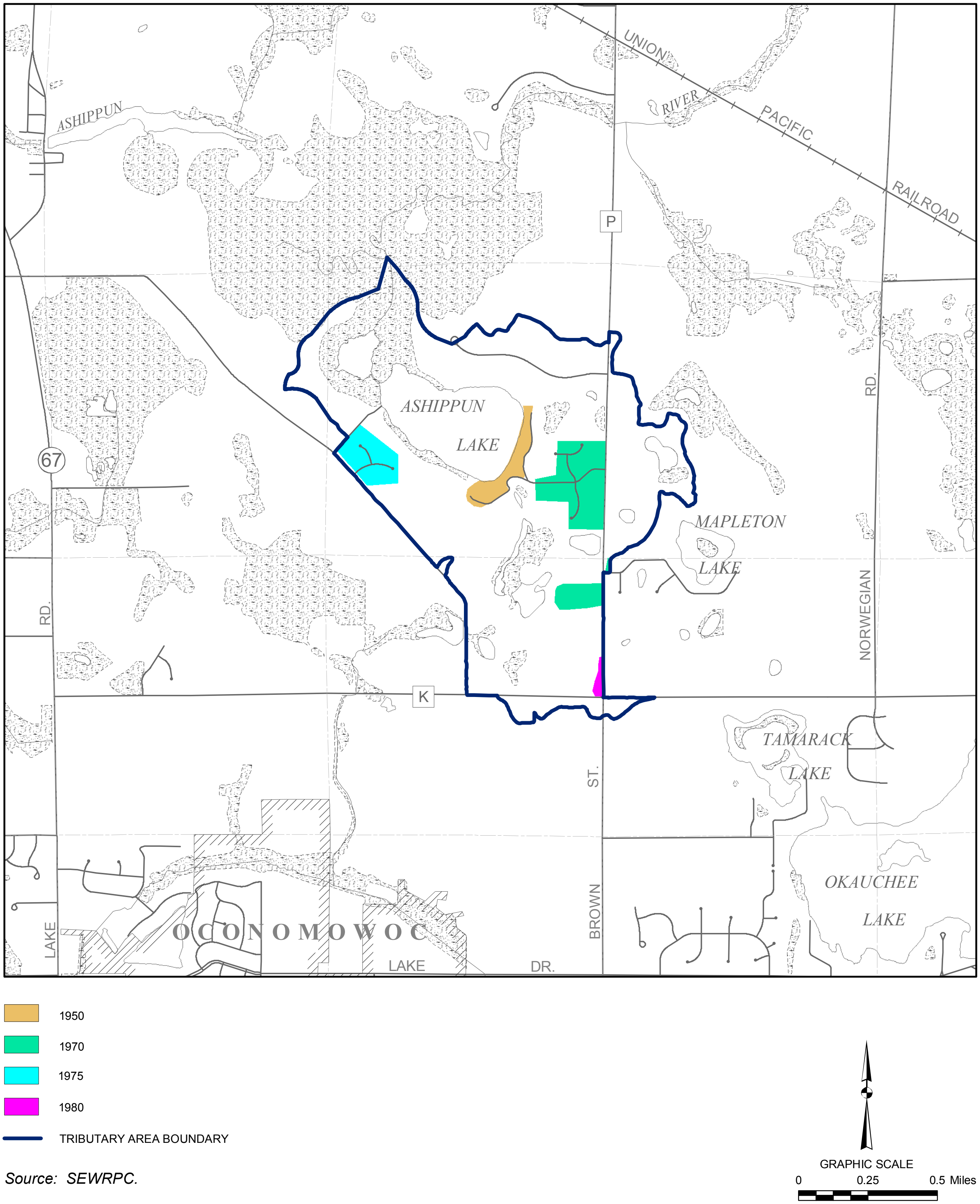
Section 87.30 of the *Wisconsin Statutes* requires that cities, villages, and counties, with respect to their unincorporated areas, adopt floodland zoning to preserve the floodwater conveyance and storage capacity of floodplain areas and to prevent the location of new flood damage-prone development in flood hazard areas. The

[2]*See SEWRPC Planning Guide No. 7,* Rural Cluster Development Guide*, December 1996.*

[3]*The same powers are granted to villages under Section 61.35,* Wisconsin Statutes*.*

## Map 8

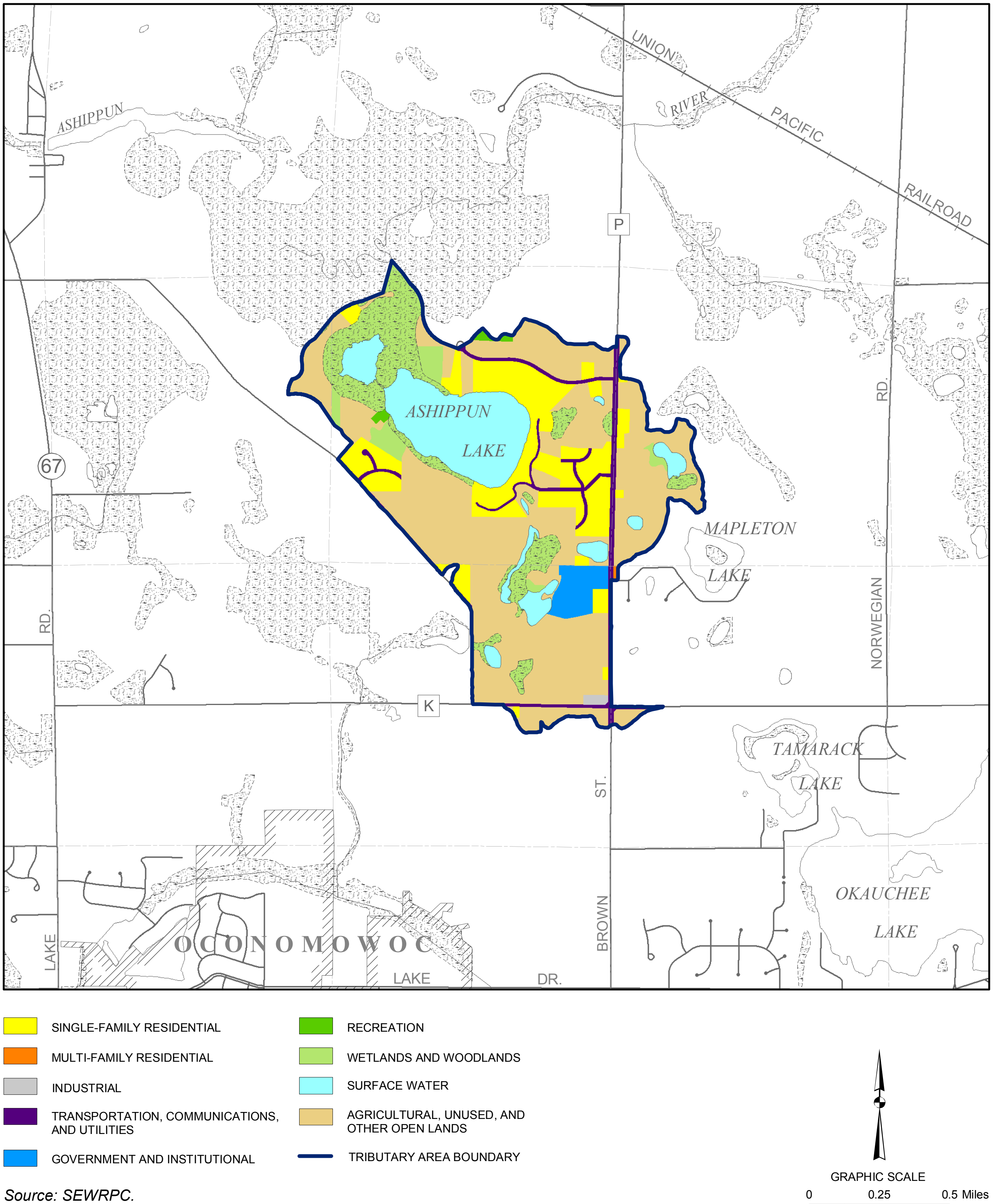
### HISTORIC URBAN GROWTH WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE




*Source: SEWRPC.*

**Map 9**

**EXISTING LAND USE WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE: 2000**




*Source: SEWRPC.*

Table 6

EXISTING AND PLANNED LAND USE WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE: 2000 AND 2020

| Land Use Categories[a] | 2000 Acres | 2000 Percent of Tributary Drainage Area | 2020 Acres | 2020 Percent of Tributary Drainage Area |
|---|---|---|---|---|
| Urban | | | | |
| Residential | 119 | 15.0 | 169 | 21.4 |
| Commercial | - - | - - | - - | - - |
| Industrial | 2 | 0.3 | 2 | 0.3 |
| Governmental and Institutional | 18 | 2.3 | 58 | 7.3 |
| Transportation, Communication, and Utilities | 36 | 4.6 | 37 | 4.7 |
| Recreation | 3 | 0.4 | 29 | 3.7 |
| Subtotal | 178 | 22.6 | 295 | 37.4 |
| Rural | | | | |
| Agricultural | 385 | 48.5 | 268 | 33.7 |
| Wetlands | 90 | 11.4 | 90 | 11.4 |
| Woodlands | 18 | 2.3 | 18 | 2.3 |
| Water | 120 | 15.2 | 120 | 15.2 |
| Extractive | - - | - - | - - | - - |
| Subtotal | 613 | 77.4 | 496 | 62.6 |
| Total | 791 | 100.0 | 791 | 100.0 |

[a]*Parking included in associated use.*

*Source: SEWRPC.*

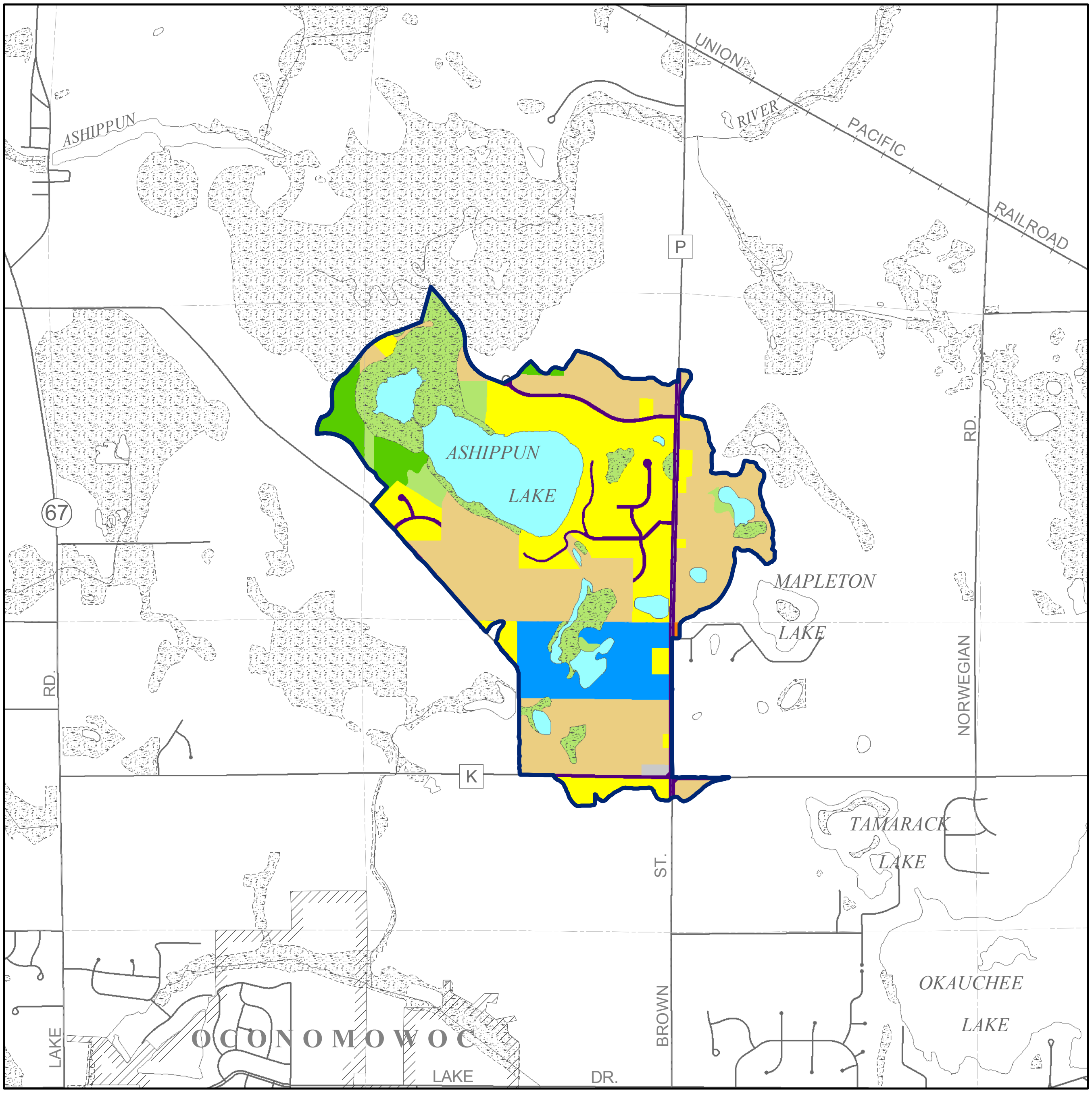
minimum standards which such ordinances must meet are set forth in Chapter NR 116 of the *Wisconsin Administrative Code*. The required regulations govern filling and development within a regulatory floodplain, which is defined as the area subject to inundation by the 100-year recurrence interval flood event, the event which has a 1 percent probability of occurring in any given year. 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 100-year recurrence peak flood flow. Local regulations must also restrict filling and development within the flood fringe, which is that portion of the floodplain located outside the floodway that would be covered by floodwater during the 100-year recurrence 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. It should be noted that towns may enact floodland zoning regulations which may be more restrictive than those in the County Shoreland and Floodland Protection Zoning Ordinance. All of the lands within the area tributary to Ashippun Lake currently are regulated by the county floodplain zoning ordinance which requires preservation of floodwater storage capacity.

## Shoreland Zoning

Under Section 59.692 of the *Wisconsin Statutes*, counties in Wisconsin are required to adopt zoning regulations within statutorily defined shoreland areas. These statutorily defined lands are those lands within 1,000 feet of a navigable lake, pond, or flowage, or 300 feet of a navigable stream, or to the landward side of the floodplain, whichever distance is greater, within unincorporated areas. Minimum standards for county shoreland zoning ordinances are set forth in Chapter NR 115 of the *Wisconsin Administrative Code*. Chapter NR 115 sets forth requirements regarding lot sizes and building setbacks; restrictions on the cutting of trees and shrubs; and restrictions on filling, grading, lagooning, dredging, ditching, and excavating that must be incorporated into county shoreland zoning regulations. In addition, Chapter NR 115 requires that counties place all wetlands with

Map 10

**PLANNED LAND USE WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE: 2020**




SINGLE-FAMILY RESIDENTIAL

MULTI-FAMILY RESIDENTIAL

INDUSTRIAL

TRANSPORTATION, COMMUNICATIONS, AND UTILITIES

GOVERNMENT AND INSTITUTIONAL

RECREATION

WETLANDS AND WOODLANDS

SURFACE WATER

AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS

TRIBUTARY AREA BOUNDARY

GRAPHIC SCALE

0 0.25 0.5 Miles

*Source: SEWRPC.*

**Table 7**

**LAND USE REGULATIONS WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE IN WAUKESHA COUNTY: 2006**

| Community | Type of Ordinance | | | | |
|---|---|---|---|---|---|
| | General Zoning | Floodland Zoning | Shoreland or Shoreland-Wetland Zoning | Subdivision Control | Erosion Control and Stormwater Management |
| Waukesha County.......... | Adopted | Adopted | Adopted and Wisconsin Department of Natural Resources approved | Floodland and shoreland only | Adopted |
| Town of Oconomowoc ... | County ordinance | County ordinance | Adopted and Wisconsin Department of Natural Resources approved | Adopted | County ordinance[a] |

[a]*Ordinance is administered and enforced by Waukesha County.*

*Source: SEWRPC.*

an area of five acres or larger and within the statutory shoreland zoning jurisdiction area into a wetland conservancy zoning district to ensure their preservation, after completion of appropriate wetland inventories by the WDNR.

In 1982, the State Legislature extended shoreland-wetland zoning requirements for cities and villages in Wisconsin. Under Sections 62.231 and 61.351, respectively, of the *Wisconsin Statutes*, cities and villages in Wisconsin are required to place wetlands with an area of 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 identification of wetlands to be protected under Chapters NR 115 and NR 117 is the Wisconsin Wetlands Inventory. Mandated by the State Legislature in 1978, the Wisconsin Wetlands Inventory resulted in the preparation of 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 on the basis of its 1980, one inch equals 2,000 feet scale, ratioed and rectified aerial photographs, as discussed in Chapter V.[4]

The Town of Oconomowoc has adopted their own shoreland-wetland ordinance, approved by the WDNR, as shown in Table 7.

**Subdivision Regulations**

Chapter 236 of the *Wisconsin Statutes* requires the preparation of 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

[4]*SEWRPC, in cooperation with the WDNR, is updating wetland delineations for the entire seven-county Region. That inventory is expected to be completed in early 2008, and it will be available for use in updating local shoreland-wetland zoning maps.*

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.

The subdivision regulatory powers of towns and counties are confined to unincorporated areas. City and village subdivision control ordinances may be applied to extraterritorial areas, as well as to the incorporated areas. It is possible for both a county and a town to have concurrent jurisdiction over land divisions in unincorporated areas, or for a city or village to have concurrent jurisdiction with a town or county in the city or village extraterritorial plat approval area. In the case of overlapping jurisdiction, the most restrictive requirements apply. The subdivision control ordinances adopted and administered by Waukesha County apply to the unincorporated statutory shoreland areas of the County, including the area tributary to Ashippun Lake.

**Construction Site Erosion Control and Stormwater Management Regulations**
Section 62.23 of the *Wisconsin Statutes* grants authority to cities and villages in Wisconsin to adopt ordinances for the prevention of erosion from construction sites and the management of stormwater runoff from lands within their jurisdiction. Towns may adopt village powers and subsequently utilize the authority conferred on cities and villages under Section 62.23 to adopt their own erosion control and stormwater management ordinances, subject to county board approval where a county ordinance exists. The administrative rules for the State stormwater discharge permit program are set forth in Chapter NR 216 of the *Wisconsin Administrative Code*, which initially took effect on November 1, 1994, and was most recently recreated effective August 1, 2004. Currently, Waukesha County, the City of Oconomowoc, and the Town of Oconomowoc have been identified by the WDNR as being urbanized areas that have been, or will be, required to obtain stormwater discharge permits, unless they receive exemptions.

Through 1997 Wisconsin Act 27, the State Legislature required the WDNR and the Wisconsin Department of Agriculture, Trade and Consumer Protection (WDATCP) to develop performance standards for controlling nonpoint source pollution from agricultural and nonagricultural land and from transportation facilities.[5] Chapter NR 216 of the *Wisconsin Administrative Code* identifies several categories of municipalities, industries, and construction sites that must obtain permits. The permit requirements are based on the performance standards set forth in Chapter NR 151 of the *Wisconsin Administrative Code*, which became effective on October 1, 2002 and were revised in July 2004.

***Agricultural Performance Standards***
Agricultural performance standards cover the following areas:

- Cropland sheet, rill, and wind erosion control,
- Manure storage,
- Clean water diversions, and
- Nutrient management.

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[5]*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, “Runoff Management Grant Program,” Chapter NR 154, “Best Management Practices, Technical Standards and Cost-Share Conditions,” and Chapter NR 155 “Urban Nonpoint Source Water Pollution Abatement and Stormwater Management Grant Program.” 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. The Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) revised Chapter ATCP 50, “Soil and Water Resource Management,” to incorporate changes in DATCP programs as required under 1997 Wisconsin Act 27.*

For existing land that does not meet the Chapter NR 151 standards and that was cropped or enrolled in the U.S. Department of Agriculture (USDA) Conservation Reserve Program (CRP) or Conservation Reserve Enhancement Program (CREP) as of October 1, 2002, agricultural performance standards are required to be met only if cost share funding is available. 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.

***Nonagricultural (urban) Performance Standards***

The nonagricultural performance standards set forth in Chapter NR 151 of the *Wisconsin Administrative Code* 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 phase for new development and redevelopment,
- Developed urban areas, and
- Nonmunicipal property fertilizing.

Chapter NR 151 requires municipalities with WPDES stormwater discharge permits to reduce the amount of total suspended solids in stormwater runoff from areas of existing development that were 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, and
- By October 1, 2013, the standards call for a 40 percent reduction.

Also, permitted municipalities must implement: 1) public information and education programs relative to specific aspects of nonpoint source pollution control; 2) municipal programs for the collection and management of leaf and grass clippings; and, 3) site-specific programs for the application of lawn and garden fertilizers on municipally controlled properties with over five acres of pervious surface. Under the requirements of Chapter NR 151, by March 10, 2008, incorporated municipalities with average population densities of 1,000 people per square mile or more that are not required to obtain municipal stormwater discharge permits must implement these same programs.

Regardless of whether a municipality is required to have a stormwater discharge permit under Chapter NR 216 of the *Wisconsin Administrative Code*, Chapter NR 151 requires that all construction sites that disturb one acre or more of land must achieve an 80 percent reduction in the sediment load generated by 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 load from the site by 80 percent for new development, 40 percent for redevelopment, and 40 percent for infill development occurring prior to October 1, 2012. After October 1, 2012, infill development will be required to achieve an 80 percent reduction. 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.

Stormwater management practices in urban areas, under the provisions of Section NR 151.12 of the *Wisconsin Administrative Code*, require infiltration, 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, either 90 percent of the predevelopment infiltration volume or 25 percent of the post-development runoff volume from a two-year recurrence interval, 24-hour storm, is required to be infiltrated. However, no more than 1 percent of the area of the project site is required to be used as effective infiltration area; in commercial, industrial and institutional areas, 60 percent of the predevelopment infiltration volume or 10 percent of the post-development runoff volume from a two-year recurrence interval, 24-hour storm, is required to be infiltrated, provided that no more than 2 percent of the rooftop and parking lot areas are required to be used as effective infiltration area.

Impervious area setbacks of 50 feet from streams, lakes, and wetlands generally apply. This setback distance is increased to 75 feet around Chapter NR 102-designated Outstanding or Exceptional Resource Waters or Chapter NR 103-designated wetlands of special natural resource interest. Reduced setbacks from less susceptible wetlands and drainage channels of not less than 10 feet may be allowed.

In addition to these provisions, Section NR 151.13 of the *Wisconsin Administrative Code* requires municipalities to implement informational and educational programming to promote good housekeeping practices in developed urban areas, as well as related operational programs in those municipalities subject to stormwater permitting requirements pursuant to Chapter NR 216 of the *Wisconsin Administrative Code*.

Waukesha County has adopted construction erosion control and stormwater management ordinances. These ordinances apply to the unincorporated town lands in the county. The Waukesha County construction site erosion control ordinance applies to all lands requiring a subdivision plat or certified survey, to sites upon which construction activities will disturb 3,000 square feet or more and/or 400 cubic yards or more of material, and to sites where pipeline placement operations disturb 300 linear feet or more of land surface. These ordinances require persons engaging in land disturbing activities to employ soil erosion control practices on affected sites that are consistent with those set forth in the *Wisconsin Construction Site Best Management Practice Handbook*[6] or equivalent practices. In general, these practices are designed to minimize soil loss from disturbed sites through prior planning and phasing of land disturbing activities and use of appropriate onsite erosion control measures.

The Waukesha County stormwater management ordinance applies to residential lands of five acres or more in areal extent, residential lands of between three and five acres in areal extent where there is at least 1.5 acres of impervious surface, nonresidential lands of 1.5 acres in areal extent where there is at least 0.5 acre of impervious surface, or other lands on which development activities may result in stormwater runoff likely to harm public property or safety. Lands within an area covered by an approved stormwater management plan are specifically exempted from the Waukesha County ordinance. The stormwater management ordinance establishes performance standards to manage both rate and volume of stormwater flows from regulated sites and water quality. Performance standards adopted in this ordinance and the resultant design of appropriate management practices are based on calculation procedures and principles set forth in *Urban Hydrology for Small Watersheds*.[7]

Waukesha County administers and enforces the construction site erosion control and stormwater management ordinance in the Town of Oconomowoc.

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[6]*Wisconsin League of Municipalities and Wisconsin Department of Natural Resources,* Wisconsin Construction Site Best Management Practices Handbook*, April 1994.*

[7]*U.S. Department of Agriculture Technical Release 55,* Urban Hydrology of Small Watersheds*, June 1992.*

# Chapter IV

# WATER QUALITY

## INTRODUCTION

The earliest data on water quality conditions in many Wisconsin lakes date back to the early 1900s, when E.A. Birge and C. Juday, widely recognized pioneering lake researchers from the University of Wisconsin, collected basic information on Wisconsin lakes.[1] However, most water quality information for Ashippun Lake is relatively recent, having been collected and recorded periodically from 1973 to the present. Data utilized in this plan included Secchi disk readings, temperature-depth profiles, and dissolved oxygen, total phosphorus and chlorophyll-*a* concentrations for the period from 1990 through 2003, as well as various other Wisconsin Department of Natural Resources (WDNR) reports and file data and the earlier Southeastern Wisconsin Regional Planning Commission (SEWRPC) plan.[2]

## EXISTING WATER QUALITY CONDITIONS

Water quality data gathered under the auspices of the WDNR monitoring programs were used to assess water quality in Ashippun Lake. For purposes of the initial water quality management plan for Ashippun Lake, data for the period from 1973 through 1978 were used to determine water quality conditions in the Lake and to characterize the suitability of the Lake for recreational use and for the support of fish and aquatic life. These data are supplemented with more recent data, collected during the period from 1990 through 2003, to determine and evaluate current water quality conditions in the Lake. Water quality samples generally were taken seasonally from the main basin of the Lake.

### Thermal Stratification

Thermal and dissolved oxygen profiles for Ashippun Lake are shown in Figure 2. In the initial plan, water temperatures in Ashippun Lake ranged from a minimum of 32°F (0°C) during the winter to a maximum of 78°F (26°C) during the summer. Between 1993 and 2001, water temperatures in Ashippun Lake ranged from a minimum of 32°F (0°C) during the winter to 82°F (28°C) during the summer. The maximum summer temperatures were approximately 5ºF to 10ºF warmer in recent years than those recorded during the initial

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[1]*E.A. Birge and C. Juday,* The Inland Lakes of Wisconsin, *1.* The Dissolved Gases and their Biological Significance, *Bulletin, Wisconsin Geological and Natural History Survey, Volume 22, 1911.*

[2]*SEWRPC Community Assistance Planning Report No. 48,* A Water Quality Management Plan for Ashippun Lake, Waukesha County, Wisconsin, *January 1982.*

**Figure 2**

**DISSOLVED OXYGEN AND TEMPERATURE PROFILES FOR ASHIPPUN LAKE: 1993-2003**

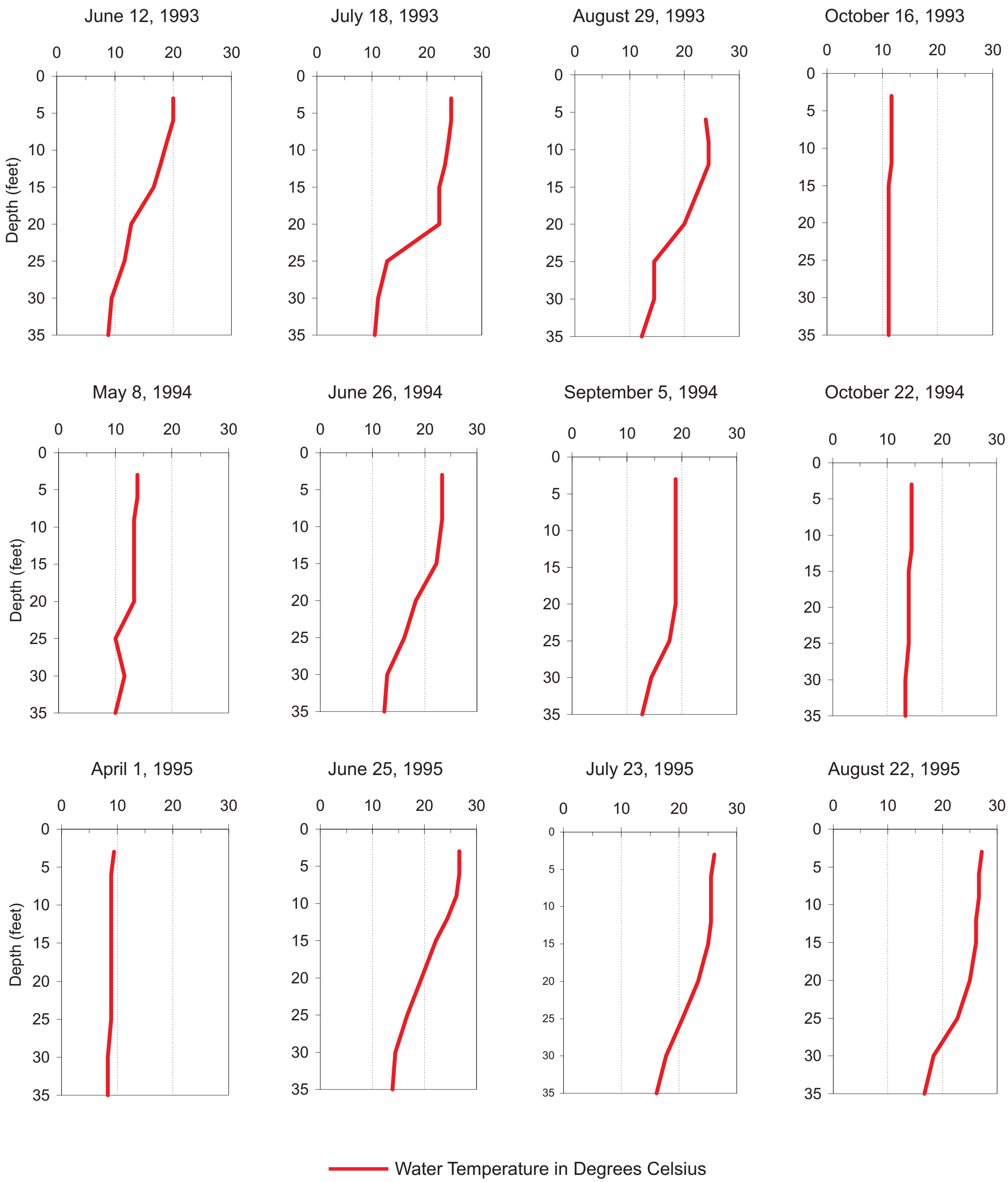


**Figure 2 (continued)**

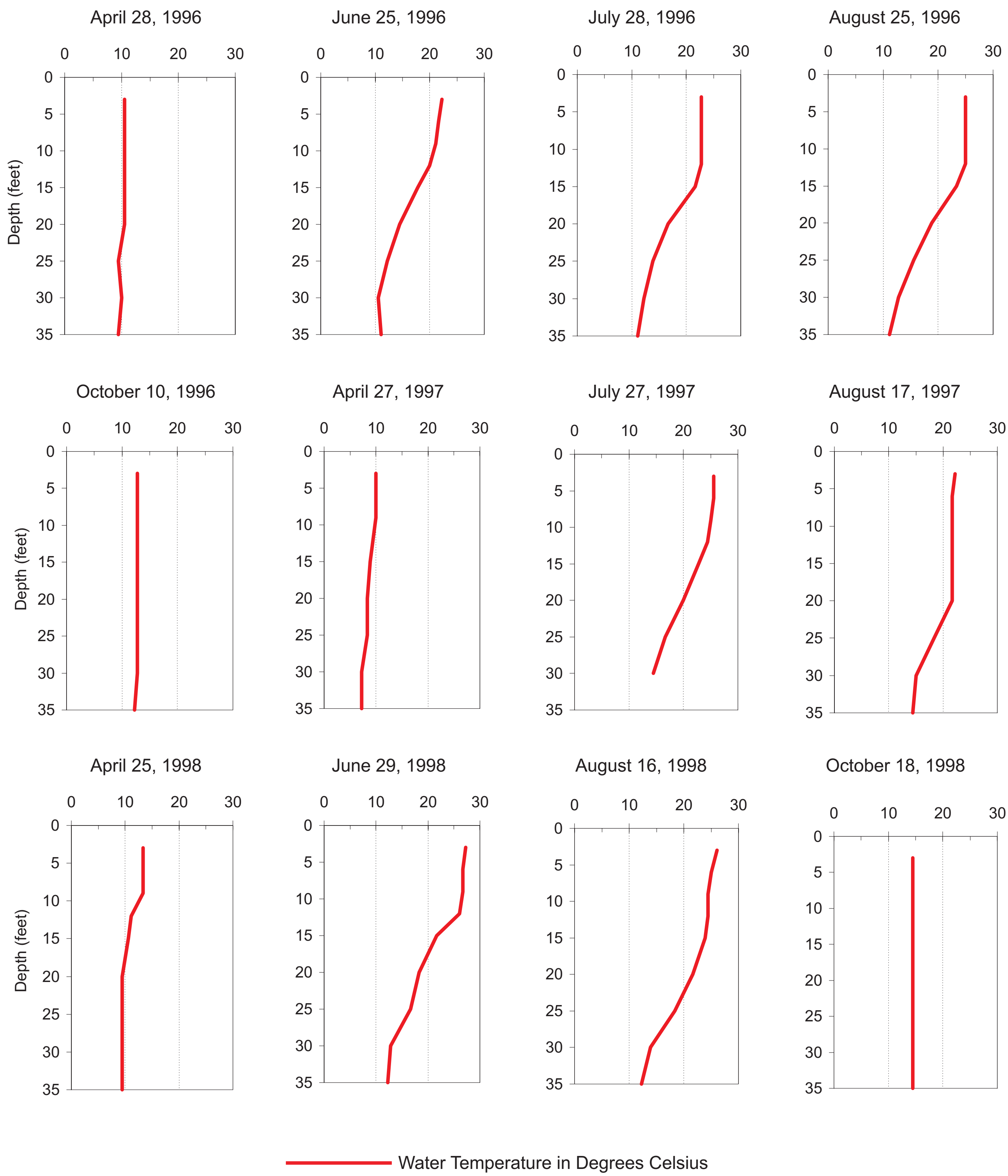


**Figure 2 (continued)**

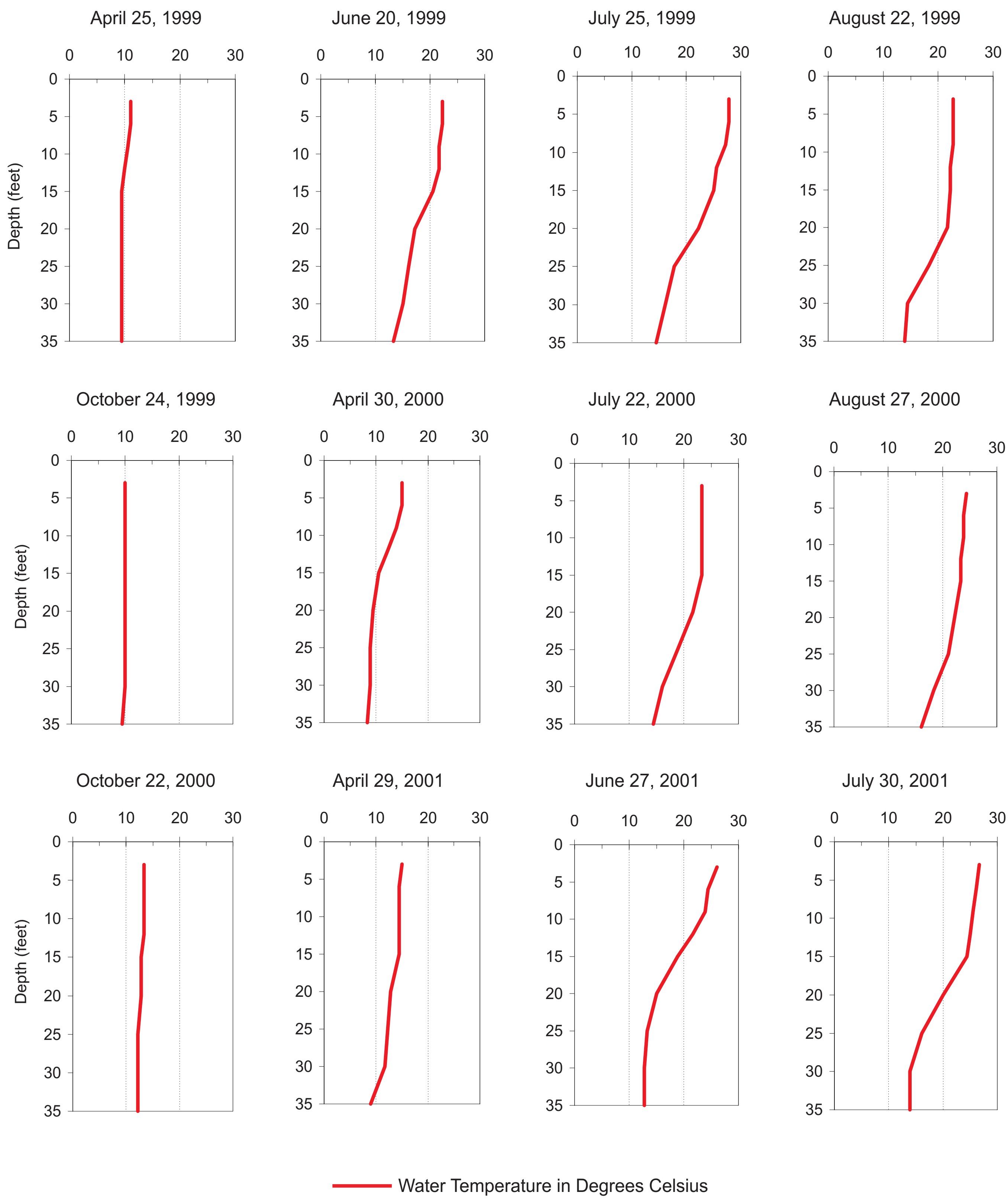
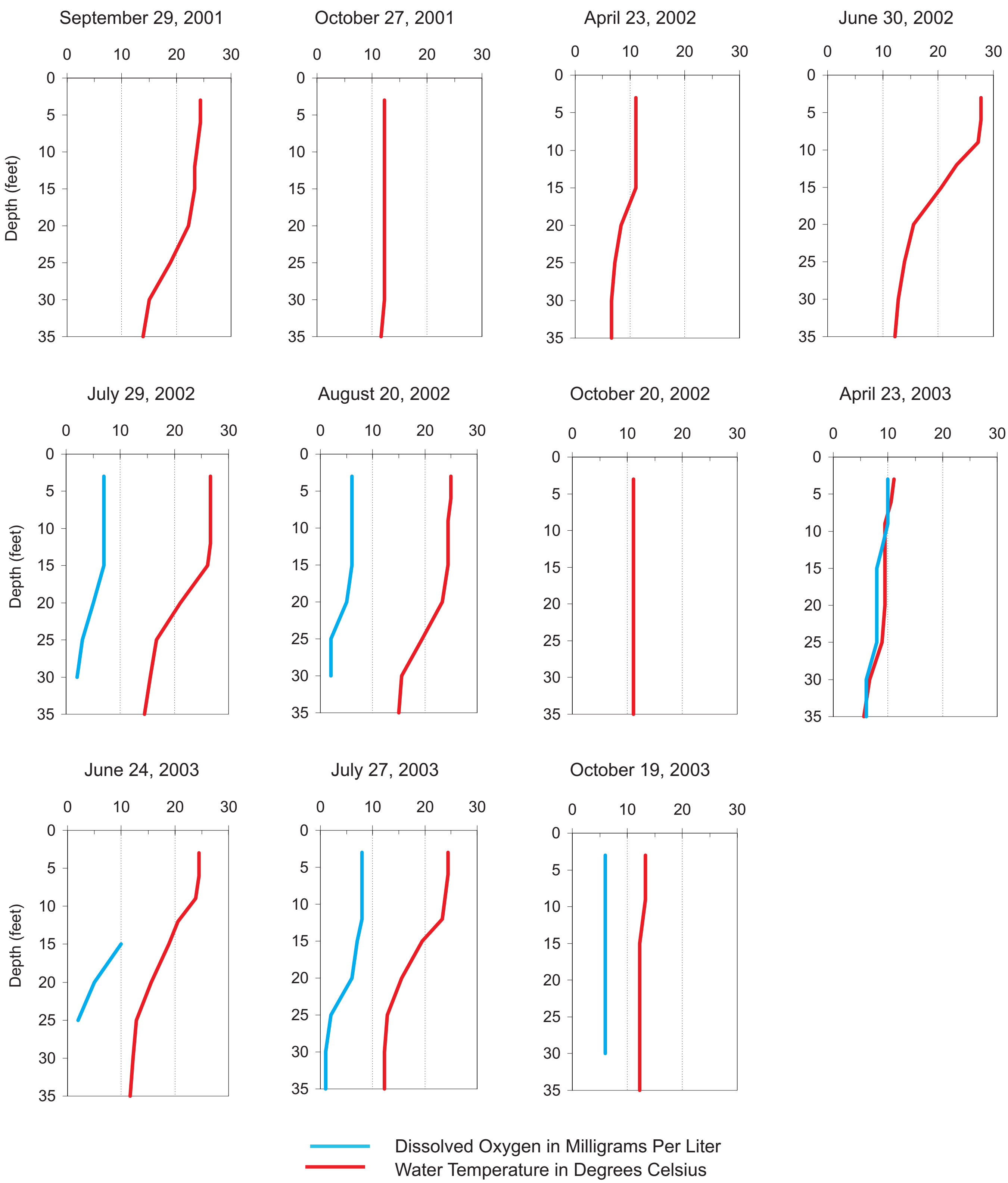


**Figure 2 (continued)**




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

planning study, conducted during 1976 and 1977. This observation is consistent with similar observations in other lakes in southeastern Wisconsin, including Lac La Belle and Pewaukee Lake.[3]

The Lake is dimictic, which means that it mixes completely two times per year, and is subject to thermal stratification during summer and winter. This process is illustrated diagrammatically in Figure 3. Thermal stratification is a result of the differential heating of the lake water, and the resulting water temperature-density relationships at various depths within the lake water column. Water is unique among liquids because it reaches its maximum density, or mass per unit of volume, at about 39°F (4°C). The development of summer thermal stratification begins in early summer, reaches its maximum in late summer, and disappears in the fall. Stratification may also occur during winter under ice cover. The annual thermal cycle within Ashippun Lake is described below.

As summer begins, the Lake absorbs solar energy at the surface. Wind action and, to some extent, internal heat transfer mechanisms transmit this energy to the underlying portions of the waterbody. As the upper layer of water is heated by solar energy, a physical barrier, created by differing water densities between warmer and cooler water, begins to form between the warmer surface water and the colder, heavier bottom water, as shown in Figure 3. This "barrier" is marked by a sharp temperature gradient known as the thermocline and is characterized by a 1°C drop in temperature per one meter (or about a 2°F drop in temperature per three feet) of depth that separates the warmer, lighter, upper layer of water (the epilimnion) from the cooler, heavier, lower layer (the hypolimnion), as shown in Figure 4. Although this barrier is readily crossed by fish, provided sufficient oxygen exists, it essentially prohibits the exchange of water between the two layers. This condition has a major impact on both the chemical and biological activity in a lake.

The autumn mixing period occurs when air temperatures cool the surface water and wind action results in the erosion of the thermocline: as the surface water cools, it becomes heavier, sinking and displacing the now relatively warmer water below. The colder water sinks and mixes under wind action until the entire column of water is of uniform temperature, as shown in Figure 3. This action, which follows summer stratification, is known as "fall turnover."

From fall turnover until freeze-up, surface waters continue to cool in response to the continued decline in ambient air temperatures. Once the temperature of the water at the surface drops to the point of maximum water density, 39.2°F, these waters will now have become more dense than the warmer waters below them. As a consequence of this density difference, the surface waters begin to "sink" to the bottom. Eventually, the entire water column is cooled to the point of maximum density at 39.2°F. The surface waters continue to cool until they reach about 32°F, and are, once again, less dense than the waters below which remain at about 39°F. At 32°F, the lake surface may then become ice covered, isolating the lake water from the atmosphere for a period of up to four months. On Ashippun Lake, ice cover typically exists from December until early April. As shown in Figure 3, winter stratification occurs as the colder, lighter water and ice remains at the surface, separated from the relatively warmer, heavier water near the bottom of the lake. The ice shuts the water column off from the atmospheric source of oxygen.

Spring brings a reversal of the process. Once the surface ice has melted, the upper layer of water continues to warm until it reaches 39.2°F, the maximum density point of water and the temperature of the deeper waters below it. At this point, the entire water column is, once again, the same temperature (and density) from surface to bottom and wind action results in a mixing of the entire lake. This is referred to as "spring turnover" and usually occurs within weeks after the ice goes out, as shown in Figure 3. After spring turnover, the water at the surface continues

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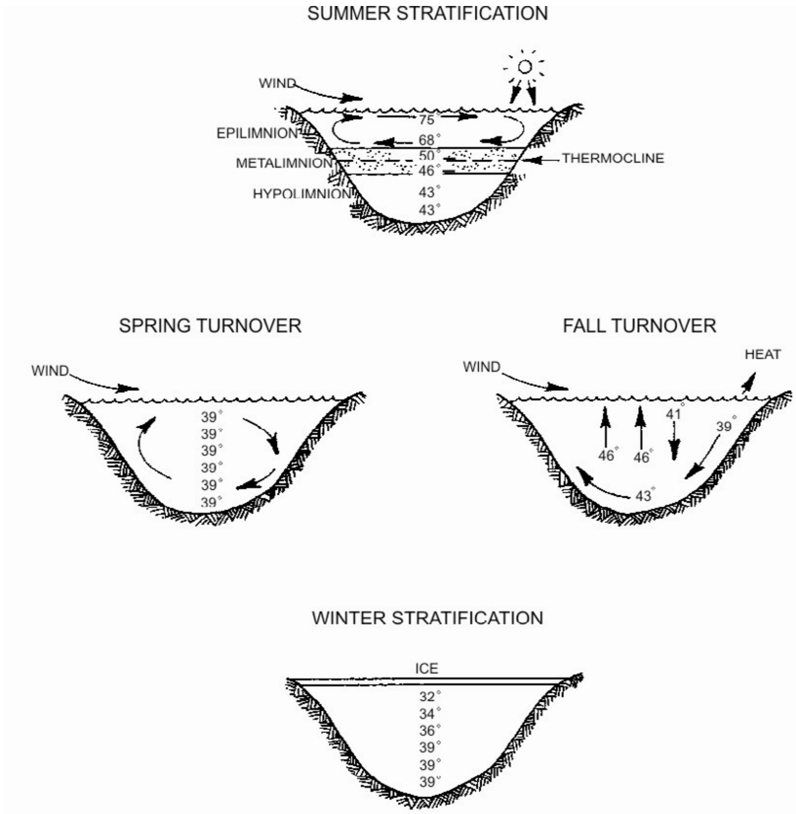
[3]*See SEWRPC Community Assistance Planning Report No. 47 , 2nd Edition,* A Water Quality Management Plan for Lac La Belle, Waukesha County, Wisconsin*, May 2007; SEWRPC Community Assistance Planning Report No. 58, 2nd Edition,* A Lake Management Plan for Pewaukee Lake, Waukesha County, Wisconsin*, May 2003.*

**Figure 3**

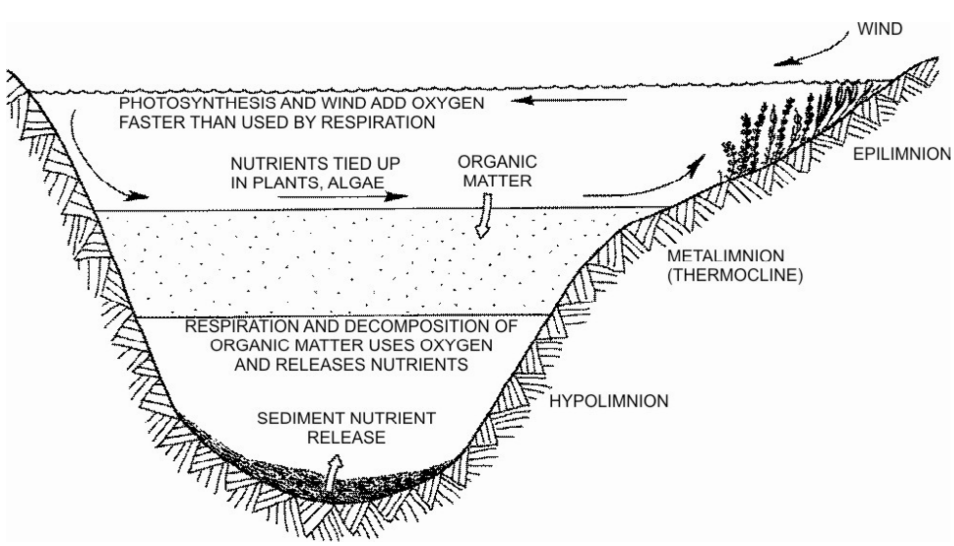
**THERMAL STRATIFICATION OF LAKES**




*Source: University of Wisconsin-Extension and SEWRPC.*

**Figure 4**

**LAKE PROCESSES DURING SUMMER STRATIFICATION**




*Source: University of Wisconsin-Extension and SEWRPC.*

to warm and become less dense, causing it to float above the colder, deeper water. Wind and resulting waves carry some of the energy of the warmer, lighter water to lower depths, but only to a limited extent. Thus begins the formation of the thermocline and another period of summer thermal stratification.

**Dissolved Oxygen**

Dissolved oxygen levels are one of the most critical factors affecting the living organisms of a lake ecosystem. As shown in Figure 2, dissolved oxygen levels were generally higher at the surface of Ashippun Lake, where there was an interchange between the water and atmosphere, stirring by wind action, and production of oxygen by plant photosynthesis. Dissolved oxygen levels were lowest on the bottom of the Lake, where decomposer organisms and chemical oxidation processes utilized oxygen in the decay process. When any lake becomes thermally stratified, as described above, the surface supply of dissolved oxygen to the hypolimnion is cut off. Gradually, if there is not enough dissolved oxygen to meet the total demands from the bottom dwelling aquatic life and decaying organic material, the dissolved oxygen levels in the bottom waters may be reduced, even to zero, a condition known as anoxia or anaerobiasis, as shown in Figure 4.

Although total oxygen depletion in the hypolimnion of Ashippun Lake is not indicated in Figure 2, it should be noted that the quantity of dissolved oxygen data collected between 1990 and 2003 from Ashippun Lake is extremely limited. These data, therefore, may not be generally indicative of the dissolved oxygen regime in Ashippun Lake. Nevertheless, the dissolved oxygen data presented in the previous report, wherein a condition of hypolimnetic anoxia was indicated on one sampling date, when viewed in combination with the current data, would suggest that anoxic conditions in Ashippun Lake are rare, even though diminished dissolved oxygen concentrations would appear to be common during the summer period. Consequently, the risk of summer-kill of fishes due to oxygen depletion stress is low.

Fall turnover, between September and October in most years, naturally restores the supply of oxygen to the bottom water. The data for 2003, shown in Figure 2, suggest that Ashippun Lake follows this trend. Hypolimnetic anoxia can be reestablished during the period of winter thermal stratification. Winter anoxia is more common during the years of heavy snowfall, when snow covers the ice, reducing the degree of light penetration and reducing algal photosynthesis that takes place under the ice. In some lakes in the Region, hypolimnetic anoxia can occur during winter stratification. Under these conditions, anoxia can contribute to the winter-kill of fish. At the end of winter, dissolved oxygen concentrations in the bottom waters of the lake are restored during the period of spring turnover, which generally occurs between March and May, as shown in Figure 2.

Hypolimnetic anoxia is common in many of the lakes in southeastern Wisconsin during summer stratification. The depleted oxygen levels in the hypolimnion cause fish to move upward, nearer to the surface of the lakes, where higher dissolved oxygen concentrations exist. This migration, when combined with temperature, can select against some fish species that prefer the cooler water temperatures that generally prevail in the lower portions of the lakes. When there is insufficient oxygen at these depths, these fish are susceptible to summer-kills, or, alternatively, are driven into the warmer water portions of the lake where their condition and competitive success may be severely impaired.

In addition to these biological consequences, the lack of dissolved oxygen at depth can enhance the development of chemoclines, or chemical gradients, with an inverse relationship to the dissolved oxygen concentration. For example, the sediment-water exchange of elements such as phosphorus, iron, and manganese is increased under anaerobic conditions, resulting in higher hypolimnetic concentrations in these elements. Under anaerobic conditions, iron and manganese change oxidation states enabling the release of phosphorus from the iron and manganese complexes to which they are bound under aerobic conditions. This “internal loading” can affect water quality significantly if these nutrients and salts are mixed into the epilimnion, especially during early summer when these nutrients can become available for algal and rooted aquatic plant growth. The likely import of internal loading on the nutrient budget of Ashippun Lake is discussed further below.

**Specific Conductance**

Specific conductance is an indicator of the concentration of dissolved solids in the water; as the amount of dissolved solids increases, the specific conductance increases. During periods of thermal stratification, specific conductance can increase at the lake bottom due to an accumulation of dissolved materials in the hypolimnion. This is a consequence of the "internal loading" phenomenon noted above. As noted in the initial plan,[4] the specific conductance of Ashippun Lake during spring of 1975 through spring of 1978 ranged from 413.5 to 493.0 microSiemens per centimeter (µS/cm). This range was within the normal range for lakes in southeastern Wisconsin.[5] There are no current data regarding conductivity on Ashippun Lake.

**Chloride**

During the initial water quality study, chloride concentrations ranged from about 13 to 23 milligrams per liter (mg/l), with an average of about 18 mg/l, which was typical for lakes in southeastern Wisconsin at the time. Although no current documentation of chloride levels in Ashippun Lake exists, generally, an increasing trend in chloride concentrations in lakes has been observed within the Southeastern Wisconsin Region and could be expected in Ashippun Lake. Sources of chlorides to lakes include salts used on streets and highways for winter snow and ice control, salts discharged from water softeners, and salts from sewage and animal wastes. Given the rural character and relatively undeveloped nature of the area tributary to Ashippun Lake, however, the rate of increase in chloride concentration in Ashippun Lake could be expected to be somewhat less than that observed in the more heavily developed and urbanized lakes in the Region.

**Alkalinity and Hardness**

Alkalinity is an index of the buffering capacity of a lake, or the capacity of a lake to absorb and neutralize acids. The alkalinity of a lake depends on the levels of bicarbonate, carbonate, and hydroxide ions present in the water. Lakes in southeastern Wisconsin typically have a high alkalinity because of the types of soils and bedrock underlying the Region's watersheds. In contrast, water hardness is a measure of the multivalent metallic ion concentrations, such as those of calcium and magnesium, present in a lake. Hardness is usually reported as an equivalent concentration of calcium carbonate ($CaCO_3$). During the initial study period, the alkalinity averaged about 197 mg/l; there were no data reported for hardness. There are no current data for Ashippun Lake with regard to either alkalinity or hardness. Despite the scarcity of definitive data, Ashippun Lake is generally regarded as a hard-water alkaline lake. Most lakes in southeastern Wisconsin are classified as such. Consequently, Ashippun Lake may be expected to fall within a similar range of parameters as other such lakes in the Oconomowoc River basin.

**Hydrogen Ion Concentration (pH)**

The pH is a logarithmic measure of hydrogen ion concentration, on a scale of 0 to 14 standard units. A pH of 7 indicates neutrality; a pH above 7 indicates basic (or alkaline) water; and, a pH below 7 indicates acidic water. In Ashippun Lake, the pH was found to range between 7.8 and 8.2 standard units during the initial study period. Since, at that time, Ashippun Lake had a relatively high alkalinity or buffering capacity, pH values did not fluctuate below 7. Consequently, the Lake was not considered to be susceptible to the harmful effects of acidic deposition. While no current data are available for Ashippun Lake with regard to pH, there is no reason to believe

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[4]*SEWRPC Community Assistance Planning Report No. 48,* op. cit.

[5]*See, for example, water quality data compiled within SEWRPC Community Assistance Planning Report No. 98, 2nd Edition,* A Lake Management Plan for Friess Lake, Washington County, Wisconsin, *November 1997; SEWRPC Community Assistance Planning Report No. 54,* A Water Quality Management Plan for North Lake, Waukesha County, Wisconsin, *July 1982; SEWRPC Community Assistance Planning Report No. 53, 2nd Edition,* A Water Quality Management Plan for Okauchee Lake, Waukesha County, Wisconsin, *October 2003; SEWRPC Community Assistance Planning Report No. 181,* A Water Quality Management Plan for Oconomowoc Lake, Waukesha County Wisconsin, *March 1990; SEWRPC Community Assistance Planning Report No. 187,* A Management Plan for Fowler Lake, Waukesha County, Wisconsin, *March 1994.*

that this buffering capacity is likely to have diminished. Consequently, pH is likely to remain neutral to mildly alkaline, with little risk to the Lake and its biota from acidification.

**Water Clarity**

Water clarity, or transparency, provides an indication of overall water quality; clarity may decrease because of turbidity caused by high concentrations of organic and inorganic suspended materials, such as algae and zooplankton or suspended sediment, and/or because of color caused by high concentrations of dissolved organic or humic substances. Water clarity is measured with a Secchi disc: a black-and-white, eight-inch-diameter disk, which is lowered into the water until a depth is reached at which the disk is no longer visible. This depth is known as the "Secchi-disc reading." Such measurements comprise an important part of the WDNR Self-Help Monitoring Program in which citizen volunteers assist in lake water quality monitoring efforts.

Water clarity generally varies throughout the year as algal populations increase and decrease in response to changes in weather conditions and nutrient loadings. Secchi-disc depth measurements for Ashippun Lake during the initial study period ranged from a low of 2.5 feet in February 1978 to a high of 9.3 feet in April 1977, with an average depth of 5.8 feet. During the current study period, 1990 through 2003, Secchi-disc readings for Ashippun Lake ranged from a minimum of 3.0 feet to a maximum of 19.0 feet, with an average of 7.6 feet.

Seasonal variations in Secchi disk measurements, as shown in Table 8, indicate a trend of gradually diminishing Secchi disk depths as the seasons progress, from spring through summer into fall. This is not unusual for lakes in the Southeastern Wisconsin Region. As shown in Figure 5, during the recent study period, these values indicate fair to good water quality compared to other lakes in southeastern Wisconsin.[6] In recent years, some lakes in southeastern Wisconsin have experienced improved water clarity that may be related to the presence of the zebra mussel, *Dreissena polymorpha*, an invasive, nonnative filter feeding mollusk known to impact water clarity in inland lakes. Currently, however, there are no data to support the presence of zebra mussels in Ashippun Lake.[7]

**Chlorophyll-*a***

Chlorophyll-*a* is the major photosynthetic ("green") pigment in algae. The amount of chlorophyll-*a* present in the water is an indication of the biomass or amount of algae in the water. A single measure of chlorophyll-*a* concentration in Ashippun Lake, obtained during 1976, indicated that the chlorophyll-*a* concentration was close to 30 micrograms per liter (µg/l) or well into the eutrophic or enriched range. During the current study period, additional chlorophyll-*a* data were obtained. Chlorophyll-*a* concentrations ranged from 1 to 24 µg/l, with mean chlorophyll-*a* concentrations generally being below 10 µg/l during this later period. Chlorophyll-*a* levels above about 10 µg/l result in a green coloration of the water that may be severe enough to impair recreational activities such as swimming or waterskiing.[8] As shown in Table 8, seasonal variations of chlorophyll-*a* indicated a decline in average concentrations during the summer to about 4 µg/l, followed by an increase in the fall to about 11 µg/l. These values are within the range of chlorophyll-*a* concentrations recorded in other lakes in the Region[9] and indicate good to very good water quality, as illustrated in Figure 5.

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[6]*R.A. Lillie and J.W. Mason, Wisconsin Department of Natural Resources Technical Bulletin No. 138,* Limnological Characteristics of Wisconsin Lakes, *1983.*

[7]*Wisconsin Department of Natural Resources Memorandum, "Zebra Mussel Presence in Wisconsin Waters," March 2004.*

[8]*J.R. Vallentyne, 1969 "The Process of Eutrophication and Criteria for Trophic State Determination." in* Modeling the Eutrophication Process—Proceedings of a Workshop at St. Petersburg, Florida, *November 19-21, 1969, pp. 57-67.*

[9]*WDNR Technical Bulletin No. 138,* op. cit.

**Table 8**

**SEASONAL WATER QUALITY IN ASHIPPUN LAKE: 1990-2003**

| Parameter | Spring | Summer | Fall |
|---|---|---|---|
| Secchi Disc Depth (feet) | | | |
| Number of Samples | 39 | 108 | 65 |
| Range | 4.3 – 14.3 | 3 – 19 | 3 – 9.8 |
| Average | 8.1 | 7.8 | 6.8 |
| Standard Deviation | 2.5 | 3.1 | 1.4 |
| Chlorophyll-*a* (µg/l) | | | |
| Number of Samples | 3 | 27 | 12 |
| Range | 3 – 10 | 1 – 10 | 1 – 24 |
| Average | 7 | 4.0 | 11 |
| Standard Deviation | 3.6 | 2.2 | 6.7 |
| Total Phosphorus (µg/l) | | | |
| Number of Samples | 7 | 28 | 12 |
| Range | 2 – 52 | 7 – 27 | 13 – 50 |
| Average | 21.7 | 13.4 | 25.5 |
| Standard Deviation | 15.3 | 4.9 | 9.9 |

*Source: Wisconsin Department of Natural Resources.*

**Nutrient Characteristics**

Aquatic plants and algae require such nutrients as phosphorus and nitrogen for growth. In hard-water alkaline lakes, most of these nutrients are generally found in concentrations that exceed the needs of growing plants. However, in lakes where the supply of one or more of these nutrients is limited, plant growth is limited by the amount of the nutrient that is available in the least quantity relative to all of the others. The ratio (N:P) of total nitrogen (N) to total phosphorus (P) in lake water indicates which nutrient is the factor most likely to be limiting aquatic plant growth in a lake.[10] Where the N:P ratio is greater than 14:1, phosphorus is most likely to be the limiting nutrient. If the ratio is less than 10:1, nitrogen is most likely to be the limiting nutrient. The nitrogen-to-phosphorus ratios in samples collected from Ashippun Lake during the initial study period were always equal to or greater than 14:1. This indicates that plant production was most likely consistently limited by phosphorus. Nitrogen samples have not been obtained during recent years, so there are no current data from which N:P ratios can be developed. However, given that aquatic plant growth in most inland lakes in Wisconsin is limited by the available phosphorus, it is likely that plant growth in Ashippun Lake continues to be phosphorus-limited.

Both total phosphorus and soluble phosphorus concentrations were measured for Ashippun Lake during the initial study period, whereas only total phosphorus concentrations were measured during the recent study period. Soluble phosphorus, being dissolved in the water column, is readily available for plant growth. However, its concentration can vary widely over short periods of time as plants take up and release this nutrient. Therefore, total phosphorus is usually considered a better indicator of nutrient status. Total phosphorus includes the phosphorus contained in plant and animal fragments suspended in the lake water, phosphorus bound to sediment particles, and phosphorus dissolved in the water column.

In Ashippun Lake, during the period 1975 through 1978, the mean concentration of total phosphorus was about 60 µg/l during the spring turnover, and about 50 µg/l on an average annual basis. These levels were found to exceed the levels necessary to support nuisance algae blooms. For lakes, the guideline value set forth in the adopted

[10]*M.0. Allum, R.E. Gessner, and T.H. Gakstatter, U.S. Environmental Protection Agency Working Paper No. 900,* An Evaluation of the National Eutrophication Data*, 1976.*

**Figure 5**

**PRIMARY WATER QUALITY INDICATORS FOR ASHIPPUN LAKE: 1990-2003**

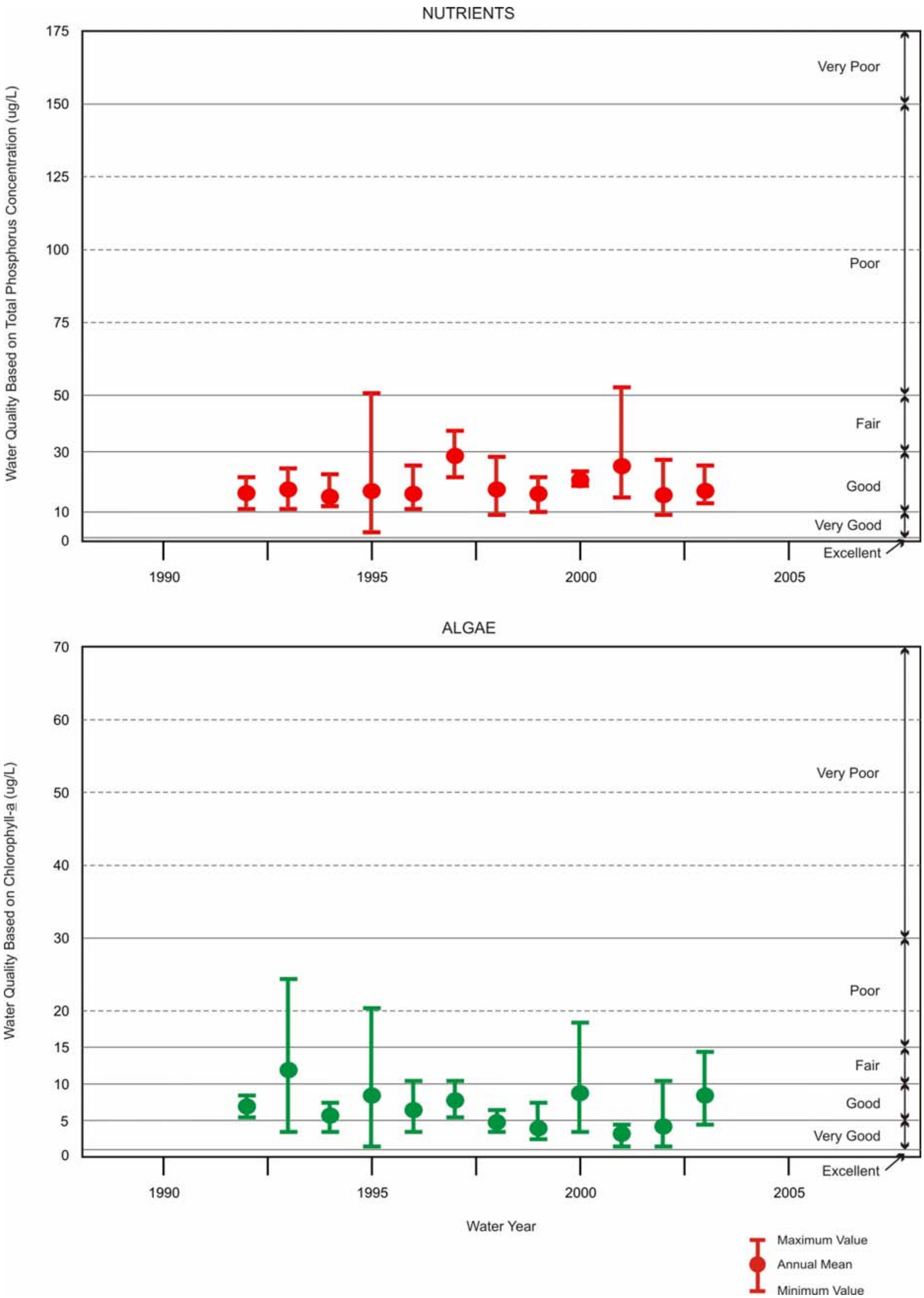
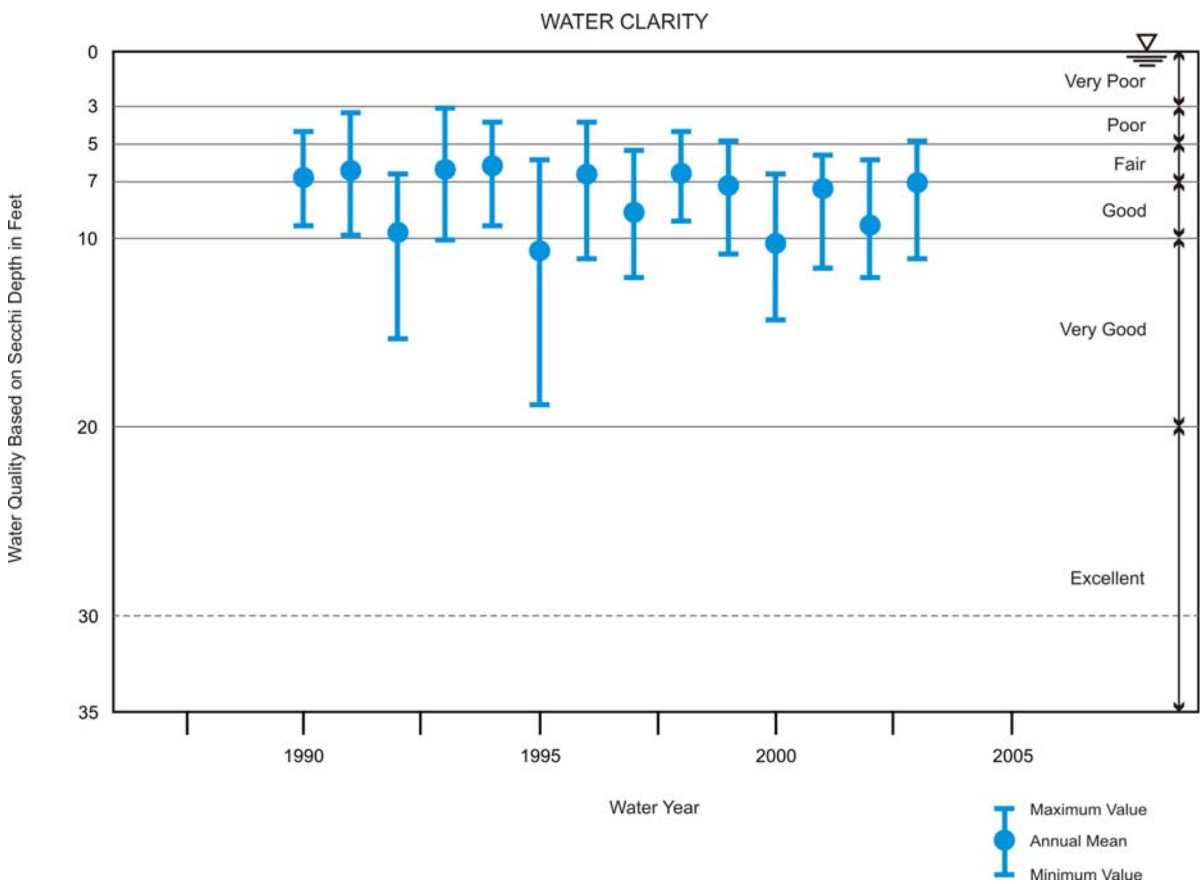


**Figure 5 (continued)**




*Source: U.S. Geological Survey, Wisconsin Department of Natural Resources, and SEWRPC.*

regional water quality management plan is 20 μg/l of total phosphorus or less during spring turnover. This is the level considered as necessary to limit algal and aquatic plant growths to levels consistent with the recreational and warmwater fishery and other aquatic life water use objectives. As was noted in the earlier report, runoff from local livestock operations may have been the source of additional phosphorus to the Lake, as livestock from a nearby farm were known to graze along the shoreline and occasionally within the lake itself. During the recent study period, total phosphorus concentrations in Ashippun Lake, as shown in Table 8, fell generally within the recommended water quality guidelines for phosphorus. Total phosphorus concentrations during the summer averaged about 13 μg/l. These average concentrations increased during fall to about 25 μg/l, which was slightly higher than the recommended spring turnover concentration. These values indicate generally good water quality conditions, as shown in Figure 5.

The seasonal gradients of phosphorus concentration between the epilimnion and hypolimnion reflect the biogeochemistry of this growth element. When aquatic organisms die, they usually sink to the bottom of the lake, where they are decomposed. Phosphorus from these organisms is then either stored in the bottom sediments or rereleased into the water column. Because phosphorus is not highly soluble in water, it readily forms insoluble precipitates with calcium, iron, and aluminum under aerobic conditions and accumulates, predominantly, in the lake sediments. If the bottom waters become depleted of oxygen during stratification, however, certain chemical changes occur, especially the change in the oxidation state of iron from the insoluble $Fe^{3+}$ state to the more soluble $Fe^{2+}$ state. The effect of these chemical changes is that phosphorus becomes soluble and is more readily released from the sediments. This process also occurs under aerobic conditions, but generally at a slower rate than under anaerobic conditions. As the waters mix, this phosphorus may be widely dispersed throughout the lake waterbody and become available for algal growth.

Based upon the extremely limited amount of data on hypolimnetic anoxia both during 1976 and 1977, and during 2002 and 2003, it can be concluded that the likelihood of internal loading of phosphorus from the bottom sediments of Ashippun Lake is slight. Should any such loading occur, the magnitude of the release and its concomitant effects in contributing to algal growth in the surface waters of the Lake may be moderated by a number of circumstances, including the rates of mixing during the spring and fall overturn events. Rapid mixing generally results in any phosphorus released into the bottom waters of the Lake being re-precipitated and unavailable to aquatic plants. Given the relatively small surface-to-bottom gradients in total phosphorus concentration, the contribution of phosphorus from the bottom waters of Ashippun Lake could be considered minimal in terms of the total phosphorus load, and is not considered further.

## CHARACTERISTICS OF BOTTOM SEDIMENT

Sediment composition has an important effect on the biogeochemistry of a lake. Sediment particles serve as transport mechanisms for a variety of pollutants and play a key role in establishing benthic habitat and macrophyte substrate.

In 1997, the WDNR conducted a sediment core analysis to determine historical water quality trends in Ashippun Lake.[11] The results of this study suggested that there was a general increase in the rate of sedimentation in Ashippun Lake since the time of European settlement in the mid-1800s. This increased rate of sedimentation continued through the 1930s, after which there was a slight decline in the rate of sedimentation. This reduced rate of sedimentation continued through the 1960s, when there was a further increase in the sedimentation rate from about 1970 through the 1990s. The WDNR also noted a shift in the algal population indicative of elevated nutrient levels, initially, through the mid-1900s as a consequence of agricultural activity, and, later, through the late-1900s as a consequence of residential development. Since about 1990, the WDNR noted that the rate of accumulation of phosphorus in the lake sediments has decreased as the lakeshore residential community has stabilized and land disturbing activities have ceased.

## POLLUTION LOADINGS AND SOURCES

Pollutant loads to a lake are generated by various natural processes and human activities that take place in the area tributary to a lake. These loads are transported to the lake through the atmosphere, across the land surface, and by way of inflowing streams. Pollutants transported by the atmosphere are deposited onto the surface of the lake as dry fallout and direct precipitation. Pollutants transported across the land surface enter the lake as direct runoff and, indirectly, as groundwater inflows, including drainage from onsite wastewater treatment systems. Pollutants transported by streams enter a lake as surface water inflows. In drained lakes, like Ashippun Lake, pollutant loadings transported across the land surface directly tributary to a lake, in the absence of identifiable or point source discharges from industries or wastewater treatment facilities, comprise the principal route by which contaminants enter the waterbody.[12] Currently, there are no significant point source discharges of pollutants to Ashippun Lake or to the surface waters tributary to Ashippun Lake. For this reason, the discussion that follows is based upon nonpoint source pollutant loadings to Ashippun Lake.

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[11] *Wisconsin Department of Natural Resources,* A Paleolimnological Study of the Water Quality Trends In Ashippun Lake, Waukesha County, Wisconsin, *1997.*

[12] *Sven-Olof Ryding and Walter Rast,* The Control of Eutrophication of Lakes and Reservoirs, *Unesco Man and the Biosphere Series, Volume 1, Parthenon Press, Carnforth, 1989; Jeffrey A. Thornton, Walter Rast, Marjorie M. Holland, Geza Jolankai, and Sven-Olof Ryding,* The Assessment and Control of Nonpoint Source Pollution of Aquatic Ecosystems, *Unesco Man and the Biosphere Series, Volume 23, Parthenon Press, Carnforth, 1999.*

Nonpoint sources of water pollution include urban sources, such as runoff from residential, commercial, transportation, construction, and recreational activities; and rural sources, such as runoff from agricultural lands and onsite sewage disposal systems. The tributary area of Ashippun Lake is about 790 acres in areal extent. Nonpoint source phosphorus, suspended solids, and urban-derived metals input to, and output from, Ashippun Lake were estimated using the Wisconsin Lake Model Spreadsheet (WILMS version 3.0), and unit area load-based models developed for use within the Southeastern Wisconsin Region.

**Phosphorus Loadings**

Phosphorus has been identified as the factor generally limiting aquatic plant growth in Ashippun Lake. Thus, excessive levels of phosphorus in the Lake are likely to result in conditions that interfere with the desired use of the Lake.

During the initial study, as shown in Table 9, existing 1975 and forecast year 2000 phosphorus sources to the lake were identified and quantified using Commission 1975 land use inventory data; Commission planned year 2000 land use data, derived from the adopted regional land use plan; and the Commission water quality simulation model. Of the approximately 200 pounds of phosphorus assumed to have entered the Lake from those lands draining directly to Ashippun Lake,[13] the largest single source was estimated to be onsite sewage disposal systems, contributing about one-third of the total annual phosphorus load. At that time, other major sources of phosphorus loads to the lake included direct contributions from the atmosphere via precipitation washout and dry fallout which contributed about one-quarter of the phosphorus load, the occasional back-water inflows from the Ashippun River during high stream flow periods which contributed about one-eighth of the phosphorus load, and agricultural runoff which contributed about one-tenth of the phosphorus load. These loads were not expected to change significantly between 1975 and 2000.

Subsequent to these studies, changes in land use have occurred throughout the area tributary to Ashippun Lake, as noted in Chapter III. In addition, the areal extent of the tributary area was refined, adding approximately 50 acres to the tributary area as it was identified during the initial planning period. Consequently, the phosphorus load to Ashippun Lake under year 2000 conditions was estimated to be 420 pounds, as shown in Table 10.[14] Of this total, agricultural lands were estimated to contribute two-thirds, or about 275 pounds, of phosphorus per year, while residential and other urban land uses were estimated to contribute one-quarter, or about 115 pounds per year. Malfunctioning septic tank systems were estimated to contribute 30 pounds of phosphorus per year, or approximately 6 percent of the total phosphorus load to the Lake, while woodlands, wetlands, and direct deposition onto the water surface from the atmosphere were estimated to contribute 35 pounds, or 8 percent of the phosphorus entering the Lake.

Forecast phosphorus loads for Ashippun Lake, based upon planned 2020 land use, are set forth in Table 11. The forecast loads suggest a slight diminution of the phosphorus load as agricultural lands within the area converted to residential and other urban land uses. Phosphorus originating from agricultural lands is expected to decrease to less than two-thirds of the total phosphorus load to the Lake, while urban residential lands will contribute about one-tenth of the load, approximately double the contribution estimated for the year 2000 condition. This situation may be exacerbated by the increasing use of agrochemicals in urban lawn and garden care applications. Urban

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[13]*The area used in the initial plan included only a portion of the wetlands and agricultural lands located to the south of the Lake, comprising about 370 acres in areal extent. Investigations conducted during the present study suggested that the actual area, as modified through recent reconstruction of the intersection of CTH K and CTH P as well as commercial development south of CTH K, was somewhat greater in areal extent, totaling about 420 acres. This modification of the tributary area, as well as land use changes not envisioned in the initial plan, has resulted in the higher overall phosphorus load to Ashippun Lake reported for the year 2000 in Table 10.*

[14]Ibid.*; the higher phosphorus loads reported for year 2000 conditions and forecast for year 2020 conditions generally reflect the larger watershed area, rather than new or additional sources of phosphorus entering the lake.*

**Table 9**

**ESTIMATED TOTAL PHOSPHORUS LOADS TO ASHIPPUN LAKE: 1975 AND 2000**

| Source | Existing 1975 | | | Anticipated 2000[a] | | |
|---|---|---|---|---|---|---|
| | Extent | Total Loading (pounds per year) | Percent Distribution | Extent | Total Loading (pounds per year) | Percent Distribution |
| Urban | | | | | | |
| Residential (acres) | 72.7 | 8 | 4.3 | 72.7 | 8 | 4.3 |
| Commercial (acres) | - - | - - | - - | - - | - - | - - |
| Industrial (acres) | - - | - - | - - | - - | - - | - - |
| Governmental and Institutional (acres) | 0.9 | 1 | 0.5 | 0.9 | 1 | 0.5 |
| Transportation (acres) | 10.1 | 6 | 3.3 | 10.1 | 6 | 3.3 |
| Recreational (acres) | 1.5 | - - | - - | 1.5 | - - | - - |
| Subtotal | 85.2 | 15 | 40.9 | 85.2 | 15 | 40.9 |
| Rural | | | | | | |
| Agricultural (acres) | 199.0 | 19 | 10.2 | 199.0 | 19 | 10.2 |
| Atmospheric Contribution (acres of receiving surface water)[b] | 12.2 | 48 | 25.8 | 12.2 | 48 | 25.8 |
| Woodlands (acres) | 4.6 | 1 | 0.5 | 4.6 | 1 | 0.5 |
| Wetlands (acres) | 69.3 | - - | - - | 69.3 | - - | - - |
| Open Land (acres) | 0.3 | - - | - - | 0.3 | - - | - - |
| Subtotal | 285.4 | 68 | 36.5 | 285.4 | 68 | 36.5 |
| Onsite Sewage Disposal Systems (numbers)[c] | 21.0 | 61 | 32.8 | 21.0 | 61 | 32.8 |
| Groundwater inflow (acre-feet/year) | 217.0 | 12 | 6.5 | 217.0 | 12 | 6.5 |
| Reverse Flow from Ashippun River (acre-feet/year) | 126.0 | 30 | 16.1 | 126.0 | 30 | 16.1 |
| Total | - - | 186 | 100.0 | - - | 186 | 100.0 |

[a]*Assumes no nonpoint source control.*

[b]*Includes the surface area of Ashippun Lake.*

[c]*Includes only those systems on soils having severe or very severe limitations for disposal of septic tank effluent.*

*Source: SEWRPC.*

residential lands fertilized with a phosphorus-based fertilizer can contribute up to two-times more dissolved phosphorus to a lake than lawns fertilized with a phosphorus-free fertilizer or not fertilized at all.[15]

Phosphorus release from the lake bottom sediments—internal loading—may also contribute phosphorus to the Lake. However, this loading was assumed to be negligible given the infrequent anoxia observed in the hypolimnion of the Lake and good agreement between predicted and observed phosphorus concentrations. Also, during periods of stratification, it is likely that overturn events generally occurred at rates such that little of this hypolimnetic phosphorus would be mixed into the epilimnion of the Lake—i.e., at rates on the order of days rather than hours.[16]

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[15]*U.S. Geological Survey Water-Resources Investigations Report No. 02-4130,* Effects of Lawn Fertilizer on Nutrient Concentration in Runoff from Lakeshore Lawns, Lauderdale Lakes, Wisconsin, *July 2002.*

[16]*Werner Stumm and James J. Morgan,* Aquatic Chemistry: An Introduction Emphasizing Chemical Equilibria in Natural Waters, *Wiley-Interscience, New York, 1970.*

**Table 10**

**ESTIMATED EXTERNAL SOURCES OF PHOSPHORUS TO ASHIPPUN LAKE**

| Source | 2000 | | 2020 | |
|---|---|---|---|---|
| | Pounds[a] | Percent[a] | Pounds[a] | Percent[a] |
| Urban[b] | | | | |
| High-Density (commercial and industrial uses and multi-family residential uses) | 75 | 18 | 130 | 32 |
| Low-Density (single-family and suburban-density residential uses) | 38 | 8 | 41 | 10 |
| Subtotal | 113 | 26 | 171 | 42 |
| Rural | | | | |
| Mixed Agricultural | 275 | 65 | 191 | 47 |
| Pasture/Grass | <1 | <1 | 9 | 2 |
| Wetlands | 11 | 3 | 11 | 3 |
| Woodlands | 2 | <1 | 2 | <1 |
| Water | 21 | 5 | 21 | 5 |
| Subtotal | 309 | 74 | 234 | 58 |
| Total | 422 | 100 | 405 | 100 |

*[a]Percentages estimated from WILMS model results.*

*[b]Includes the contribution from onsite sewage disposal systems in the tributary drainage area to Ashippun Lake, estimated within the WILMS model as ranging from three pounds per year to as much as 1,620 pounds per year, depending upon soil type, system condition, and system location. For purposes of this analysis, 27 pounds per year were used as the contribution from onsite sewage disposal systems as that value provided the loading that was best correlated to the measured in-lake phosphorus concentrations.*

*Source: SEWRPC.*

**Table 11**

**ESTIMATED CONTAMINANT LOADS TO ASHIPPUN LAKE: 2000 AND 2020**

| Land Use | 2000 | | | | | 2020 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Area (acres) | Sediment (pounds) | Copper (pounds) | Zinc (pounds) | Cadmium (pounds) | Area (acres) | Sediment (pounds) | Copper (pounds) | Zinc (pounds) | Cadmium (pounds) |
| Residential | 119 | 2,320 | 0.0 | 1.2 | 0.00 | 169 | 3,296 | 0.0 | 1.7 | 0.00 |
| Commercial | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| Industrial | 2 | 1,504 | 0.4 | 3.0 | 0.02 | 2 | 1,504 | 0.4 | 3.0 | 0.02 |
| Communications and Utilities | 36 | 342 | 0.0 | 0.0 | 0.00 | 37 | 351 | 0.0 | 0.0 | 0.00 |
| Governmental | 18 | 9,198 | 1.3 | 14.4 | 0.00 | 58 | 29,638 | 4.1 | 46.4 | 0.00 |
| Recreational | 3 | 72 | - - | - - | - - | 29 | 696 | - - | - - | - - |
| Water[a] | 120 | 22,560 | - - | - - | - - | 120 | 22,560 | - - | - - | - - |
| Wetlands | 90 | 333 | - - | - - | - - | 90 | 333 | - - | - - | - - |
| Woodlands | 18 | 67 | - - | - - | - - | 18 | 67 | - - | - - | - - |
| Agricultural | 385 | 173,250 | - - | - - | - - | 268 | 120,600 | - - | - - | - - |
| Total | 791 | 209,646 | 1.7 | 18.6 | 0.02 | 791 | 179,045 | 4.5 | 51.1 | 0.02 |

*[a]Contaminant loadings deposited directly on the water surface as both wet and dry fallout from the atmosphere.*

*Source: SEWRPC.*

## Sediment Loadings

The estimated sediment budget for Ashippun Lake under existing year 2000 land use conditions is shown in Table 11. A total annual sediment load of between 105 tons of sediment was estimated to be contributed to Ashippun Lake. Of the likely annual sediment load, it was estimated that 87 tons per year, or about 83 percent of the total loading, was contributed by runoff from rural land, with approximately seven tons per year being contributed from urban lands and about 11 tons of sediment per year being contributed by direct precipitation onto the lake surface. Of the sediment load generated from rural land uses, the largest percentage of the load, about 88 percent, was indicated as being of agricultural origin.

Under 2020 conditions, as set forth in the Waukesha County development plan and adopted regional land use plan,[17] the annual sediment load to the Lake is anticipated to diminish slightly, as shown in Table 11. The most likely annual sediment load to the Lake under buildout conditions is estimated to be 89 tons. While agricultural lands are expected to remain the largest single contributor, producing about 60 tons of sediment per year, urban land uses are expected to produce about 18 tons, or more than double the load estimated under year 2000 conditions. An estimated 11 tons of sediment per year are estimated to be contributed by direct precipitation onto the Lake surface.

**Urban Heavy Metals Loadings**

Urbanization brings with it increased use of metals and other materials that contribute pollutants to aquatic systems.[18] Table 11 sets forth the estimated loadings of copper, zinc, and cadmium likely to be contributed to Ashippun Lake from urban development surrounding the Lake. The majority of these metals become associated with sediment particles,[19] and are likely to be encapsulated into the bottom sediments of the Lake.

The estimated heavy metal loads to Ashippun Lake under existing 2000 land use conditions are shown in Table 11. Two pounds of copper, 19 pounds of zinc, and 0.02 pound of cadmium were estimated to be contributed annually to Ashippun Lake from urban lands.

Under 2020 conditions, as set forth in the Waukesha County development plan and adopted regional land use plan, the annual heavy metal loads to the Lake are anticipated to increase by approximately three-fold. The most likely annual loads to the Lake under buildout conditions are estimated to be 4.5 pounds of copper, 51 pounds of zinc, and 0.02 pound of cadmium.

**Groundwater**

During the 1977 planning program, groundwater flows were monitored in five paired observation wells located around Ashippun Lake. These wells indicated that groundwater entering the Lake flowed out of the Lake to the north as surface outflow. Groundwater quality was not measured. However, groundwater quality measurements made during the 1976-1977 Lac La Belle lake management planning program suggested that groundwater concentrations of total nitrogen averaged 2.25 mg/l, while total phosphorus concentrations in groundwater generally ranged from less than 0.01 mg/l.[20] Consequently, groundwater quality is not an issue of concern.

**In-Lake Sinks**

Of the annual total phosphorus load entering Ashippun Lake, it is estimated that 65 percent of the total phosphorus load, or about 260 pounds of phosphorus, is retained within the Lake. This mass of phosphorus is either used by the biomass within the Lake or deposited in the lake sediments.[21] The balance of the phosphorus entering the Lake is transported downstream.

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[17]*SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin*, August 1996; SEWRPC Planning Report No. 45, A* Regional Land Use Plan for Southeastern Wisconsin: 2020*, December 1997.*

[18]*Jeffrey A. Thornton, et al.,* op. cit.

[19]*Werner Stumm and James J. Morgan,* op. cit.

[20]*See SEWRPC Community Assistance Planning Report No. 47, 2nd Edition,* op. cit.

[21]*D.P. Larsen and H.T. Mercier, "Phosphorus retention capacity of lakes,"* Journal of the Fisheries Research Board of Canada*, Volume 33, 1976, pp. 1742-1750.*

## RATING OF TROPHIC CONDITION

Lakes are commonly classified according to their degree of nutrient enrichment—or trophic status. The ability of lakes to support a variety of recreational activities and healthy fish and other aquatic life communities is often correlated to the degree of nutrient enrichment which has occurred. There are three terms generally used to describe the trophic status of a lake: oligotrophic, mesotrophic, and eutrophic.

Oligotrophic lakes are nutrient-poor lakes. These lakes characteristically support relatively few aquatic plants and often do not contain very productive fisheries. Oligotrophic lakes may provide excellent opportunities for swimming, boating, and waterskiing. Because of the naturally fertile soils and the intensive land use activities, there are relatively few oligotrophic lakes in southeastern Wisconsin.

Mesotrophic lakes are moderately fertile lakes which may support abundant aquatic plant growths and productive fisheries. However, nuisance growths of algae and macrophytes are usually not exhibited by mesotrophic lakes. These lakes may provide opportunities for all types of recreational activities, including boating, swimming, fishing, and waterskiing. Many lakes in southeastern Wisconsin are mesotrophic.

Eutrophic lakes are nutrient-rich lakes. These lakes often exhibit excessive aquatic macrophyte growths and/or experience frequent algae blooms. If the lakes are shallow, fish winterkills may be common. While portions of such lakes are not ideal for swimming and boating, eutrophic lakes may support very productive fisheries.

Several numeric "scales," based on one or more water quality indicators, have been developed to define the trophic condition of a lake. Because trophic state is actually a continuum from very nutrient poor to very nutrient rich, a numeric scale is useful for comparing lakes and for evaluating trends in water quality conditions. Care must be taken, however, that the particular scale used is appropriate for the lake to which it is applies. In this case, two indices, appropriate for Wisconsin lakes, have been used; namely, the Vollenweider-OECD open-boundary trophic classification system,[22] and the Carlson Trophic State Index (TSI).[23] In addition, the Wisconsin Trophic State Index value (WTSI) is presented.[24] The WTSI is a refinement of the Carlson TSI designed to account for the greater humic acid content—brown water color—present in Wisconsin lakes, and has been adopted by the WDNR for use in lake management investigations.

**Vollenweider Trophic State Classification**

Using the Vollenweider trophic system and applying the data in Table 8, Ashippun Lake would be classified as having about a 60 percent probability of being mesotrophic based upon phosphorus levels, as shown in Figure 6. The Lake would have about a 30 percent probability of being oligotrophic, and a 10 percent probability of being eutrophic, based upon mean annual phosphorus concentrations. Based upon chlorophyll-*a* levels, the Lake would be classified as having a 55 percent probability of being mesotrophic, with about a 35 percent probability of being eutrophic, and about a 10 percent probability of being oligotrophic, with a very slight probability of being hypertrophic, as shown in Figure 6. Based upon Secchi-disc readings, the Lake would be classified as having a 55 percent probability of being eutrophic, with a 20 percent probability of being either hypertrophic or mesotrophic, and a 5 percent probability of being oligotrophic, as shown in Figure 6.

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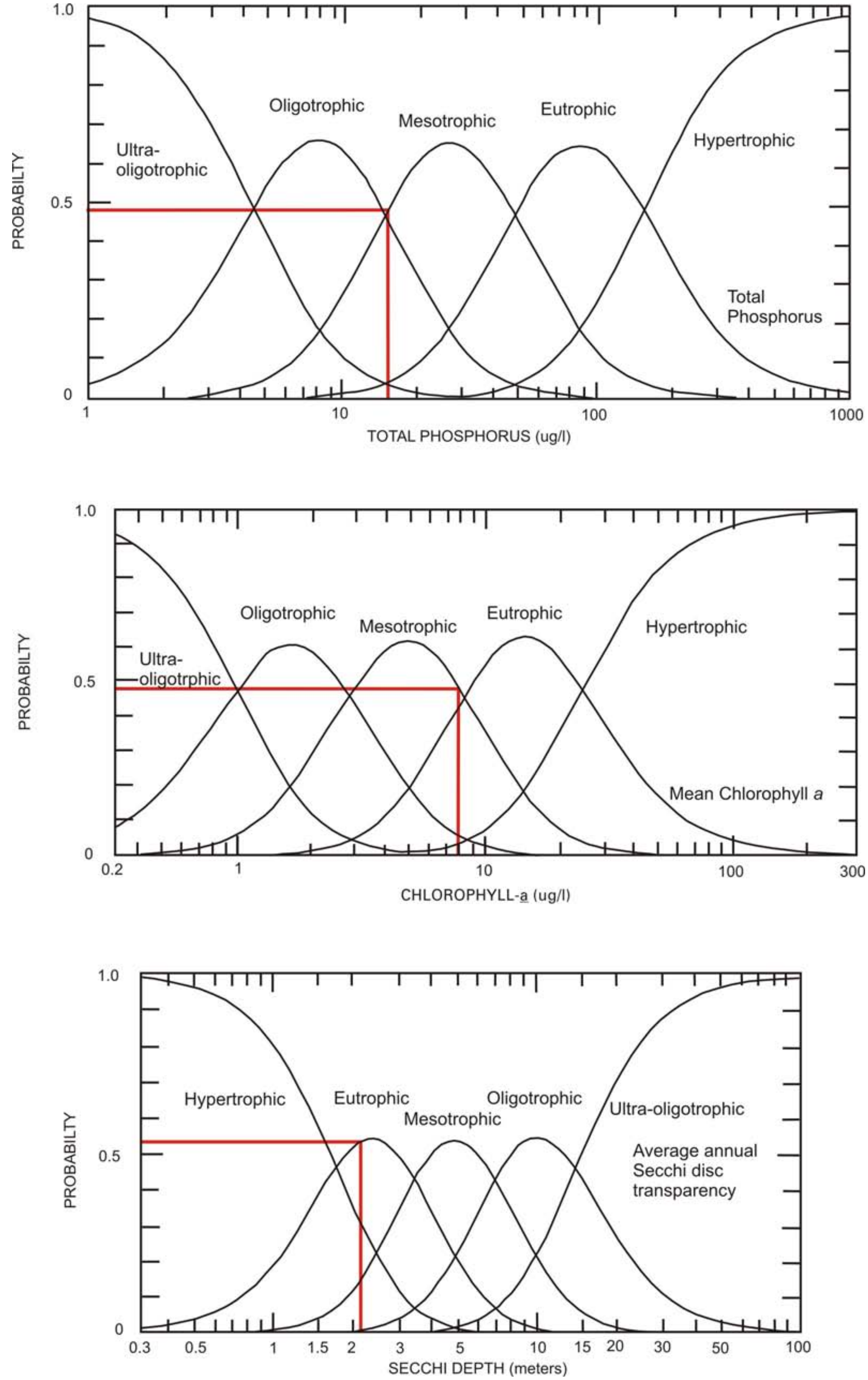
[22]*H. Olem and G. Flock, U.S. Environmental Protection Agency Report EPA-440/4-90-006,* The Lake and Reservoir Restoration Guidance Manual, Second Edition*, Washington, D.C., August 1990.*

[23]*R.E. Carlson, "A Trophic State Index for Lakes,"* Limnology and Oceanography*, Vol. 22, No. 2, 1977.*

[24]*See R.A. Lillie, S. Graham, and P. Rasmussen, "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes,"* Research and Management Findings*, Wisconsin Department of Natural Resources Publication No. PUBL-RS-735 93, May 1993.*

**Figure 6**

**TROPHIC STATE CLASSIFICATION OF ASHIPPUN LAKE BASED UPON THE VOLLENWEIDER MODEL: 2003**




*Source: U.S. Geological Survey and SEWRPC.*

While these indicators result in slightly differing lake trophic state classifications, it may be concluded that Ashippun Lake should be classified as a mesotrophic lake, or a lake with acceptable water quality for most uses.

**Trophic State Index**

The Trophic State Index (TSI) assigns a numerical trophic condition rating based on Secchi-disc transparency, and total phosphorus and chlorophyll-*a* concentrations. The original TSI developed by Carlson has been modified for Wisconsin lakes by the WDNR using data on 184 lakes throughout the State.[25] The Wisconsin Trophic State Index (WTSI) ratings for Ashippun Lake are shown in Figure 7 as a function of sampling date. Based on the WTSI rating of between about 45 and 55, Ashippun Lake may be classified as mesotrophic.

## SUMMARY

Ashippun Lake represents a typical hard-water, alkaline lake that is considered to have relatively good water quality. Physical and chemical parameters measured during the study period indicated that the water quality was within the "good" to "very good" range, depending upon the parameters considered. Total phosphorus levels were found to be generally at or below the level considered to cause nuisance algal and macrophytic growths. Summer stratification was not commonly observed in Ashippun Lake, and the surface waters of the Lake remained well oxygenated. The Lake supported a healthy fish population, and winterkill was not reported to be a problem in Ashippun Lake. Likewise, internal releases of phosphorus from the bottom sediments were not considered to be a problem in Ashippun Lake.

There are no significant point sources of pollution in the Ashippun Lake watershed. Nonpoint sources of pollution include stormwater runoff from urban and agricultural areas. In 2000, the total annual phosphorus load to Ashippun Lake was estimated to be 420 pounds. Runoff from the rural lands contributed the largest amount of phosphorus, about 65 percent of the total phosphorus load, with the runoff from urban lands contributing about 25 percent of the total phosphorus load. In addition, direct precipitation onto the Lake surface contributed about 5 percent of the total phosphorus load, or a relatively minor amount. Agricultural lands constituted the primary source of phosphorus to the Lake under current land use conditions within the area tributary to the Lake. Under forecast year 2020 conditions, both agricultural and urban lands are anticipated to contribute approximately equal masses of phosphorus to Ashippun Lake, each contributing in excess of 40 percent of the load. Approximately 10 percent of the phosphorus load, under buildout conditions, is anticipated to be from woodlands, wetlands, and direct deposition onto the Lake surface.

Approximately 65 percent, or about 260 pounds, of the total phosphorus load is estimated to remain in the Lake by conversion to biomass or through sedimentation, resulting in a net transfer of about 160 pounds of phosphorus downstream.

Based on the Vollenweider phosphorus loading model and the WTSI ratings calculated from the Ashippun Lake data, Ashippun Lake may be classified as a mesotrophic lake.

[25]*R.A. Lillie, S. Graham, and P. Rasmussen*, op. cit.

**Figure 7**

**WISCONSIN TROPHIC STATE INDEX FOR ASHIPPUN LAKE: 1988-2004**

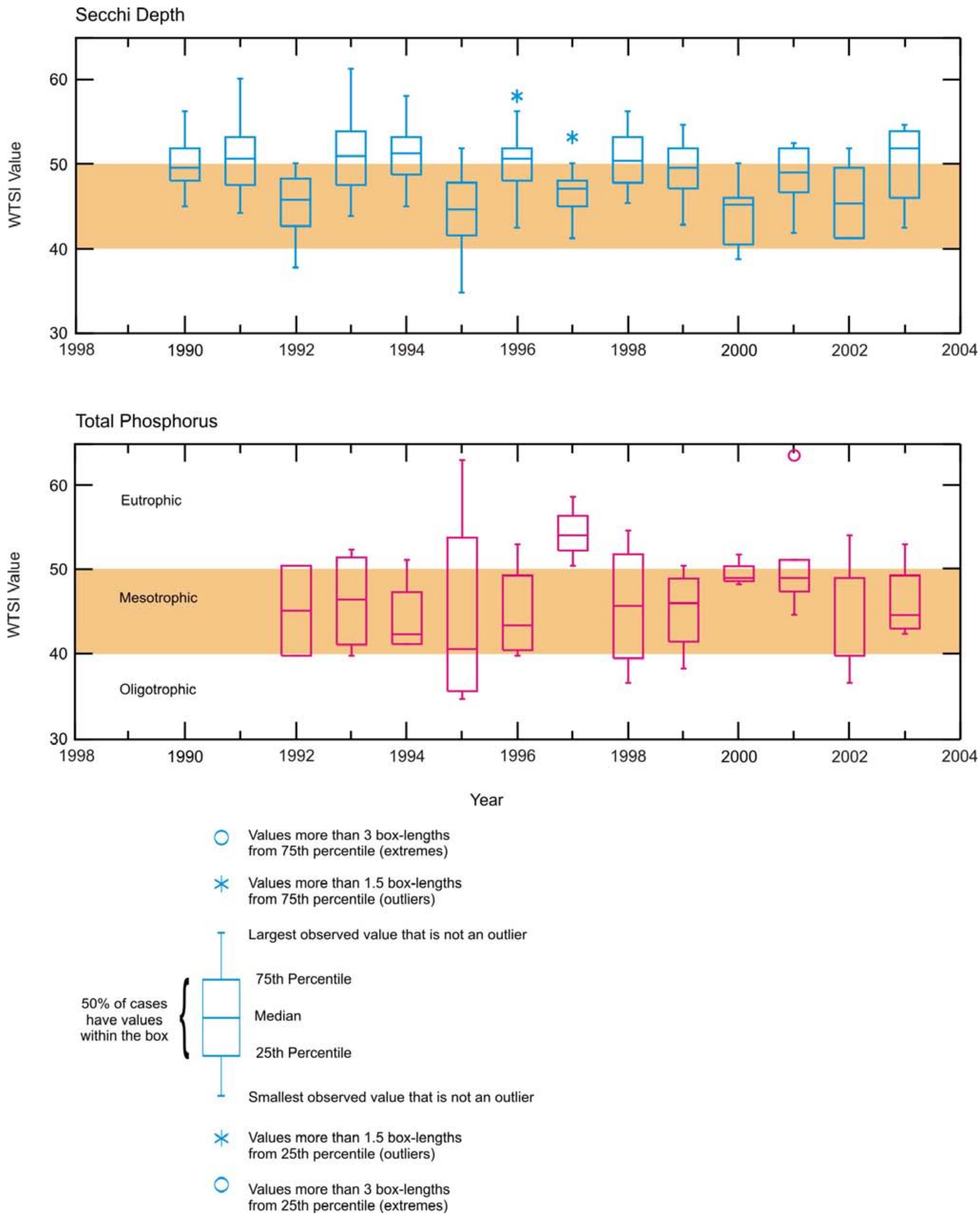
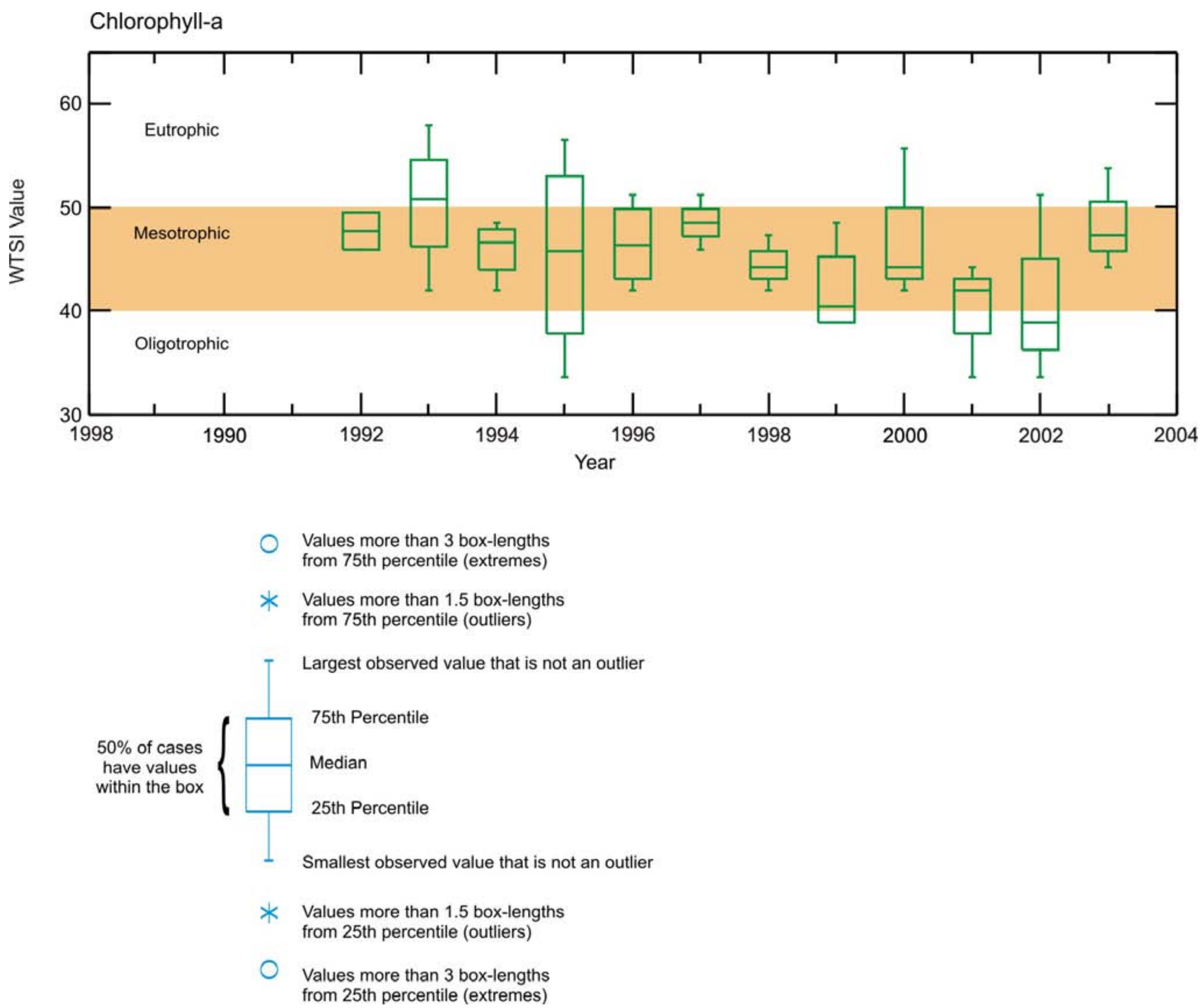


**Figure 7 (continued)**




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

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## Chapter V

# AQUATIC BIOTA AND ECOLOGICALLY VALUABLE AREAS

## INTRODUCTION

Ashippun Lake is an important element of the natural resource base of the Town of Oconomowoc. The Lake, its biota, and the residential lands combine to contribute to the quality of life in the area. When located in urban settings, resource features, such as lakes and wetlands, are typically subject to extensive recreational use and high levels of pollutant discharges, common forms of stress to aquatic systems, and these may result in the deterioration of these natural resource features. For this reason, the formulation of sound management strategies must be based on a thorough knowledge of the pertinent characteristics of the individual resource features, as well as of the urban development in the area concerned. Accordingly, this chapter provides information concerning the natural resource features of the Ashippun Lake watershed, including data on aquatic macrophytes, fish, wildlife, wetlands and woodlands, and environmental corridors. Recreational activities are described and quantified in Chapter VI.

## AQUATIC PLANTS

Aquatic plants include larger plants, or macrophytes, and microscopic algae, or phytoplankton. These plants form an integral part of the aquatic food web, converting inorganic nutrients present in the water and sediments into organic compounds that are directly available as food to other aquatic organisms. In this process, known as photosynthesis, plants utilize energy from sunlight and release oxygen required by other aquatic life forms.

To document the types, distribution, and relative abundance of aquatic macrophytes in Ashippun Lake, an aquatic plant survey was conducted by the Commission staff during the summer of 2001.

### Phytoplankton

Phytoplankton, or algae, are small, generally microscopic plants that are found in all lakes and streams. They occur in a wide variety of forms, in single cells or colonies, and can be either attached or free-floating. Phytoplankton abundance varies seasonally with fluctuations in solar irradiance, turbulence due to prevailing winds, and nutrient availability. In lakes with high nutrient levels, heavy growths of phytoplankton, or algal blooms, may occur. Typically, algal groups are determined on the basis of pigmentation as revealed in their color. Two algal groups especially important in aquatic ecosystems are the green algae and the blue-green algae.

Green algae (Chlorophyta) are the most important sources of food for zooplankton, or microscopic animals, in the lakes of southeastern Wisconsin. Blue-green algae (Cyanophyta) are not ordinarily utilized by zooplankton or fish populations, and may become over-abundant and out of balance with the organisms that feed on them. Dramatic population increases or "blooms" of blue-green algae may occur when excessive nutrient supplies are available, optimum sunlight and temperature conditions exist, and there is a lack of competition from other aquatic plant species and of grazing by zooplankton.

Algal blooms may reach nuisance proportions in fertile, or eutrophic, lakes, resulting in the accumulation of surface scums or slimes. In some cases, heavy concentrations of wind-blown algae accumulate along shorelines, where they die and decompose, causing noxious odors and unsightly conditions. The decay process consumes oxygen, sometimes depleting available supplies and resulting in fish kills. Also, certain species of blue-green algae may release toxic materials into the water.

During late-winter, February through mid-April, another type of algae, the diatoms (Baccilariophyta), generally become the dominant group. Fluctuations in diatom cell counts are common. This seasonal increase or pulse in diatom growth is common to lakes in the Region, and is known as the spring diatom bloom. Diatoms are adapted to grow well under low light and cool temperature conditions and can, in some instances, form a brownish, slippery covering on submerged objects. After the subsidence of the spring diatom bloom, warmer water temperatures and greater light intensities often result in renewed growth and dominance of blue-green algae.

Analyses of the types and abundance of algae were conducted during 1977 and reported in the initial study. Algae populations at that time were highest during late summer and again in early fall with the lowest concentration of algae being reported in the spring. The dominant diatom species reported in the initial study included: *Navicula* sp., *Astrionella formosa*, a star-shaped colony of match stick-shaped cells commonly found in cool waters of moderate to poor quality; and, *Synedra* sp., a needle-shaped cell. The types and relative abundances of algae present in Ashippun Lake were also analyzed in 1978 by the Wisconsin Department of Natural Resources (WDNR), the results of which are shown in Table 12. As was noted in the earlier report, the presence of the blue-green alga, *Oscillatoria prolifica*, at that time could have been signaling a potential decline in water quality. No current data on algae populations in Ashippun Lake is available, although a decrease in water clarity, which may be the result of increased algae populations, has been a concern of the residents during the current study period. The chlorophyll-*a* concentrations reported in Chapter IV, which generally average about 10 micrograms per liter (µg/l), would suggest that the Lake supports a moderately abundant population of phytoplankton, with a tendency toward more abundant growths during the fall, when chlorophyll-*a* values can exceed 20 µg/l, as shown in Table 8 in Chapter IV of this report. Chlorophyll-*a* values in excess of 10 µg/l typically impart a visibly greenish tinge to the water, and can result in public concern.

**Aquatic Macrophytes**

Aquatic macrophytes, including emergent species, such as rushes and cattails; floating-leaves species, such as lily pads; and submergent species, such as pondweeds, coontail, and water milfoil, play an important role in the ecology of southeastern Wisconsin lakes. Depending on their types, distribution, and abundance, they can be either beneficial or a nuisance. Macrophytes growing in reasonable densities in lakes are beneficial in maintaining lake fisheries and wildlife populations, providing habitats for a variety of aquatic organisms. They also may remove nutrients from the water that otherwise would contribute to excessive algal growths. Aquatic plants can become a nuisance when their densities become so great as to interfere with swimming and boating activities, when their growth forms limit habitat diversity, and when the plants reduce the aesthetic appeal of the resource. Many factors, including lake configuration, depth, water clarity, nutrient availability, bottom substrate, wave action, and type and size of fish populations present, determine the distribution and abundance of aquatic macrophytes in lakes. Most waterbodies within the Southeastern Wisconsin Region naturally support abundant and diverse aquatic plant communities. Illustrations of representative macrophyte species observed in Ashippun Lake are set forth in Appendix A.

The initial aquatic plant survey of Ashippun Lake was conducted in June and August of 1977, the results of which are shown in Table 13. The growth of macrophytes in Ashippun Lake at that time was characterized as both moderate and diverse. The dominant species were: coontail in the deeper water depths of 10 to 15 feet; Eurasian water milfoil in the mid-depth range of four to 10 feet; and white water lily in the shallow depths of less than four feet. There was a natural succession of species, both in the lake and along the shore, as the summer progressed

Table 12

**ALGAE POPULATIONS IN ASHIPPUN LAKE: APRIL 28, 1978**

| Species | Algae Type | Relative Abundance |
|---|---|---|
| *Achnanthes minitissema* | Diatom | Rare |
| *Asterionella formosa* | Diatom | Present |
| *Chroomonas acuta* | Golden brown | Present |
| *Chroomonas coerulea* | Golden brown | Rare |
| *Chroomonas reflexa* | Golden brown | Scarce |
| *Cryptomonas ovata* | Golden brown | Rare |
| *Cryptomonas* species | Golden brown | Rare |
| *Dinobryon* species | Yellow-green | Scarce |
| *Erkinia* species | Yellow-green | Common |
| *Glenodinium pulvisculus* | Dinoflagellate | Present |
| *Golenkinia radiata* | Green | Rare |
| *Melosira islandica* | Diatom | Rare |
| *Navicula* species | Diatom | Present |
| *Oscillatoria prolifica* | Blue-green | Rare |
| *Oscillatoria tenuis* | Bluegreen | Scarce |
| *Scenedesmus quadricauda* | Green | Rare |
| *Stephanodiscus astrea* | Diatom | Rare |
| *Synedra acus* | Diatom | Present |
| *Synedra radians* | Diatom | Scarce |

*Source: Wisconsin Department of Natural Resources.*

from June to August with the bushy pondweeds and wild celery increasing in abundance while other varieties of pondweeds decreased. Such changes are common in lakes in southeastern Wisconsin.

More recently, an aquatic plant survey was conducted by staff of the Southeastern Wisconsin Regional Planning Commission (SEWRPC) during July of 2001, the results of which are shown in Table 14. One of the dominant submerged macrophytes identified during that survey was Eurasian water milfoil (*Myriophyllum spicatum*), a nonnative, invasive species introduced from Europe. Eurasian water milfoil is one of eight milfoil species found in Wisconsin. It is one of two designated nonnative invasive species identified in Chapter NR 109 of the *Wisconsin Administrative Code*, the other being curly-leaf pondweed, *Potamogeton crispus*. Because of its nonnative nature, Eurasian water milfoil has few natural enemies that can inhibit its explosive growth under suitable conditions. The plant exhibits this characteristic growth pattern in lakes with organic-rich sediments, or where the lake bottom has been disturbed. In such cases, the Eurasian water milfoil populations can displace native plant species which can lead to the loss of plant diversity, degradation of water quality, and reduction in habitat value for fish, invertebrates, and wildlife, and can interfere with the aesthetic and recreational use of the waterbodies. This plant has been known to cause severe recreational use problems in lakes within the Southeastern Wisconsin Region.

Eurasian water milfoil reproduces by the rooting of plant fragments. Consequently, some recreational uses of lakes can result in the expansion of Eurasian water milfoil communities, especially when boat propellers fragment Eurasian water milfoil plants. These fragments, as well as fragments that occur for other reasons, such as wind-induced turbulence or fragmentation of the plant by fishes, are able to generate new root systems, allowing the plant to colonize new sites. The fragments also can cling to boats, trailers, motors, and/or bait buckets, and can stay alive for weeks contributing to the transfer of Eurasian water milfoil to other lakes. For this reason, it is very important to remove all vegetation from boats, trailers, and other equipment after removing them from the water and prior to launching in other waterbodies. Informational placards encouraging this behavior are placed at the public recreational boating access site.

Other common macrophytes included Sago pondweed (*Potamogeton pectinatus*) and muskgrass, also known as stonewort (*Chara* sp.). Emergent species observed included: water bulrush (*Scirpus subterminalis*), bulrush (*Scirpus* spp.), and arrowhead (*Sagittaria latifolia*). The appearance of various pondweed species, such as clasping-leaf pondweed (*Potamogeton richardsonii*), Sago pondweed (*Potamogeton pectinatus*), Illinois pondweed (*Potamogeton illinoensis*), flat-stemmed pondweed (*Potamogeton zosteriformis*), variable pondweed (*Potamogeton gramineus*), and white-stem pondweed (*Potamogeton praelongus*), is generally considered to be a positive sign. Table 15 outlines the positive ecological significance of all aquatic plant species found in Ashippun Lake. The distribution of aquatic plant communities in Ashippun Lake, as surveyed by commission staff during July 2001, is shown on Map 11. These results suggest a diverse and abundant aquatic plant community.

A comparison of the macrophyte communities surveyed during 1977 with that noted to have been present in the Lake during 2001 is presented in Table 16. The apparent increase of Eurasian water milfoil within the Lake during the recent survey, concurrent with a decrease in coontail, may reflect the cyclical nature of the climatic

**Table 13**

**FREQUENCY OF OCCURRENCE OF PLANT SPECIES OF ASHIPPUN LAKE: JUNE AND AUGUST 1977**

| Common Name | Scientific Name | Frequency of Occurrence[a] (percent) June | Frequency of Occurrence[a] (percent) August | Observer-Reported Relative Abundance[b] |
|---|---|---|---|---|
| Arrowhead | *Sagittaria latifolia* | 5.8 | 2.5 | Sparse |
| Bladderwort | *Utricularia* spp. | 10.7 | 6.6 | Abundant |
| Bur Reed | *Sparganium eurycarpum* | 0.8 | 0.8 | Very sparse |
| Bushy Pondweed | *Najas flexilis* | 3.3 | 12.4 | Common |
| Cattail | *Typha angustifolia* | 5.0 | 1.7 | Sparse |
| Clasping-Leaf Pondweed | *Potamogeton richardsonii* | 0.8 | 2.5 | Very sparse |
| Coontail | *Ceratophyllum demersum* | 45.5 | 40.5 | Abundant |
| Eel Grass | *Vallisneria americana* | 5.8 | 13.2 | Common |
| Eurasian Water Milfoil | *Myriophyllum spicatum* | 32.2 | 43.8 | Common |
| Flat-Stem Pondweed | *Potamogeton zosteriformis* | 6.6 | 0.8 | Sparse |
| Floating-Leaf Pondweed | *Potemogeton natans* | 0.8 | 0.0 | Very sparse |
| Fries's Pondweed | *Potamogeton friesii* | 6.6 | 0.0 | Sparse |
| Horsetail | *Equisetum fluviatile* | 0.8 | 0.0 | Very sparse |
| Illinois Pondweed | *Potamogeton illinoisensis* | 11.6 | 10.7 | Common |
| Muskgrass | *Chara* spp. | 39.7 | 28.1 | Abundant |
| Native Water Milfoil | *Myriophyllum verticillatum* | 9.9 | 0.8 | Sparse |
| Pickerel Weed | *Pontederia cordata* | 11.6 | 8.3 | Sparse |
| Sago Pondweed | *Potamogeton pectinatus* | 41.3 | 39.7 | Common |
| Sedge | *Carex aquatilis substricta* | 5.8 | 2.5 | Sparse |
| Softstem Bulrush | *Scirpus validus* | 16.5 | 14.1 | Common |
| Spike Rush | *Eleocharis acicularis* | 3.3 | 0.0 | Sparse |
| Spike Rush | *Eleocharis calva* | 4.1 | 1.7 | Sparse |
| Spiny Naiad | *Najas marina* | 0.8 | 11.6 | Common |
| Star Duckweed | *Lemna trisulca* | 0.8 | 0.8 | Very sparse |
| Stiff water crowfoot | *Ranunculus longirostris* | 1.7 | 0.0 | Very sparse |
| Variable Pondweed | *Potamogeton gramineus* | 0.0 | 4.1 | Common |
| Water Bulrush | *Scirpus subterminalis* | 0.8 | 0.8 | Common |
| Water Stargrass | *Zosterella dubia* | 9.9 | 12.4 | Sparse |
| Waterweed | *Anacharis canadensis* | 1.7 | 1.7 | Very sparse |
| White-Stem Pondweed | *Potamogeton praelongus* | 2.5 | 0.8 | Very sparse |
| White Water Lily | *Nymphaea tuberosa* | 23.1 | 20.6 | Abundant |
| Wild Rice | *Zizania aquatica interior* | 0.8 | 0.8 | Very sparse |
| Yellow Water Lily | *Nuphar variegatum* | 9.9 | 8.3 | Abundant |

NOTE: There were 122 sites sampled during the June and August 1977 surveys.

[a]*The percent frequency of occurrence refers to the percent of the 122 sampling sites in which the plant species was noted.*

[b]*The relative abundance is approximately related to Average Density, as reported in Table 14, as follows: absent = 0.0; very scarce = 1.0; scarce = 2.0; common = 3.0; and abundant = 4.0*

*Source: SEWRPC.*

regime within the Region, and the tolerance of the Eurasian water milfoil to colder water temperatures than those generally tolerated by native aquatic plant species.

### Aquatic Plant Management

Records of aquatic plant management efforts on Wisconsin lakes were not maintained by the WDNR prior to 1950. Thus, while previous interventions were likely, the first recorded efforts to manage the aquatic plants in Ashippun Lake have taken place since 1950. As was reported in the initial study, aquatic plant management activities in Ashippun Lake can be categorized as chemical macrophyte and algal control. Currently, all forms of aquatic plant management are subject to permitting by the WDNR pursuant to authorities granted the WDNR under Chapters NR 107 and NR 109 of the *Wisconsin Administrative Code.*

Table 14

FREQUENCY OF OCCURRENCE OF SUBMERGENT PLANT SPECIES IN ASHIPPUN LAKE: JULY 2001

| Common Name | Scientific Name | Sites Found | Frequency of Occurrence[a] (percent) | Average Density[b] | Importance Value[c] |
|---|---|---|---|---|---|
| Bladderwort | *Utricularia* spp. | 2 | 3.2 | 2.5 | 0.08 |
| Bushy Pondweed | *Najas flexilis* | 17 | 27.4 | 1.7 | 0.47 |
| Clasping-Leaf Pondweed | *Potamogeton richardsonii* | 7 | 11.3 | 1.4 | 0.16 |
| Coontail | *Ceratophyllum demersum* | 2 | 3.2 | 1.5 | 0.05 |
| Eel Grass | *Vallisneria americana* | 9 | 14.5 | 2.1 | 0.31 |
| Eurasian Water Milfoil | *Myriophyllum spicatum* | 32 | 51.6 | 2.5 | 1.31 |
| Flat-Stem Pondweed | *Potamogeton zosteriformis* | 3 | 4.8 | 2.0 | 0.10 |
| Illinois Pondweed | *Potamogeton illinoisensis* | 13 | 21.0 | 1.8 | 0.37 |
| Muskgrass | *Chara* spp. | 36 | 58.1 | 3.2 | 1.87 |
| Sago Pondweed | *Potamogeton pectinatus* | 42 | 67.7 | 2.4 | 1.61 |
| Spiny Naiad | *Najas marina* | 45 | 72.6 | 2.5 | 1.82 |
| Variable Pondweed | *Potamogeton gramineus* | 21 | 33.9 | 1.7 | 0.56 |
| Water Bulrush | *Scirpus subterminalis* | 3 | 4.8 | 1.3 | 0.06 |
| Water Stargrass | *Zosterella dubia* | 1 | 1.6 | 1.0 | 0.02 |
| White-Stem Pondweed | *Potamogeton praelongus* | 2 | 3.2 | 1.0 | 0.03 |

NOTE: There were 62 sites sampled during the July 2001 survey.

[a] *The percent frequency of occurrence is the number of occurrences of a species divided by the number of samplings with vegetation, expressed as a percentage. It is the percentage of times a particular species occurred when there was aquatic vegetation present, and is analogous to the Jesson and Lound point system.*

[b] *The average density is the sum of density ratings for a species divided by the number of sampling points with vegetation. The maximum density possible of 4.0 is assigned to plants that occur at all 4 points sampled at a given depth and is an indication of how abundant a particular plant is throughout a lake.*

[c] *The importance value is the product of the relative frequency of occurrence and the average density, expressed as a percentage. This number provides an indication of the dominance of a species within a community.*

*Source: SEWRPC.*

### *Chemical Controls*

Perceived excessive growths of aquatic macrophytes in Ashippun Lake have historically resulted in the application of a chemical control program. Although the use of chemicals to control aquatic plants has been regulated in Wisconsin since 1941, records of aquatic herbicide applications have only been maintained by the WDNR beginning in 1950. Recorded chemical herbicide treatments that have been applied to Ashippun Lake from 1950 through 1979 were reported in the initial study. Chemical treatments to Ashippun Lake for the period of 1950 to 2003 are set forth in Table 17. During the period from 1989 through 2003, documented chemical control of aquatic macrophytes has not occurred.

The amounts of the aquatic herbicide sodium arsenite applied to Ashippun Lake, and years of application during the period 1950 through 1969, are listed in Table 17. The total amount of sodium arsenite applied over this period was about 400 pounds. This amount is relatively small when compared to the amounts of sodium arsenite applied to other Wisconsin lakes during the same time period. Sodium arsenite, an agricultural herbicide, was first applied to lakes in the Madison area in 1926, and, by the 1930s, sodium arsenite was widely used throughout the State for aquatic plant control. Sodium arsenite was typically sprayed onto the surface of Ashippun Lake within an area of up to 200 feet from the shoreline. Treatment typically occurred between mid-June and mid-July. The amount of sodium arsenite used was calculated to result in a concentration of about 10 milligrams per liter (mg/l) sodium arsenite (about five mg/l arsenic) in the treated lake water. The sodium arsenite typically remained in the water column for less than 120 days. Although the arsenic residue was naturally converted from a highly toxic form to a less toxic and less biologically active form, much of the arsenic residue was deposited in the lake sediments. When it became apparent that arsenic was accumulating in the sediments of treated lakes and that the accumulations of arsenic were found to present potential health hazards both to humans and aquatic life, the use

**Table 15**

**POSITIVE ECOLOGICAL SIGNIFICANCE OF AQUATIC PLANT AND WETLAND SPECIES PRESENT IN ASHIPPUN LAKE**

| Common Name | Scientific Name | Ecological Significance[a] |
|---|---|---|
| Arrowhead | *Saggitaria latifolia* | High value for wildlife; seeds are food for marsh birds, and shore birds; tubers are food for waterfowl; tubers and leaves are food for muskrats, beavers, and porcupines; leaves provide shelter and shade for young fish |
| Bladderwort | *Utricularia* spp. | Provides good food and cover for fish |
| Bulrush | *Scirpus* spp. | Food source for waterfowl and muskrat; provides cover for waterfowl and other shallow-water marsh wildlife |
| Bur Reed | *Sparganium eurycarpum* | Colonies anchor sediment and provide nesting sites for waterfowl and shorebirds; food for waterfowl, muskrat, and deer |
| Bushy Pondweed | *Najas flexilis* | Provides food for waterfowl and marsh birds; cover for young largemouth bass, northern pike, small bluegills and perch |
| Cattail | *Typha* spp. | Stalks and roots support insects; important food for muskrat and beaver; attracts marsh birds, waterfowl and songbirds; used as spawning grounds by sunfish and shelter for young fish |
| Clasping-Leaf Pondweed | *Potamogeton richardsonii* | Provides cover for panfish, largemouth bass, muskellunge and northern pike; bluegills nest near them and eat insects found on leaves; supports insects; valuable as food for fish and ducklings |
| Coontail | *Ceratophyllum demersum* | Provides good shelter for young fish; supports insects; food for fish and ducklings |
| Eel Grass | *Vallisneria americans* | Provides good shade and shelter; supports insects; valuable fish food |
| Eurasian Water Milfoil | *Myriophyllum spicatum* | None known |
| Flat-Stem Pondweed | *Potamogeton zosteriformis* | Provides some cover for bluegills, perch, northern pike and muskellunge; food for waterfowl; supports insects; valuable food for fish and ducklings |
| Fries's Pondweed | *Potamogeton fresii* | Eaten by ducks |
| Horsetail | *Equisetum* spp. | Food source for waterfowl |
| Illinois Pondweed | *Potamogeton illinoisensis* | Good food source for waterfowl, muskrat, beaver, and deer; provides shade and cover for fish; supports insects |
| Muskgrass | *Chara* spp. | Excellent producer of fish food, especially for young trout, bluegill, smallmouth and largemouth bass; stabilizes bottom sediments; has softening effect on the water by removing lime and carbon dioxide |
| Pickerel Weed | *Pontederia cordata* | Provides shelter for insects, food for waterfowl, and helps stabilize shorelines |
| Sago Pondweed | *Potamogeton pectinatus* | Good source of food for waterfowl; provides food and shelter for young fish |
| Sedge | *Carex* spp. | Important food source for many species of birds, beaver, deer, and muskrat; provides valuable spawning habitat for fish |

**Table 15 (continued)**

| Common Name | Scientific Name | Ecological Significance[a] |
|---|---|---|
| Spike Rush | *Eleocharis acicularis* | Source of food for waterfowl and muskrats, shelter and spawning habitat for fish |
| Spike Rush | *Eleocharis clava* | Source of food for waterfowl and muskrats, shelter and spawning habitat for fish |
| Spiny Naiad | *Najas marina* | Provides good food and shelter for fish and food for ducks |
| Star Duckweed | *Lemna trisulca* | Good food source for waterfowl; provides cover for fish and insects |
| White Water Crowfoot | *Ranunculus longirostris* | Food source for many waterfowl and some fish; habitat for insects |
| Variable Pondweed | *Potamogeton gramineus* | Provides food for waterfowl, muskrat, deer, and beaver; habitat for insects; foraging opportunities for fish |
| Water Bulrush | *Scirpus subterminalis* | Good habitat for insects and shelter for fish |
| Water Star Grass | *Zosterella dubia* | Food for waterfowl; good cover and foraging for fish |
| Waterweed | *Elodea canadensis* | Offers valuable shelter for fish; food for muskrat and waterfowl; good insect habitat |
| White-Stem Pondweed | *Potamogeton praelongus* | Provides food for trout and wildfowl; provides feeding grounds for muskellunge |
| Wild Rice | *Zizania aquatica interior* | Valuable food source for some migrating waterfowl in fall; food source and construction material for muskrats |
| Yellow Water Lily | *Nuphar variegatum* | Leaves, stems, and flowers are eaten by deer; roots eaten by beaver and porcupine; seeds eaten by waterfowl; leaves provide harbor to insects, shade and shelter for fish |

NOTE: There were 62 sites sampled during the July 2001 survey.

[a]*Information obtained from* A Manual of Aquatic Plants *by Norman C. Fassett;* Guide to Wisconsin Aquatic Plants*, Wisconsin Department of Natural Resources; and* Through the Looking Glass…A Field Guide to Aquatic Plants *by Susan Borman, Robert Korth, and Jo Temte.*

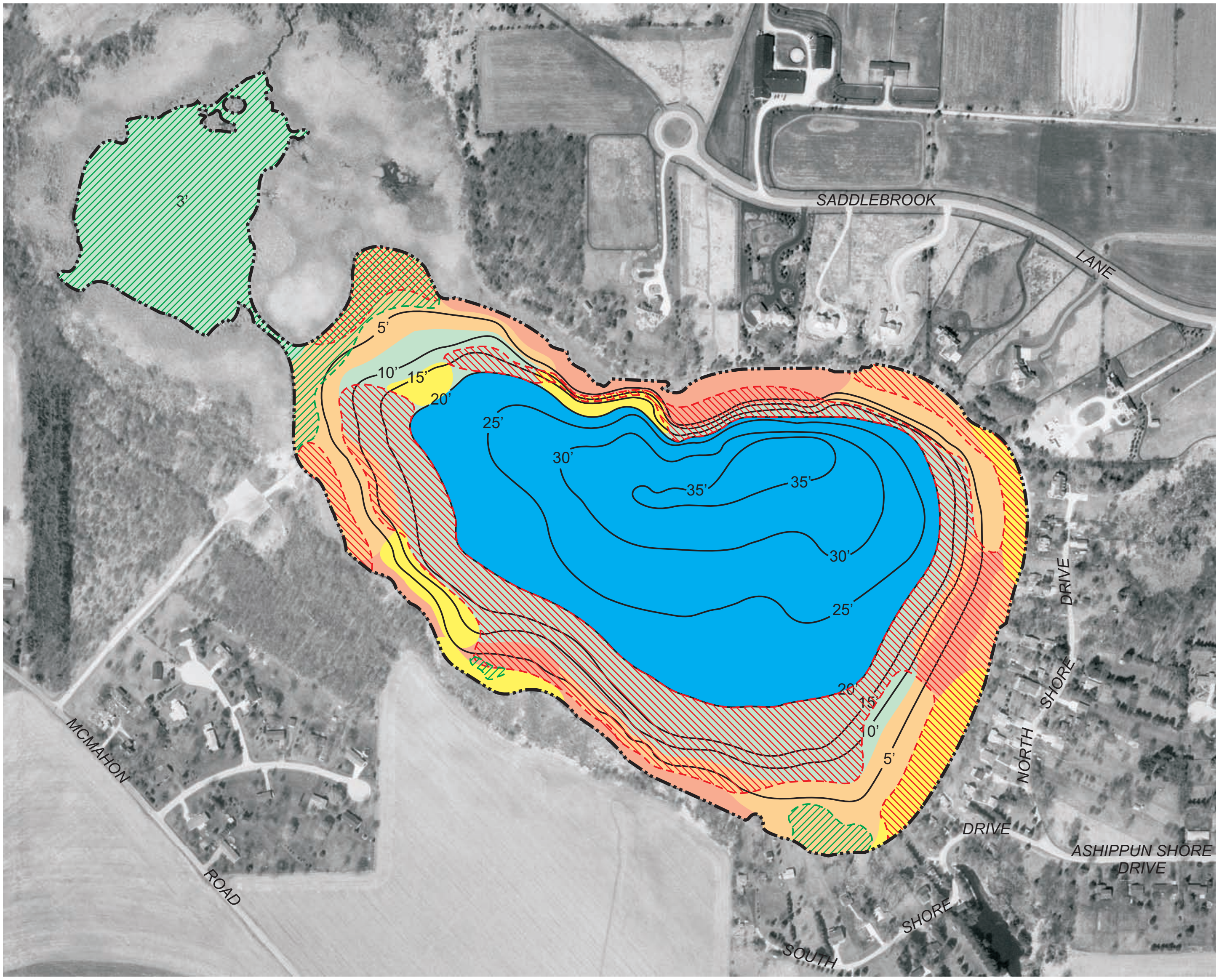
*Source: SEWRPC.*

of sodium arsenite was discontinued in the State in 1969. No other chemicals were applied in significant amounts to control macrophytes until recent years, when a number of organic chemical herbicides came into general use.

As shown in Table 17, the aquatic herbicides diquat, Endothal, and 2,4-D have been applied to Ashippun Lake to control aquatic macrophyte growth. Diquat and endothall (Aquathol) are contact herbicides and kill plant parts exposed to the active ingredient. Diquat use is restricted to the control of duckweed (*Lemna* sp.), milfoil (*Myriophyllum* spp.), and waterweed (*Elodea* sp.). However, this herbicide is nonselective and will kill many other aquatic plants, such as pondweeds (*Potamogeton* spp.), bladderwort (*Utricularia* sp.), and naiads (*Najas* spp.). Endothall primarily kills pondweeds, but does not control such nuisance species as Eurasian water milfoil. The herbicide 2,4-D is a systemic herbicide that is absorbed by the leaves and translocated to other parts of the plant; it is more selective than the other herbicides listed above and is generally used to control Eurasian water milfoil. However, it will also kill species, such as water lilies (*Nymphaea* sp. and *Nuphar* sp.). All of these aquatic herbicides have been used on Ashippun Lake during the 1970s and 1980s. The present restrictions on water use after application of these herbicides are given in Table 18.

Map 11

**AQUATIC PLANT COMMUNITY DISTRIBUTION IN ASHIPPUN LAKE: 2001**




DATE OF PHOTOGRAPHY: MARCH 2000

- 20' WATER DEPTH CONTOUR IN FEET
- OPEN WATER
- WATER LILIES
- EURASIAN WATER MILFOIL
- MUSKGRASS, SPINEY NAIAD, WATER BULRUSH, BUSHY PONDWEED, ILLINOIS PONDWEED, AND SAGO PONDWEED
- MUSKGRASS, WILD CELERY, BUSHY PONDWEED, FLAT-STEM PONDWEED, CLASPING PONDWEED, VARIABLE PONDWEED, SAGO PONDWEED, AND ILLINOIS PONDWEED
- MUSKGRASS, SPINEY NAIAD, WATER BULRUSH, WILD CELERY, BLADDERWORT, BUSHY PONDWEED, VARIABLE PONDWEED, CLASPING PONDWEED, ILLINOIS PONDWEED, AND SAGO PONDWEED
- SPINEY NAIAD, COONTAIL, BLADDERWORT, WATER STAR GRASS, WILD CELERY, BUSHY PONDWEED, SAGO PONDWEED, FLAT-STEM PONDWEED, CLASPING PONDWEED, VARIABLE PONDWEED, ILLINOIS, AND WHITE-STEM PONDWEED

GRAPHIC SCALE
0 300 600 FEET

*Source: SEWRPC.*

**Table 16**

**AQUATIC PLANT SPECIES PRESENT IN ASHIPPUN LAKE: 1977 AND 2001**

| Common Name | Scientific Name | Frequency of Occurrence (percent)[d] | | |
|---|---|---|---|---|
| | | June 1977 | August 1977 | July 2001 |
| Arrowhead | *Saggitaria latifolia* | 5.8 | 2.5 | - -[a] |
| Bladderwort | *Utricularia* spp. | 10.7 | 6.6 | 3.2 |
| Bulrush | *Scirpus* spp. | 16.5 | 14.1 | - -[a] |
| Bur Reed | *Sparganium eurycarpum* | 0.8 | 0.8 | - -[b] |
| Bushy Pondweed | *Najas flexilis* | 3.3 | 12.4 | 27.4 |
| Cattail | *Typha* spp. | 5.0 | 1.7 | - -[a] |
| Clasping-Leaf Pondweed | *Potamogeton richardsonii* | 0.8 | 2.5 | 11.3 |
| Coontail | *Ceratophyllum demersum* | 45.5 | 40.5 | 3.2 |
| Eel Grass | *Vallisneria americans* | 5.8 | 13.2 | 14.5 |
| Eurasian Water Milfoil | *Myriophyllum spicatum* | 32.2 | 43.8 | 51.6 |
| Flat-Stem Pondweed | *Potamogeton zosteriformis* | 6.6 | 0.8 | 4.8 |
| Floating-Leaf Pondweed | *Potamogeton natans* | 0.8 | 0.0 | 0.0 |
| Fries's Pondweed | *Potamogeton fresii* | 6.6 | 0.0 | 0.0 |
| Horsetail | *Equisetum* spp. | 0.8 | 0.0 | - -[a] |
| Illinois Pondweed | *Potamogeton illinoisensis* | 11.6 | 10.7 | 21.0 |
| Muskgrass | *Chara* spp. | 39.7 | 28.1 | 58.1 |
| Native Water Milfoil | *Myriophyllum verticillatum* | 9.9 | 0.8 | 0.0 |
| Pickerel Weed | *Pontederia cordata* | 11.6 | 8.3 | - -[a] |
| Sago Pondweed | *Potamogeton pectinatus* | 41.3 | 39.7 | 67.7 |
| Sedge | *Carex* spp. | 5.8 | 2.5 | - -[a] |
| Spike Rush | *Eleocharis acicularis* | 3.3 | 0.0 | - -[a] |
| Spike Rush | *Eleocharis clava* | 4.1 | 1.7 | - -[a] |
| Spiny Naiad | *Najas marina* | 0.8 | 11.6 | 72.6 |
| Star Duckweed | *Lemna trisulca* | 0.8 | 0.8 | - -[c] |
| Stiff Water Crowfoot | *Ranunculus* spp. | 1.7 | 0.0 | - -[a] |
| Variable Pondweed | *Potamogeton gramineus* | 0.0 | 4.1 | 33.9 |
| Water Bulrush | *Scirpus subterminalis* | 0.8 | 0.8 | 4.8 |
| Water Stargrass | *Zosterella dubia* | 9.9 | 12.4 | 1.6 |
| Waterweed | *Anacharis canadensis* | 1.7 | 1.7 | - -[a] |
| White-Stem Pondweed | *Potamogeton praelongus* | 2.5 | 0.8 | 3.2 |
| White Water Lily | *Nymphaea tuberosa* | 23.1 | 20.6 | - -[c] |
| Wild Rice | *Zizania aquatica interior* | 0.8 | 0.8 | - -[a] |
| Yellow Water Lily | *Nuphar variegatum* | 9.9 | 8.3 | - -[c] |

NOTE: There were 62 sites sampled during the July 2001 survey.

[a]*Emergent (wetland) plant inventoried during the 2001 survey, but not included in this analysis.*

[b]*Emergent (wetland) plant not inventoried during the 2001 survey.*

[c]*Floating-leaved aquatic plant.*

[d]*The percent frequency of occurrence is the number of occurrences of a species divided by the number of samplings with vegetation, expressed as a percentage. It is the percentage of times a particular species occurred when there was aquatic vegetation present, and is analogous to the Jesson and Lound point system.*

*Source: SEWRPC.*

In addition to the chemical herbicides used to control large aquatic plants, algicides have also been applied to Ashippun Lake to control growths of phytoplankton. As shown in Table 17, copper sulfate (Cutrine Plus) has been applied to Ashippun Lake, on occasion. Like arsenic, copper, the active ingredient in many algicides, including Cutrine Plus, may accumulate in the bottom sediments. Excessive levels of copper may be toxic to fish

**Table 17**

**CHEMICAL CONTROL OF AQUATIC PLANTS IN ASHIPPUN LAKE: 1950-2003**

| | | Algae Control | | | Macrophyte Control | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Total Area Treated (acres) | Copper Sulfate | Blue Vitriol | Cutrine or Cutrine-+ (gallons) | Sodium Arsenite (pounds) | 2, 4-D (gallons) | 2, 4-D (pounds) | Diquat (gallons) | Endothal (gallons) | Aquathol (gallons) |
| 1950-1952 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1953 | 88 | - - | - - | - - | 400 | - - | - - | - - | - - | - - |
| 1954 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1955 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1956 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1957 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1958 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1959 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1960 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1961 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1962 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1963 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1964 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1965 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1966 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1967 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1968 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1969 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1970 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1971 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1972 | 4.0 | - - | - - | - - | - - | - - | - - | 4 | - - | 10.0 |
| 1973 | 4.6 | - - | - - | 45.0 | - - | - - | - - | - - | - - | - - |
| 1974 | 4.6 | - - | - - | 36.0 | - - | - - | - - | - - | - - | - - |
| 1975 | 8.2 | - - | - - | 8.0 | - - | 14.0 | - - | - - | 14 | - - |
| 1976 | 5.6 | - - | - - | 3.0 | - - | - - | 90 | - - | 10 | - - |
| 1977 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1978 | - - | - - | - - | - - | - - | - - | - - | - - | - - | - - |
| 1979 | - - | - - | - - | 12.5 | - - | - - | - - | - - | 26 | - - |
| 1980 | 5.3 | - - | - - | 6.5 | - - | - - | - - | - - | - - | 13.0 |
| 1981 | - - | - - | - - | | - - | - - | - - | - - | - - | |
| 1982 | 4.8 | - - | - - | 5.3 | - - | - - | - - | - - | - - | 10.5 |
| 1983-1984 | | - - | - - | | - - | - - | - - | - - | - - | |
| 1985 | 6.6 | - - | - - | 5.0 | - - | 1.5 | - - | - - | - - | 10.0 |
| 1986 | 1.2 | - - | - - | 1.8 | - - | 2.0 | - - | - - | - - | 3.5 |
| 1987 | - - | - - | - - | | - - | - - | - - | - - | - - | - - |
| 1988 | 2.8 | - - | - - | 2.5 | - - | 7.0 | - - | - - | - - | 5.0 |
| 1989-2003 | | - - | - - | | - - | - - | - - | - - | - - | |
| Total | 135.7 | - - | - - | 125.6 | 400 | 24.5 | 90 | 4 | 50 | 52.0 |

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

and benthic organisms, but, generally, have not been found to be harmful to humans.[1] Restrictions on water uses after application of copper sulfate are also given in Table 18. WDNR sediment quality guidelines are set forth in Table 19.

## AQUATIC ANIMALS

Aquatic animals include microscopic zooplankton; benthic, or bottom-dwelling, invertebrates; fish, and reptiles; amphibians; mammals; and waterfowl, and other birds that inhabit the Lake and its shorelands. These make up the primary and secondary consumers of the food web.

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[1]*Jeffrey A. Thornton and Walter Rast, "The Use of Copper and Copper Compounds as Algicides," in H. Wayne Richardson,* Handbook of Copper Compounds and Applications*, Marcel Dekker, New York, 1997, pp. 123-142.*

**Table 18**

**PRESENT RESTRICTIONS ON WATER USES AFTER APPLICATION OF AQUATIC HERBICIDES[a]**

| Use | Days after Application | | | | | |
|---|---|---|---|---|---|---|
| | Copper Sulfate | Diquat | Glyphosate | Endothall | 2,4-D | Fluridone |
| Drinking | - -[b] | 14 | - -[c] | 7-14 | - -[d] | - -[e] |
| Fishing | 0 | 14 | 0 | 3 | 0 | 0 |
| Swimming | 0 | 1 | 0 | - - | 0 | 0 |
| Irrigation | 0 | 14 | 0 | 7-14 | - -[d] | 7-30 |

[a]*The U.S. Environmental Protection Agency has indicated that, if these restrictions are observed, pesticide residues in water, irrigated crops, or fish will not pose an unacceptable risk to humans and other organisms using or living in the treatment zone.*

[b]*According to the Wisconsin Department of Natural Resources, if water is to be used as potable water, the residual copper content cannot exceed one part per million (ppm).*

[c]*According to the Wisconsin Department of Natural Resources, if water is to be used as potable water, the drinking water tolerance of glyphosate (Rodeo®) is one part per million (ppm).*

[d]*2,4-D products are not to be applied to waters used for irrigation, animal consumption, drinking, or domestic uses, such as cooking and watering vegetation.*

[e]*According to the Wisconsin Department of Natural Resources, if water is to be used as potable water, the drinking water tolerance of fluridone (Sonar®) is 0.15 parts per million (ppm).*

*Source: Wisconsin Department of Natural Resources.*

**Table 19**

**WISCONSIN DEPARTMENT OF NATURAL RESOURCES DRAFT SEDIMENT QUALITY SCREENING CRITERIA[a]**

| Chemical | Lowest Effect Level (LEL) | Medium Effect Level (MEL) | Severe Effect Level (SEL) |
|---|---|---|---|
| Arsenic | 6.00 | 33.0 | 85.0 |
| Copper | 25.00 | 110.0 | 390.0 |
| Lead | 31.00 | 110.0 | 250.0 |
| Mercury | 0.15 | 0.2 | 1.3 |
| Ammonia-Nitrogen | 75.00 | - - | - - |

[a]*Units are in mg/kg dry sediment.*

*Source: Wisconsin Department of Natural Resources.*

## Zooplankton

Zooplankton are microscopic animals which inhabit the same environment as phytoplankton, the microscopic plants. An important link in the food chain, zooplankton feed mostly on algae and, in turn, are a good food source for fish. Crustacean zooplankton were found in varying abundances in Ashippun Lake during the 1977 study year, as reported in the initial study. Populations of zooplankton species in Ashippun Lake were of relatively low density throughout 1977 except for a pulse of *Daphnia* and *Cyclops* species during the spring. There are no current data available on zooplankton species in Ashippun Lake.

## Benthic Invertebrates

The benthic, or bottom dwelling, animal communities of lakes include such organisms as sludge worms, midges, and caddisfly larvae. These organisms are an important part of the food chain, acting as processors of organic material that accumulates on the lake bottom. Some benthic fauna are opportunistic in their feeding habits, while others are predaceous. The diversity of benthic faunal communities can be used as an indicator of lake trophic status. In general, a reduced or limited diversity of organisms present is indicative of a eutrophic lake; however, there is no single "indicator organism." Rather, the entire community must be assessed to determine trophic status as populations can fluctuate widely through the year and between years as a consequence of season, climatic variability, and localized water quality changes.

The benthic fauna of Ashippun Lake were not sampled during the initial report and there are no current data available regarding this population.

**Fishes of Ashippun Lake**

In the initial study, Ashippun Lake was reported to support a relatively large and diverse fish community, as shown in Table 20. Important predatory fish in Ashippun Lake included largemouth bass and northern pike. These fish species are carnivorous, feeding primarily on other fish, crayfish, and frogs and are among the largest and most prized game fish sought by Ashippun Lake anglers.

In a 1989 report, set forth in Appendix B of this report, the WDNR indicated that the pothole lake to the northwest of the main lake basin provided excellent quality spawning habitat for northern pike and cover for largemouth bass. In this same report, it was noted that, although carp were known to be present in the Lake, the population was not considered to be large enough to constitute a significant problem. Other WDNR reports, dating from between 1956 and 1990, indicated that, although Ashippun Lake appeared to provide suitable habitat for reproduction of desirable sport fish species, especially northern pike, the numbers of northern pike were lower than would have been expected. It was suggested that this lower than expected number of northern pike might be due in large part to the moderate to high fishing pressure that Ashippun Lake experiences during summer and winter. In response to the 1990 survey, it was recommended that stocking of northern pike be continued.

Periodic stocking to Ashippun Lake of northern pike had taken place on seven different occasions between 1969 and 1979. In addition to the aforementioned northern pike stocking, Table 21 shows WDNR stocking records for Ashippun Lake over the period from 1951 through 2001. Walleyed pike and largemouth bass fingerlings have been stocked from 1951 through 1989, while stocking of northern pike fingerlings was continued through 2001, in order to enhance and maintain sport fishing opportunities for anglers using Ashippun Lake.

A wide range of panfish are present in the Lake. "Panfish" is a common term applied to a broad group of smaller fish with a relatively short and usually broad shape that makes them a perfect size for the frying pan. Panfish species known to exist in Ashippun Lake include bluegills, pumpkinseeds, yellow perch, and black crappies. The habitats of panfish vary widely among the different species, but their cropping of the plentiful supply of insects and plants, coupled with prolific breeding rates, leads to large populations with a rapid turnover. Some lakes within southeastern Wisconsin have stunted, or slow-growing, panfish populations because their numbers are not controlled by predatory fishes. Panfish frequently feed on the fry of predatory fish and, if the panfish population is overabundant, they may quickly deplete the predator fry population. Figure 8 illustrates the importance of a balanced predator-prey relationship, using walleyed pike and perch as an example.

"Rough fish" is a broad term applied to species, such as carp, that do not readily bite on hook and line, but feed on game fish, destroy habitat needed by more desirable species, and are commonly considered in southeastern Wisconsin as undesirable for human consumption. Carp have been reported from Ashippun Lake, but are not present in such abundance as to warrant concern.

Ashippun Lake is currently passively managed for the production of bluegills, yellow perch, black crappie, northern pike, and largemouth and smallmouth bass by the WDNR, which regulates the harvest of fishes from the Lake under current state fishing regulations. The 2006-2007 regulations governing the harvest of fishes from the waters of the State are summarized in Table 22.

**Table 20**

**SPECIES OF FISH CAPTURED IN ASHIPPUN LAKE: 1952-1975**

| Species | Family | Scientific Name |
|---|---|---|
| Black Bullhead | Ictaluridae | *Ictalurus melas* |
| Black Crappie | Centrarchidae | *Pomoxis nigromaculatus* |
| Bluegill | Centrarchidae | *Lepomis macrochirus* |
| Bowfin | Amiidae | *Amia calva* |
| Brown Bullhead | Ictaluridae | *Ictalurus nebulosus* |
| Common Carp | Cyprinidae | *Cyprinus carpio* |
| Common Shiner | Cyprinidae | *Notropis cornutus* |
| Golden Shiner | Cyprinidae | *Notemigonus crysoleucas* |
| Grass Pickerel | Esocidae | *Esox americanus vermiculatus* |
| Green Sunfish | Centrarchidae | *Lepomis cyanellus* |
| Largemouth Bass | Centrarchidae | *Micropterus salmoides* |
| Longnose Gar | Lepisosteidae | *Lepisosteus osseus* |
| Northern Pike | Esocidae | *Esox lucius* |
| Pumpkinseed | Centrarchidae | *Lepomis gibbosus* |
| Rock Bass | Centrarchidae | *Ambloplites ruperstris* |
| Walleyed Pike | Percidae | *Stizotedion vitreum vitreum* |
| Warmouth | Centrarchidae | *Lepomis gulosus* |
| Yellow Bullhead | Ictaluridae | *Ictalurus natalis* |
| Yellow Perch | Percidae | *Perca flavescens* |

*Source: Wisconsin Department of Natural Resources.*

## Other Wildlife

Although a quantitative field inventory of amphibians, reptiles, birds, and mammals was not conducted as a part of the Ashippun Lake study, it is possible, by polling naturalists and wildlife managers familiar with the area, to complete a list of amphibians, reptiles, birds, and mammals which may be expected to be found in the area under existing conditions. The technique used in compiling the wildlife data involved obtaining lists of those amphibians, reptiles, birds, and mammals known to exist, or known to have existed, in the Ashippun Lake area; associating these lists with the historic and remaining habitat areas in the Ashippun Lake area as inventoried; and projecting the appropriate amphibian, reptile, bird, and mammal species into the Ashippun Lake area. The net result of the application of this technique is a listing of those species which were probably once present in the area; those species which may be expected to still be present under currently prevailing conditions; and those species which may be expected to be lost or gained as a result of urbanization within the area.

A variety of mammals, ranging in size from large animals like the northern white-tailed deer to small animals like the least shrew, are expected to be found in the Ashippun Lake area. Mink, muskrat, beaver, white-tailed deer, red and grey fox, grey and fox squirrel, and cottontail rabbits are mammals reported to frequent the area. Table 23 lists 38 mammals whose ranges are known to extend into the area.

A large number of birds, ranging in size from large game birds to small songbirds, also are expected to be found in the Ashippun Lake area. Table 24 lists those birds that normally occur in the area. Each bird is classified as to whether it breeds within the area, winters in the area, visits the area only during the annual migration periods, or visits the area only on rare occasions. The area tributary to Ashippun Lake supports a significant population of waterfowl, including mallard and teal. Larger numbers of birds move through the area during migrations when most of the regional species may also be present. Mallards, wood ducks, blue-winged teal and Canada geese are the most numerous waterfowl and are known to nest in the area. Many game birds, songbirds, waders, and raptors also reside or visit the Lake and its environs. Ospreys and loons are notable migratory visitors.

Because of the mixture of lowland and upland woodlots, wetlands, and agricultural lands still present in the area, along with the favorable summer climate, the area supports many other species of birds. Hawks and owls function as major rodent predators within the ecosystem. Swallows, whippoorwills, woodpeckers, nuthatches, and flycatchers, as well as several other species, serve as major insect predators. In addition to their ecological roles, birds, such as robins, red-winged blackbirds, orioles, cardinals, kingfishers, and mourning doves, serve as subjects for bird watchers and photographers. Threatened species migrating in the vicinity of Ashippun Lake include the Cerulean warbler, the Acadian flycatcher, great egret, and the red-shouldered hawk. Endangered species migrating in the vicinity of Ashippun Lake include the common tern, Caspian tern, Forster's tern, and the loggerhead shrike.

In the initial study, the 40-acre wetland complex in the northwest corner of the Ashippun Lake drainage basin was noted for its significant population of marsh birds, including great blue heron, black tern, and Forster's tern. As noted in that earlier study, great blue heron and black tern numbers were reported to be on the decline but not yet to the point where these species would be considered rare, threatened, or endangered; however, Forster's tern was considered endangered. Forster's tern continues to be considered endangered, the great blue heron is now on the list of uncommon species, and the black tern is now considered rare.

## Table 21

### FISH STOCKED INTO ASHIPPUN LAKE: 1951-2001

| Year | Northern Pike | | | | Walleye | | | | Largemouth Bass | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Pounds | Size (inches) | Age[a] | Number | Pounds | Size (inches) | Age[a] | Number | Pounds | Size (inches) | Age[a] |
| 1951 | - - | - - | - - | - - | - - | - - | - - | - - | 1,800 | - - | - - | Fingerling |
| 1952 | - - | - - | - - | - - | - - | - - | - - | - - | 1,600 | - - | - - | Fingerling |
| 1953 | - - | - - | - - | - - | - - | - - | - - | - - | 880 | - - | - - | Fingerling |
| 1967 | 26 | 77.0 | - - | Adult | - - | - - | - - | - - | - - | - - | - - | - - |
| 1969 | 133 | - - | 9.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1970 | 200,000 | - - | - - | Fry | - - | - - | - - | - - | - - | - - | - - | - - |
| 1972 | 74 | 210.0 | 20.0 | Adult | - - | - - | - - | - - | - - | - - | - - | - - |
| | 5,000 | 50.0 | 3.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1975 | 480 | 240.0 | 20.0 | Adult | - - | - - | - - | - - | - - | - - | - - | - - |
| 1978 | - - | - - | - - | - - | - - | - - | - - | - - | 10,000 | 125 | 3 | Fingerling |
| 1979 | 100,000 | - - | - - | Fry | 5,000 | 31 | 3 | Fingerling | - - | - - | - - | - - |
| 1980 | 200,000 | - - | - - | Fry | - - | - - | - - | - - | - - | - - | - - | - - |
| | 250 | - - | 9.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1981 | 162 | 242.0 | 15.0 | Adult | - - | - - | - - | - - | - - | - - | - - | - - |
| 1983 | 200 | 24.0 | 8.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1984 | - - | - - | - - | - - | 4,000 | 12 | 2 | Fingerling | - - | - - | - - | - - |
| 1985 | 200 | 21.0 | 8.0 | Fingerling | 4,000 | 22 | 3 | Fingerling | - - | - - | - - | - - |
| 1986 | 4,000 | 32.0 | 3.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1989 | 5,200 | 23.0 | 2.0 | Fingerling | 2,150 | 4 | 2 | Fingerling | - - | - - | - - | - - |
| 1991 | 440 | 34.5 | 8.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1992 | 800 | 77.0 | 8.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1993 | 420 | 47.0 | 8.0 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1994 | 420 | 8.1 | 4.8 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1996 | 180 | 2.6 | 4.3 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1998 | 420 | 6.4 | 3.9 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 1999 | 420 | 4.0 | 3.7 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 2000 | 420 | 3.7 | 3.5 | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |
| 2001 | 500 | 4.0 | - - | Fingerling | - - | - - | - - | - - | - - | - - | - - | - - |

[a] *A fry is a newly hatched fish, a fingerling is a fish in its first year, a yearling is an immature fish.*

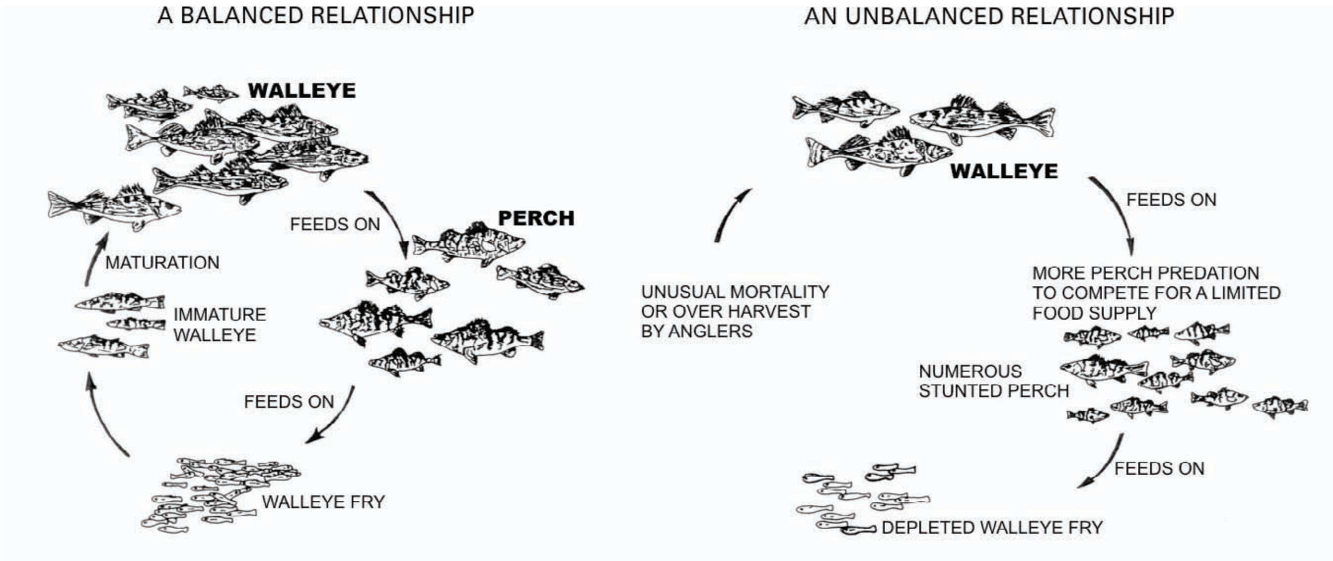
*Source: Wisconsin Department of Natural Resources and SEWRPC.*

Amphibians and reptiles are vital components of the ecosystem in an environmental unit like the Ashippun Lake area. Examples of amphibians native to the area include frogs, toads, and salamanders. Turtles and snakes are examples of reptiles common to the Ashippun Lake area. Table 25 lists 14 amphibian and 15 reptile species normally expected to be present in the Ashippun Lake area under present conditions and identifies those species most sensitive to urbanization. Most amphibians and reptiles have definite habitat requirements that are adversely affected by advancing urban development, as well as by certain agricultural land management practices. The major detrimental factors affecting the maintenance of amphibians in a changing environment is the destruction of breeding ponds, urban development occurring in migration routes, and changes in food sources brought about by urbanization.

The complete spectrum of wildlife species originally native to Waukesha County has, along with its habitat, undergone significant change in terms of diversity and population size since the European settlement of the area. This change is a direct result of the conversion of land by the settlers from its natural state to agricultural and urban uses, beginning with the clearing of the forest and prairies, the draining of wetlands, and ending with the development of extensive urban areas. Successive cultural uses and attendant management practices, both rural and urban, have been superimposed on the land use changes and have also affected the wildlife and wildlife habitat. In agricultural areas, these cultural management practices include draining land by ditching and tiling, and the expanding use of fertilizers, herbicides, and pesticides. In urban areas, cultural management practices that affect wildlife and their habitat include the use of fertilizers, herbicides, and pesticides; the use of road salt for snow and ice control; the presence of heavy motor vehicle traffic that produces disruptive noise levels and air pollution and nonpoint source water pollution; and the introduction of domestic pets.

**Figure 8**

**THE PREDATOR-PREY RELATIONSHIP**




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

## WILDLIFE HABITAT AND RESOURCES

As reported in the initial study, wildlife habitat areas remaining in the Region were originally inventoried by SEWRPC in 1963, with subsequent updating by the WDNR in 1970. Five major criteria were used to determine the value of these wildlife habitat areas:

1. Diversity: An area must maintain a great, but balanced, diversity of species for a temperate climate, balanced in such a way that the proper predatory-prey (consumer-food) relationships can occur. In addition, a reproductive interdependence must exist.

2. Territorial Requirements: The maintenance of proper spatial relationships among species, allowing for a certain minimum population level, can occur only if the territorial requirements of each major species within a particular habitat are met.

3. Vegetative Composition and Structure: The composition and structure of vegetation must be such that the required levels for nesting, travel routes, concealment, and protection from weather are met for each of the major species.

4. Location with Respect to Other Wildlife Habitat Areas: It is very desirable that wildlife habitat maintains its proximity to other wildlife habitat areas.

5. Disturbance: Minimum levels of disturbance from human activities are necessary for good wildlife habitat, other than those activities of a wildlife management nature.

On the basis of these five criteria, the wildlife habitat areas in the area tributary to Ashippun Lake were categorized in the current report as either Class I, High-Value; Class II, Medium-Value; or Class III, Good-Value, habitat areas. Class I wildlife habitat areas contain a good diversity of wildlife, are adequate in size to meet all of

**Table 22**

**FISHING REGULATIONS APPLICABLE TO ASHIPPUN LAKE: 2006-2007**

| Species | Open Season | Daily Limit | Minimum Size |
|---|---|---|---|
| Northern Pike | May 6 to March 4 | 2 | 26 inches |
| Walleyed Pike | May 6 to March 4 | 5 in total | 15 inches |
| Largemouth and Smallmouth Bass | May 6 to March 4 | 5 in total | 14 inches |
| Muskellunge | May 6 to November 30 | 1 | 34 inches |
| Bluegill, Pumpkinseed (sunfish), Crappie, and Yellow Perch | Open all year | 25 in total | None |
| Bullhead and Rough Fish | Open all year | None | None |

*Source: Wisconsin Department of Natural Resources Publication No. PUBL-FH-301 2006,* Guide to Wisconsin Hook and Line Fishing Regulations 2006-2007*, 2006; and SEWRPC.*

the habitat requirements for the species concerned, are generally located in proximity to other wildlife habitat areas, and meet all five criteria listed above. Class II wildlife habitat areas generally fail to meet one of the five criteria in the preceding list for a high-value wildlife habitat. However, they do retain a good plant and animal diversity. Class III wildlife habitat areas are remnant in nature in that they generally fail to meet two or more of the five criteria for a high-value wildlife habitat. Nevertheless, Class III habitat areas may be important, if located in proximity to medium- or high-value habitat areas, if they provide corridors linking wildlife habitat areas of higher value or if they provide the only available habitat in an area.

As shown on Map 12 for this study, about 190 acres, or about 24 percent of the area tributary to Ashippun Lake, were classified in the current inventory as wildlife habitat. This area is somewhat larger than that reported in the initial planning study due to the inclusion of additional lands within the area as reported in Chapter IV. Of the current area of wildlife habitat, about 110 acres, or about 14 percent of the tributary area, were classified as Class I habitat; 22 acres, or 3 percent, were classified as Class II habitat; and 58 acres, or 7 percent, were classified as Class III habitat. The Class I habitat within the area tributary to Ashippun Lake lies primarily in the wetland areas to the northwest and the southeast of the main waterbody.

In June of 1989, the WDNR conducted a sensitive area delineation within the Ashippun Lake basin, pursuant to criteria established under Chapter NR 107 of the *Wisconsin Administrative Code*. The summary report of this delineation is appended hereto as Appendix B. The summary concluded that, other than along the developed areas of shoreline, the entire lake could be considered a sensitive area containing habitat unique to the area. The wetland complex located in the northwest area of the Lake was considered to be an extremely valuable area.

## NATURAL AREAS AND CRITICAL SPECIES HABITAT

The Ashippun Lake area is of regional and local importance due to its richness of natural habitat and diversity of biota. Within the locale of Ashippun Lake, four areas have been designated as Natural Areas or areas of Critical Species Habitat: [2]

1. Ashippun Lake—The Lake is listed as one of the Critical Lakes of Southeast Wisconsin and has been given an AQ-2 designation identifying it as aquatic area of countywide or regional significance. This designation was the result of an assessment based on water quality, quality of wildlife habitat, presence of endangered, threatened, or special-concern species, shoreline development, and other physical attributes. In addition, Ashippun Lake was recognized as possessing a large and diverse fish community, including habitat for special-concern species, such as the Least Darter (*Etheostoma microperca*), pictured in Appendix C.

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

**Table 23**

**MAMMALS OF THE ASHIPPUN LAKE AREA**

| Scientific (family) and Common Name | Scientific Name |
|---|---|
| Didelphidae | |
| Virginia Opossum | *Didelphis virginiana* |
| Soricidae | |
| Cinereous Shrew | Sorex cinereus |
| Short-Tailed Shrew | *Blarina brevicauda* |
| Least Shrew | *Cryptotis parva* |
| Vespertilionidae | |
| Little Brown Bat | *Myotis lucifugus* |
| Silver-Haired Bat | *Lasisoncteris octivagans* |
| Big Brown Bat | *Eptesicus fuscus* |
| Red Bat | *Lasiurus borealus* |
| Hoary Bat | *Lasiurus cinereus* |
| Leporidae | |
| Cottontail Rabbit | *Sylvilgus floridanus* |
| Sciuridae | |
| Woodchuck | *Marmota monax* |
| Thirteen-lined Ground Squirrel (gopher) | *Spermophilus tridencemilineatus* |
| Eastern Chipmunk | *Tamias striatus* |
| Grey Squirrel | *Sciurus carolinensis* |
| Western Fox Squirrel | *Sciurus niger* |
| Red Squirrel | *Tamiasciurus hudsonicus* |
| Southern Flying Squirrel | *Glaucomys volans* |
| Castoridae | |
| American Beaver | *Castor canadensis* |
| Cricetidae | |
| Woodland Deer Mouse | *Peromyscus maniculatus* |
| Prairie Deer Mouse | *Peromyscus leucopus bairdii* |
| White-Footed Mouse | *Microtus pennsylvanicus* |
| Meadow Vole | *Microtus ochrogaster* |
| Common Muskrat | *Ondatra zibethicus* |
| Muridae | |
| Norway Rat (introduced) | *Rattus norvegicus* |
| House Mouse (introduced) | *Mus musculus* |
| Zapodidae | |
| Meadow Jumping Mouse | *Zapas hudonius* |
| Canidae | |
| Coyote | *Canis latrans* |
| Eastern Red Fox | *Vulpes vulpes* |
| Gray Fox | *Urocyon cinereoargenteus* |
| Procyonidae | |
| Raccoon | *Procyon lotor* |
| Mustelidae | |
| Least Weasel | *Mustela nivalis* |
| Short-Tailed Weasel | *Mustela erminea* |
| Long-Tailed Weasel | *Mustela frenata* |
| Mink | *Mustela vison* |
| Badger (occasional visitor) | *Taxidea taxus* |
| Stiped Skunk | *Mephitis mephitis* |
| Otter (occasional visitor) | *Lontra canadensis* |
| Cervidae | |
| White-Tailed Deer | *Odecoileus virginianus* |

*Source: H.T. Jackson,* Mammals of Wisconsin, *1961, U.S. Department of Agriculture Integrated Taxonomic Information System, National Museum of Natural History, Smithsonian Institute, and SEWRPC.*

2. Meadow View School Bog—This area to the southeast of the Lake is a significant wetland complex recognized as an NA-3 designated Natural Area of local significance. Comprised of 11 acres, it contains a moderate- to good-quality sphagnum bog with small tamaracks, rich in plant and animal species diversity.

3. Ashippun River Lowlands—This good quality wetland complex bordering the Ashippun River extends upstream from the Monterey Dam and is designated as an NA-2 Natural Area of countywide or regional significance. Comprised of 244 acres, about one third of which is currently under protective ownership, this area supports a varied biota, including habitat for seven species of birds that are on the endangered, threatened, rare or special-concern list for Wisconsin, as listed in Table 26.

4. Ashippun River—The Ashippun River upstream of Monterey Dam contains approximately 6.8 Critical Stream Miles providing habitat for the slender madtom (*Noturus exilis*), a State-listed Endangered species of fish, pictured in Appendix C.

## WETLANDS

Wetlands are defined by SEWRPC as, "areas that have a predominance of hydric soils and that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions." This definition, which is also used by the U.S. Army Corps of Engineers (USCOE) and the U.S. Environmental Protection Agency (USEPA), is essentially the same as the definition used by the U.S. Natural Resource Conservation Service (NRCS) of the U.S. Department of Agriculture.[3]

[3]*Lands designated as prior converted cropland, that is, lands that were cleared, drained, filled, or otherwise manipulated to make them capable of supporting a commodity crop prior to December 23, 1985, may meet the criteria of the U.S. Natural Resource Conservation Service wetland definition, but they would not be regulated under Federal wetland programs. If such lands are not cropped, managed, or maintained for agricultural production, for five consecutive years, and in that time the land reverts back to wetland, the land would then be subject to Federal wetland regulations.*

Table 24

**BIRDS KNOWN OR LIKELY TO OCCUR IN THE ASHIPPUN LAKE AREA**

| Scientific (family) and Common Name | Breeding | Wintering | Migrant |
|---|---|---|---|
| *Gaviidae* | | | |
| Common Loon[a] | - - | - - | X |
| *Podicipedidae* | | | |
| Pied-Billed Grebe | X | - - | X |
| Horned Grebe | - - | - - | X |
| *Phalacrocoracidae* | | | |
| Double-Crested Cormorant | - - | - - | X |
| *Ardeidae* | | | |
| American Bittern[a] | X | - - | X |
| Least Bittern[a] | X | - - | X |
| Great Blue Heron[a] | X | R | X |
| Great Egret[b] | - - | - - | X |
| Cattle Egret[a,c] | - - | - - | R |
| Green Heron | X | - - | X |
| Black-Crowned Night Heron[a] | - - | - - | X |
| *Anatidae* | | | |
| Tundra Swan | - - | - - | X |
| Mute Swan[c] | X | X | X |
| Snow Goose | - - | - - | X |
| Canada Goose | X | X | X |
| Wood Duck | X | - - | X |
| Green-Winged Teal | - - | - - | X |
| American Black Duck[a] | - - | X | X |
| Mallard | X | X | X |
| Northern Pintail[a] | - - | - - | X |
| Blue-Winged Teal | X | - - | X |
| Northern Shoveler | - - | - - | X |
| Gadwall | - - | - - | X |
| American Widgeon[a] | - - | - - | X |
| Canvasback[a] | - - | - - | X |
| Redhead[a] | - - | - - | X |
| Ring-Necked Duck | - - | - - | X |
| Lesser Scaup[a] | - - | - - | X |
| Greater Scaup | - - | - - | R |
| Common Goldeneye[a] | - - | X | X |
| Bufflehead | - - | - - | X |
| Red-Breasted Merganser | - - | - - | X |
| Hooded Merganser[a] | R | - - | X |
| Common Merganser[a] | - - | - - | X |
| Ruddy Duck | - - | - - | X |
| *Cathartidae* | | | |
| Turkey Vulture | X | - - | X |
| *Accipitridae* | | | |
| Osprey[a] | - - | - - | X |
| Bald Eagle[a,d] | - - | - - | R |
| Northern Harrier[a] | X | R | X |
| Sharp-Shinned Hawk | X | X | X |
| Cooper's Hawk[a] | X | X | X |
| Northern Goshawk[a] | - - | R | X |
| Red-Shouldered Hawk[b] | R | - - | X |
| Broad-Winged Hawk | R | - - | X |
| Red-Tailed Hawk | X | X | X |
| Rough-Legged Hawk | - - | X | X |
| American Kestrel | X | X | X |
| Merlin[a] | - - | - - | X |

**Table 24 (continued)**

| Scientific (family) and Common Name | Breeding | Wintering | Migrant |
|---|---|---|---|
| *Phasianidae* | | | |
| Grey Partridge[c] | R | R | - - |
| Ring-Necked Pheasant[c] | X | X | - - |
| Wild Turkey | X | X | - - |
| *Rallidae* | | | |
| Virginia Rail | X | - - | X |
| Sora | X | - - | X |
| Common Moorhen | X | - - | X |
| American Coot | X | R | X |
| *Gruidae* | | | |
| Sandhill Crane | X | - - | X |
| *Charadriidae* | | | |
| Black-Bellied Plover | - - | - - | X |
| Semi-Palmated Plover | - - | - - | X |
| Killdeer | X | - - | X |
| *Scolopacidae* | | | |
| Greater Yellowlegs | - - | - - | X |
| Lesser Yellowlegs | - - | - - | X |
| Solitary Sandpiper | - - | - - | X |
| Spotted Sandpiper | X | - - | X |
| Upland Sandpiper[a] | R | - - | X |
| Semi-Palmated Sandpiper | - - | - - | X |
| Pectoral Sandpiper | - - | - - | X |
| Dunlin | - - | - - | X |
| Common Snipe | R | - - | X |
| American Woodcock | X | - - | X |
| Wilson's Phalarope | - - | - - | X |
| *Laridae* | | | |
| Ring-Billed Gull | - - | - - | X |
| Herring Gull | - - | X | X |
| Common Tern[e] | - - | - - | R |
| Caspian Tern[e] | - - | - - | R |
| Forster's Tern[e] | - - | - - | R |
| Black Tern[a] | X | - - | X |
| *Columbidae* | | | |
| Rock Dove[c] | X | X | - - |
| Mourning Dove | X | X | X |
| *Cuculidae* | | | |
| Black-Billed Cuckoo | X | - - | X |
| Yellow-Billed Cuckoo[a] | X | - - | X |
| *Strigidae* | | | |
| Eastern Screech Owl | X | X | - - |
| Great Horned Owl | X | X | - - |
| Snowy Owl | - - | R | - - |
| Barred Owl | X | X | - - |
| Long-Eared Owl[a] | - - | X | X |
| Short-Eared Owl[a] | - - | R | X |
| Northern Saw-Whet Owl | - - | - - | X |
| *Caprimulgidae* | | | |
| Common Nighthawk | X | - - | X |
| Whippoorwill | - - | - - | X |
| *Apodidae* | | | |
| Chimney Swift | X | - - | X |
| *Trochilidae* | | | |
| Ruby-Throated Hummingbird | X | - - | X |

**Table 24 (continued)**

| Scientific (family) and Common Name | Breeding | Wintering | Migrant |
|---|---|---|---|
| *Alcedinidae* | | | |
| Belted Kingfisher | X | X | X |
| *Picidae* | | | |
| Red-Headed Woodpecker[a] | X | R | X |
| Red-Bellied Woodpecker | X | X | - - |
| Yellow-Bellied Sapsucker | - - | R | X |
| Downy Woodpecker | X | X | - - |
| Hairy Woodpecker | X | X | - - |
| Northern Flicker | X | R | X |
| *Tyrannidae* | | | |
| Olive-Sided Flycatcher | - - | - - | X |
| Eastern Wood Pewee | X | - - | X |
| Yellow-Bellied Flycatcher[a] | - - | - - | X |
| Acadian Flycatcher[b] | R | - - | X |
| Alder Flycatcher | R | - - | X |
| Willow Flycatcher | X | - - | X |
| Least Flycatcher | R | - - | X |
| Eastern Phoebe | X | - - | X |
| Great Crested Flycatcher | X | - - | X |
| Eastern Kingbird | X | - - | X |
| *Alaudidae* | | | |
| Horned Lark | X | X | X |
| *Hirundinidae* | | | |
| Purple Martin[a] | X | - - | X |
| Tree Swallow | X | - - | X |
| Northern Rough-Winged Swallow | X | - - | X |
| Bank Swallow | X | - - | X |
| Cliff Swallow | X | - - | X |
| Barn Swallow | X | - - | X |
| *Corvidae* | | | |
| Blue Jay | X | X | X |
| American Crow | X | X | X |
| *Paridae* | | | |
| Tufted Titmouse | R | R | - - |
| Black-Capped Chickadee | X | X | X |
| *Sittidae* | | | |
| Red-Breasted Nuthatch | R | X | X |
| White-Breasted Nuthatch | X | X | - - |
| *Certhiidae* | | | |
| Brown Creeper | - - | X | X |
| *Troglodytidae* | | | |
| Carolina Wren | - - | - - | R |
| House Wren | X | - - | X |
| Winter Wren | - - | - - | X |
| Sedge Wren[a] | X | - - | X |
| Marsh Wren | X | - - | X |
| *Regulidae* | | | |
| Golden-Crowned Kinglet | - - | X | X |
| Ruby-Crowned Kinglet[a] | - - | - - | X |
| Blue-Gray Gnatcatcher | X | - - | X |
| Eastern Bluebird | X | - - | X |
| Veery[a] | X | - - | X |
| Gray-Cheeked Thrush | - - | - - | X |
| Swainson’s Thrush | - - | - - | X |
| Hermit Thrush | - - | - - | X |
| Wood Thrush[a] | X | - - | X |
| American Robin | X | X | X |

**Table 24 (continued)**

| Scientific (family) and Common Name | Breeding | Wintering | Migrant |
|---|---|---|---|
| *Mimidae* | | | |
| Gray Catbird | X | - - | X |
| Brown Thrasher | X | - - | X |
| *Bombycillidae* | | | |
| Bohemian Waxwing | - - | R | - - |
| Cedar Waxwing | X | X | X |
| *Laniidae* | | | |
| Northern Shrike | - - | - - | X |
| Loggerhead Shrike[e] | - - | - - | R |
| *Sturnidae* | | | |
| European Starling[c] | X | X | X |
| Vireonidae | | | |
| Bell's Vireo | - - | - - | R |
| Solitary Vireo | - - | - - | X |
| Yellow-Throated Vireo | X | - - | X |
| Warbling Vireo | X | - - | X |
| Philadelphia Vireo | - - | - - | X |
| Red-Eyed Vireo | X | - - | X |
| *Parulidae* | | | |
| Blue-Winged Warbler | X | - - | X |
| Golden-Winged Warbler[a] | R | - - | X |
| Tennessee Warbler[a] | - - | - - | X |
| Orange-Crowned Warbler | - - | - - | X |
| Nashville Warbler[a] | - - | - - | X |
| Northern Parula | - - | - - | X |
| Yellow Warbler | X | - - | X |
| Chestnut-Sided Warbler | - - | - - | X |
| Magnolia Warbler | - - | - - | X |
| Cape May Warbler[a] | - - | - - | X |
| Black-Throated Blue Warbler | - - | - - | X |
| Yellow-Rumped Warbler | - - | R | X |
| Black-Throated Green Warbler | - - | - - | X |
| Cerulean Warbler[b] | R | - - | R |
| Blackburnian Warbler | - - | - - | X |
| Palm Warbler | - - | - - | X |
| Bay-Breasted Warbler | - - | - - | X |
| Blackpoll Warbler | - - | - - | X |
| Black-and-White Warbler | - - | - - | X |
| Prothonotary Warbler[a] | - - | - - | R |
| American Redstart | X | - - | X |
| Ovenbird | X | - - | X |
| Northern Waterthrush | - - | - - | X |
| Connecticut Warbler[a] | - - | - - | X |
| Mourning Warbler | R | - - | X |
| Common Yellowthroat | X | - - | X |
| Wilson's Warbler | - - | - - | X |
| Kentucky Warbler[b] | - - | - - | R |
| Canada Warbler | R | - - | X |
| Hooded Warbler[b] | R | - - | R |
| *Thraupidae* | | | |
| Scarlet Tanager | X | - - | X |
| *Cardinalidae* | | | |
| Northern Cardinal | X | X | - - |
| Rose-Breasted Grosbeak | X | - - | X |
| Indigo Bunting | X | - - | X |

**Table 24 (continued)**

| Scientific (family) and Common Name | Breeding | Wintering | Migrant |
|---|---|---|---|
| *Emberizidae* | | | |
| Dickcissel[a] | R | - - | X |
| Eastern Towhee | X | - - | X |
| American Tree Sparrow | - - | X | X |
| Chipping Sparrow | X | - - | X |
| Clay-Colored Sparrow | R | - - | X |
| Field Sparrow | X | - - | X |
| Vesper Sparrow[a] | X | - - | X |
| Savannah Sparrow | X | - - | X |
| Grasshopper Sparrow[a] | X | - - | X |
| Henslow's Sparrow[b] | R | - - | X |
| Fox Sparrow | - - | R | X |
| Song Sparrow | X | X | X |
| Lincoln's Sparrow | - - | - - | X |
| Swamp Sparrow | X | X | X |
| White-Throated Sparrow | - - | R | X |
| White-Crowned Sparrow | - - | - - | X |
| Dark-Eyed Junco | - - | X | X |
| Lapland Longspur | - - | R | X |
| Snow Bunting | - - | R | X |
| *Icteridae* | | | |
| Bobolink[a] | X | - - | X |
| Red-Winged Blackbird | X | X | X |
| Eastern Meadowlark[a] | X | R | X |
| Western Meadowlark[a] | R | - - | X |
| Yellow-Headed Blackbird | X | - - | X |
| Rusty Blackbird | - - | R | X |
| Common Grackle | X | X | X |
| Brown-Headed Cowbird | X | R | X |
| Orchard Oriole[a] | R | - - | R |
| Baltimore Oriole | X | - - | X |
| *Fringillidae* | | | |
| Purple Finch | - - | X | X |
| Common Redpoll | - - | X | X |
| Pine Siskin[a] | - - | X | X |
| American Goldfinch | X | X | X |
| House Finch | X | X | X |
| Evening Grosbeak | - - | X | X |
| *Passeridae* | | | |
| House Sparrow[c] | X | X | - - |

NOTE: Total number of bird species: 219
Number of alien, or nonnative, bird species: 7 (3 percent)

Breeding: Nesting species
Wintering: Present January through February
Migrant: Spring and/or fall transient

X - Present, not rare
R - Rare

[a]*State-designated species of special concern. Fully protected Federal and State laws under the Migratory Bird Act.*

[b]*State-designated threatened species.*

[c]*Alien, or nonnative, bird species.*

[d]*Federally designated threatened species.*

[e]*State-designated endangered species.*

*Source: Samuel D. Robbins, Jr.,* Wisconsin Bird Life, Population & Distribution, Past and Present*, 1991; John E. Bielefeldt, Racine County Naturalist; Zoological Society of Milwaukee County and Birds Without Borders-Aves Sin Fronteras,* Report for Landowners on the Avian Species Using the Pewaukee, Rosendale and Land O' Lakes Study Sites*, April-August, 1998; Wisconsin Department of Natural Resources; and SEWRPC.*

**Table 25**

**AMPHIBIANS AND REPTILES OF THE ASHIPPUN LAKE AREA**

| Scientific (family) and Common Name | Scientific Name | Species Reduced or Dispersed with Full Area Urbanization | Species Lost with Full Area Urbanization |
|---|---|---|---|
| Amphibians | | | |
| Proteidae | | | |
| Mudpuppy | *Necturus maculosus maculosus* | X | - - |
| Ambystomatidae | | | |
| Blue-Spotted Salamander | *Ambystoma laterale* | - - | X |
| Spotted Salamander | *Ambystoma maculatum* | | |
| Eastern Tiger Salamander | *Ambystoma tigrinum tigrinum* | X | - - |
| Salamandridae | | | |
| Central Newt | *Notophthalmus viridescens louisianensi* | X | - - |
| Bufonidae | | | |
| American Toad | *Bufo americanus americanus* | X | - - |
| Hylidae | | | |
| Western Chorus Frog | *Pseudacris triseriata triseriata* | X | - - |
| Blanchard's Cricket Frog[a,b] | *Acris crepitans blanchardi* | X | - - |
| Northern Spring Peeper | *Hyla crucifer crucifer* | - - | X |
| Gray Tree Frog | *Hyla versicolor* | - - | X |
| Ranidae | | | |
| Bull Frog[c] | *Rana catesbeiana* | - - | X |
| Green Frog | *Rana clamitans melanota* | X | - - |
| Northern Leopard Frog | *Rana pipiens* | - - | X |
| Pickerel Frog[c] | *Rana palustris* | - - | X |
| Reptiles | | | |
| Chelydridae | | | |
| Common Snapping Turtle | *Chelydra serpentina serpentina* | X | - - |
| Kinosternidae | | | |
| Musk Turtle (stinkpot) | *Sternotherus odoratus* | X | - - |
| Emydidae | | | |
| Western Painted Turtle | *Chrysemys picta belli* | X | - - |
| Midland Painted Turtle | *Chrysemys picta marginata* | X | - - |
| Blanding's Turtle[d] | *Emydoidea blandingii* | - - | X |
| Trionychidea | | | |
| Eastern Spiny Softshell | *Trionyx spiniferus spiniferus* | X | - - |
| Colubridae | | | |
| Northern Water Snake | *Nerodia sipedon sipedon* | X | - - |
| Midland Brown Snake | *Storeria dekayi wrightorum* | X | - - |
| Northern Red-Bellied Snake | *Storeria occipitomaculata occipitomaculata* | X | - - |
| Eastern Garter Snake | *Thamnophis sirtalis sirtalis* | X | - - |
| Chicago Garter Snake | *Thamnophis sirtalis semifasciata* | X | - - |
| Butler's Garter Snake[d] | *Thamnophis butleri* | X | - - |
| Eastern Hognose Snake | *Heterodon platyrhinos* | - - | X |
| Smooth Green Snake | *Opheodrys vernalis vernalis* | - - | X |
| Eastern Milk Snake | *Lampropeltis triangulum triangulum* | - - | X |

[a]*Likely to be extirpated from the watershed.*

[b]*State-designated endangered species.*

[c]*State-designated special concern species.*

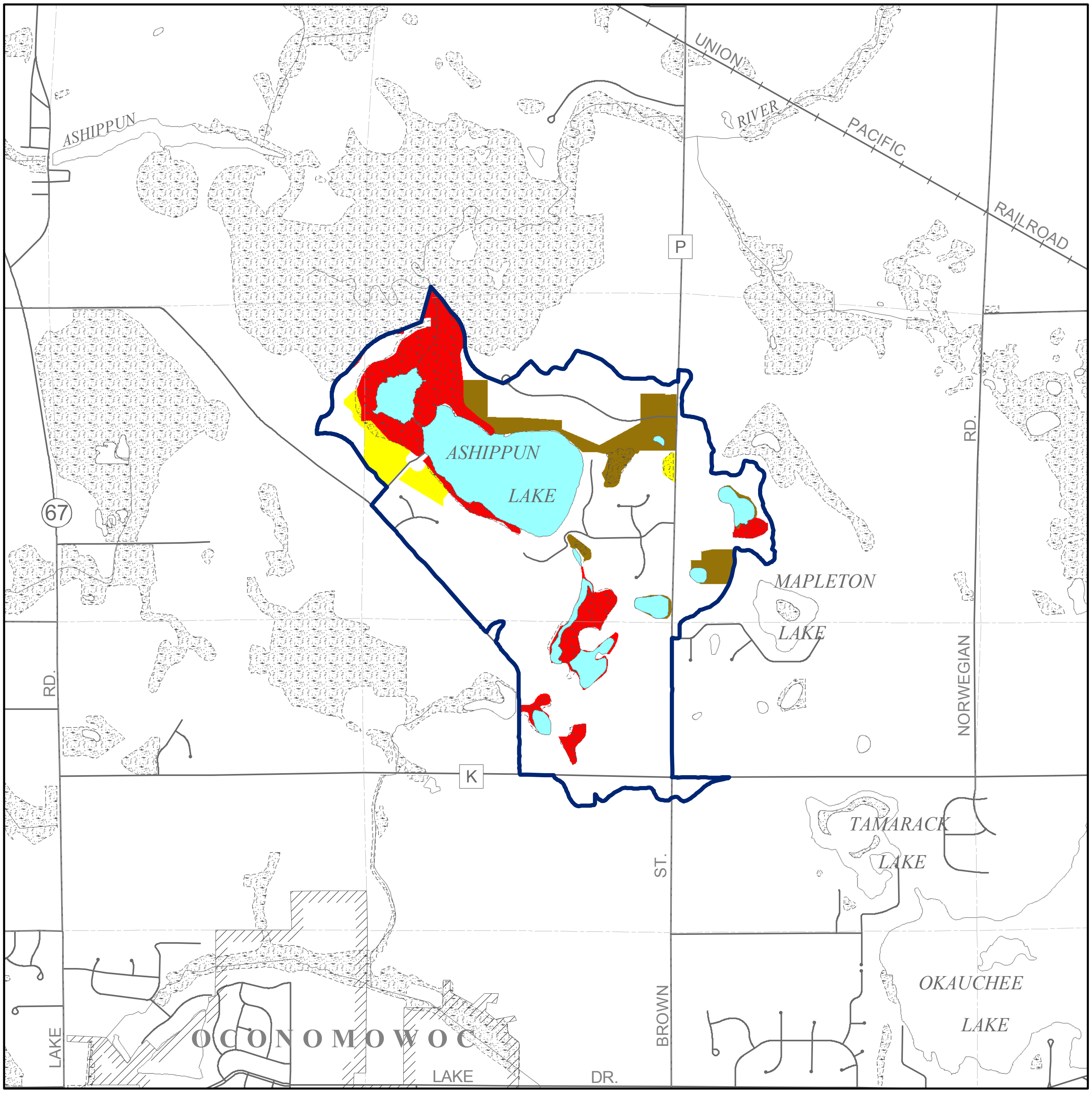
[d]*State-designated threatened species.*

*Source: Gary S. Casper,* Geographical Distribution of the Amphibians and Reptiles of Wisconsin*, 1996, Wisconsin Department of Natural Resources, Kettle Moraine State Forest, Lapham Peak Unit; and SEWRPC.*

Another definition, which is applied by the WDNR and which is set forth in Chapter 23 of the *Wisconsin Statutes*, defines a wetland as "an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation, and which has soils indicative of wet conditions." In practice, the WDNR definition differs from that of SEWRPC in that the WDNR considers very poorly drained, poorly drained, and some of the somewhat poorly drained soils as wetland soils meeting the WDNR "wet condition" criterion. The SEWRPC definition only considers the very poorly drained and poorly drained soils as meeting the "hydric

**Map 12**

**WILDLIFE HABITAT AREAS WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE: 1985**



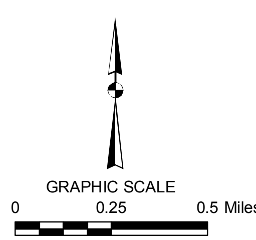

CLASS I, HIGH-VALUE HABITAT

CLASS II, MEDIUM-VALUE HABITAT

CLASS III, GOOD-VALUE HABITAT

SURFACE WATER

TRIBUTARY AREA BOUNDARY




*Source: SEWRPC.*

**Table 26**

**ENDANGERED, THREATENED, RARE OR SPECIAL CONCERN, AND UNCOMMON BIRD SPECIES HABITAT SITES IN THE ASHIPPUN LOWLANDS NATURAL AREA: 1994**

| Species of Concern | Scientific Name | Species Status |
|---|---|---|
| Forster's Tern | *Sterna fosteri* | Endangered |
| Common Moorhen | *Gallinula chloropus* | Rare |
| Black Tern | *Chlidonias niger* | Rare |
| Alder Flycatcher | *Empidonax minimus* | Uncommon |
| Veery | *Hylocichla fuscescens* | Uncommon |
| American Woodcock | *Philohela minor* | Uncommon |
| Great Blue Heron | *Ardea herodias* | Uncommon |

*Source: SEWRPC.*

soil" criterion. Thus, the State definition as actually applied is more inclusive than the Federal and Commission definitions in that the WDNR may include some soils that do not show hydric field characteristics as wet soils capable of supporting wetland vegetation, a condition that may occur in some floodlands.[4]

As a practical matter, experience has shown that application of the WDNR, the USEPA and USCOE, and SEWRPC definitions produce reasonably consistent wetland identifications and delineations in the majority of situations within the Southeastern Wisconsin Region. That consistency is due in large part to the provision in the Federal wetland delineation manual that allows for the application of professional judgment in cases where satisfaction of the three criteria for wetland identification is unclear.

Wetlands in southeastern Wisconsin are classified predominantly as deep marsh, shallow marsh, southern sedge meadow, fresh (wet) meadow, shrub carr, alder thickets, low prairie, fens, bogs, southern wet- and wet-mesic hardwood forest, and coniferous swamp. Wetlands form an important part of the landscape in and adjacent to Ashippun Lake in that they perform an important set of natural functions that make them ecologically and environmentally invaluable resources. Wetlands affect the quality of water by acting as a filter or a buffer zone allowing silt and sediments, and their associated pollutants, to settle out and by absorbing potential contaminants within the plant biomass. They also influence the quantity of water by providing water during periods of drought and holding it back during periods of flood. When located along shorelines of lakes and streams, wetlands help protect those shorelines from erosion. Wetlands also may serve as groundwater discharge and recharge areas in addition to being important resources for overall ecological health and diversity by providing essential breeding and feeding grounds, shelter, and cover or refuge for many forms of fish and wildlife.

Wetlands are poorly suited to urban use. This is due to the high soil compressibility and instability, high water table, low load-bearing capacity, and high shrink-swell potential of wetland soils, and, in some cases, to the potential for flooding. In addition, metal conduits placed in some types of wetland soils may be subject to rapid corrosion. These constraints, if ignored, may result in flooding, wet basements, and excessive operation of sump pumps, unstable foundations, failing pavements, broken sewer and water lines, and excessive infiltration of clear water into sanitary sewerage systems, where such systems exist. In addition, there are significant onsite preparation and maintenance costs associated with the development of wetlands, particularly as they relate to roads, foundations, and public utilities.

Table 27 characterizes the wetland plant species typically found in the drainage basin. In the initial report, a variety of wetlands was reported in the Ashippun Lake drainage basin, including a 5.5-acre wetland in the northeast portion of the drainage basin which contained a small conifer swamp dominated by tamarack (*Larix larcina*). As shown on Map 13, in 1995, wetlands covered about 92 acres, or about 11 percent, of the area tributary to Ashippun Lake, including the tamarack swamp noted in the initial plan. The major wetland communities located in the area tributary to Ashippun Lake include deep and shallow marsh, Southern sedge

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[4]*Although prior converted cropland is not subject to Federal wetland regulations unless cropping ceases for five consecutive years and the land reverts to a wetland condition, the State may consider prior converted cropland to be subject to State wetland regulations if the land meets the criteria set forth in the State wetland definition before it has not been cropped for five consecutive years.*

**Table 27**

**EMERGENT WETLAND PLANT SPECIES IN THE AREA DIRECTLY TRIBUTARY TO ASHIPPUN LAKE**

| Scientific Name: Family, Genus, and Species | Common Name |
|---|---|
| Polypodiaceae | |
| *Thelypteris palustris* | Marsh fern |
| Equisetaceae | |
| *Equisetum arvense* | Common horsetail |
| Typhaceae | |
| *Typha latifolia* | Broadleaf cat-tail |
| *Typha angustifolia* | Narrowleaf cat-tail |
| *Typha glauca* | Hybrid cat-tail |
| Pinaceae | |
| *Latrix larcina* | Tamarack |
| Alismataceae | |
| *Sagittaria latifolia* | Arrow-head |
| Gramineae | |
| *Zizania aquatica* | Wild rice |
| *Calamagrostis canadensis* | Canada bluojoint grass |
| *Muhlenbergia mexicana-racemosa*[b] | Muhly grass |
| *Phalaris arundinacea*[a] | Reed canary grass |
| Cyperaceae | |
| *Eleocharis* spp | Spike-rush |
| *Scirpus validus* | Softstem bulrush |
| *Scirpus acutus* | Hardstem bulrush |
| *Scirpus atrovirens* | Green bulrush |
| *Carex aquatilis* | Aquatic sedge |
| *Carex stricta* | Tussock sedge |
| *Carex lacustris* | Lake sedge |
| *Carex* spp. | Sedges |
| Araceae | |
| *Sumplocarpus foetidus* | Skunk cabbage |
| Pontederiaceae | |
| *Pontederia cordata* | Pickerel-weed |
| Iridaceae | |
| *Iris* | |
| Salicaceae | |
| *Sailix bebbiana* | Beaked willow |
| *Salix nigra* | Black willow |
| *Salix* spp | Willows |
| *Salix discolor* | Pussy willow |
| Nymphaeaceae | |
| *Nuphar advena* | Yellow water lily |
| *Nymphaea odorata* | White water lily |
| Ulmaceae | |
| *Ulmus americana* | American elm |
| Urticaceae | |
| *Urtica dioica* | Stinging nettle |
| Aquifoliaceae | |
| *Ilex verticillata* | Winterberry |
| Aceraceae | |
| *Acer negundo* | Boxelder |
| *Acer saccharinum* | Silver maple |
| Balsaminaceae | |
| *Impatiens capensis* | Jewel weed |
| Rhamnaceae | |
| *Rhamnus cathartica*[a] | Common buckthorn |
| *Rhamnus frangula*[b] | glossyf buckthorn |
| Lythraceae | |
| *Decodon verticillatus* | Water-willow |
| *Lythrum salicaria*[a] | Purple loosestrife |
| Umbelliferae | |
| *Cicuta bulbifera* | Water-hemlock |
| Cornaceae | |
| *Cornsus stolonifera* | Red osier dogwood |
| Oleaceae | |
| *Fraxinus pennsylvanic* | Green ash |
| Asclepiadaceae | |
| *Asclipias incarnata* | Marsh milkweed |
| Verbenaceae | |
| *Verbena hastata* | Blue vervain |
| Labiatae | |
| *Scutellaria galericulata* | Marsh skullcap |
| *Lycopus uniflorus* | Northern bugleweed |
| *Mentha* spp | Mint |
| Caprifoliceae | |
| *Sambucus canadensis* | Elderberry |
| Compositae | |
| *Bidens vulgata* | Tall beggars-ticks |
| *Bidens* spp | Beggars-ticks |
| *Ambrosia trifida* | Giant ragweed |
| *Solidago patula* | Swamp goldenrod |
| *Solidago gigantea* | Giant goldenrod |
| *Aster junciformis* | Rush aster |
| *Aster puniceus* | Red-stemmed aster |
| *Eupatorium maculatum* | Joe-pye wed |
| *Eupatorium perfoliatum* | Boneset |
| Polygonaceae | |
| *Rumex orbiculatus* | Water dock |
| *Polygonum natans* | Smartweed |
| Ranunculaceae | |
| *Caltha palustris* | Marsh marigold |
| *Ranunculus sceleratus* | Cursed crowfoot |

NOTE: This table is presented in taxonomic order.

[a]*Alien or nonnative plant species.*

[b]*Plant species located in the fen.*

[c]*Identified as a Wisconsin endangered plant species in DNR Technical Bulletin No. 92, Endangered and Threatened Vascular Plants in Wisconsin, by Robert H. Reed.*

[d]*Identiried as a Wisconsin threatened plant species, Ibid.*

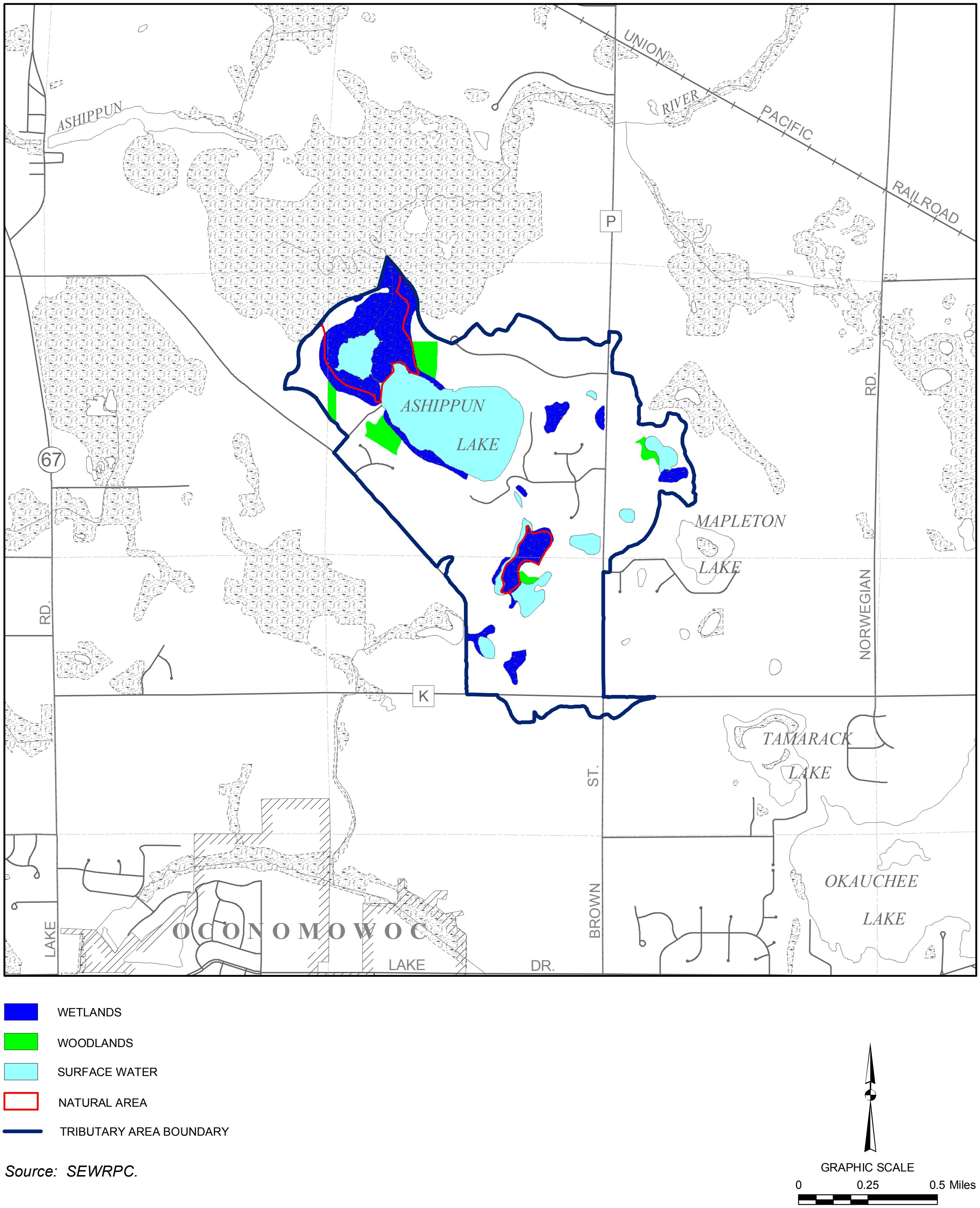
*Source: Waukesha County Park and Planning Commission and SEWRPC.*

meadow, fresh (wet) meadow, tamarack swamp, and second growth, Southern wet- to wet-mesic lowland hardwoods. The amount and distribution of wetlands in the area should remain relatively constant if the recommendations contained in the adopted regional land use plan are followed. No Federal- or State-designated Special Concern, Threatened, or Endangered species were observed during the field inspections.

The deep and shallow marsh plant communities at Ashippun Lake are dominated by cattails (*Typha* spp.). Other emergent plant species commonly occurring in the deep and shallow marshes within the Ashippun Lake drainage

**Map 13**

**WETLANDS AND WOODLANDS WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE: 2000**




*Source: SEWRPC.*

basin include arrowhead (*Sagittaria latifolia*), bulrush (*Scirpus* spp.), lake sedge (*Carex lacustris*), and willow (*Salix* spp).

Sedge meadows are considered to be stable wetland plant communities that tend to perpetuate themselves if dredging activities and water level changes are prevented from occurring. Sedge meadows in southeastern Wisconsin are characterized by the tussock sedge (*Carex stricta*) and, to a lesser extent, by Canada blue-joint grass (*Calamagrostis canadensis*). Sedge meadows that are drained or disturbed to some extent typically succeed to shrub carrs.

Shrub carrs, in addition to the sedges and grasses found in the sedge meadows, contain an abundance of shrubs, such as willow (*Salix* spp.) and red osier dogwood (*Cornus stolonifera*). In extremely disturbed shrub carrs, the willow, red osier dogwood, and sedges are replaced by such exotic plants as honeysuckle (*Lonicera* sp.), buckthorn (*Rhamnus* sp.), and the very aggressive reed canary grass (*Phalaris arundinacea).*

Fresh (wet) meadows are essentially lowland meadows which are dominated by forbes, such as the marsh aster (*Aster simplex*), swamp aster (*Aster lucidulus*), New England aster (*Aster novae-angliae*), and giant goldenrod (*Solidago gigantea*).

## WOODLANDS

Woodlands are defined by SEWRPC as those areas containing a minimum of 17 trees per acre with a diameter of at least four inches at breast height (4.5 feet above the ground).[5] The woodlands are classified as dry, dry-mesic, mesic, wet-mesic, wet hardwood, and conifer swamp forests; the last three of which are also considered wetlands. SEWRPC also maintains an inventory of woodlands within the Region which is updated every five years. In the initial study, a 4.6-acre woodland stand located in the northern portion of the drainage basin was noted. In this report, the area tributary to Ashippun Lake, shown on Map 13, as of 2000, contains approximately 11 acres of woodland. These woodlands, located adjacent to the wetlands areas at the northern end of the Lake, covered about 1 percent of the area.

The amount and distribution of woodlands in the area should remain relatively stable if the recommendations contained in the Waukesha County development and regional land use plans are followed. If, however, urban development is allowed to continue within the watershed much of the remaining woodland cover may be expected to be lost.

## ENVIRONMENTAL CORRIDORS

One of the most important tasks undertaken by SEWRPC as part of its regional planning efforts was the identification and delineation of those areas of the Region having high concentrations of natural, recreational, historic, aesthetic, and scenic resources and which, therefore, should be preserved and protected in order to maintain the overall quality of the environment. Such areas normally include one or more of the following seven elements of the natural resource base which are essential to the maintenance of both the ecological balance and the natural beauty of the Region: 1) lakes, rivers, and streams and the associated undeveloped shorelands and floodlands; 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. While the foregoing seven elements constitute integral parts of the natural resource base, there are five additional elements which, although not a part of the natural resource base *per se*, are closely related to or centered on that base and therefore are important considerations in identifying and delineating areas with scenic, recreational, and educational value. These additional elements are: 1) existing outdoor recreation sites; 2) potential outdoor recreation and related open space sites; 3) historic, archaeological, and other cultural sites; 4) significant scenic areas and vistas; and 5) natural and scientific areas.

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[5]*Bruce P. Rubin and Gerald H. Emmerich, Jr., "Refining the Delineation of Environmental Corridors in Southeastern Wisconsin,"* SEWRPC Technical Record*, Vol. 4, No. 2, March 1981*.

The delineation of these 12 natural resource and natural resource-related elements on a map results in an essentially linear pattern of relatively narrow, elongated areas which have been termed "environmental corridors" by SEWRPC. Primary environmental corridors include a wide variety of the abovementioned important resource and resource-related elements and are at least 400 acres in size, two miles in length, and 200 feet in width. The primary environmental corridors identified in the area directly tributary to Ashippun Lake are contiguous with environmental corridors and isolated natural resource areas lying outside the lake area boundary, and, consequently, meet these size and natural resource element criteria.

It is important to point out that, because of the many interlocking and interacting relationships between living organisms and their environment, the destruction or deterioration of any one element of the total environment may lead to a chain reaction of deterioration and destruction among the others. The drainage of wetlands, for example, may have far-reaching effects, since such drainage may destroy fish spawning grounds, wildlife habitat, groundwater recharge areas, and natural filtration and floodwater storage areas of interconnecting lake and stream systems. The resulting deterioration of surface water quality may, in turn, lead to a deterioration of the quality of the groundwater. Groundwater serves as a source of domestic, municipal, and industrial water supplies, and provides a basis for low flows in rivers and streams. Similarly, the destruction of woodland cover, which may have taken a century or more to develop, may result in soil erosion and stream siltation and in more rapid runoff and increased flooding, as well as destruction of wildlife habitat. Although the effects of any one of these environmental changes may not in and of itself be overwhelming, the combined effects may lead eventually to the deterioration of the underlying and supporting natural resource base, and of the overall quality of the environment for life. The need to protect and preserve the remaining environmental corridors within the area directly tributary to Ashippun Lake thus becomes apparent.

In the area tributary to Ashippun Lake, the riverbanks and lakeshores located within the environmental corridors should be candidates for immediate protection through proper zoning or through public ownership. Of the areas not already publicly owned, the remaining areas of natural shoreline, and riparian wetland areas, are perhaps the most sensitive areas in need of greatest protection. In this regard, the regional natural areas and critical species habitat protection and management plan recommends public acquisition of specific lands.[6] Within the area tributary to Ashippun Lake, the Meadow View School Bog which adjoins the southeastern shoreline of Ashippun Lake, is comprised of 11 acres, six acres of which are recommended for acquisition by a private conservancy group.[7] Outside the area tributary to Ashippun Lake, but contiguous with it, the Ashippun River Lowlands area consists of 244 acres, 162 of which are recommended to be acquired by Waukesha County.

**Primary Environmental Corridors**

The primary environmental corridors in southeastern Wisconsin generally lie along major stream valleys and around major lakes, and contain almost all of the remaining high-value woodlands, wetlands, and wildlife habitat areas, and all of the major bodies of surface water and related undeveloped floodlands and shorelands. These corridors are subject to urban encroachment because of their desirable natural resource amenities. Unplanned or poorly planned intrusion of urban development into these corridors, however, not only tends to destroy the very resources and related amenities sought by the development, but tends to create severe environmental and development problems as well.

About 120 acres, or about 15 percent, of the area tributary to the Lake was identified as primary environmental corridor in 2000, as shown on Map 14. No primary environmental corridors were specifically delineated in the area tributary to Ashippun Lake during the initial planning process. The preservation of these corridors is one of the major ways in which the water quality of Ashippun Lake can be maintained and perhaps improved.

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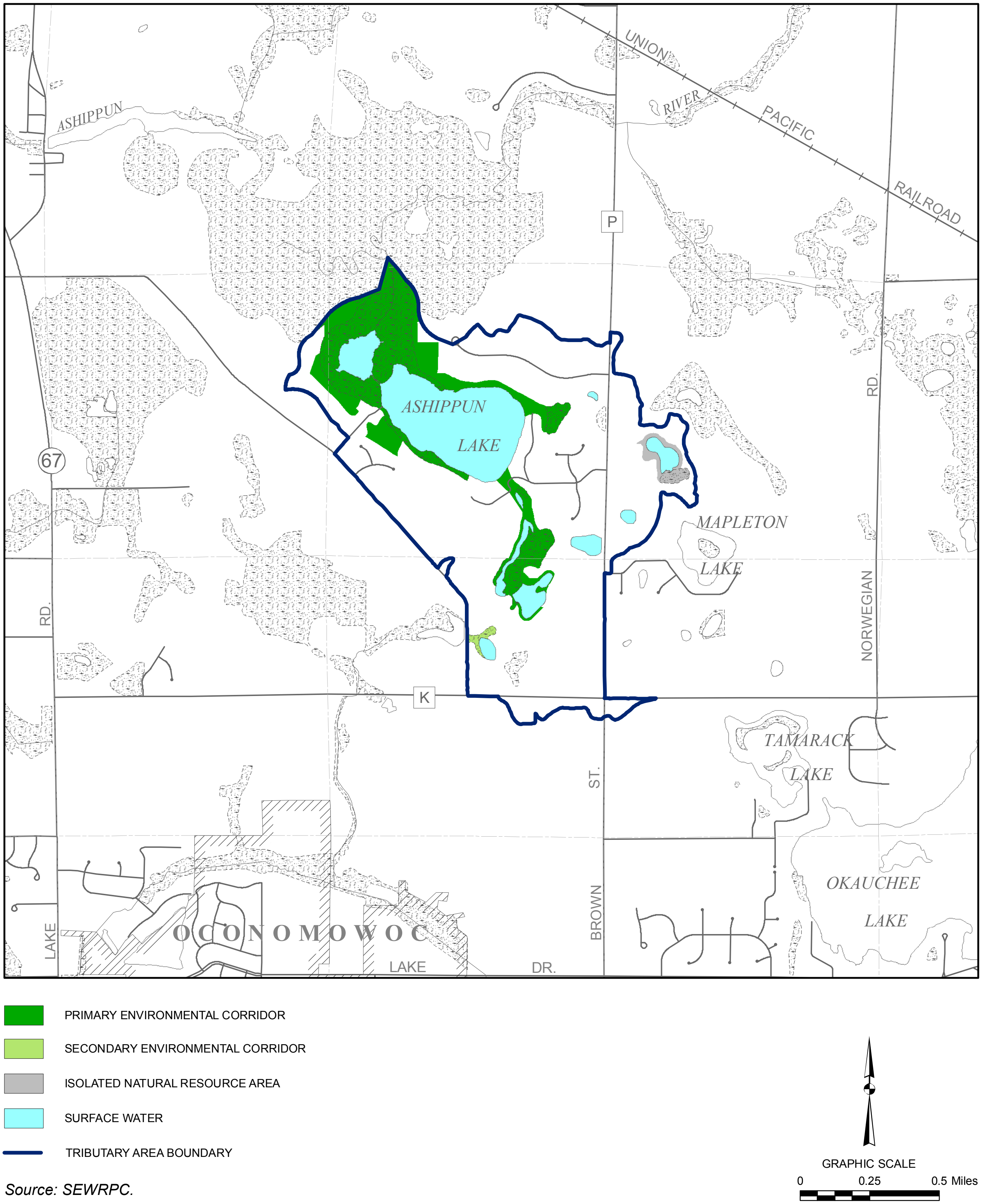
[6]*SEWRPC Planning Report No. 42,* op.cit.

[7]Ibid.

Map 14

ENVIRONMENTAL CORRIDORS AND NATURAL AREAS WITHIN THE AREA TRIBUTARY TO ASHIPPUN LAKE: 2000




*Source: SEWRPC.*

**Secondary Environmental Corridors**

The secondary environmental corridors in the Ashippun Lake area are located in isolation from the primary corridors in the southern part of the area tributary to Ashippun Lake. These secondary environmental corridors contain a variety of resource elements, often remnant resources from primary environmental corridors which have been developed for intensive agricultural purposes or urban land uses. Secondary environmental corridors facilitate surface water drainage, maintain "pockets" of natural resource features, and provide for the movement of wildlife, as well as for the movement and dispersal of seeds for a variety of plant species. Such corridors, while not as important as the primary environmental corridors, should be preserved in essentially open, natural uses as urban development proceeds within the area, particularly when the opportunity is presented to incorporate the corridors into urban stormwater detention areas, associated drainageways, and neighborhood parks. Secondary environmental corridors encompassed only about two acres of the area directly tributary to Ashippun Lake in 2000, as shown on Map 14.

**Isolated Natural Resource Areas**

In addition to the environmental corridors, other, small concentrations of natural resource base elements exist within the area tributary to Ashippun Lake. These resource base elements are isolated from the environmental corridors by urban development or agricultural uses and, although separated from the environmental corridor network, have important natural values. Isolated natural resource areas may provide the only available wildlife habitat in an area, provide good locations for local parks and nature study areas, and lend an aesthetic character or natural diversity to an area. Important isolated natural resource features within southeastern Wisconsin include a geographically well-distributed variety of isolated wetlands, woodlands, and wildlife habitat. These isolated natural resource features should also be protected and preserved in a natural state whenever possible. Such isolated areas, five or more acres in areal extent within the area tributary to Ashippun Lake, totaled about seven acres as of 2000, or less than 1 percent of the area, as shown on Map 14.

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# Chapter VI

# CURRENT WATER USES AND WATER USE OBJECTIVES

## INTRODUCTION

Nearly all major lakes in the Southeastern Wisconsin Region serve multiple purposes, ranging from recreation to receiving waters for stormwater runoff. Recreational uses range from noncontact, passive recreational activities, such as picnicking and walking along the shoreline, to full-contact, active recreational activities, such as swimming, boating, and waterskiing. To accommodate this range of uses, the State of Wisconsin has developed water use objectives for the surface waters of the State, and has promulgated these objectives in Chapters NR 102 and NR 104 of the *Wisconsin Administrative Code*. Complementary water use objectives and supporting water quality guidelines have been adopted by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) as set forth in the adopted regional water quality management plan for all major lakes and streams in the Region.[1] The current water uses, as well as the water use objectives and supporting water quality guidelines for Ashippun Lake, are discussed in this chapter.

## RECREATIONAL USES AND FACILITIES

Ashippun Lake supports a full range of lake uses. These uses include angling, during both the summer and winter fishing seasons, recreational boating, swimming, and aesthetic viewing. Winter recreational uses of Ashippun Lake also include cross-country skiing, ice skating, and snowmobiling. The scope of these recreational uses engaged in on Ashippun Lake is sufficiently broad to be consistent with the recommended use objectives of full recreational use and the support of a healthy warmwater sport fishery, as set forth in the adopted regional water quality management plan.

### Angling

The Ashippun Lake fishery has been supported by Wisconsin Department of Natural Resources (WDNR) stocking programs, as discussed in Chapter V. Fisheries surveys indicated that the Lake supports an excellent panfish stock, as well as largemouth bass and northern pike populations. Evidence of the good fishing is provided by the number of ice fishing shelters that appear on the ice during the winter months, and by the numbers of fishing boats and shoreline anglers using the Lake during the summer.

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[1]*SEWRPC Planning Report No. 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000*, Volume One,* Inventory Findings*, September 1978; Volume Two,* Alternative Plans*, February 1979; and Volume Three,* Recommended Plan*, June 1979. See also SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995.*

**Recreational Boating**

Boat traffic on Ashippun Lake is variable throughout the season. During 2001 and again in 2004, SEWRPC staff conducted recreational use surveys on Ashippun Lake, the results of which are shown in Table 28. These surveys were intended to establish "typical" recreational boating use patterns, and, consequently, the intensity of use quantified in the table does not reflect peak levels of use experienced, for example, on holiday weekends. During both surveys, fishing boats constituted the majority of the boat traffic observed on the Lake, during both weekdays and weekends, accounting for an average of about 80 percent of the watercraft in use on all observation dates in 2001 and 2004. During both the 2001 and 2004 surveys, powerboats and ski boats were still below critical levels, as defined by the recreational boating guidelines set forth in the adopted regional park and open space plan; an area of 40 acres per boat being considered to be a minimum area for safe waterskiing and fast boating pursuant to the aforementioned Regional guidelines.[2]

During 2001, a boat count conducted by SEWRPC staff resulted in a total of 66 watercraft of various descriptions: fishing, pontoon, skiing, sailing, rowing vessels, and personal watercraft, being recorded, as shown in Table 29.

**Public Lake Access**

There is a publicly owned inland lake recreational boating access site on the western shore of Ashippun Lake, as shown on Map 2 in Chapter II of this report. This site includes the boating access, picnic tables, toilet facilities, and an area for parking of automobiles and trailers. Waukesha County operates this site under an agreement with the WDNR. This site is considered to provide an adequate level of public recreational boating access to Ashippun Lake, pursuant to standards set forth in Chapter NR 1 of the *Wisconsin Administrative Code*.

Subsequent to the publication of the initial plan, changes to Chapter NR 1 of the *Wisconsin Administrative Code* established quantitative criteria for determining the adequacy of public recreation boating access, including the setting of maximum and minimum access standards be based upon car-trailer units. As of 2006, pursuant to these standards, Ashippun Lake continues to have adequate public recreational boating access opportunities.

It is important to note that the provision of park and open space sites within the area tributary to Ashippun Lake should continue to be guided by the recommendations contained in the Waukesha County development plan.[3] The purpose of that plan, in part, is to guide the preservation, acquisition, and development of land for park, outdoor recreation, and related open space purposes and to protect and enhance the underlying and sustaining natural resource base of the locale. With respect to the Ashippun Lake area, the plan recommends the maintenance of existing park and open space sites in the area. In addition, the plan recommends that the undeveloped lands in the primary environmental corridor area tributary to Ashippun Lake be retained and maintained as natural open space.

**Wisconsin Department of Natural Resources Recreational Rating**

Ashippun Lake provides a variety of outdoor recreational opportunities. Ashippun Lake received 53 of a possible 72 points according the WDNR rating scale, as shown in Table 30. This rating indicates that the Lake provides a range of recreational opportunities, including boat launch sites, water quality conditions conducive to boating, and some marsh areas suitable for wildlife observation. Features that were considered to detract from the recreational rating included a minor rough fish problem, occasional algal blooms, and excessive macrophyte growths in portions of the Lake.

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[2]*SEWRPC Planning Report No. 27,* A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000*, November 1977, as refined in SEWRPC Planning Report No. 48,* A Regional Land Use Plan for Southeastern Wisconsin: 2035*, June 2006; SEWRPC Community Assistance Planning Report No. 137,* A Park and Open Space Plan for Waukesha County*, December 1989; and, SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin*, August 1996.*

[3]*SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin*, August 1996; see also SEWRPC Community Assistance Planning Report No. 137,* A Park and Open Space Plan for Waukesha County*, December 1989.*

**Table 28**

**RECREATIONAL USE SURVEY ON ASHIPPUN LAKE: 2001-2004**

| Date and Time | Weekend Participants | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fishing | Pleasure Boating | Skiing | Sailing | Jetskiing | Swimming | Other | Total |
| August 3, 2001 | | | | | | | | |
| Morning | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Afternoon | 2 | 0 | 1 | 0 | 0 | 11 | 0 | 14 |
| Total for the day | 4 | 0 | 1 | 0 | 0 | 11 | 0 | 16 |
| Percent | 25 | 0 | 6 | 0 | 0 | 69 | 0 | 100 |

| Date and Time | Weekend Participants | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fishing | Pleasure Boating | Skiing | Sailing | Jetskiing | Swimming | Other | Total |
| July 24, 2004 | | | | | | | | |
| Morning | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 7 |
| Afternoon | 6 | 2 | 0 | 1 | 1 | 2 | 0 | 12 |
| Total for the day | 12 | 2 | 0 | 1 | 1 | 2 | 1 | 19 |
| Percent | 63 | 11 | 0 | 5 | 5 | 11 | 5 | 100 |

| Date and Time | Weekday Participants | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fishing | Pleasure Boating | Skiing | Sailing | Jetskiing | Swimming | Other | Total |
| June 30, 2004 | | | | | | | | |
| Morning | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 7 |
| Afternoon | 4 | 0 | 0 | 0 | 0 | 4 | 4 | 12 |
| Total for the day | 10 | 1 | 0 | 0 | 0 | 4 | 4 | 19 |
| Percent | 53 | 5 | 0 | 0 | 0 | 21 | 21 | 100 |

*Source: SEWRPC.*

**Table 29**

**WATERCRAFT ON ASHIPPUN LAKE: 2001**

| Type of Watercraft | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Power Boat | Fishing Boat | Pontoon Boat | Canoe | Paddle Boat | Sailboat | Kayak | Wind Surf Board | Personal Water Craft | Other | Total |
| 12 | 11 | 11 | 9 | 8 | 5 | 1 | - - | 7 | 2 | 66 |

*Source: SEWRPC.*

## WATER USE OBJECTIVES AND QUALITY STANDARDS

The regional water quality management plan recommends the adoption of full recreational use and warmwater sport fisheries objectives for Ashippun Lake. The findings of the inventories of the natural resource base, set forth in Chapters III through V, indicate that the use of the Lake and the resources of the area are generally supportive of such objectives, although it is expected that remedial measures may be required if the Lake is to fully meet the objectives. The recommended warmwater sport fish objective is supported by the observed fishery which is based

Table 30

**WISCONSIN DEPARTMENT OF NATURAL RESOURCES RECREATIONAL RATING OF ASHIPPUN LAKE**

| | | | | | |
|---|---|---|---|---|---|
| Fish: | | | | | |
| __ 9 | High production | X 6 | Medium production | __ 3 | Low production |
| X 9 | No problems | __ 6 | Modest problems, such as infrequent winterkill, small rough fish problems | __ 3 | Frequent and overbearing problems, such as winterkill, carp, excessive fertility |
| Swimming: | | | | | |
| __ 6 | Extensive sand or gravel substrate (75 percent or more) | __ 4 | Moderate sand or gravel substrate (25 to 50 percent) | X 2 | Minor sand or gravel substrate (less than 25 percent) |
| __ 6 | Clean water | X 4 | Moderately clean water | __ 2 | Turbid or darkly stained water |
| __ 6 | No algal or weed problems | X 4 | Moderate algal or weed problems | __ 2 | Frequent or severe algal or weed problems |
| Boating: | | | | | |
| X 6 | Adequate water depths (75 percent of basin more than five feet deep) | __ 4 | Marginally adequate water depths (50 to 75 percent of basin more than five feet deep) | __ 2 | Inadequate depths (less than 50 percent of basin more than five feet deep) |
| __ 6 | Adequate size for extended boating (more than 1,000 acres) | __ 4 | Adequate size for some boating (200 to 1,000 acres) | X 2 | Limit of boating challenge and space (less than 200 acres) |
| __ 6 | Good water quality | X 4 | Some inhibiting factors, such as weedy bays, algal blooms, etc. | __ 2 | Overwhelming inhibiting factors, such as weedbeds throughout |
| Aesthetics: | | | | | |
| X 6 | Existence of 25 percent or more wild shore | __ 4 | Less than 25 percent wild shore | __ 2 | No wild shore |
| X 6 | Varied landscape | __ 4 | Moderately varied | __ 2 | Unvaried landscape |
| __ 6 | Few nuisances, such as excessive algae, carp, etc. | X 4 | Moderate nuisance conditions | __ 2 | High nuisance condition |
| Total Quality Rating: 53 out of a possible 72 | | | | | |

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

largely on largemouth bass, northern pike, and panfish. These fishes have traditionally been sought after in Ashippun Lake.[4]

The water quality standards supporting the warmwater fishery and full recreational use objectives, as established for planning purposes in the regional water quality management plan, are set forth in Table 31. These standards are similar to those set forth in Chapters NR 102 and 104 of the *Wisconsin Administrative Code*, but were refined for planning purposes in terms of their application. Standards are recommended for temperature, pH, and dissolved oxygen, fecal coliform, and total phosphorus concentrations. These standards apply to the epilimnion of

[4]*Although walleyed pike have been stocked in the Lake, as shown in Table 21 in Chapter V of this report, the current walleye population in the Lake, as indicated by WDNR surveys, is not believed to represent a significant segment of the sport fishing activities on Ashippun Lake.*

Table 31

**RECOMMENDED WATER QUALITY STANDARDS TO SUPPORT RECREATIONAL AND WARMWATER FISH AND AQUATIC LIFE USE**

| Water Quality Parameter | Water Quality Standard |
|---|---|
| Maximum Temperature | 89°F[a,b] |
| pH Range | 6.0-9.0 standard units |
| Minimum Dissolved Oxygen | 5.0 mg/l[b] |
| Maximum Fecal Coliform | 200/400 MFFCC/100 ml[c] |
| Maximum Total Residual Chlorine | 0.01 mg/l |
| Maximum Un-ionized Ammonia Nitrogen | 0.02 mg/l |
| Maximum Total Phosphorus | 0.02 mg/l[d] |
| Other | - -[e,f] |

[a]*There shall be no temperature changes that may adversely affect aquatic life. Natural daily and seasonal temperature fluctuations shall be maintained. The maximum temperature rise at the edge of the mixing zone above the existing natural temperature shall not exceed 3°F for lakes.*

[b]*Dissolved oxygen and temperature standards apply to the epilimnion of stratified lakes and to the unstratified lakes; the dissolved oxygen standard does not apply to the hypolimnion of stratified inland lakes. Trends in the period of anaerobic conditions in the hypolimnion of stratified inland lakes should be considered important to the maintenance of water quality, however.*

[c]*The membrane filter fecal coliform count per 100 milliliters (MFFCC/100 ml) shall not exceed a monthly geometric mean of 200 per 100 ml based on not less than five samples per month, nor a level of 400 per 100 ml in more than 10 percent of all samples during any month.*

[d]*This standard for lakes applies only to total phosphorus concentrations measured during spring when maximum mixing is underway.*

[e]*All waters shall meet the following minimum standards at all times and under all flow conditions: Substances that will cause objectionable deposits on the shore or in the bed of any body of water shall not be present in such amounts as to interfere with public rights in 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 amounts that are acutely harmful to animal, plant, or aquatic life.*

[f]*Unauthorized concentrations of substances are not permitted that alone or in combination with other material present are toxic to fish or other aquatic life. Standards for toxic substances are set forth in Chapter NR 105 of the* Wisconsin Administrative Code*.*

*Source: SEWRPC.*

the lakes and to streams. The total phosphorus standard applies to spring turnover concentrations measured in the surface waters. Such contaminants as oil, debris, scum; or odor, taste, and color-producing substances; and toxins are not permitted in concentrations harmful to the aquatic life as set forth in Chapters NR 102 of the *Wisconsin Administrative Code*. The adoption of these standards is intended to specify conditions in the waterways concerned that mitigated against excessive macrophyte and algal growths and promoted all forms of recreational use, including angling, in these waters. As indicated in Chapter IV, the ambient in-lake water quality conditions, as summarized in Table 8, are generally consistent with the stated water quality objectives.

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# Chapter VII

# ALTERNATIVE LAKE MANAGEMENT MEASURES

## INTRODUCTION

Based upon review of the inventories and analyses set forth in Chapters II through VI, four issues were identified requiring consideration in the formulation of alternative and recommended lake management measures. These issues are related to: 1) land use; 2) water quality; 3) aquatic biota, including aquatic plants; and, 4) water uses. The management measures considered herein are focused primarily on those measures which are applicable within the Ashippun Lake Protection and Rehabilitation District, and to the Town of Oconomowoc, with lesser emphasis given to those measures which are applicable to others with jurisdiction within the area tributary to Ashippun Lake.

## WATERSHED MANAGEMENT ALTERNATIVES

### Land Use Management

A basic element of any water quality management effort for a lake is the promotion of sound land use development and management in the tributary watershed. The type and location of future urban and rural land uses in the tributary area to Ashippun Lake will determine, to a large degree, the character, magnitude, and distribution of nonpoint sources of pollution; the practicality of, as well as the need for, stormwater management; and, to some considerable degree, the water quality of the Lake itself.

#### *Development in the Shoreland Zone*

Existing 2000 and planned buildout land use patterns and existing zoning regulations in the tributary area to Ashippun Lake have been described in Chapter III. If the recommendations set forth in the adopted Waukesha County development plan and regional land use plan are followed, under buildout conditions, some additional urban residential development within the area tributary to Ashippun Lake would occur. Much of this residential development is likely to occur on agricultural lands. Infilling of existing platted lots and some backlot development, as well as the redevelopment and reconstruction of existing single-family homes on lakefront properties, also may be expected to occur. Recent surveillance indicates that this type of development is currently occurring, primarily along the County Trunk Highways that form the major access routes into this lake-oriented community and which approximate portions of the boundary of the tributary area. Accordingly, given the potential impact of lakeshore development on the lake resources, land use development or redevelopment proposals around the shoreline of Ashippun Lake, as well as those generally within the area tributary to the Lake, should be evaluated for potential impacts on the Lake, as such proposals are advanced.

Recent studies of the potential impact of riparian landscaping activities on the nutrient loadings to lakes in southeastern Wisconsin have suggested that urban residential lands can contribute up to twice the mass of phosphorus to a lake when subjected to an active program of urban lawn care than similar lands managed in a more natural fashion.[1] The application of agrochemicals to such lands, in excess of the plant requirements, therefore, results in enhanced nutrient loading directly to the adjacent waterbodies. To address these concerns, a number of communities have enacted turf management ordinances to better manage the application of fertilizers and agrochemicals to urban lands. Other communities have opted for a public informational programming approach, such as that discussed below; a few communities, such as the Big Cedar Lake Protection and Rehabilitation District, also have purchased bulk lots of phosphorus-free lawn and garden fertilizers for resale to riparian landowners. Given the increasing importance of urban land uses within the riparian area of Ashippun Lake, and within its area, consideration of programs to reduce phosphorus in urban agricultural practices may be of value. To this end, the State of Wisconsin has promulgated guidance for turf nutrient management targeted at residential lands, parks, and high use areas, such as golf courses.[2]

***Development in the Tributary Area***

The level of development envisioned in the Waukesha County development plan for the area tributary to Ashippun Lake indicates continuing urban development, generally on large suburban-density lots. Careful review of applicable zoning ordinances to incorporate levels and patterns of development consistent with the plan within the area tributary to Ashippun Lake is considered a viable option for the management plan. Changes in the zoning ordinances could be considered to better reflect the land use patterns recommended in the County development plan. One feasible option would be giving consideration to minimizing the areal extent of development by providing specific provisions and incentives to cluster residential development on smaller lots while preserving portions of the open space on each property or group of properties considered for development, utilizing the principles of conservation development.[3] Provision of stormwater management facilities to serve specific types of new development is required pursuant to Chapters NR 151 and NR 216 of the *Wisconsin Administrative Code*, as summarized in Chapter III and set forth below. Periodic review of building codes and subdivision requirements to ensure best practice is considered a viable option.

***Stormwater Management on Development Site***

With respect to stormwater management on development sites, both the Town of Oconomowoc and Waukesha County have adopted stormwater management ordinances, with the Town adopting the County ordinance as noted in Table 7 in Chapter III of this report. These ordinances reflect current best practices insofar as the determination of stormwater flows, mitigation of flooding potential, and the control of contaminants from land use activities are concerned. Periodic review of these ordinances and their provisions for consistency with best management practices, and to ensure their currency with the state-of-the-art, should be undertaken on a regular basis to facilitate control of urban-sourced contaminants that would likely be delivered to the Lake. Promulgation of appropriate legal requirements, and implementation of relevant stormwater management practices is considered a viable option.

***Protection of Environmentally Sensitive Lands***

Environmentally sensitive lands within the area tributary to Ashippun Lake include wetlands, woodlands, and wildlife habitat areas. Nearly all of these areas within the Ashippun Lake area are included in the environmental corridors and isolated natural resource features delineated by the Southeastern Wisconsin Regional Planning Commission (SEWRPC). Upland areas, woodlands, and wildlife habitat areas, currently, are protected primarily through local land use regulation, while wetlands enjoy a wider range of protections set forth in State and Federal legislation.

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[1]*U.S. Geological Survey Water-Resources Investigations Report No. 02-4130,* Effects of Lawn Fertilizer on Nutrient Concentration in Runoff from Lakeshore Lawns, Lauderdale Lakes, Wisconsin*, July 2002.*

[2]*Wisconsin Department of Natural Resources, Technical Standard No. 1100,* Turf Nutrient Management*, 2006.*

[3]*See SEWRPC Planning Guide No. 7,* Rural Cluster Development Guide*, December 1996.*

Wetland protection can be accomplished through land use regulation and, in cases where land use regulations may not offer an adequate degree of protection, through public acquisition of sensitive sites. These wetland areas are currently protected to a degree by current zoning and regulatory programs administered by the U.S. Army Corps of Engineers (USCOE), Wisconsin Department of Natural Resources (WDNR), Waukesha County, and municipal authorities under one or more of the Federal, State, County, and local regulations.

Some of the wetland, woodland, and wildlife habitat areas within the area tributary to Ashippun Lake, however, have been recommended for public acquisition in the adopted regional natural areas and critical species habitat management and protection plan. These lands include 162 acres of the Ashippun River Lowlands and six acres of the Meadow View School Bog.[4] Public acquisition of these lands, including acquisition by not-for-profit conservation organizations, as recommended in the adopted regional natural areas and critical species habitat protection and management plan is considered a viable option.

Wetlands adjacent to lakes and streams help enhance water quality conditions, while preserving desirable open space characteristics for residents of the area that allow them to participate in a wide range of resource-oriented recreational activities. Protection and preservation of these shoreland wetlands also helps to avoid the creation of new environmental and developmental problems as urbanization proceeds within the watershed. In parallel with such protection and preservation, the use of natural and native vegetation as shoreline protection is required pursuant to Chapter NR 328 of the *Wisconsin Administrative Code* as best practice along lake shorelines where such measures are feasible. Consequently, protection and enhancement of shoreland wetlands is considered a viable option.

**Pollution Abatement and Stormwater Management**

All human activities upon the land surface result in some degree of mobilization of contaminants and modification of surface runoff patterns that can affect lakes and streams, their quality, and biotic condition. Many human activities can be mitigated to a large extent by the implementation of sound planning, appropriate nonpoint source pollution abatement measures, and the actions of an informed public. In the first instance, sound land use development and management in the tributary watershed, and protection of environmentally sensitive lands, are the fundamental building blocks for protecting lake and stream water quality and habitat, and preserving human use opportunities that will support a broadly based recreational and residential community. In addition, specific nonpoint source pollution control and abatement measures should be integrated into land use regulations and promoted by a far-reaching informational and educational program within the area tributary to individual lakes and streams. In the initial plan, it was recommended that, to meet the adopted water use objectives and standards at that time, about a 50 percent reduction in nonpoint source loads from the area directly tributary to Ashippun Lake would need to be achieved. This was refined in the adopted regional water quality management plan to a recommended load reduction of 25 percent.[5] This level of reduction was recommended to be achieved through reductions in both urban and rural nonpoint source pollution loads.

***Nonpoint Source Pollution Abatement***

Watershed management measures may be used to minimize nonpoint source pollutant loadings from the watershed by locating development within a drainage basin in accordance with sound planning. Beyond such actions, specific interventions may be required to control the mass of contaminants generated by various types of land use activity that are transported to the Lake. Rural sources of contaminants arise as pollutants transported by runoff from cropland and pastureland; urban sources include contaminants transported by runoff from residential, commercial, industrial, transportation, and recreational land uses, and from construction activities. Alternative,

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

[5]*SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995.*

watershed-based nonpoint source pollution control measures considered in this report are based upon the recommendations set forth in the regional water quality management plan[6] and in the Waukesha County land and water resource management plan.[7]

The regional water quality management plan recommends that the nonpoint source pollution loads from the areas tributary to Ashippun Lake be reduced by up to 25 percent in both urban and rural areas, in addition to implementation of urban construction erosion controls, stream bank erosion controls, and onsite sewage disposal system management practices. As described in Chapter IV, the most readily controllable loadings are associated primarily with runoff from urban lands within the direct area tributary to the Lake and from urbanizing lands throughout the total area tributary to the Lake that are linked to the Lake by way of streams and stormwater drainage systems. These loadings constituted about 25 percent of the total phosphorus loading to Ashippun Lake, about 10 percent of the sediment loading, and 100 percent of the heavy metals loadings, based upon 2000 land uses. Contaminant loadings from the remainder of the tributary area, and from direct deposition onto the Lake surface, contributed the balance of the total loadings. The contributions of phosphorus, sediment and heavy metals from urban lands are expected to increase as agricultural lands are progressively converted to urban uses.

While some proportion of these contaminant loads may be attenuated as a consequence of the wetland areas to the southeast of Ashippun Lake, the ability of these wetlands to assimilate pollutants is wholly dependent upon the maintenance of their structure and function within their ecosystems. These features can be overwhelmed by inappropriate land uses that result in the degradation of the wetlands, diminishing their ability to capture contaminants, or creating contaminant loads of such magnitude that the wetlands are overloaded. Thus, the control of nonpoint sources of water pollution at their sources is an important consideration. Properly applied, such controls can reduce the pollutant loadings to a lake by about 25 percent or more.

Appendix D presents a list of alternative nonpoint source pollution management measures that could be considered for use in the Ashippun Lake area. Information on the cost and effectiveness of the measures is also presented in Appendix D. It should be noted that appropriate public informational programming, described below, provides a means of disseminating information on various nonpoint source control measures that can be targeted to specific sectors of the community. Many of the measures are low-cost or no-cost measures that can be implemented by individual landowners. Selected measures are discussed below.

*Rural Nonpoint Source Controls*

Upland erosion from agricultural and other rural lands is a contributor of sediment to streams and lakes. Estimated phosphorus and sediment loadings from croplands, woodlots, pastures, and grasslands in the area tributary to Ashippun Lake were presented in Chapter IV. These data were utilized in determining the pollutant load reduction that could be achieved, the types of practices needed, and the extent of the areas to which the practices need to be applied within the area tributary to Ashippun Lake.

Based upon the pollutant loading analysis set forth in Chapter IV, a total annual phosphorus load of 420 pounds is estimated to be contributed to Ashippun Lake. Of that mass, it is estimated that 310 pounds per year, or 75 percent of the total loading, were contributed by runoff from rural land. In addition, it is estimated that 86 tons of sediment, or about 80 percent of the total sediment load to Ashippun Lake, were contributed annually from agricultural lands in the area tributary to the Lake. As of 2000, such lands comprised about 385 acres, or about one-half of the drainage area of Ashippun Lake. Agricultural lands are anticipated to diminish to about 270 acres, or about one-third, of the tributary area by the year 2020.

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[6]*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; SEWRPC Memorandum Report No. 93,* op. cit.

[7]*Waukesha County*, Land and Water Resource Management Plan: 2006-2010, *March 2006.*

While agricultural land uses are anticipated to be a declining form of land use within the area tributary to Ashippun Lake, the agricultural operations that remain within the area will continue to contribute a significant proportion of the sediment load to the waterbody. Table 11 in Chapter IV of this report suggests that, based upon estimated year 2020 conditions, agricultural land uses will contribute about 67 percent of the total sediment load, or about 60 tons of sediment annually, to Ashippun Lake. Thus, detailed farm conservation plans will be required to adapt and refine erosion control and nutrient and pest management practices for individual farm units. Generally prepared with the assistance of staff from the U.S. Natural Resources Conservation Service (NRCS) or County Land Conservation Department, such plans identify desirable tillage practices, cropping patterns, and rotation cycles. The plans also consider the specific topography, hydrology, and soil characteristics of the farm; identify the specific resources of the farm operator; and articulate the operator objectives of the owners and managers of the land.

*Urban Nonpoint Source Controls*
As of 2000, established urban land uses comprised about 178 acres, or about 23 percent, of the area tributary to Ashippun Lake. The annual phosphorus loading from these urban lands was estimated to be 115 pounds, or about 25 percent of the total load of phosphorus to the Lake. This is anticipated to increase to about 40 percent of the total load of phosphorus under buildout conditions. Those urban-sourced pollutant loadings that are most controllable include runoff from the residential lands adjacent to the Lake, and urban runoff from areas with a high proportion of impervious surface. The potential also exists within the Ashippun Lake watershed for significant construction site erosion impacts if development continues in the tributary area according to recent trends.

Potentially applicable urban nonpoint source control measures include stormwater management measures, wet detention basins, grassed swales, and good urban “housekeeping” practices. Generally, the application of low-cost urban housekeeping practices may be expected to reduce nonpoint source loadings from urban lands by about 25 percent. Public educational programs can be developed to encourage good urban housekeeping practices, to promote the selection of building and construction materials which reduce the runoff contribution of metals and other toxic pollutants, and to promote the acceptance and understanding of the proposed pollution abatement measures and the importance of lake water quality protection. Urban housekeeping practices and source controls include restricted use of fertilizers and pesticides, improved pet waste and litter control, the substitution of plastic for galvanized steel and copper roofing materials and gutters, proper disposal of motor vehicle fluids, increased leaf collection, and continued use of reduced quantities of street deicing salt.

Particular attention also should be given to reducing pollutant loadings from high pollutant loading areas, such as parking lots and material storage areas. To the extent practicable, parking lot stormwater runoff should be diverted to areas covered by pervious soils and appropriate vegetation, rather than being directly discharged to surface waters. Material storage areas may be enclosed or periodically cleaned, and diversion of stormwater away from these sites may further reduce pollutant loadings. Street sweeping, increased catch basin cleaning, stream protection, leaf litter and vegetation debris collection, and stormwater storage and infiltration measures can enhance the control of nonpoint source pollutants from urban and urbanizing areas, and reduce urban nonpoint source pollution loads by up to about 50 percent.

Waukesha County administers and enforces a stringent stormwater management ordinance applicable to new development within the Town of Oconomowoc. While these measures limit the potential impacts of new development, they do not address impacts from existing land uses nor do they address the cumulative impacts of past development. Therefore, additional measures to reduce nonpoint source pollution from existing development would appear to be warranted. Proper design and application of structural urban nonpoint source control measures, such as grassed swales and detention basins, requires the preparation of a detailed stormwater management system plan that addresses stormwater drainage problems and controls nonpoint sources of pollution.

*Developing Area Nonpoint Source Controls*
Developing areas can generate significantly higher pollutant loadings than established areas of similar size. Developing areas include a wide array of activities, including urban renewal projects, individual site development

within the existing urban area, and new land subdivision development. The regional land use and county development plans envision only limited new urban development within the area. However, as previously noted, the potential for some large-lot suburban-density development exists in the area tributary to Ashippun Lake, together with the redevelopment of existing, platted lakefront lots.

Construction sites, especially, may be expected to produce suspended solids and phosphorus loadings at rates several times higher than established urban land uses. Construction site erosion controls are temporary measures taken to reduce pollutant loadings from construction sites during stormwater runoff events. Erosion controls may be expected to reduce pollutant loadings from construction sites by about 75 percent. Such practices are expected to have only a minimal impact on the total pollutant loading to the Lake due to the relatively small amount of land proposed to be developed at any given time. Cumulatively, however, such controls are important pollution control measures that can abate localized short-term loadings of phosphorus and sediment from the area and the upstream tributary area. The control measures include such revegetation practices as temporary seeding, mulching, and sodding, and such runoff control measures as filter fabric fences, straw bale barriers, storm sewer inlet protection devices, diversion swales, sediment traps, and sedimentation basins.

At the present time, Waukesha County administers and enforces a construction site erosion control ordinance in both the shoreland and nonshoreland areas of the area tributary to Ashippun Lake. The provisions of these ordinances apply to all development except single- and two-family residential construction. Single- and two-family construction erosion control measures are to be specified as part of the building permit process. In the Town of Oconomowoc, this function is performed by the Town. Because of the potential for development in the area tributary to Ashippun Lake, it is important that adequate construction erosion control programs, including enforcement, be in place.

***Public Sanitary Sewerage System***

A portion of the southern part of the area tributary to Ashippun Lake was identified in the Northwestern Waukesha County Sanitary Sewerage System Plan,[8] and the subsequent amendment to the regional water quality management plan, as an unrefined public sanitary sewer service area. Lands lying within the area tributary to Ashippun Lake are currently utilizing onsite sewage disposal systems.

***Onsite Sewage Disposal System Management***

In the initial lake study, it was reported that over 200 persons residing in the area tributary to Ashippun Lake utilized onsite sewage disposal systems. As reported in Chapter IV, total phosphorus loadings from onsite sewage disposal systems are estimated to contribute 5 percent of the total phosphorus load to the Lake, which proportion is anticipated to decline if public sanitary sewerage services are extended within the tributary area pursuant to the adopted regional water quality management plan[9] and the sewer service area plan.[10] In addition to lake water quality considerations, sewage disposal options in the area have implications for groundwater quality and property values. Thus, onsite sewage disposal is an important consideration. Two basic alternatives are available for abatement of pollution from onsite sewage disposal systems: continued reliance on, and management of, the onsite sewage disposal systems, and, alternatively, the expansion of the public sanitary sewer system currently serving portions of the Waukesha County "Lake Country."

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[8]*SEWRPC,* Amendment to the Regional Water Quality Management Plan Northwestern Waukesha County*, March 2001; Black & Veatch Corporation*, Sanitary Sewerage System Plan for the Northwestern Waukesha County Area*, April 2000.*

[9]*SEWRPC Memorandum Report No. 93,* op. cit.

[10]*SEWRPC,* Amendment to the Regional Water Quality Management Plan: Northwestern Waukesha County, op. cit.

Where onsite sewage disposal systems remain the primary wastewater treatment method, an onsite sewage disposal system management program, including the conduct of an ongoing informational and educational effort, is considered a viable option. Homeowners in areas served by onsite systems should be advised of the rules, regulations, and system limitations governing onsite sewage disposal systems, and should be encouraged to undertake preventive maintenance programs. Waukesha County currently has such a program in place, pursuant to Chapter Comm 83 of the *Wisconsin Administrative Code* for onsite sewage disposal systems installed after 1983, and consideration is currently being given by the Wisconsin Legislature to extending this inspection program to all onsite sewage disposal systems.

## IN-LAKE MANAGEMENT ALTERNATIVES

The reduction of external nutrient loadings to Ashippun Lake by the measures described previously should help to continue to protect lake water quality. These measures, however, may not completely eliminate existing water quality and lake-use problems. In mesotrophic and eutrophic lakes, the nutrients previously delivered to, and retained in, such lakes can continue to result in abundant macrophyte growth that can result in restricted water use potentials, even after the implementation of watershed-based management measures. Given that Ashippun Lake falls within this trophic range, the application of in-lake rehabilitation techniques should be considered.

The applicability of specific in-lake rehabilitation techniques is highly dependent on lake-specific characteristics. The success of any lake rehabilitation technique can seldom be guaranteed, and because of the relatively high cost of applying most techniques, a cautious approach to implementing in-lake rehabilitation techniques is generally recommended. Certain in-lake rehabilitation techniques should be applied only to lakes in which: 1) nutrient inputs have been reduced below the critical level; 2) there is a high probability of success in applications of the particular technology to lakes of similar size, shape, and quality; and 3) the possibility of adverse environmental impacts is minimal. Finally, it should be noted that some in-lake rehabilitation techniques require the issuance of permits from appropriate State and Federal agencies prior to implementation.

Alternative lake rehabilitation measures include in-lake water quality management, water level management, aquatic plant and fisheries management, and water use management measures. Each of these groups of management measures is described further below.

### Surface Water Quality Management

As discussed in Chapter IV, water quality information for Ashippun Lake has been compiled from 1973 to the present mainly through the efforts of volunteers as part of the WDNR Self-Help Monitoring Program.[11] Volunteers enrolled in this program gather data at regular intervals on water clarity through the use of a Secchi disk. Because pollution tends to reduce water clarity, Secchi disk measurements are generally considered one of the key parameters in determining the overall quality of a lake's water as well as a lake's trophic status. Secchi disk measurement data are added to the WDNR-sponsored data base containing lake water quality information for most of the lakes in Wisconsin and is accessible on-line through the WDNR website. The WDNR also offers an Expanded Self-Help Monitoring Program that involves collecting data on several key physical and chemical parameters in addition to the Secchi disk measurements. Under this program, samples of lake water are collected by volunteers at regular intervals and analyzed by the State Laboratory of Hygiene. Data collection is more extensive and, consequently, places more of a burden on volunteers. In addition to the volunteer-based Self-Help program, the U.S. Geological Survey (USGS) also offers an extensive water quality monitoring program. USGS field personnel conduct a series of approximately four monthly samplings beginning with the spring turnover. Samples are analyzed for an extensive array of physical and chemical parameters. The University of Wisconsin–Stevens Point also offers several water quality sampling programs. Under these latter programs, volunteers collect water samples and send them to the UW-SP Water and Environmental Analysis Laboratory for analysis.

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[11]*As of 2006, the University of Wisconsin-Extension, Lakes Partnership, has assumed responsibility for the administration of the Self-Help Monitoring Program.*

The basic WDNR Self-Help Monitoring Program is available at no charge, but does require volunteers to be committed to taking Secchi measurements at regular intervals throughout the spring, summer, and fall. The Expanded Self-Help Program requires additional commitment by volunteers to take a more extensive array of measurements and samples for analysis, also on a regular basis. As with any volunteer-collected data, despite the implementation of standardized field protocols, individual variations in levels of expertise due to background and experiential differences can lead to variations in data and measurements from lake to lake and from year to year for the same lake especially when volunteer participation changes. The UW-SP turnover sampling programs require only a once-a-year sampling, thereby requiring a smaller time commitment by the volunteers, but, there is a modest charge for the laboratory analysis and, because sampling is performed by volunteers, is subject to those variations identified above. Additionally, since samples need to be taken as closely as possible to the actual turnover period, which occurs only during a relatively short window of time, volunteers need to try to monitor lake conditions as closely as possible to be able to determine when the turnover period is occurring. The USGS program does not require volunteer sampling. All sampling and analysis is provided by USGS personnel using standardized field techniques and protocols. As a result, a more standardized set of data and measurements may be expected. However, the cost of the USGS program is significantly higher than the UW-SP program, even with state cost-share availability. The WDNR offers Small Grant cost-share funding within the Chapter NR190 Lake Management Planning Grant Program that can be applied for to defray the costs of laboratory analysis and sampling equipment. Because of the above reasons, the WDNR Self-Help Program and the WDNR Expanded Self-Help Program are considered the most viable options for inclusion in the management plan, although the UW-SP program and the USGS program are worthy of consideration.

**Water Quality Improvement Measures**

This group of in-lake management practices includes a variety of measures designed to directly modify the magnitude of either a water quality determinant or biological response. Specific measures aimed at managing aquatic biota and water uses are separately considered below.

***Phosphorus Precipitation and Inactivation***

Nutrient inactivation is a restoration measure that is designed to limit the biological availability of phosphorus by chemically binding the element in the lake sediments using a variety of divalent or trivalent cations, highly positively charged elements. Aluminum sulfate (alum), ferric chloride, and ferric sulfate are commonly used cation sources. The use of these techniques to remove phosphorus from nutrient-rich lake waters is an extension of common water supply and wastewater treatment processes. Costs depend on the lake volume and type and dosage of chemical used. Approximately 100 tons of alum, costing about $150 per ton, can treat a lake area of about 40 acres. Effectiveness depends, in part, on the ability of the alum flocculent to form a stable "blanket" on the lakebed; to wit, on flushing time, turbulence, lake water acidity (pH) and rate of continued sedimentation. Impacts can include the release of toxic quantities of free aluminum into the water. The resulting improved water clarity can also encourage the spread of rooted aquatic plants.

Nutrient inactivation is not considered a viable option for Ashippun Lake due to the generally soft sediments and shallow depth of management areas, the susceptibility to wind- and boat motor-induced mixing, and the overall pollutant loading which mediate against the effective use of nutrient inactivation.

***Nutrient Load Reduction***

Nutrient diversion is a restoration measure, which is designed to reduce the trophic state or degree of over-feeding of a waterbody and thereby control the growth response of the aquatic plants in the system. Control of nutrients in surface water runoff in the watershed is generally preferable to attempting such control within a lake. Many of the techniques presented in the watershed management section above are designed for this purpose.

In-lake control of nutrients generally involves removal of contaminated sediments or encapsulation of nutrients by chemical binding. Costs are generally high, involving an engineered design and usually some form of pumping or excavation. Effectiveness is variable, and impacts include the re-release of nutrients into the environment. The widespread use of in-lake nutrient load reduction measures is not considered feasible in Ashippun Lake, especially given that internal loading from the lake sediments does not appear to be an important nutrient course to the water column. As noted in Chapter IV, the good agreement between predicted and observed phosphorus concentrations in the Lake strongly suggests that the external nutrient load to the Lake accounts for the entire phosphorus concentration in the Lake water column.

***Hydraulic and Hydrologic Management***

This group of in-lake management measures consists of actions designed to modify the depth of water in the waterbody. Generally, the objectives of such manipulation are to enhance a particular class of recreational uses, to control the types and densities of organisms within a waterbody, or to minimize high water or flooding problems. Consideration can be given to outlet control modifications, drawdown, and dredging.

Given the generally low gradients in the area, and the risk of flooding of riparian homesteads surrounding Ashippun Lake, the maintenance of lake water levels is an issue to be considered. Primarily, monitoring of the Lake level is the recommended action. Such monitoring should be based upon a surveyed lake level gauge of known elevation so that the level data can be tied to an actual elevation in National Geodetic Vertical Datum. These data should be stored by a public agency, such as the WDNR or USGS, which latter agency has installed and maintains water level gauges on other lakes within the Southeastern Wisconsin Region. In addition, when high water conditions are experienced, the Ashippun Lake Protection and Rehabilitation District Commissioners should investigate the cause and take remedial action should the increased elevation be due to wildlife activity in the watershed. Further, it is recommended that the District evaluate the replacement of the temporary dam to limit reverse flows from the Ashippun River to the Lake. However, it is strongly suggested that such an action be predicated upon the conduct of a hydraulic and hydrologic analysis of the Ashippun River to validate the likely need for such a structure and the frequency at, and duration for, which it is likely to be required.

*Outlet Control Operations*

There is no permanent dam or weir in the outflow stream of the Lake to regulate the outflow of water draining from Ashippun Lake to the Ashippun River, although, as previously noted, a temporary structure has been placed periodically at the Lake outlet. The outflow from Ashippun Lake is influenced, indirectly, by an abandoned concrete mill dam located on the Ashippun River about a mile and a half downstream from the Lake in the unincorporated community of Monterey. The normal level of the Lake is generally considered to be about 868.5 feet, although there has been a history of water from the Ashippun River backing up into the Lake following unusually high rainfall events. Mitigation of such hydraulic blocks has, in the past, generally been achieved as a result of the gradual, natural recession of the Ashippun River to normal levels. There was an unsuccessful attempt by residents to reduce the back up of Ashippun River water into Ashippun Lake through the use of a back-flow inhibitor device installed in the outflow channel near the west side of the Lake. Due to the unpredictable nature and relative infrequency of such water back-up occurrences and in consideration for the natural functioning of Ashippun Lake as high water relief in the context of the Ashippun River ecological system, the conduct of a hydrological study is considered to be a viable option. Further actions to mitigate the periodic reverse flows in the unnamed channel flowing out of Ashippun Lake would be considered viable if the hydrological study indicated that such control were necessary.

*Drawdown*

Drawdown refers to the manipulation of lake water levels, especially in impounded lakes, in order to change or create specific types of habitat and thereby manage species composition within a waterbody. Drawdown may be used to control aquatic plant growth and to manage fisheries. With regard to aquatic plant management, periodic drawdowns can reduce the growth of some shoreland plants by exposing the plants to climatic extremes, while the growth of others is unaffected or enhanced. Both desirable and undesirable plants are affected by such actions. Costs are primarily associated with loss of use of the waterbody surface area during drawdown, provided there is a means of controlling water level in place, such as a dam or other outlet control structure. Effectiveness is variable with the most significant side effect being the potential for increased plant growth.

Drawdown can affect the lake fisheries both indirectly, by reducing the numbers of food organisms, and directly, by reducing available habitat and desiccating (drying out) eggs and spawning habitat. In contrast, increasing water levels, especially during spring, can provide enhanced fish breeding habitat for some species, such as pike and muskellunge, and increase the food supply for opportunistic feeders, such as bass, by providing access to terrestrial insects, for example. Costs are primarily associated with loss of use. Effectiveness is better than for aquatic plant control, but the potential for side effects remains high given that undesirable fish species may also benefit from water level changes.

Sediment exposure and desiccation by means of lake drawdown has been used as a means of stabilizing bottom sediments, retarding nutrient release, reducing macrophyte growth, and reducing the volume of bottom sediments. During the period of drawdown, the exposed sediments are allowed to oxidize and consolidate. It is believed that by reducing the sediment oxygen demand and increasing the oxidation state of the surface layer of the sediments, drawdown may retard the subsequent movement of phosphorus from the sediments. Sediment exposure may also curb sediment nutrient release by physically stabilizing the upper flocculent, sediment-water interface zone of the sediments which plays an important role in the exchange reaction and mixing of the sediments with the overlying water. Drawdown may thus increase the volume of the lake by dewatering and compacting the bottom sediments. The amount of compaction depends upon the organic content of the sediment, the thickness of sediment exposed above the water table, and the timing and duration of the drawdown.

Possible improvements resulting from a lake drawdown include reduced turbidity from wind action, improved game fishing, an opportunity to collect fish more effectively in fish removal programs, an opportunity to improve docks and dams, and an opportunity to clean and repair shorelines and deepen areas using conventional earth-moving equipment. Limited, over-winter drawdowns, conducted pursuant to the dam operating permit, are designed to limit shoreland damage by ice and ice movements during the winter months.

In contrast, depending on the timing and duration of the drawdown, drawbacks include loss of fish breeding habitat, loss of benthic food organisms, and disruption of waterfowl feeding and roosting patterns. Increased turbidity and unpleasant odors from rotting organic matter may occur during the period of the drawdown. Other adverse impacts of lake drawdown include algal blooms after reflooding, loss of use of the lake during the drawdown, changes in species composition, and a reduction in the density of benthic organisms following drawdown and reflooding. In some drawdown projects, it has been found that several years after reflooding, flocculent sediments began to reappear because of algae and macrophyte sedimentation. Therefore, to maintain the benefits of a drawdown project, the lake may have to be drawn down every five to 10 years to recompact any new sediments.

Given that there is no formal lake level control structure governing the outflow from Ashippun Lake, drawdown is not considered a viable option for inclusion in the management plan.

*Water Level Stabilization*

While water level management in a lake is a common technique for managing fish and aquatic macrophytes, the consequences of manipulating lake water levels can be both beneficial and deleterious. The major impacts from the riparian owners standpoint is that the fluctuating water levels affect shoreline erosion, interfere with proper pier height and placement, as well as the correct placement of shoreline protection structures.

Periodic changes in precipitation and weather patterns between years often result in fluctuation of water loads to the lake. These fluctuations in turn can affect lake levels. Most plant and animal species can cope with this level of water surface fluctuation without experiencing the consequences, both positive and negative, noted above. Consequently, artificial stabilization of the water surface is not considered a feasible option. It is desirable from the point of view of aquatic habitat that water level fluctuations be maintained within natural limits.

*Dredging*

Sediment removal is a restoration measure that is carried out using a variety of techniques, both land-based and water-based, depending on the extent and nature of the sediment removal to be carried out. For larger-scale applications, a barge-mounted hydraulic or cutter-head dredge is generally used. For smaller-scale operations a shore-based drag-line system is typically employed. Both methods are expensive, especially if a suitable disposal site is not located close to the dredge site. Costs for removal and disposal begin at between $10 and $15 per cubic yard, with the cost of sediment removal alone beginning at between $3.00 and $5.00 per cubic yard. Effectiveness of dredging varies with the effectiveness of watershed controls in reducing or minimizing the sediment sources. Federal and State permits are required for use of this option.

Dredging is the only restoration technique that directly removes the accumulated products of degradation and sediment from a lake system and can return a lake to a younger "age." If carried to the extreme, dredging can be used, in effect, to construct a new lake with a size and depth to suit the management objectives. Dredging has been used in other lakes to increase water depth; remove toxic materials; decrease sediment oxygen demand, prevent fish winterkills and nutrient recycling; restore fish breeding habitat; and decrease macrophyte growth. The objective of a dredging program at Ashippun Lake would be to increase water depth to maintain recreational boating access and increased public safety.

Dredging may have serious, though generally short-term, adverse effects on the Lake. These adverse effects could include increased turbidity caused by sediment resuspension, toxicity from dissolved constituents released by the dredging, oxygen depletion as organic sediments mix with the overlying water, water temperature alterations, removal of native plant seeds, and destruction of benthic and fisheries habitats. There may also be impacts at upland spoil disposal sites, such as odor problems, restricted use of the site, and disturbances associated with heavy truck traffic. In the longer term, disruption of the lake ecosystem by dredging can encourage the colonization of disturbed portions of the lakebed by less desirable species of aquatic plants and animals, including Eurasian water milfoil, which is present in Ashippun Lake.

In addition, while dredging can result in an immediate increase in lake depth, such increases may be short-lived if the sources of sediment being deposited in the lake are not controlled within the area tributary to the lake. The sediment load reaching Ashippun Lake comes from both urban and agricultural lands within the area tributary to Ashippun Lake. Sediment also may be generated from streambank and shoreland erosion. Many of these sources can be effectively controlled through the adoption, implementation, and maintenance of recommended control measures within the watershed. Such practices should be implemented in the area tributary to the Lake, as noted above, regardless of the likely conduct of any dredging project.

As noted above, dredging of lakebed material from navigable waters of the State requires a WDNR Chapter 30 permit and a USCOE Chapter 404 permit. In addition, current solid waste disposal regulations define dredged material as a solid waste. Chapter NR 180 of the *Wisconsin Administrative Code* requires that any dredging project of over 3,000 cubic yards submit preliminary disposal plans to the WDNR for review and potential solid waste licensing of the disposal site. Because sodium arsenite was applied to Ashippun Lake during the 1950s and 1960s, as noted in Chapter V, sediment samples may need to be analyzed to determine the extent and severity of any residual arsenic contamination.

Because of the considerations noted above, extensive dredging of Ashippun Lake is not considered a viable alternative at this time.

### Aquatic Plant and Fisheries Management

#### *Fisheries Management Measures*

Ashippun Lake provides a quality habitat for a healthy, warmwater fishery. Currently, adequate water quality, dissolved oxygen levels, sand and gravel shorelines, and diverse plant community exist for the maintenance of a sportfish population in the Lake. The Lake supports a largemouth bass and northern pike fishery, along with a wide range of panfish.

*Habitat Protection*

Habitat protection refers to a range of conservation measures designed to maintain existing fish spawning habitat, including measures, such as restricting recreational use and other intrusions into gravel-bottomed shoreline areas during the spawning season. For bass this is mid-April to mid-June. Use of natural vegetation in shoreland management zones and other "soft" shoreline protection options aids in habitat protection. Costs are generally low, unless the habitat is already degraded. Modification of aquatic plant harvesting operations may be considered to support restoration and protection of native aquatic plant beds and maintenance of fish breeding habitat during the early summer period. Effectiveness is variable depending in part on community acceptance and enforcement. Generally, it is more effective to maintain a good habitat than to restore a habitat after it is degraded.

Loss of habitat should be a primary concern of any fisheries management program. The environmentally valuable areas identified within the Lake and its watershed are the most important areas to be protected. In addition, limiting or restricting certain activities in sensitive areas of the Lake will prevent significant disturbance of fish nests and aquatic plant beds. The areas currently designated by the WDNR as sensitive areas within Ashippun Lake, pursuant to authorities granted under Chapter NR 107 of the *Wisconsin Administrative Code*, are shown diagrammatically on Map 15. In addition to the areas shown on Map 15, it should be noted that the sensitive area designation includes the lake bed deeper than three feet along the developed shoreline. Within these areas, aquatic plant management measures may be restricted, and dredging, filling, and the construction of piers and docks may be discouraged. It also should be noted that water level fluctuations other than those consequent to natural climatic variability and water quality conditions can affect fish habitat and the breeding success of fishes. In this regard, the maintenance of Lake water levels within natural limits, and the maintenance of good water quality, cannot be overemphasized as fish habitat protection measures.

*Shoreline Maintenance*

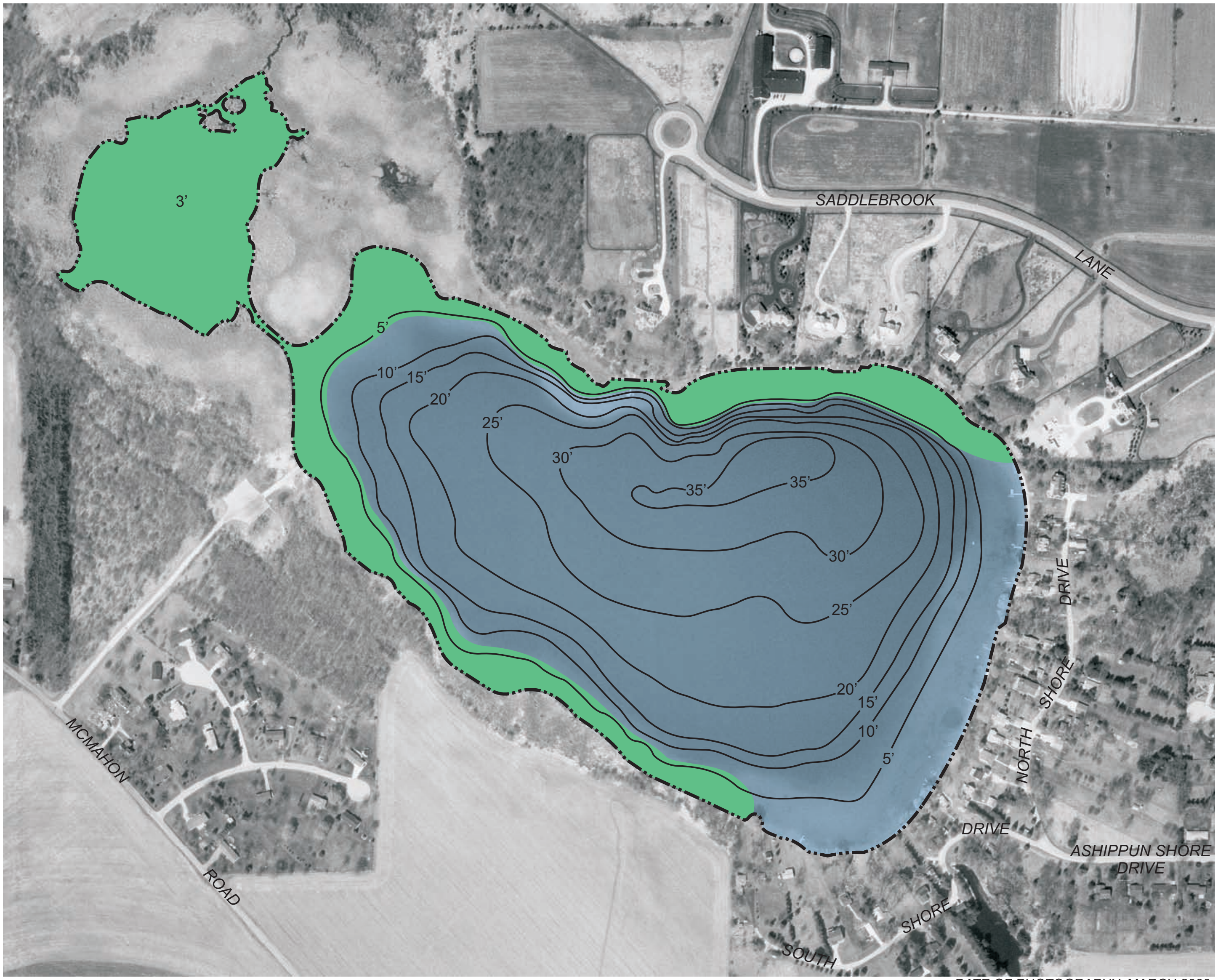
Shoreline maintenance refers to a group of measures designed to reduce and minimize shoreline loss due to erosion by waves, ice, or related actions of the water. Currently, about 25 percent of the shoreline of the main basin of Ashippun Lake is protected by some type of structural measure, as shown on Map 3 in Chapter II of this report. Four shoreline erosion control techniques were in use in 2000: vegetative buffer strips, rock revetments, wooden and concrete bulkheads, and beach. Maintenance of a vegetated buffer strip immediately adjacent to the Lake is the simplest, least costly, and most natural method of reducing shoreline erosion. This technique employs natural vegetation, rather than maintained lawns, within five to 10 feet of the lakeshore and the establishment of emergent aquatic vegetation from two to six feet lakeward of the shoreline. The use of such natural shorescaping techniques is generally required pursuant to Chapter NR 328 of the *Wisconsin Administrative Code*, except in moderate- to high-energy shorelines where more robust structural approaches may be required. A Worksheet is provided within Section NR 328.08 Table 1 as a means of assisting property owners who wish to install or modify existing shoreline protection structures.

Desirable plant species that may be expected and encouraged to invade a buffer strip, or which could be planted, include arrowhead (*Sagittaria latifolia*), cattail (*Typha* spp.), common reed (*Phragmites communis*), water plantain (*Alisma plantago-aquatica*), bur-reed (*Sparganium eurycarpum*), and blue flag (*Iris versicolor*) in the wetter areas; and jewelweed (*Impatiens biflora*), elderberry (*Sambucus canadensis*), giant goldenrod (*Solidago gigantea*), marsh aster (*Aster simplex*), red-stem aster (*Aster puniceus*), and white cedar (*Thuja occidentalis*) in the drier areas. In addition, trees and shrubs, such as silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), black willow (*Salix nigra*), and red-osier dogwood (*Cornus stolonifera*) could become established. These plants will develop a more extensive root system than the lawn grass and the aboveground portion of the plants will protect the soil against the erosive forces of rainfall and wave action. A narrow path to the Lake can be maintained as lake access for boating, swimming, fishing, and other activities. A vegetative buffer strip would also serve to trap nutrients and sediments washing into the Lake via direct overland flow. This alternative would involve only minimal cost.

Rock revetments, or riprap, are a highly effective method of shoreline erosion control applicable to many types of erosion problems, especially in areas of low banks and shallow water. These structures are already in place along limited stretches of the shoreline at Ashippun Lake. The technique involves the shaping of the shoreline slope, the placement of a porous filter material, such as sand, gravel, or pebbles, on the slope and the placement of rocks on top of the filter material to protect the slope against the actions of waves and ice. The advantages of rock revetments are that they are highly flexible and not readily weakened by movements caused by settling or ice expansion, they can be constructed in stages, and they require little or no maintenance. The disadvantages of rock revetments are that they limit some uses of the immediate shoreline. The rough, irregular rock surfaces are unsuitable for walking; require a relatively large amount of filter material and rocks to be transported to the

**Map 15**

**WISCONSIN DEPARTMENT OF NATURAL RESOURCES-DELINEATED SENSITIVE AREAS IN ASHIPPUN LAKE: 1989**




DATE OF PHOTOGRAPHY: MARCH 2000

— 20' — WATER DEPTH CONTOUR IN FEET

SENSITIVE AREA

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

GRAPHIC SCALE
0 300 600 FEET

lakeshore; and can cause temporary disruptions and contribute sediment to the lake. If improperly constructed, revetments may fail because of washout of the filter material. A rock revetment is estimated to cost $25 to $35 per linear foot.

Vegetated buffer strips and riprap, as shown in Figure 9, are considered as viable options for achieving shoreline maintenance, especially in those areas of Ashippun Lake subject to significant wind-wave, boat wake, and ice scour erosion. In those portions of the Lake subject to direct action of wind waves and ice scour, the use of riprap would provide a more robust means of stabilizing shorelines, while elsewhere along the lakeshore creation of vegetated buffer strips would provide not only shoreline erosion protection but also enhanced shoreland habitat for fish and wildlife. In this regard, it should be noted that the selection of appropriate shoreland protection structures is subject to the provisions of Chapter NR 328 of the *Wisconsin Administrative Code*.

*Modification of Species Composition*
Species composition management refers to a group of conservation and restoration measures that include selective harvesting of undesirable fish species and stocking of desirable species designed to enhance the angling resource value of a lake. These measures also include water level manipulation both to aid in the breeding of desirable species, for example, increasing water levels in spring to provide additional breeding habitat for pike, and to disadvantage undesirable species, for example, drawing a lake down to concentrate forage fish and increase predation success and also to strand juveniles and desiccate the eggs of undesirable species. Costs, as with water level management above, are primarily associated with loss of use; effectiveness is good, but by no means certain; and side effects include collateral damage to desirable fish populations.

More extreme measures include organized fishing events and selective cropping of certain fish species, poisoning, and enhancement of predation by stocking. In lakes with an unbalanced fishery, dominated by carp and other rough fish, chemical eradication has been used to manage the fishery. Lake drawdown is often used along with chemical treatments to expose spawning areas and eggs and concentrate fish in shallow pools, thereby increasing their availability to anglers, commercial harvesters, or chemical eradication treatments. Fish barriers are usually used to prevent reintroduction of undesirable species from up- or downstream, and the habitat thus created will benefit the desired gamefish populations. Chemical eradication is a drastic, costly measure and the end result may be highly unpredictable. Although effectiveness is generally good, such extreme measures are not considered a feasible option for Ashippun Lake.

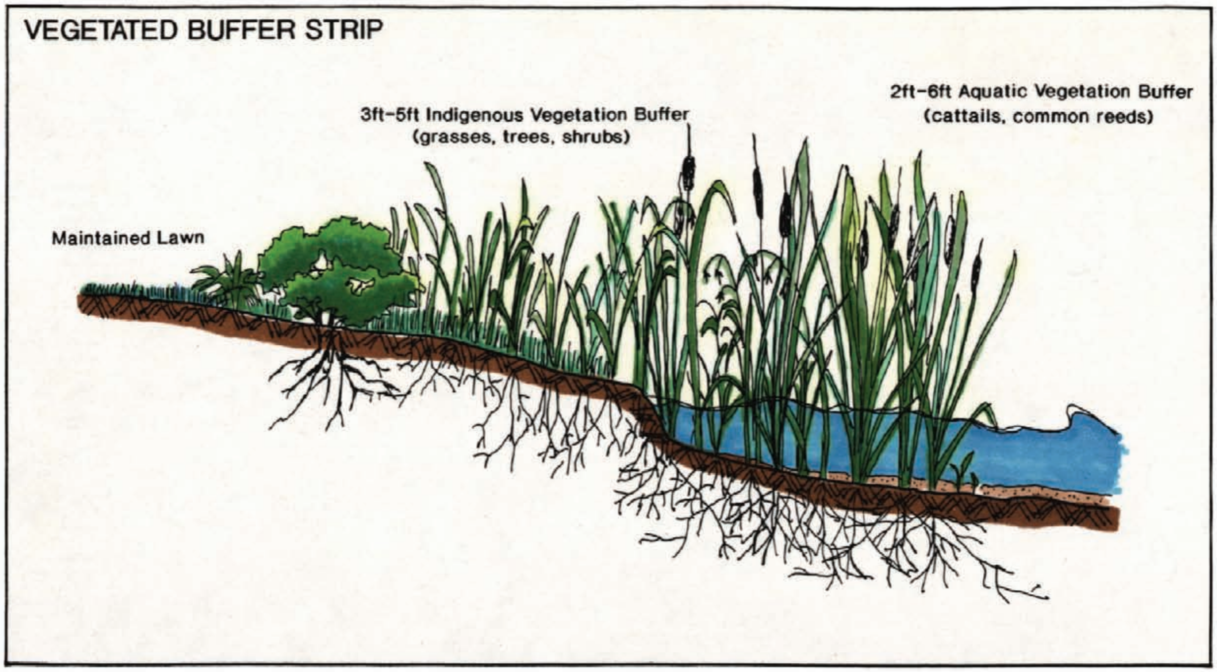
As noted in Chapter V, Ashippun Lake is currently managed for warmwater sportfish, and selective stocking has, in the past, been undertaken by the WDNR. Continued fish stocking by the WDNR or by private organizations is considered a viable option for Ashippun Lake, subject to monitoring and creel and other surveying data collected from the Lake by the WDNR. Additional fish population control measures do not appear to be warranted at this time, although rough fish populations should continue to be monitored.

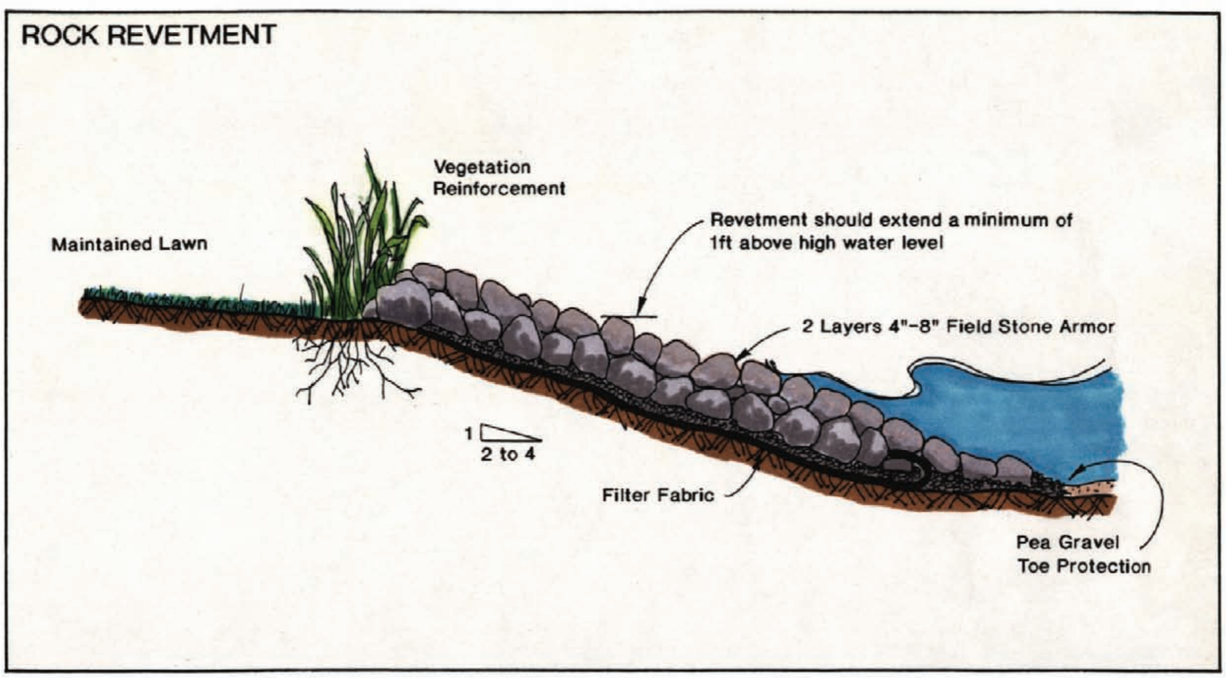
*Regulations and Public Information*
To reduce the risk of overharvest, the WDNR has placed restrictions on the number and size of certain fish species caught by anglers. The open season, size limits, and bag limits for the fish species of Ashippun Lake are given in Table 22 in Chapter V of this report. Enforcement of these regulations is critical to the success of any sound fish management program.

***Aquatic Plant Management Measures***
Aquatic plant management refers to a group of management and restoration measures aimed at both removal of nuisance vegetation and manipulation of species composition in order to enhance and provide for recreational water use. Generally, aquatic plant management measures are classified into three groups: physical measures, which include lake bottom coverings and water level management; mechanical removal measures, which include harvesting and manual removal; and chemical measures, which include using aquatic herbicides and biological control measures, which in turn include the use of various organisms, including insects. All of these measures are stringently regulated and require a State permit.

**Figure 9**

**RECOMMENDED ALTERNATIVES FOR SHORELINE EROSION CONTROL**




NOTE: Design specifications shown herein are for typical structures. The detailed design of shoreline protection structures must be based upon analysis of local conditions.

*Source: SEWRPC.*

Costs of aquatic plant management measures range from minimal for manual removal of plants using rakes and hand-pulling to upwards of $100,000 for the purchase of a mechanical plant harvester and ancillary equipment, the operational costs for which can approach $10,000 to $20,000 per year depending on staffing and operating policies. Harvesting is probably the measure best applicable to larger areas while chemical controls may be best suited to use in confined areas and for initial control of invasive plants. Planting of native plant species is largely experimental in the Lake, but can be considered a specialized shoreland management zone at the water's edge. Physical controls and mechanical harvesting may have side effects in the expansion of plant habitat and the spread of reproductive vegetative fragments.

*Aquatic Herbicides*

Chemical treatment with aquatic herbicides is a short-term method of controlling heavy growths of aquatic macrophytes and algae. Chemicals are applied to the growing plants in either liquid or granular form. The advantages of using chemical herbicides to control aquatic macrophyte growth are the relative ease, speed, and convenience of application. Herbicides also offer a degree of selectivity, targeting specific types of aquatic plants. However, the disadvantages associated with chemical control include the following:

1. The short-term, lethal effects of chemicals are relatively well known. However, properly applied, chemical applications should not result in such effects. Potential long-term, sublethal effects, especially on fish, fish-food organisms, and humans, are relatively unknown.

2. The elimination of macrophytes eliminates their competition with algae for light and nutrients. Algal blooms may then develop unless steps are taken simultaneously to control the sources of nutrient input.

3. Since much of the dead plant materials are left to decay in the lake, nutrients contained in them are rapidly released into the water and fuel the growth of algae. The decomposition of the dead plant material also consumes dissolved oxygen and increases the potential for fish kills. Accretion of additional organic matter in the sediments as a result of decomposition also increases the organic content of the soils and predisposes the sediments toward reintroduction of other (or the same) nuisance plant species. Long-term deposition of plant material may result in the need for other management measures, such as dredging.

4. The elimination of macrophyte beds destroys important cover, food sources, and spawning areas for desirable fish species.

5. Adverse impacts on other aquatic organisms may be expected. At the concentrations used for macrophyte control, Diquat has been known to kill the zooplankton *Daphnia* and *Hyalella*, both important fish foods. *Daphnia* is the primary food for the young of nearly all fish species found in the Region's lakes.[12]

6. Areas generally must be treated again in the following season and aquatic plant beds may need to be treated more than once in a summer, although certain herbicides may give relief over a period of up to three years in some lakes.

7. Many of the chemicals available often affect nontarget, desirable species, such as water lilies, as well as the "weeds," such as Eurasian water milfoil, as both species share similar biological characteristics, being dicotyledons.

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[12]*P.A. Gilderhus, "Effects of Diquat on Bluegills and Their Food Organisms,"* The Progressive Fish-Culturist*, Vol. 2, No. 9, 1967, pp. 67-74.*

The advantages and disadvantages of chemical macrophyte control also apply to the chemical control of algae. Copper, the active ingredient in algicides, may accumulate in the bottom sediments, where excessive amounts are toxic to fish and benthic animals. Fortunately, copper is rapidly eliminated from human systems and few cases of copper sensitivity among humans are known.[13]

Costs of chemical treatments vary widely. Large, organized treatments are more efficient and tend to decrease unit costs for commercial applications compared to individual treatments. Other factors, such as the type of chemical used and the number of treatments needed, are also important. Estimated costs for lakes in southeastern Wisconsin range from $240 to $480 per acre. Chemical treatments must be permitted by the State under Chapter NR 107 of the *Wisconsin Administrative Code*.

In the absence of a demonstrated need to control aquatic plants in Ashippun Lake, chemical treatment is considered to be a viable management option only in limited, nearshore areas of the Lake, around piers and structures, or in order to control nuisance aquatic plants, especially nonnative species, such as purple loosestrife and Eurasian water milfoil. Widespread use of chemical herbicides is not considered a feasible option for inclusion in the management plan at this time.

*Aquatic Plant Harvesting*

Aquatic macrophytes are mechanically harvested with specialized equipment consisting of a cutting apparatus which cuts up to five feet below the water surface and a conveyor system that picks up the cut plants and hauls them to shore. Advantages of macrophyte harvesting include the following:

1. Harvesting removes the plants from the lake. The removal of this plant biomass decreases the rate of accumulation of organic sediment. A typical harvest of submerged macrophytes from eutrophic lakes in southeastern Wisconsin can yield between 140 and 1,100 pounds of biomass per acre per year.[14]

2. Harvesting removes plant nutrients, including nitrogen and phosphorus, which would otherwise "refertilize" the lake as the plants decay. A typical harvest of submerged macrophytes from eutrophic lakes in southeastern Wisconsin can remove between four and 34 pounds of nitrogen and 0.4 to 3.4 pounds of phosphorus per acre per year. In addition to the physical removal of nutrients, plant harvesting may reduce internal nutrient recycling. Several studies have shown that aquatic macrophytes can act as nutrient pumps, recycling nutrients from the bottom sediments into the water column. Ecosystem modeling results have indicated that a harvest of 50 percent of the macrophytes in Lake Wingra, Wisconsin, could reduce instantaneous phosphorus availability by about 30 percent, with a maximum reduction of 40 to 60 percent, depending on the season.

3. Repeated macrophyte harvesting may reduce the regrowth of certain aquatic macrophytes. The regrowth of milfoil has been reported to have decreased as harvesting frequency was increased.

4. Where dense growths of filamentous algae are closely associated with macrophyte stands, they may be harvested simultaneously.

5. The macrophyte stalks remaining after harvesting provide cover for fish and fish-food organisms, and stabilize the bottom sediment against wind erosion.

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[13]*J.A. Thornton, and W. Rast, "The Use of Copper and Copper Compounds as an Algicide,"* Copper Compounds Applications Handbook*, H.W. Richardson, ed., Marcel Dekker, New York, 1997.*

[14]*James E. Breck, Richard T. Prentki, and Orie L. Loucks, editors,* Aquatic Plants, Lake Management, and Ecosystem Consequences of Lake Harvesting*, Proceedings of Conference at Madison, Wisconsin, February 14-16, 1979.*

6. Selective macrophyte harvesting may reduce stunted populations of panfish in lakes where excessive cover has adversely influenced predator-prey relationships. By allowing an increase in predation on young panfish, both gamefish and the remaining panfish may show increased growth.[15]

7. The cut plant material can be used as mulch.

The disadvantages of macrophyte harvesting include the following:

1. Harvesting is most effective in water depths greater than two feet. Large harvesters cannot operate in shallow water or around docks and buoys. Operation of harvesting equipment in shallow waters can result in significant increases in turbidity and disruption of the lake bottom and lake bottom-dwelling fauna.

2. The reduction in aquatic macrophytes by harvesting reduces their competition with algae for light and nutrients. Thus, algal blooms may develop.

3. Fish, especially young-of-the-year bluegills and largemouth bass, as well as fish-food organisms, are frequently caught in the harvester. As much as 5 percent of the juvenile fish population can be removed by harvesting. A WDNR study found that four pounds of fish were removed per ton of plants harvested.[16]

4. The reduction in aquatic macrophyte biomass by harvesting or chemical control can reduce the diversity and productivity of macroinvertebrate fish-food organisms feeding on the epibiota. Bluegills generally move into the shoreline area after sunset, where they consume these macroinvertebrates. After sunrise they migrate to open water, where they graze, primarily on zooplankton. If harvesting or chemical control shifts the dominance of the littoral macroinvertebrate fauna to sediment dwellers, the macroinvertebrate component of the bluegill diet could be restricted.[17] This would increase predation pressure on zooplankton and reduce the growth rate of the panfish; it could eventually lead to undesirable ramifications throughout the food web in a lake.

5. Macrophyte harvesting may influence the community structure of macrophytes by favoring such plants as milfoil (*Myriophyllum* spp.) that propagate from cut fractions. This may allow these plants to spread into new areas through the rerooting of the cut fractions.

6. Certain species of plants, such as coontail, are difficult to harvest due to lack of root system.

7. The efficiency of macrophyte harvesting is greatly reduced around piers, rafts, and buoys because of the difficulty in maneuvering the harvesting equipment in those restricted areas. Manual methods have to be used in these areas.

8. High capital and labor costs may be associated with harvesting programs.

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[15]*James E. Breck, and J.F. Kitchell, "Effects of Macrophyte Harvesting on Simulated Predator-Prey Interactions," edited by Breck et al., 1979, pp. 211-228.*

[16]*Wisconsin Department of Natural Resources,* Environmental Assessment Aquatic Nuisance Control (NR 107) Program*, 3rd Edition, 1990, 213 pp.*

[17]*James E. Breck, et. al.,* op. cit.

A harvesting program should be designed to provide optimal benefits and minimal adverse impacts. Small fish are common in dense macrophyte beds, but larger fish, such as largemouth bass, do not utilize these dense beds.[18] Narrow channels may be harvested to provide navigational access and "cruising lanes" for predator fish to migrate into the macrophyte beds to feed on smaller fish. "Shared access" lanes may also be cut, allowing several residents to use the same lane. Increased use of these lanes should keep them open for longer periods than would be the case if a less directed harvesting program was followed. "Clear cutting" of aquatic plants and denuding the lake bottom of flora should be avoided. However, top cutting of plants, such as Eurasian water milfoil, as shown in Figure 10, can be an effective control measure for these plants. The harvest of water lilies and emergent native plants, however, should be avoided. Due to the absence of a demonstrated need to control aquatic plants at this time, widespread mechanical harvesting is not considered a feasible option for inclusion in the plan. Mechanical harvesting of aquatic plants must be permitted by the State under Chapter NR 109 of the *Wisconsin Administrative Code*.

Native aquatic plant communities contribute most effectively to the maintenance of good water quality by providing suitable habitat for desirable fish and other aquatic organisms which promote stable or increased property values and quality of life.[19] Protecting native aquatic plant communities from disturbances can help prevent Eurasian water milfoil from spreading within a lake. Recent studies show that native plants can effectively compete with Eurasian water milfoil. However, the exotic species tends to outcompete native plants when the lake's ecosystem is stressed.[20] Stress can be brought on by watershed pollution, shoreline development, changing water levels, boating activity, carp, and aquatic nuisance controls. The maintenance of a healthy aquatic plant community has been found to be the most efficient way of managing aquatic plants, as opposed to other means of managing problems once they occur.

*Manual Harvesting*

Due to water depth limitations imposed by the size and maneuverability of the harvesters, it is not always possible for harvesters to reach the shoreline of every property. Likewise, because of the cost and other concerns relating to the use of chemical herbicides, alternative measures for the control of aquatic plant growth in specific areas of the Lake should be considered. A number of specially designed rakes are available from commercial outlets to assist lakefront homeowners in manually removing aquatic plants from the shoreline area. The advantages of these rakes are that they are easy and quick to use, and result in an immediate result, in contrast to chemical treatments that involve a waiting period. This method also removes the plants from the lake avoiding the accumulation of organic matter on the lake bottom. Unfortunately, manual harvesting is feasible in only very limited areas and is not practical for large-scale use. Nevertheless, manual harvesting does offer a reasonable level of aquatic plant control in the vicinity of docks and piers, and is therefore considered a viable option. Manual harvesting beyond a 30-feet wide recreational corridor, or within a WDNR-delineated environmentally sensitive area, must be permitted by the State under Chapter NR 109 of the *Wisconsin Administrative Code*. Pursuant to the provision of this Chapter, piers and other recreational areas must be placed within the 30-feet wide recreational corridor. Manual harvesting is considered to be a viable management option in limited, nearshore areas of the Lake, around piers and structures, or in order to control nuisance aquatic plants, especially nonnative species, such as purple loosestrife and Eurasian water milfoil.

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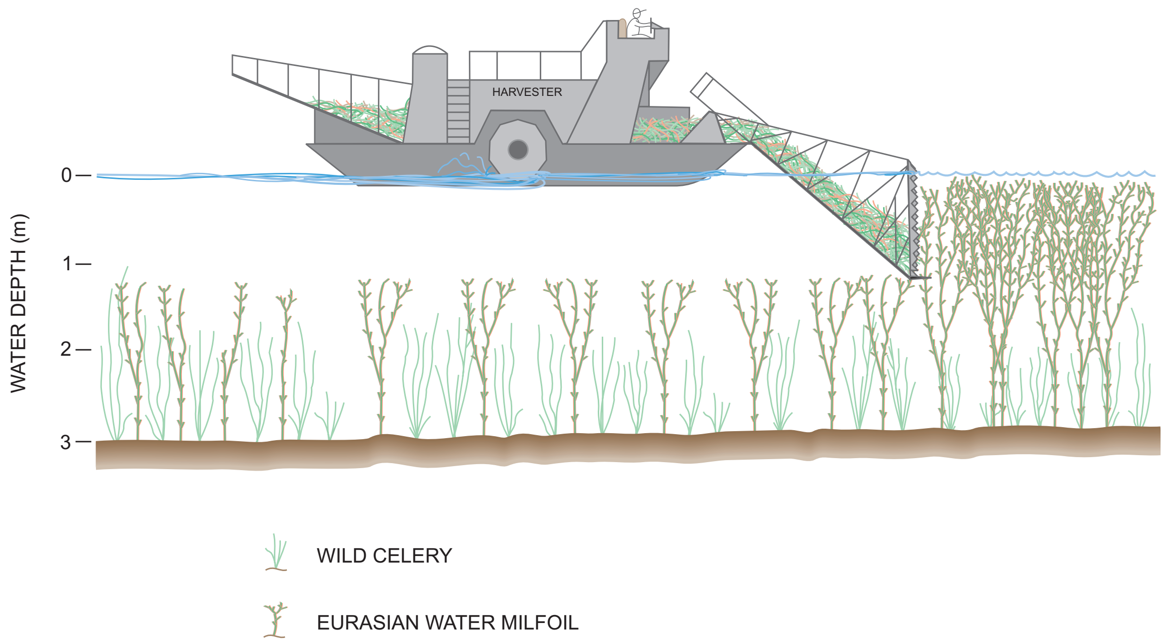
[18] *S. Nichols, Wisconsin Department of Natural Resources Technical Bulletin No. 77,* Mechanical and Habitat Manipulation for Aquatic Plant Management: A Review of Techniques*, 1974.*

[19] *Roy Bouchard, Kevin J. Boyle, and Holly J. Michael,* Water Quality Affects Property Prices: A Case Study of Selected Maine Lakes*, Miscellaneous Report 398, February 1996.*

[20] *Wisconsin Department of Natural Resources,* Eurasian Water Milfoil in Wisconsin: A Report to the Legislature*, 1992.*

Figure 10

**PLANT CANOPY REMOVAL WITH AN AQUATIC PLANT HARVESTER**




NOTE: Selective cutting or seasonal harvesting can be done by aquatic plant harvesters. Removing the canopy of Eurasian water milfoil may allow native species to reemerge.

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

*Biological Controls*

Another alternative approach to controlling nuisance weed conditions, in this particular case Eurasian water milfoil, is biological control. Classical biological control has been successfully used to control both weeds and herbivorous insects.[21] Recent documentation states that *Eurhychiopsis lecontei*, an aquatic weevil species, has the potential as a biological control agent for Eurasian water milfoil. In 1989, the weevil was discovered during a study investigating a decline of Eurasian water milfoil growth in a Vermont pond. *Eurhychiopsis* proved to have significant negative effects on Eurasian water milfoil in the field and in the lab. The adult weevil feeds on the milfoil causing lesions which make the plant more susceptible to pathogens, such as bacteria or fungi, while the weevil larvae burrows in the stem of the plant causing enough tissue damage for the plant to lose buoyancy and collapse.[22] The few studies that have been done since that time have indicated the following potential advantages to use of this weevil as a means of Eurasian water milfoil control:

1. *Eurhychiopsis lecontei* is known to cause fatal damage to the Eurasian water milfoil plant and over a period of time has the potential to cause a decrease in the milfoil population.

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[21]*C.B. Huffacker, D.L. Dahlsen, D.H. Janzen, and G.G. Kennedy,* Insect Influences in the Regulation of Plant Population and Communities*, 1984, pp. 659-696; C.B. Huffacker and R.L. Rabb, editors,* Ecological Entomology*, John Wiley, New York, New York, USA.*

[22]*Sally P. Sheldon, "*The Potential for Biological Control of Eurasian Water Milfoil (*Myriophyllum spicatum*) 1990-1995 Final Report*," Department of Biology, Middlebury College, February 1995.*

2. *Eurhychiopsis lecontei* larvae are easy to produce.

3. *Eurhychiopsis lecontei* are not known to cause damage to existing native aquatic plants.

The potential disadvantages of using *Eurhychiopsis lecontei* include:

1. The studies done on *Eurhychiopsis* are very recent and more tests are necessary to determine if there are significant adverse effects.[23]

2. Since the upper portion of the Eurasian water milfoil plant is preferred by the weevil, harvesting would have to be extremely limited or not used at all in conjunction with this type of aquatic plant management control.

Relatively few studies have been completed using *Eurhychiopsis lecontei* as a means of aquatic plant management control. These have resulted in variable levels of control, and, while priced competitively with aquatic herbicides, are not considered a viable option for Ashippun Lake at this time. Use of biological control agents must be permitted by the State under Chapter NR 109 of the *Wisconsin Administrative Code*. While the use of biological control agents, such as the Eurasian water milfoil weevil and the beetles, *Hylobius transversovittatus*, *Galerucella pusilla*, *Galerucella calmariensis*, *Nanophyes brevis*, and *Nanophyes marmoratus,* used to control infestations of purple loosestrife in wetlands and along shorelands has been shown to be beneficial in certain circumstances, the use of other biological control agents is prohibited in Wisconsin; the use of the grass carp, *Ctenopharyngodon idella*, for aquatic plant control is expressly prohibited. Given the presence of both Eurasian water milfoil and purple loosestrife in and around Ashippun Lake, the use of biological control agents is considered to be a viable management option, especially for the control of purple loosestrife. Should the use of biological control agents be contemplated, chemical herbicides should not be used.

*Lake Bottom Covering*

Lake bottom covers and light screens provide limited control of rooted plants by creating a physical barrier which reduces or eliminates the sunlight available to the plants. They have been used to create swimming beaches on muddy shores, to improve the appearance of lakefront property, and to open channels for motorboating. Sand and gravel are usually readily available and relatively inexpensive to use as cover materials, but plants readily recolonize areas so covered in about a year. Synthetic materials, such as polyethylene, polypropylene, fiberglass, and nylon, can provide relief from rooted plants for several years. The screens are flexible and can be anchored to the lakebed in spring or draped over plants in summer.

The advantages of bottom covers and screens are that control can be confined to specific areas, the covers and screens are usually unobtrusive and create no disturbance on shore, and the covers are relatively easy to install over small areas. The disadvantages of bottom covers and screens are that they do not reduce eutrophication of the lake, they are expensive, they are difficult to spread and anchor over large areas or obstructions, they can slip on steep grades or float to the surface after trapping gases beneath them, and they may be difficult to remove or relocate.

Screens and covers should not be used in areas of strong surfs, heavy angling, or shallow waters where motorboating occurs. They should also not be used where aquatic vegetation is desired for fish and wildlife habitat. To minimize interference with fish spawning, screens should be placed before or after spawning. A permit from the WDNR is required for use of sediment covers and light screens. Permits require inspection by WDNR

[23] *The use of* Eurhychiopsis *sp. on an experimental basis to control Eurasian water milfoil was monitored in selected Wisconsin lakes by the Wisconsin Department of Natural Resources and the University of Wisconsin-Stevens Point from 1995 through 1998. These results indicated mixed success, suggesting that this organism has specific habitat requirements that limit its utility as a Eurasian water milfoil control agent within Wisconsin.*

staff during the first two years, with subsequent permits issued for three-year periods. Annual removal of such barriers is generally required as a permit condition.

The estimated cost of lake bottom covers that would control plant growth along a typical shoreline property, an area of about 700 square feet, ranges from $100 for burlap to $300 for aquascreen. Placement of lake bottom screens requires a WDNR permit pursuant to Chapter 30 of the *Wisconsin Statutes*. Because of the limitations involved, placement of lake bottom covers as a method to control aquatic plant growth is not considered a viable option for Ashippun Lake.

Use of sand blankets and pea gravel deposits has also been proposed as a physical barrier to aquatic plant growth in certain situations. Placement of materials on the bed of a navigable lake or waterway also requires a WDNR permit pursuant to Chapter 30 of the *Wisconsin Statutes*, and the use of these materials is generally confined to the creation and augmentation of swimming beaches. Use of these materials for aquatic plant management purposes is not considered feasible as deposition of sediments above the sand or gravel layer limits the longer term viability of this technique.

*Aquatic Plant Monitoring*

Due to the lack of a significant amount of reported problems concerning aquatic plants as an impediment to either navigational or recreational activities, preparation of a "stand-alone" aquatic plant management plan is not recommended at this time. However, reconnaissance surveys of the aquatic plant communities on a regular basis, either annually or every two to four years, is considered a feasible option. Results of such surveys could indicate the necessity for the development of an aquatic plant management plan with subsequent updates every three to five years.

*Public Informational Programming*

Aquatic plant management usually centers on the eradication of nuisance aquatic plants for the improvement of recreational lake use. The majority of the public views all aquatic plants as "weeds" and residents often spend considerable time and money removing desirable plant species from a lake without considering their environmental impacts. As shown in Table 15 in Chapter V of this report, many aquatic plants have positive ecological value within the lake ecosystem, and most native aquatic plants rarely interfere with human water uses. Thus, public information is an important component of an aquatic plant management program and should include informational programming on:

1. The types of aquatic plants in Ashippun Lake and their value to water quality, fish, and wildlife.

2. The preservation of existing stands of desirable plant species.

3. The identification of nuisance species and the methods of preventing their spread.

4. Alternative methods for controlling existing nuisance plants, including the positive and negative aspects of each method.

An organized aquatic plant identification/education day is one method of providing hands-on education to lake residents. Other sources of information and technical assistance include the WDNR and the University of Wisconsin-Extension (UWEX). The aquatic plant species lists provided in Chapter V, and the illustrations of common aquatic plants present in Ashippun Lake appended hereto as Appendix A, may serve as a checklist for individuals interested in identifying the plants near their residences. Residents can observe and record changes in the abundance and types of plants in their part of a lake on an annual basis.

Of the submerged floating and free-floating aquatic plant species found in Ashippun Lake, Eurasian water milfoil is one of the few species likely to cause lake-use problems. Eurasian water milfoil, unlike most aquatic plants, can reproduce from fragments and often forms dense, monotypic beds with little habitat value for fish or waterfowl. Lakeshore residents should be encouraged to collect fragments that wash ashore after storms and, especially, from weekend boat traffic. The plant fragments can be used as mulch on flower gardens or ornamental planting areas.

Likewise, lake users should be encouraged to inspect boats and trailers both prior to launch and following recovery as Eurasian water milfoil and other aquatic plants can be transported between lakes as fragments on boats and boat trailers. This effort also limits the likelihood of transporting zebra mussel, *Dreissena polymorpha*, between lakes and into new areas of the Lake.

To prevent unwanted introductions of plants and invasive aquatic animals into lakes, boaters should remove all plant fragments from their boats and trailers when exiting a lake, and allow wet wells, engine water jackets, and bilges to dry thoroughly for up to one week. Alternatively, boaters can run their vessels through a car wash, where high pressure, high temperature water sprays can remove and destroy organisms, such as the zebra mussel juveniles (veligers).[24] Providing the opportunity for the removal of plant fragments at the boat landing on Ashippun Lake, and provision of signage at the boat landing, including provision of disposal containers at the boat landing, may help motivate boaters to utilize this practice. Posters and pamphlets are available from the WDNR and UWEX that provide information and illustrations of milfoil, zebra mussel, and other nonnative aquatic species; discuss the importance of removing plant fragments from boats; and, remind boaters of their duty in this regard.

In accordance with measures to prevent unwanted introductions and spread of invasive aquatic biota, as well as to monitor native aquatic plant populations, periodic reconnaissance and surveying updates of aquatic plant species, especially in proximity to the public recreational boating access site, are considered viable options in this management plan.

**Water Use Management**

Regulatory measures provide a basis for controlling lake use and use of the shorelands around a waterbody. On land, shoreland zoning, requiring set backs and shoreland buffers can protect and preserve views both from the water and from the land, controls development around a lake to minimize its environmental impacts and manages public and private access to a waterbody. On water, recreational use zoning can provide for safe and multiple-purpose use of lakes by various groups of lake users and protect environmentally sensitive areas of a lake. Use zoning can take the form of allocating times of use, such as the annual fishing season established by the State, or areas of use, wherein the types or rate of use is controlled, as in the case of shallow water, slow-no-wake speed limits.

A key issue in zoning a waterbody for use is equity; the same rules must apply to both riparian owners/residents and off-lake users. This condition is usually met in situations where use zoning is motivated by the protection of fish habitat, for example, as both on- and off-lake users would appreciate an enhanced fishery. Costs are relatively low, associated with creating and posting the ordinance, and effectiveness can be good with regular/consistent enforcement. Costs increase for measures requiring buoyage.

Currently, watercraft are restricted to slow-no-wake speeds within approximately 200 feet of shore or 150 feet of pierheads. These areas typically coincide with water depths of less than five feet in depth. Consequently, the Town of Oconomowoc should continue to enforce recreational boating ordinances, and winter lake use ordinances, appended hereto as Appendix E. Further water use ordinances are not considered to be viable options at this time, although all ordinances should be reviewed periodically for currency with applicable State and Federal regulations.

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[24] *See Wisconsin Department of Natural Resources Publication No. PUBL-WR-383 95-REV.,* Zebra Mussel Boater's Guide*, 1995; Wisconsin Department of Natural Resources Publication No. PUBL-WR-463 96-REV.,* The Facts...On Eurasian Water Milfoil*, February 1996.*

## ANCILLARY MANAGEMENT MEASURES

**Public Informational and Educational Programming**

Educational and informational brochures and pamphlets, of interest to homeowners and supportive of the recreational use and shoreland zoning regulations, are available from the UWEX, WDNR, and Waukesha County Department of Parks and Land Use. These latter cover topics, such as beneficial lawn care practices and household chemical use guidelines. These brochures could be provided to homeowners through local media, direct distribution, or targeted school or public library displays. Other Waukesha County lake organizations, in cooperation with the Waukesha County Department of Parks and Land Use, have compiled and distributed information packets to landowners on water quality protection measures and residential "good housekeeping" practices. Many of these ideas can be integrated into ongoing, larger-scale municipal activities, such as anti-littering campaigns, recycling drives, and similar pro-environment activities.

In addition to public informational programming, or informal educational programming, discussed above, there are a number of school-based educational opportunities that the community can utilize. A number of these programs are currently being implemented at the middle school level throughout the region. Extension of these educational opportunities at the high school level is recommended. Programs and curricula, such as Project WET, Adopt-A-Lake, and the Waukesha Water Walk program are available from and supported by the UWEX and Waukesha County, respectively. Through these programs, youth have an opportunity to experience "hands on" the aquatic environment and become better informed about current and future lake issues and concerns.

Finally, the participation of the Ashippun Lake community in the WDNR Self-Help Monitoring Program should be continued. Volunteer monitoring under the auspices of the WDNR "Self-Help Monitoring Program" involves citizens in taking Secchi-disc transparency readings in the Lake at regular intervals. The Lake Coordinator of the WDNR-Southeast Region can assist in enlisting volunteers in this program. The information gained at first hand by the public during participation in this program increases the credibility of the proposed changes in the nature and intensity of use to which the Lake is subjected.

## SUMMARY

This chapter has described options that could be employed in managing the types of problems recorded as occurring in Ashippun Lake and which could, singly or in combination, assist in achieving and maintaining the water quality and water use objectives set forth in Chapter VI of the lake watershed inventory. Selected characteristics of these measures are summarized in Table 32.

An evaluation of the potential management measures for improving the Ashippun Lake water quality was carried out on the basis of the effectiveness, cost, and technical feasibility of the measures. Those alternative measures not considered further at this time include: phosphorus precipitation and inactivation, drawdown by water level control modifications, dredging, mechanical control of aquatic plants, and physical control of aquatic plants by lake bottom covering. The measures to be considered further for incorporation into the recommended plan are described in Chapter VIII.

**Table 32**

**SELECTED CHARACTERISTICS OF ALTERNATIVE LAKE MANAGEMENT MEASURES FOR ASHIPPUN LAKE**

| Plan Element | Subelement | Alternative Management Measures | Estimated Costs: 2000 Capital | Estimated Costs: 2000 Operation and Maintenance | Considered Viable for Inclusion in Plan |
|---|---|---|---|---|---|
| Land Use | Zoning | Implement regional land use and county development plans within watershed<br>Maintain existing density management in lakeshore areas; consider conservation development principles<br>Develop stormwater management ordinances in riparian communities; periodic review of stormwater ordinances | - -<br>- -<br>- - | - -<br>- -<br>- - | Yes<br>Yes<br>Yes |
| | Protecting Environmentally Sensitive Lands | Implement regional natural areas and critical species habitat protection and management plan recommendations within watershed | - - | - - | Yes |
| Pollution Abatement | General Nonpoint Source Pollution Abatement | Implement regional water quality management plan, and county land and water resource management plan recommendations within watershed | - - | - - | Yes |
| | Rural Nonpoint Source Controls | Develop farm conservation plans that encourage conservation tillage, contour farming, contour strip cropping, crop rotation, grassed waterways, and pasture and streambank management in agricultural areas of the watershed | - -[a] | - -[a] | Yes |
| | Urban Nonpoint Source Controls | Promote urban housekeeping practices, public educational programming, and grassed swales<br>Implement additional urban nonpoint source controls, including street sweeping, catch basin cleaning, leaf litter and garden refuse collection, materials storage facility protection, and stormwater management measures in urban areas of the watershed | - -[a]<br>- -[a] | - -[a]<br>- -[a] | Yes<br>Yes |
| | Developing Area Nonpoint Source Controls | Enforce construction site erosion control ordinances requiring soil stabilization, surface roughening, barriers, diversion swales, sediment traps and basins | $250 per acre | $25 per acre | Yes |
| | Onsite Sewage Disposal System Management | Implement onsite sewage disposal system management, including inspection and maintenance | - - | $100[b] | Yes |
| Water Quality | Phosphorus and Nutrient Load Management | Conduct alum treatment to achieve phosphorus inactivation in lake sediments | - - | - - | No |
| | | Promote nutrient load reduction within the Lake basin through sediment management | - - | Variable | No |
| | Hydraulic and Hydrologic Management | Modify outlet control operations<br>Drawdown<br>Water level stabilization<br>Dredging | - -<br>- -<br>- -<br>- - | - -<br>- -<br>- -<br>- - | No<br>No<br>No<br>No |

**Table 32 (continued)**

| Plan Element | Subelement | Alternative Management Measures | Estimated Costs: 2000 Capital | Estimated Costs: 2000 Operation and Maintenance | Considered Viable for Inclusion in Plan |
|---|---|---|---|---|---|
| Aquatic Biota | Fisheries Management | Protect fish habitat | - - | - - | Yes |
| | | Maintain shoreline and littoral zone fish habitat by maintaining existing shoreline structures and repair as necessary using vegetative means insofar as practicable; reconstruction may require WDNR Chapter 30 permits | - - | - - | Yes |
| | | Continue stocking of selected game fish species and monitor rough fish populations | - - | - - | Yes |
| | | Enforce size and catch limit regulations | - - | - - | Yes |
| | Aquatic Plant Management | Limited use of aquatic herbicides for control of nuisance plants such as Eurasian water milfoil and purple loosestrife | - - | Variable | Yes[d] |
| | | Widespread mechanical harvesting of aquatic macrophytes to control nuisance plants and maintain navigational channels | $100,000[e] | $10,000-$20,000[f] | No |
| | | Manually harvest aquatic plants from around docks and piers | $100 | - - | Yes |
| | | Employ biological controls using inocula of Eurasian water milfoil weevils and/or purple loosestrife beetles | - - | Variable | Yes |
| | | Use sediment covers to shade out aquatic plant growth around piers and docks | - - | $40 to $220 per 700 square feet | No |
| | | Conduct public informational and educational programming on aquatic plants and options for their management | - - | $100 to $300 | Yes |
| | | Collect floating plant fragments from shoreland areas to minimize rooting of Eurasian water milfoil | - - | - - | Yes |
| | | Encourage methods of preventing unwanted intrusions of invasive biota at public recreational boat access | - - | - - | Yes |
| Water Use | Recreational Use Management | Enforce boating regulations to maximize public safety | - - | - - | Yes |
| | | Develop time and/or space zoning schemes to limit surface use conflicts | - - | - - | No |
| Ancillary Management Measures | Public Informational and Educational Programming | Conduct public informational programming utilizing seminars and distribution of informational materials | - - | - - | Yes |
| | | Support participation of schools in Project WET, Adopt-A-Lake, etc. | - - | - - | Yes |
| | | Continue participation in Self-Help Monitoring Program | - - | $200 | Yes |

[a]*Cost of nonpoint source management practices to be determined by detailed farm plans and stormwater management plans.*

[b]*Onsite sanitary sewage disposal systems installed after 1983 are subject to regular inspection and maintenance requirements under Waukesha County Code; the cost shown represents an average pumping cost per property.*

[c]*In limited areas when necessary to control exotic, invasive species.*

[d]*Cost-share available through WDNR may lower capital cost.*

[f]*Dependent upon staffing needs and cost-share availability through WDNR.*

*Source: SEWRPC.*

## Chapter VIII

# RECOMMENDED MANAGEMENT PLAN FOR ASHIPPUN LAKE

## INTRODUCTION

This chapter presents a recommended management plan for Ashippun Lake. The plan is based upon inventories and analyses of land use and land and water management practices, pollution sources in the area tributary to Ashippun Lake, the physical and biological quality of the waters of the Lake, recreational use and population forecasts, and an evaluation of alternative lake management measures. The recommended plan sets forth means for: 1) providing water quality conditions suitable for full-body contact recreational use and the maintenance of healthy communities of warmwater fish and other aquatic life, 2) reducing the severity of existing or perceived problems which constrain or preclude desired water uses, 3) improving opportunities for water-based recreational activities, and 4) protecting environmentally sensitive areas. The elements of the recommended plan were selected from among the alternatives described in Chapter VII, and evaluated on the basis of those feasible alternatives, set forth in Table 32 in Chapter VII of this report, that may be expected to best meet the foregoing lake management objectives.

Analyses of water quality and biological conditions indicate that the general condition of the water of Ashippun Lake is good. There appear to be few impediments to water-based recreation, although access by recreational watercraft is limited in some portions of the Lake by water depths and growths of aquatic macrophytes. Nevertheless, based upon a review of the inventory findings and consideration of planned developments within the area tributary to the Lake, as set forth in the adopted Waukesha County development plan, measures will be required to continue to protect and maintain the high quality of the Lake for future lake users. Therefore, this plan sets forth recommendations for: land use management in the area tributary to Ashippun Lake, protection of environmentally sensitive lands, nonpoint source pollution controls, water quality improvement, hydraulic and hydrologic management, aquatic plant and fisheries management, recreational use management, and informational programming. These measures complement and refine the watershedwide land use controls and management measures recommended in the adopted regional water quality management plan[1] and the Waukesha County land and water resource management plan.[2]

[1]SEWRPC Planning Report No. 30, *A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000*, Volume One, *Inventory Findings*, September 1978; Volume Two, *Alternative Plans*, February 1979; and Volume Three, *Recommended Plan*, June 1979. See also SEWRPC Memorandum Report No. 93, *A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995.

[2]*Waukesha County,* Land and Water Resource Management Plan: 2006-2010*, March 2006.*

The recommended management measures for Ashippun Lake are graphically summarized on Map 16, and are listed in Table 33. The recommended plan measures are more fully described in the following paragraphs. The recommended management agency responsibilities for watershed land management also are set forth in Table 33.

## WATERSHED MANAGEMENT RECOMMENDATIONS

### Land Use Management

A fundamental element of a sound management plan and program for Ashippun Lake is the promotion of a sound land use pattern within the area tributary to the Lake. The type and location of rural and urban land uses in the tributary area will determine, to a considerable degree, the character, magnitude, and distribution of nonpoint sources of pollution; the practicality of, as well as the need for, various land management measures; and, ultimately, the water quality of the Lake.

The recommended land use plan for the area tributary to Ashippun Lake under buildout conditions is described in Chapter III. The framework for the plan is the regional land use plan as prepared and adopted by the Southeastern Wisconsin Regional Planning Commission (SEWRPC), as refined through the Waukesha County development plan.[3] The recommended land use and county development plans envision that urban land use development within the area tributary to Ashippun Lake will occur primarily at low densities and only in areas which are covered by soils suitable for the intended use; which are not subject to special hazards, such as flooding; and which are not environmentally sensitive, that is, not encompassed within the Regional Planning Commission-delineated environmental corridors described in Chapter V.

#### *Development in the Shoreland Zone*

A major land use issue which has the potential to affect Ashippun Lake is the redevelopment of existing lakefront properties, replacing lower-density uses with higher-density, multi-family dwellings with potential for increased roof areas, parking areas, and other areas of impervious surfaces. Replacement of a pervious land surface with an impervious surface will increase the rate of stormwater runoff to the Lake, increase pollutant loadings on the Lake, and will reduce groundwater recharge. While these effects can be moderated to some extent through structural stormwater management measures, there is likely to be an adverse impact on the Lake from significant redevelopment in the area tributary to the Lake involving conversion to higher-density land uses. For this reason, maintenance of the historic low- and medium-density residential character of the shoreline of Ashippun Lake to the maximum extent practical is recommended.

It is further recommended that lakefront developments, as well as setback and landscaping provisions, be carefully reviewed by Waukesha County, the Town of Oconomowoc and the Wisconsin Department of Natural Resources (WDNR). Such review would address specific shoreland zoning requirements, and could consider the stormwater and urban nonpoint source pollution abatement practices proposed to be included in shoreland development activities. Provision for shoreland buffers, use of appropriate and environmentally friendly landscaping practices, and inclusion of stormwater management measures that provide water quality benefits are practices to be encouraged.

#### *Development in the Tributary Area*

Another land use issue which has the potential to affect the Lake is the potential development for urban uses of the agricultural and other open space lands in the tributary area. As previously noted, large-lot residential development is occurring in areas of the lake watershed, especially around the periphery, in which such development was not envisioned in the adopted regional land use plan and county development plan. If this trend continues, much of the open space areas remaining in the area will be replaced over time with large-lot urban development. This may significantly increase the pollutant loadings to the Lake and increase the pressures for

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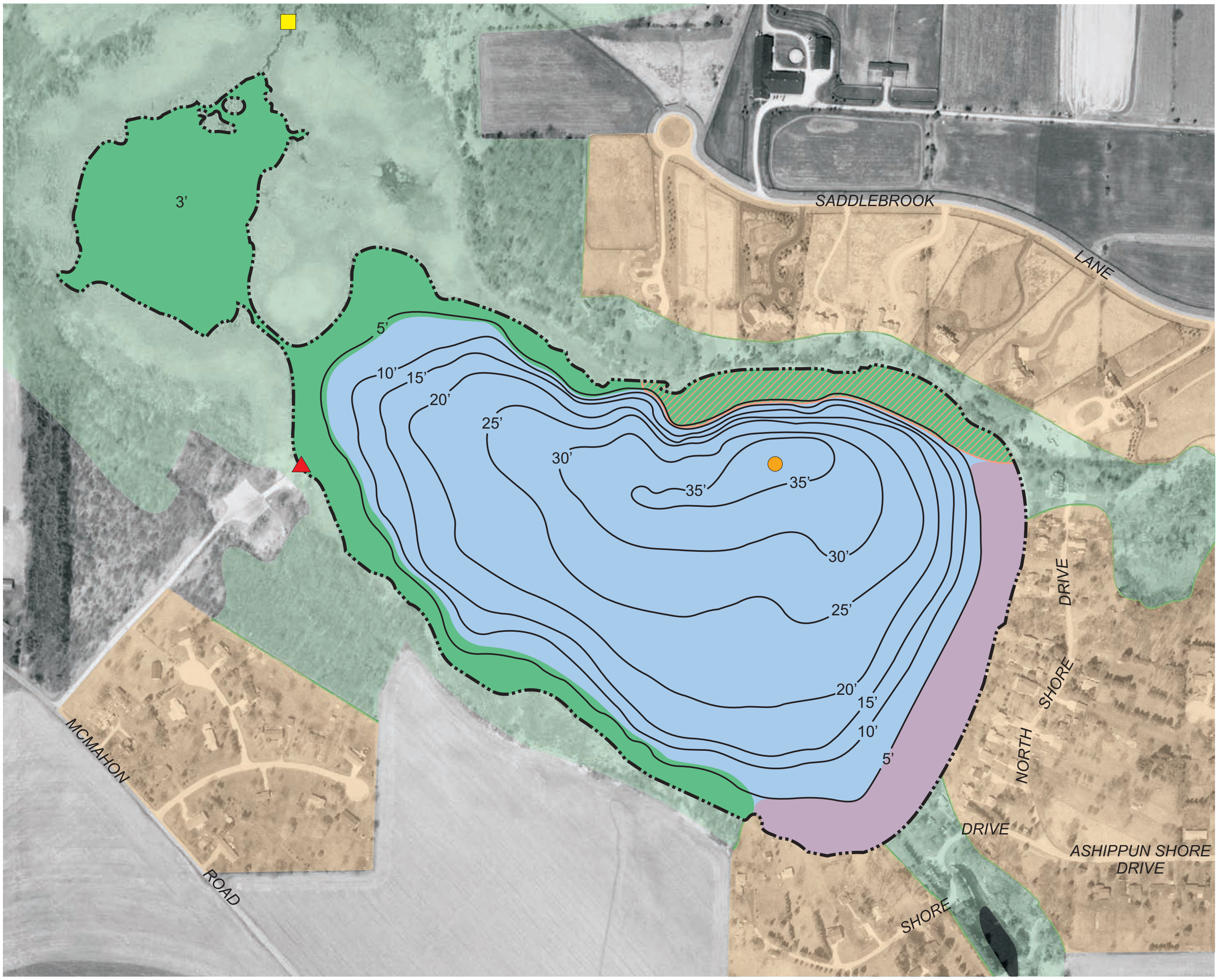
[3]*SEWRPC Community Assistance Planning Report No. 209,* A Development Plan for Waukesha County, Wisconsin*, August 1996.*

Map 16

**RECOMMENDED MANAGEMENT PLAN ELEMENTS FOR ASHIPPUN LAKE**




DATE OF PHOTOGRAPHY: MARCH 2000

- 20' — WATER DEPTH CONTOUR IN FEET
- MAINTAIN PUBLIC RECREATIONAL BOATING ACCESS
- CONTINUE PERIODIC WATER QUALITY MONITORING
- CONDUCT HYDRAULIC STUDY - CONSIDER PLACEMENT OF FLOW MANAGEMENT STRUCTURE
- PROTECT ENVIRONMENTALLY SENSITIVE LANDS
- OPEN WATER: NO MANAGEMENT REQUIRED
- WISCONSIN DEPARTMENT OF NATURAL RESOURCES-DELINEATED CHAPTER NR 107 ENVIRONMENTALLY SENSITIVE AREA
  - CHEMICAL TREATMENT: LIMITED TO NONNATIVE SPECIES
  - HARVESTING: LIMITED TO NONNATIVE SPECIES
  - MANUAL CONTROL: AROUND PIERS AND DOCKS ONLY
- RIPARIAN ZONE
  - CHEMICAL TREATMENT: LIMITED TO NONNATIVE SPECIES AND AROUND PIERS AND DOCKS
  - HARVESTING: LIMITED TO NONNATIVE SPECIES
  - MANUAL CONTROL: AROUND PIERS AND DOCKS ONLY
- PROPOSED RIPARIAN ZONE EXPANSION
- MAINTAIN HISTORIC LAKEFRONT RESIDENTIAL
  - DWELLING DENSITIES: OBSERVE GUIDELINES IN WAUKESHA COUNTY DEVELOPMENT PLAN

WATERSHED MANAGEMENT

- PROMOTE GOOD HOUSEKEEPING PRACTICES PREPARE FARM PLANS FOR AGRICULTURAL LANDS
- CONDUCT ONSITE SEWAGE DISPOSAL SYSTEMS INSPECTION PROGRAM

FISHERIES MANAGEMENT

- PERIODICALLY CONDUCT FISHERIES SURVEYS: MODIFY STOCKING AS NECESSARY; PROTECT FISH AND SHORELINE HABITAT
- CONTROL NONNATIVE SPECIES AS NECESSARY

PUBLIC INFORMATION AND EDUCATION

- CONTINUE PUBLIC AWARENESS PROGRAMS
- SUPPORT ENVIRONMENTAL EDUCATION IN LOCAL SCHOOLS

GRAPHIC SCALE

0 300 600 FEET

*Source: SEWRPC.*

## Table 33

## RECOMMENDED MANAGEMENT PLAN ELEMENTS FOR ASHIPPUN LAKE

| Plan Element | Subelement | Location | Recommended Management Measures | Management Responsibility |
|---|---|---|---|---|
| Land Use | Zoning | Entire watershed | Observe guidelines set forth in the regional land use plan and Waukesha County development plan | Waukesha County, Town of Oconomowoc |
| | | Lakeshore areas | Maintain historic lake front residential dwelling densities to extent practicable and continue to enforce setback requirements; consider conservation development principles | Waukesha County, Town of Oconomowoc |
| | | Entire watershed | Develop and periodically review ordinances especially in regard to stormwater management in areas of new development | Waukesha County, Town of Oconomowoc |
| | Protecting Environmentally Sensitive Lands | Ashippun Lake, Meadow View School Bog, Ashippun River Lowlands, Ashippun River, Ashippun Lake undeveloped shoreline | Establish adequate protection of wetlands and shorelands, and other environmental corridor lands and isolated natural resource features, and consider public or private acquisition of features of local or greater significance, as set forth in the regional natural areas and critical species habitat protection and management plan | Waukesha County, Town of Oconomowoc, Ashippun Lake Protection and Rehabilitation District |
| Pollution Abatement | General Nonpoint Source Pollution Abatement | Entire watershed | Implement recommendations made in the county and regional plans for management of land and water resources | Waukesha County, Town of Oconomowoc |
| | Rural Nonpoint Source Controls | Entire watershed | Promote sound rural land management practices to reduce soil loss and contaminant loadings through preparation of farm conservation plans in accordance with the county land and water resource management plan | USDA, WDATCP, Waukesha County |
| | Urban Nonpoint Source Controls | Entire watershed | Promote sound urban housekeeping and yard care practices through informational programming | Waukesha County, Town of Oconomowoc, Ashippun Lake Protection and Rehabilitation District |
| | | Entire watershed | Implement various urban nonpoint source controls including stormwater management measures | Waukesha County, Town of Oconomowoc |
| | Developing Area Nonpoint Source Controls | Entire watershed | Enforce construction site erosion control and stormwater management ordinances | Waukesha County, Town of Oconomowoc |
| | | New clustered developments in conservation subdivisions | Develop stormwater management systems where appropriate densities exist | Waukesha County, Town of Oconomowoc |
| | Onsite Sewage Disposal System Management | Entire watershed | Inspect and maintain onsite sewage disposal systems and provide system maintenance information to residents | Waukesha County, Town of Oconomowoc, Ashippun Lake Protection and Rehabilitation District, private landowners |

**Table 33 (continued)**

| Plan Element | Subelement | Location | Recommended Management Measures | Management Responsibility |
|---|---|---|---|---|
| Water Quality | Surface Water Quality Management | Main lake basin | Continue participation in Expanded WDNR Self-help Monitoring Program | WDNR, USGS, UW-SP, Ashippun Lake Protection and Rehabilitation District |
| | | | Consider periodic participation in U.S. Geological Survey or University of Wisconsin-Stevens Point Environmental Task Force TSI monitoring program | |
| Water Quantity | Surface Water Quantity Management | Unnamed tributary draining from Ashippun Lake to Ashippun River | Conduct a hydrologic and hydraulic analysis of the unnamed tributary draining from Ashippun Lake to Ashippun River | USGS and Ashippun Lake Protection and Rehabilitation District |
| Aquatic Biota | Fisheries Management | Entire lake | Conduct fish survey to determine management and stocking needs; conduct periodic creel census<br>Continue stocking of selected game fish species and monitor populations of rough fish<br>Enforce size and catch limit regulations | WDNR, Ashippun Lake Protection and Rehabilitation District |
| | | Lakeshore areas | Protect and maintain fish habitat in shoreline and littoral zone areas, and especially in sensitive areas<br>Encourage shoreline restoration projects and promote consistency in application of landscaping practices in sensitive shoreland areas, through informational programming and demonstration sites<br>Maintain existing shoreline structures and repair as necessary using vegetative means insofar as practicable; reconstruction may require WDNR Chapter 30 permits | WDNR, Ashippun Lake Protection and Rehabilitation District, private landowners |
| | Aquatic Plant Management | Entire Lake | Conduct periodic reconnaissance surveys of aquatic plant communities<br>Limited use of chemical aquatic herbicides to control nuisance aquatic plants such as purple loosestrife and Eurasian water milfoil where necessary<br>Use biological control agents to control purple loosestrife where necessary<br>Provide and conduct programming and information on aquatic plants and various management measures | WDNR, Ashippun Lake Protection and Rehabilitation District |
| | | Selected areas of the Lake | Manually harvest aquatic plants from around docks and piers | WDNR, Ashippun Lake Protection and Rehabilitation District |
| | | Lakeshore areas | Collect floating plant fragments from shoreland areas to minimize rooting of Eurasian water milfoil and deposition of organic materials in Lake | private landowners |

**Table 33 (continued)**

| Plan Element | Subelement | Location | Recommended Management Measures | Management Responsibility |
|---|---|---|---|---|
| Water Use | Recreational Use Management | Entire lake | Enforce regulations governing the operation of watercraft and improve posting and notification of regulations and ordinances, including signage and materials at public recreational access site to aid in the identification and control of exotic species | Waukesha County, Town of Oconomowoc, WDNR, Ashippun Lake Protection and Rehabilitation District |
| Ancillary Management Measures | Public Informational and Educational Programming | Entire watershed | Conduct informational and educational seminars and programs and distribute informational and educational materials | Waukesha County, Town of Oconomowoc, WDNR, Ashippun Lake Protection and Rehabilitation District |
| | | Entire lake | Support the participation of local schools in Project WET, Adopt-A-Lake, etc. | Waukesha County, Town of Oconomowoc, WDNR, Ashippun Lake Protection and Rehabilitation District |

*Source: SEWRPC.*

recreational use of the Lake. Under the full buildout condition envisioned under the Waukesha County development plan,[4] a significant portion of the undeveloped lands outside of the environmental corridors and other environmentally sensitive areas could potentially be developed for low-density urban uses.

The existing zoning in the drainage basin permits development, generally on large suburban-density lots, over much of the remaining open lands other than the environmental corridors. Control of shoreland redevelopment, and the related intensification of use, is not specifically addressed in the existing zoning codes. It is recommended that the impact of future land use development on Ashippun Lake be minimized through review and modification of the applicable zoning ordinance regulations and zoning district maps to address the concerns noted. Changes in zoning ordinances are recommended to minimize the areal extent of development by providing specific provisions and incentives for the clustering of residential development on smaller lots within conservation subdivisions, thus preserving significant portions of the open space within each property or group of properties considered for development.

***Stormwater Management on Development Sites***

It is recommended that Waukesha County and the Town of Oconomowoc take an active role in promoting urban nonpoint source pollution abatement. Actions to promote urban nonpoint source pollution abatement would include the conduct of specific stormwater management planning within specific portions of the tributary area where further urban development or redevelopment is anticipated. Such a planning program should include a review of the stormwater management ordinances, to ensure that the ordinance provisions reflect state-of-the-art runoff and water quality management requirements.

***Protection of Environmentally Sensitive Lands***

Wetland, woodland, and groundwater recharge area protection can be accomplished through land use regulation and public land acquisition of critical lands. Both measures are recommended for the area tributary to Ashippun Lake. The wetland areas within the area tributary to the Lake are currently largely protected through the existing regulatory framework provided by the USCOE permit program, State shoreland zoning requirements, and local zoning ordinances. Nearly all wetland areas in the Ashippun Lake tributary area are included in the environmental

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[4]Ibid.

corridors delineated by SEWRPC and protected under one or more of the existing Federal, State, County, and local regulations. Consistent and effective application of the provisions of these regulations is recommended.

Some wetland and woodland areas have been identified for acquisition in the adopted regional natural areas and critical species habitat protection and management plan, including the Meadow View School Bog and Ashippun River Lowlands.[5] Public acquisition of these lands is recommended. In this regard, implementation of the recommendations of the adopted park and open space plan for Waukesha County[6] would complement the protection and preservation of these environmentally sensitive lands.

**Pollution Abatement and Stormwater Management**

The recommended watershed land management measures are specifically aimed at reducing the water quality impacts on Ashippun Lake of nonpoint sources of pollution within the tributary area. These measures are set forth in the regional water quality management plan and the Waukesha County land and water resource management plan. As indicated in the lake and watershed inventory, the only significant sources of phosphorus loading to the Lake that are subject to potential controls are rural and urban nonpoint sources, and onsite sewage disposal systems in the area.

Nonpoint source control measures should be considered for the area tributary to Ashippun Lake. The regional water quality management plan recommended a reduction of about 25 percent in urban and rural, nonpoint source pollutants, plus streambank erosion control, construction site erosion control, and onsite sewage disposal system management be achieved in the area tributary to Ashippun Lake.

Nonpoint source pollution abatement controls in the area are recommended to be achieved through a combination of rural agricultural nonpoint controls, urban stormwater management, and construction erosion controls. The implementation of the land management practices described below may be expected to result in a reduction in nonpoint source pollutants that is considered to be the maximum practicable given the findings of the inventories and analyses compiled during the planning effort. These measures are consistent with the recommended measures set forth in the Waukesha County land and water resource management plan.

***Rural Nonpoint Source Pollution Controls***

The implementation of nonpoint source pollution controls in rural areas requires the cooperative efforts of the Town of Oconomowoc, Waukesha County, and private landowners. Technical assistance can be provided by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS); the Wisconsin Department of Agriculture, Trade and Consumer Protection (WDATCP); and the Waukesha County Department of Parks and Land Use. As discussed previously, it is recommended that the Town of Oconomowoc, in coordination with the WDNR, and Waukesha County, develop a strategy to address nonpoint source pollution. State and Federal soil erosion control and water quality management programs, individually or in combination, can be used to achieve pollutant reduction goals. Such programs include the USDA Environmental Quality Incentive Program (EQIP), the WDNR runoff management and lake protection programs, and various local land acquisition initiatives.

Highly localized, detailed, and site-specific measures are required to effectively reduce soil loss and contaminant runoff in rural areas. These measures are best defined and implemented at the local level through the preparation of detailed farm conservation plans. Practices which are considered most applicable within the area tributary to Ashippun Lake include conservation tillage, integrated nutrient and pesticide management, and pasture management. In addition, it is recommended consideration be given to cropping patterns and crop rotation cycles,

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

[6]*SEWRPC Community Assistance Planning Report No. 137,* A Park and Open Space Plan for Waukesha County*, December 1989.*

with attention to the specific topography, hydrology, and soil characteristics for each farm. A reduction of about 25 percent in the nonpoint source loading from rural lands could provide up to about a 15 percent reduction in the total phosphorus load to Ashippun Lake. Implementation of the recommendations and work planning activities set forth in the Waukesha County land and water resource management plan would constitute a major step toward implementation of these lake management recommendations.

The cost of the needed measures will vary depending upon the details of the recommended farm conservation plans. These costs may be expected to be incurred to a large extent for purposes of agricultural land erosion control in any case. The promulgation of Chapters NR 153 and NR 154 of the *Wisconsin Administrative Code*, which became effective during October 2003, provides the potential for cost-share funding to be available to encourage installation of appropriate land management measures. Likewise, cost-share funding may be available under the Chapter NR 120 nonpoint source pollution abatement program.

***Urban Nonpoint Source Pollution Controls***

The development of urban nonpoint source pollution abatement measures for the Ashippun Lake area should be the primary responsibility of the Town of Oconomowoc. In addition to the adoption of stormwater management ordinances, the most viable measures to control urban nonpoint sources of pollution appear to be good urban land management and urban housekeeping practices. Such practices consist of fertilizer and pesticide use management, litter and pet waste controls, and management of leaf litter and yard waste. The promotion of these measures requires an ongoing public informational program. It is recommended that the Ashippun Lake Protection and Rehabilitation District, in cooperation with the Town, take the lead in sponsoring such programming for the Ashippun Lake community through regular public informational meetings and mailings. The District should also ensure that relevant literature, available through the University of Wisconsin-Extension (UWEX) and the WDNR, is made available at these meetings and at the Oconomowoc Public Library and government offices.

As an initial step in carrying out the recommended urban practices, it is recommended that a fact sheet identifying specific residential land management measures beneficial to the water quality of Ashippun Lake be prepared and distributed to property owners. This fact sheet could be distributed by the Town of Oconomowoc and the Ashippun Lake Protection and Rehabilitation District, with the assistance of the UWEX and Waukesha County Department of Parks and Land Use. The recommended measures may be expected to provide about a 25 percent reduction in urban nonpoint source pollution runoff and up to about a 10 percent reduction in total phosphorus loads to the Lake.

***Developing Areas Nonpoint Source Pollution Controls***

It is recommended that Waukesha County and the Town of Oconomowoc continue efforts to control soil erosion attendant to construction activities in accordance with the existing ordinance. As noted in Chapter III, Waukesha County administers and enforces a construction erosion control ordinance in the Town of Oconomowoc. Enforcement of the ordinance by the County is generally considered effective. The provisions of this ordinance apply to all development except single- and two-family residential construction. The single- and two-family construction erosion control is to be carried out as part of the building permit process.

Construction site erosion controls may include the use of silt fences, sedimentation basins, rapid revegetation of disturbed areas; the control of "tracking" from the site; and careful planning of the construction sequence to minimize the areas disturbed. Construction site erosion control is particularly important in minimizing the more severe localized short-term nutrient and sediment loadings to Ashippun Lake that can result from uncontrolled construction sites. Consideration should be given to incorporating construction site erosion control measures into a formal stormwater management system serving larger developments following construction.

Construction site erosion control measures may be expected to reduce the phosphorus loading from that source by about 75 percent. Because of the potential for development in the area tributary to Ashippun Lake, it is important that adequate construction erosion control programs be in place.

The cost for construction site erosion control will vary depending upon the amount of land under construction at any given time. Typical costs are $250 to $500 per acre under development.

The clustering of residential development on smaller lots within conservation subdivisions, thus preserving significant portions of the open space within each property or group of properties to be developed, is recommended to minimize impact of future land use on Ashippun Lake. Concomitant with such zoning would be the development of stormwater management systems appropriate for such conservation development practices.

***Onsite Sewage Disposal System Management***

The lakeshore areas and entire area tributary to Ashippun Lake are served by onsite sewage disposal systems.[7] While such systems have been estimated to contribute less than 10 percent of the total phosphorus load to the Lake, current County ordinance provisions requiring the regular inspection and maintenance of onsite sewage disposal systems should be enforced to minimize potential phosphorus loadings from this source. It also is recommended that Waukesha County, in cooperation with the Town of Oconomowoc, assume the lead in providing the public informational and educational programs to encourage affected property owners to have existing onsite systems inspected and any needed remedial measures undertaken, as appropriate. Homeowners should be advised of the rules and regulations governing, and the limitations of, onsite sewage disposal systems, and should be encouraged to undertake preventive maintenance programs, especially of those older systems not yet subject to the inspection requirements of the County ordinance.

Typical costs for a basic inspection and maintenance service range from about $100 to $200 per year, although more extensive programs could be more expensive. The costs of the informational programming typically have been included within the operating budget of the County.

## IN-LAKE MANAGEMENT RECOMMENDATIONS

The recommended in-lake management measures for Ashippun Lake are summarized in Table 33 and are graphically summarized on Map 16. The major recommendations include water quality monitoring, fisheries management and habitat protection, shoreland protection, aquatic plant management, and recreational use management.

**Surface Water Quality Management**

Continued water quality monitoring of Ashippun Lake is recommended. Enrollment of one or more lake residents as WDNR Self-Help Monitoring Program volunteers is recommended. Such enrollment can be accomplished through the Southeast Region Office of the WDNR. A firm commitment of time is required of the volunteers. In addition, participation in the trophic state index (TSI) Expanded Self-Help Monitoring Program, measuring nutrients, chlorophyll-*a*, and temperature, is recommended. Such monitoring should be conducted five times a year at a central station in the deepest portion of the lake basin. Monitoring programs facilitated by the University of Wisconsin-Stevens Point (UW-SP) Water and Environmental Analysis Laboratory (WEAL) and the U.S. Geological Survey (USGS) are also recommended to be given consideration.

**Surface Water Quantity Management**

While there is no permanent dam or weir at the outlet of Ashippun Lake, a temporary structure has been placed periodically at the lake outlet. As noted in Chapter VII, the outflow from Ashippun Lake is influenced, indirectly,

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[7]*SEWRPC Community Assistance Planning Report No. 172, 2nd Edition,* Sanitary Sewer Service Area for the City of Oconomowoc and Environs, Waukesha County, Wisconsin*, September 1999, as amended, indicates that the Ashippun Lake community currently lies outside of the area recommended to be served by public sanitary sewerage services. As set forth in the adopted Regional water quality management plan, this recommendation should be periodically reviewed and provision of sanitary sewer service to the Ashippun Lake community considered at such time as population and urban density development around the Lake warrant.*

by an abandoned concrete mill dam located on the Ashippun River about a mile and a half downstream from the Lake in the unincorporated community of Monterey. There has been a history of water from the Ashippun River backing up into Ashippun Lake, generally following unusually high rainfall events which has led to a generally unsuccessful attempt by residents to reduce the back up of Ashippun River water into Ashippun Lake through the placement of a back-flow inhibitor device installed in the outflow channel. Further actions to mitigate the periodic reverse flows in the unnamed channel flowing out of Ashippun Lake would be considered viable if a hydraulic and hydrologic study indicated that such control were necessary. Accordingly, the conduct of such an analysis of the Ashippun River is recommended to validate the likely need for such a structure and the frequency at, and duration for, which it is likely to be required. Further, should this analysis indicate a need, it is recommended that the District replace the temporary dam with an appropriate control structure to limit reverse flows from the Ashippun River to the Lake.

In addition, if it is found that debris dams and beaver activity are associated with the high water conditions that have occurred, it is recommended the Ashippun Lake Protection and Rehabilitation District Commissioners, in concert with the WDNR, take remedial action. Action by the District with respect to hydrologic obstructions caused by tree falls or debris jams in the outlet channel should be evaluated on a case-by-case basis, and action taken as necessary to avoid risk to humans and property. Where such risks are minimal, the presence of such tree falls can form good fish habitat.[8]

**Fisheries Management**

These specific actions are recommended with respect to fisheries management: the conduct of a fishery survey and/or periodic creel census with concomitant monitoring of rough fish populations; continuation of stocking per recommendations based on fish surveys; and continued enforcement of size and bag limitations.

The fishery survey should be conducted by the WDNR at the request of the Ashippun Lake Protection and Rehabilitation District and should have the following objectives:

1. To identify changes in fish species composition that may have taken place in the Lake since the previous surveys;

2. To permit any changes in fish populations, species composition and condition factors to be related to such known interventions as stocking programs, water pollution control activities, and aquatic plant management programs;

3. To refine and update information on fish spawning areas, breeding success, and survival rates;

4. To confirm the lack of disturbance by rough fish populations; and,

5. To determine the need for, and inform the timing of, any additional stocking of northern pike, and/or other game fish species, as appropriate, by the WDNR, in order to maintain a continuing, viable sport fishery.

6. Provide data to determine the intensity of public use of the Ashippun Lake fishery through creel surveys, citizen reporting activities, and evaluation of the fish survey data; and

7. Provide data to assess the impact of harvesting of fishes from the Lake, relative to the bag limits established for Ashippun Lake.

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[8]*Greg G. Sass, James F. Kitchell, Stephen R. Carpenter, Thomas R. Hrabik, Anna E. Marburg, and Monica G. Turner, "Fish Community and Food Web Responses to a Whole-Lake Removal of Coarse Woody Habitat,"* Fisheries*, Volume 31, Number 7, July 2006.*

These actions are recommended to provide a sound basis for the District and the WDNR to consider developing a stocking program and to revise, as may be found necessary, the current fishing regulations regarding the size and number of fish to be taken seasonally.

#### ***Habitat Protection***

The habitat protection measures recommended for Ashippun Lake are designed to provide for habitat protection by avoiding disturbances in fish breeding areas during spring and autumn and maintaining stands of native aquatic plants. In particular, this recommendation extends to, and includes, the WDNR Chapter NR 107 sensitive areas located along the western, northern and eastern shorelines of the Lake as shown diagrammatically on Map 15 in Chapter VII of this report. It should be noted that the WDNR-delineated sensitive area includes portions of the lake with depths greater than three feet offshore of the developed portion of the shoreline that are not highlighted on Map 15. In addition, it is recommended that environmentally sensitive lands, including wetlands along the northwestern lakeshore be preserved.

#### ***Shoreland Protection***

About half of the Ashippun Lake shoreline is protected and no major areas of erosion, which require additional protection against wind, wave, and wake erosion, were identified in the planning effort. Various protection options are described in Chapter VII for consideration in the repair or replacement of existing protection structures. Adoption of the vegetated buffer strip method is recommended to be used in lakeshore areas and on tributary waterways wherever practical in order to maintain habitat value and the natural ambience of the lakeshore. Continued maintenance of existing revetments and other protection structures is also recommended. Conversion of bulkheads to revetments or natural vegetated shoreline or combinations is recommended to be considered where potentially viable at such time as major repairs are found necessary. Guidance provided in the proposed Chapter NR 328 of the *Wisconsin Administrative Code* sets forth a methodology for determining appropriate shoreline protection structures for inland lakes based upon wind wave action and fetch, substrate, and likely boat wake action.

In addition to the foregoing measures, it is also recommended that Waukesha County and the Town of Oconomowoc continue to enforce existing shoreland setback requirements, and construction site erosion control and stormwater management ordinances. Provision of informational materials to shoreland property owners is recommended, as set forth in the informational and educational programming element of this plan.

### **Aquatic Plant Management**

The aquatic plant management strategy set forth below recognizes the importance of fishing as a recreational use of Ashippun Lake. Integral to the aquatic plant management strategy is the protection and preservation of fish breeding habitat. In addition, this strategy recognizes the ecosystem values and functions provided within Ashippun Lake by a healthy and diverse aquatic plant community, and seeks to maximize these ecosystem level benefits necessary to ensure a balanced lake ecosystem capable of supporting a variety of diverse recreational uses and economic activities.

#### ***Recommended Aquatic Plant Management Measures***

Various aquatic plant management techniques, manual, biological, and chemical, are potentially applicable on Ashippun Lake. A number of these methods have been employed with varying success on Ashippun Lake in the past, although no major control measures have been utilized throughout the Lake in recent years. All aquatic plant control programs are subject to WDNR permitting pursuant to authorities set forth in Chapters NR 107 and NR 109 of the *Wisconsin Administrative Code*, although certain exemptions are provided under Chapter NR 109 for manual harvesting within a 30-feet wide recreational corridor and outside of the designated sensitive areas delineated by the WDNR pursuant to Chapter NR 107 authorities. In the case of Ashippun Lake, this latter area would be limited to waters of less than three feet depth along the developed shoreline as shown on Map 15.

##### *Periodic Aquatic Plant Reconnaissance Surveys*

It is recommended that the aquatic plant community be monitored through reconnaissance surveys on either an annual basis or every several years, depending upon the observed degree of change in the aquatic plant communities. In addition, information on the aquatic plant communities should be recorded and should include descriptions of major areas of nuisance plant growth and species identified. It is further recommended that should it be warranted, an aquatic plant management plan be developed and updated every three to five years. This will allow evaluation of the effectiveness of an aquatic plant management program over time and allow adjustments to be made in the program to maximize its benefit.

*Chemical Controls*
It is recommended that the use of chemical herbicides be limited to controlling nuisance growth of exotic species, such as Eurasian water milfoil and purple loosestrife. Maintenance of shoreland areas around docks and piers remains the responsibility of individual property owners. It is recommended that chemical applications, if required, be made by licensed applicators in early spring subject to State permitting requirements to maximize their effectiveness on nonnative plant species, while minimizing impacts on native plant species and acting as a preventative measure to reduce the development of nuisance conditions. Such use should be evaluated annually and the herbicide applied only on an as needed basis. Only herbicides that selectively control milfoil, such as 2,4-D and fluridone, should be used. Algicides, such as Cutrine Plus, are not recommended because there are few reported significant, recurring filamentous algal or planktonic algal problems in Ashippun Lake and valuable macroscopic algae, such as *Chara* and *Nitella* are killed by this product.

*Manual Controls*
Manual methods of aquatic plant control, such as raking or hand-pulling, while environmentally sound, are difficult to employ on a large-scale. Although very effective for small-scale application, for example, under and around docks and piers, manual techniques are generally not practical for large-scale plant control methods. Manual means are recommended on Ashippun Lake to control nearshore plant growths, especially around piers and docks, and are encouraged by the Ashippun Lake Protection and Rehabilitation District.

In addition, decomposing, floating vegetation can build up along the shorelines, and, together with terrestrial leaf litter, can limit the use of shoreline areas. Not only is this material unsightly and potentially foul smelling, but it also contributes to the organic and mucky substrates favored by invasive plant species, such as Eurasian water milfoil. Although shoreline cleanup can be a laborious job that can require substantial amounts of labor and time, it can also reduce the potential for nonnative invasive species to spread, notably Eurasian water milfoil. Consequently, the control of floating vegetation along shorelines and rooted vegetation between the piers by riparian owners is to be encouraged.

*Biological Controls*
The extensive wetland systems surrounding Ashippun Lake for areas where nonnative invasive wetland plants, such as purple loosestrife, can take hold and diminish both the aesthetic value of these systems as well as their habitat value and structural integrity. The use of the purple loosestrife beetles, *Hylobius transversovittatus*, *Galerucella pusilla*, *Galerucella calmariensis*, *Nanophyes brevis*, and *Nanophyes marmoratus,* is recommended to control such infestations.

With respect to the control of Eurasian water milfoil in the Lake, the use of the aquatic weevil, *Eurhychiopsis lecontei*, could be considered, given the relatively small number of motorized watercraft being operated on Ashippun Lake. These weevils have been shown to be susceptible to wash-off by high speed boat wakes in some of the larger lakes in the region, for example, in Whitewater Lake in Walworth County, but have proven to be effective in establishing cyclical control of Eurasian water milfoil in some of the less intensively used waterbodies, such as Spring Lake in Waukesha County.[9] While these weevils have been observed to occur naturally in most of the Lakes within southeastern Wisconsin, their populations need to be supplemented periodically in order to achieve a consistent level of control.

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[9]*See SEWRPC Community Assistance Planning Report No. 224*, A Lake Management Plan for Whitewater and Rice Lakes*, February 1997, as refined* in litt*. dated March 23, 2000; SEWRPC Memorandum Report No. 149,* A Lake Protection Plan for Spring Lake and Willow Spring Lake, Waukesha County, Wisconsin*, August 2004.*

*Informational and Educational Programming*
In addition to the in-lake rehabilitation methods, an ongoing campaign of community informational programming can support the aquatic plant management program by encouraging the use of shoreland buffer strips, responsible use of household and garden chemicals, and environmentally friendly household and garden practices to minimize the input of nutrients from these riparian areas. In addition, a community information campaign should emphasize the need to clean boats and motors/propellers when removing boats from the Lake and upon launching boats into the Lake to limit the redistribution of invasive organisms. Plants removed from boats and motors should be retained onboard and/or disposed of by composting at the boat launch or homestead to avoid their being reintroduced into the water. An informational program can also remind riparian residents and others of the habitat and ecological benefits, such as shoreline stabilization, provided by the aquatic flora of the Lake, thereby promoting the preservation of a healthy aquatic flora in the Lake.

In addition to informational programming, educational programs, such as Project WET, Adopt-A-Lake, and other school-based programs can help to build community awareness of the value of lake ecosystems, and the need for vigilance on the part of individual citizens and households within the area tributary to the Lake. School groups and other community service organizations also form a cadre of volunteers that can assist in shoreland management programs and in the dissemination and conduct of community informational programs.

The Ashippun Lake community has consistently supported informational and educational programming within their community. Efforts by the Ashippun Lake Protection and Rehabilitation District staff have encouraged environmentally sound behaviors within and downstream of the Lake. Thus, ongoing informational and educational programming is recommended.

**Water Use Management Recommendations**
With respect to boating ordinances applicable to Ashippun Lake, it is recommended that current levels of enforcement be maintained. In addition, recreational boating access users should be made aware of the presence of exotic invasive species within Ashippun Lake, including zebra mussel and Eurasian water milfoil. Appropriate signage should be placed at the public recreational boating sites, and supplemental materials on the control of invasive species should be made available to the public. These materials could be provided to riparian householders by means of mail drops or distribution of informational materials at public buildings, such as municipal buildings and the public library, and to nonriparian users by means of informational materials provided at the entrance to the Waukesha County and Ashippun Lake public recreational boating access sites. In addition, it is recommended that the Town of Oconomowoc and Waukesha County make disposal bins available at their public recreational boating access sites for disposal of plant materials and other refuse removed from watercraft using the public recreational boating access sites.[10]

## ANCILLARY LAKE MANAGEMENT RECOMMENDATIONS

**Public Informational and Educational Programs**
It is recommended that the Ashippun Lake Protection and Rehabilitation District assume the lead in the development of a public informational and educational program. Participation by the Town of Oconomowoc should be encouraged. This program should deal with various lake management-related topics, including onsite sewage disposal system management, water quality management, land management, groundwater protection, aquatic plant management, fishery management, and recreational use. Educational and informational brochures and pamphlets, of interest to homeowners and supportive of the recreational use and shoreland zoning regulations, are available from the WDNR and UWEX. These cover topics, such as beneficial lawn care practices and

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[10] *The Town of Oconomowoc and Waukesha County Department of Parks and Land Use should continue to monitor experience with the use of high pressure washing stations for the control of zebra mussel currently being gained within the Laurentian Great Lakes Basin and consider adoption of those measures proven to be successful in limiting the spread of zebra mussel within the Region. The U.S.-Canadian International Joint Commission regularly provides informational materials on this and related subjects.*

household chemical use. Such brochures should be provided to homeowners through local media, direct distribution or targeted library and civic center displays. Such distribution can also be integrated into ongoing, larger-scale activities, such as lakeside litter collections, which can reinforce anti-littering campaigns, recycling drives, and similar environmental protection activities.

Given the extent of public interest in Ashippun Lake, it is recommended that the Ashippun Lake Protection and Rehabilitation District and the local municipalities consider offering regular informational programs on the Lake and issues related thereto. Such programming can provide a mechanism to raise awareness of the Lake issues, and provide a focal point from which to distribute the informational materials referred to above.

The Ashippun Lake Protection and Rehabilitation District and the municipalities are also encouraged to take an active role in encouraging the local school districts to adopt and utilize lake-related educational programs, such as Adopt-A-Lake and Project WET, as means of more closely linking students to the lake environment.

The cost for conducting this informational and educational program is estimated to be $1,200 per year.

## PLAN IMPLEMENTATION AND COSTS

The actions recommended in this plan largely represent an extension of ongoing actions being carried out by the Ashippun Lake Protection and Rehabilitation District, in cooperation with neighboring municipalities, and county and State agencies. The recommended plan introduces few new elements, although some of the plan recommendations represent refinements of current programs. This is particularly true in the case of the fisheries and aquatic plant management programs, where the field surveys recommended in this plan will permit more efficient management of these resources.

Generally, aquatic plant and fisheries management practices, such as monitoring and public awareness campaigns, are recommended to continue with refinements as proposed herein. Some aspects of these programs lend themselves to citizen involvement through participation in the WDNR Self-Help Monitoring Program, and identification with environmentally sound owner-based land management activities. It is recommended that the Ashippun Lake Protection and Rehabilitation District, in cooperation with the local municipalities, assume the lead in the promotion of such citizen actions, with a view toward building community commitment and involvement. Assistance is generally available from agencies, such as the WDNR, UWEX, and SEWRPC. Additional lake and watershed management measures may be cost-shared through the Chapter NR 191 Lake Protection Grant Program, Chapter NR 120 Nonpoint Pollution Abatement Program, or NR 153/NR 154 runoff management programs.

The suggested lead agency or agencies for initiating program-related activities, by plan element, are set forth in Table 33, and the estimated costs of these elements, linked to possible funding sources where such are available, are summarized in Table 34. In general, it is recommended that the Ashippun Lake Protection and Rehabilitation District continue to provide a coordinating role for community-based lake management actions, in cooperation with the appropriate local government units.

Ashippun Lake is a valuable natural resource in the Southeastern Wisconsin Region, providing an abundance of natural vistas, good quality wildlife habitat, and opportunities for recreational activities that provide for an enriched quality of life. Increases in population, urbanization, income, leisure time, and individual mobility forecast for the Region may be expected to result in additional pressure for development in the area tributary to the Lake and for water-based recreation on the Lake. Adoption and administration of an effective lake management program for Ashippun Lake, based upon the recommendations set forth herein, will provide the water quality protection needed to maintain conditions in Ashippun Lake suitable for recreational use and for fish and other aquatic life.

Table 34

**ESTIMATED COSTS OF RECOMMENDED LAKE MANAGEMENT MEASURES FOR ASHIPPUN LAKE**

| Plan Element | Recommended Management Measures | Estimated Cost 2000-2020[a] Capital | Estimated Cost 2000-2020[a] Annual Operation and Maintenance | Potential Funding Sources[b] |
|---|---|---|---|---|
| Land Use | Observe regional and county land use plan guidelines | - - | - - | County, Town |
| | Density management in the shoreland zone | - - | - - | County, Town |
| | Stormwater management plan development | - - | - - | County, Town |
| | Protection of environmentally sensitive lands and environmental corridors | - - | - - | WDNR Lake Protection Grant and Stewardship Grant Programs, Waukesha County Land Conservancy, Ashippun Lake Protection and Rehabilitation District |
| Pollution Abatement | Implement county and regional plans for land and water resource management | - -[c] | - -[c] | County, USDA EQIP, WDNR/WDATCP Runoff Management Program |
| | Rural nonpoint source controls | - -[c] | - -[c] | County, USDA EQIP, WDNR/WDATCP Runoff Management Program |
| | Urban nonpoint source controls | - -[c] | - -[c] | County, WDNR/WDATCP Runoff Management Program |
| | Construction site erosion controls and stormwater management ordinances | - -[c] | $250-$500/acre[c] | County, municipalities, private firms, individuals |
| | Cluster developments | - -[c] | - -[c] | County, municipalities, private firms |
| | Onsite Sewerage system management | - -[c] | $100-$200[c] | County, private firms, individuals |
| Water Quality | Continue in Expanded WDNR Self-Help Program; consider periodic participation in U.S. Geological Survey or University of Wisconsin-Stevens Point Water and Environmental Analysis Laboratory TSI monitoring | - - | - -[d] | WDNR Self-Help and Ambient Lakes Monitoring Programs, USGS, UW-SP WEAL, Ashippun Lake Protection and Rehabilitation District |
| Water Quantity | Conduct a hydrologic and hydraulic analysis of the unnamed tributary draining from Ashippun Lake to the Ashippun River | - - | - -[e] | USGS and Ashippun Lake Protection and Rehabilitation District |
| Aquatic Biota—Fisheries | Conduct fish survey to determine management / stocking needs | $16,000 | - - | WDNR |
| | Continue stocking of selected game fish species and monitor populations of rough fish | - - | - - | Ashippun Lake Protection and Rehabilitation District, Town of Oconomowoc, WDNR |
| | Enforce size and catch limits | - - | - - | WDNR |
| | Protect and maintain fish habitat in shoreline and littoral zone and in sensitive areas | - - | - - | County, municipalities, private firms, individuals, WDNR, Ashippun Lake Protection and Rehabilitation District |
| | Maintenance of shoreline protection structures and repair as necessary using vegetative means insofar as practicable | - - | - - | Private firms, individuals |

**Table 34 (continued)**

| Plan Element | Recommended Management Measures | Estimated Cost 2000-2020[a] Capital | Estimated Cost 2000-2020[a] Annual Operation and Maintenance | Potential Funding Sources[b] |
|---|---|---|---|---|
| Aquatic Biota—Aquatic Plants | Conduct periodic aquatic plant reconnaissance and consider aquatic management plan is deemed necessary | - - | $1,500[f] | Ashippun Lake Protection and Rehabilitation District, WDNR Lake Management Planning Grant Program |
| | Limited use of chemical herbicides to control nuisance aquatic plants such as Eurasian water milfoil and purple loosestrife where necessary | - - | $1,000/acre[g] | Wisconsin Waterways Commission, Ashippun Lake Protection and Rehabilitation District, individuals |
| | Biological control of purple loosestrife and Eurasian water milfoil | - - | - - | WDNR, Ashippun Lake Protection and Rehabilitation District, school districts |
| | Manually harvest aquatic plants from around docks and piers | $100 | $100 | Ashippun Lake Protection and Rehabilitation District |
| | Collect floating plant fragments from shoreland areas to minimize rooting of Eurasian water milfoil | - - | - - | Individuals |
| Water use | Enforce regulations governing the operation of watercraft; improve posting of regulations and ordinances and signage concerning control of exotic nuisance species | $500 | $100 | Ashippun Lake Protection and Rehabilitation District, Town of Oconomowoc, WDNR |
| Ancillary Management Measures | Public informational and educational programming: seminars, programs, Project WET, Adopt-A-Lake, expanded TSI monitoring, etc. | - - | $1,200 | Ashippun Lake Protection and Rehabilitation District, UWEX/ WDNR/WAL Lakes Partnership, school districts |
| Total | - - | $16,600 | $2,900 | - - |

[a] *All costs expressed in January 2006 dollars.*

[b] *USDA is the U.S. Department of Agriculture, USGS is the U.S. Geological Survey, WDNR is the Wisconsin Department of Natural Resources, WDATCP is the Wisconsin Department of Agriculture, Trade and Consumer Protection, County is Waukesha County, Town is the Town of Oconomowoc, UWEX is the University of Wisconsin-Extension, and WAL is the Wisconsin Association of Lakes.*

[c] *Costs vary with the level of activity and effort during any given year.*

[d] *The WDNR Self-Help Monitoring Program involves no cost but does entail a time commitment from the volunteer; monitoring by the USGS can be cost-shared between the Federal agency and local cooperators.*

[e] *Water quantity monitoring should be conducted in conjunction with a hydraulic and hydrologic analysis of the entire Ashippun River system; USGS hydrological monitoring is proposed.*

[f] *Cost-share assistance may be available for lake management planning studies under the NR 190 Lake Management Planning Grant Program.*

[g] *Cost-share assistance for Eurasian water milfoil control may be available from the Wisconsin Waterways Commission Recreational Boating Facilities Grant Program.*

*Source: SEWRPC.*

# APPENDICES

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**Appendix A**

# ILLUSTRATIONS OF COMMON AQUATIC PLANTS FOUND IN ASHIPPUN LAKE

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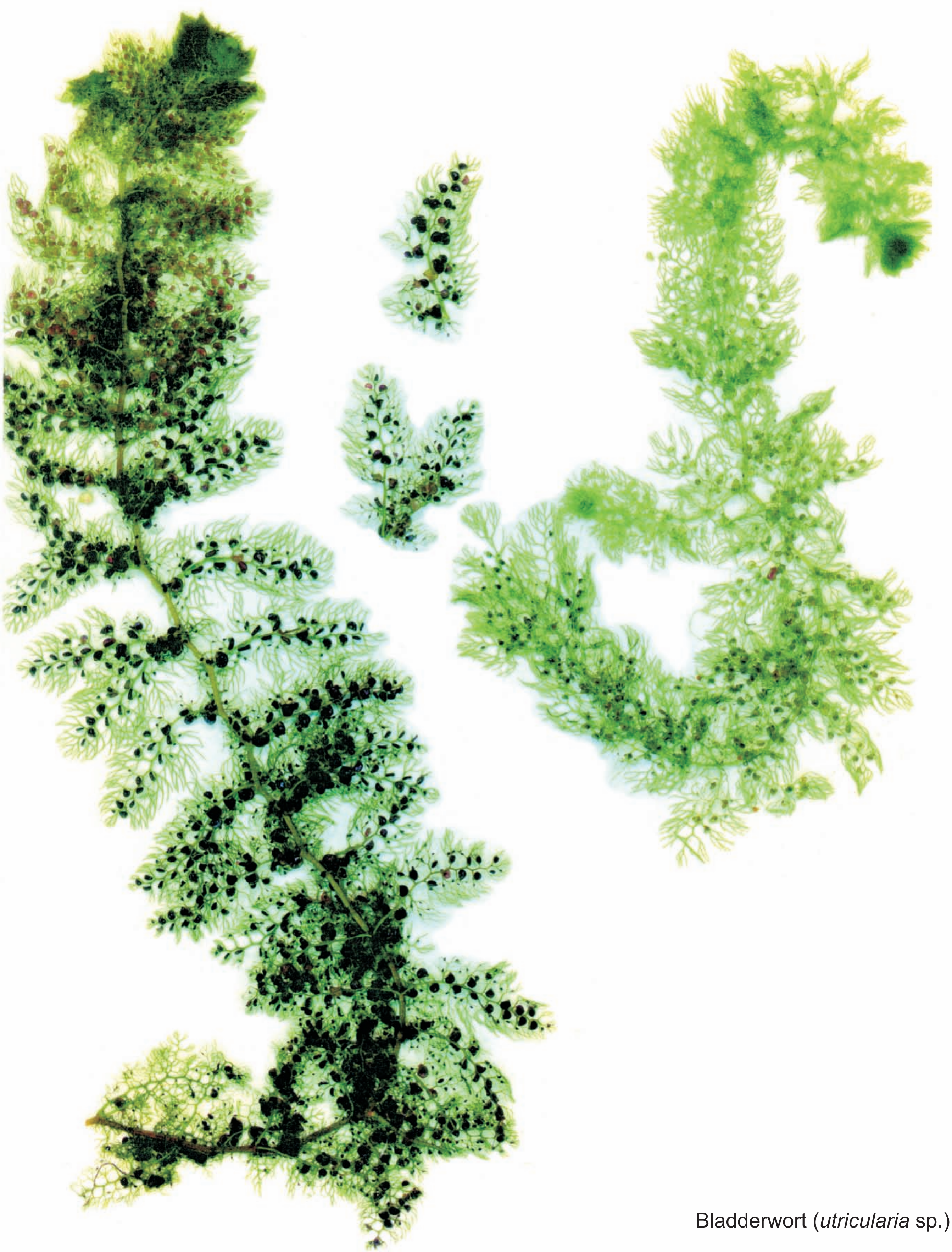
Arrowhead (sagitarria sp.)

NOTE: Plant species in photograph are not shown proportionate to actual size.

*Source: Steve D. Eggers and Donald M. Reed,* Wetland Plants and Plant Communities of Minnesota & Wisconsin*, 2nd Edition, 1997.*



Bladderwort (*utricularia* sp.)

Bushy Pondweed (*najas flexilis*)

Cattail (*typha latifolia*)

Clasping-Leaf Pondweed
(*potamogeton richardsonii*)

Coontail (*ceratophyllum demersum*)

Eel Grass / Wild Celery (*valisneria americana*)

Eurasian Water Milfoil (*myriophyllum spicatum*)

Flat-Stem Pondweed (*potamogeton zosteriformis*)

Floating-Leaf Pondweed (*potamogeton natans*)

Illinois Pondweed (*potamogeton illinoensis*)

Muskgrass (*chara vulgaris*)

Sago Pondweed (*potamogeton pectinatus*)

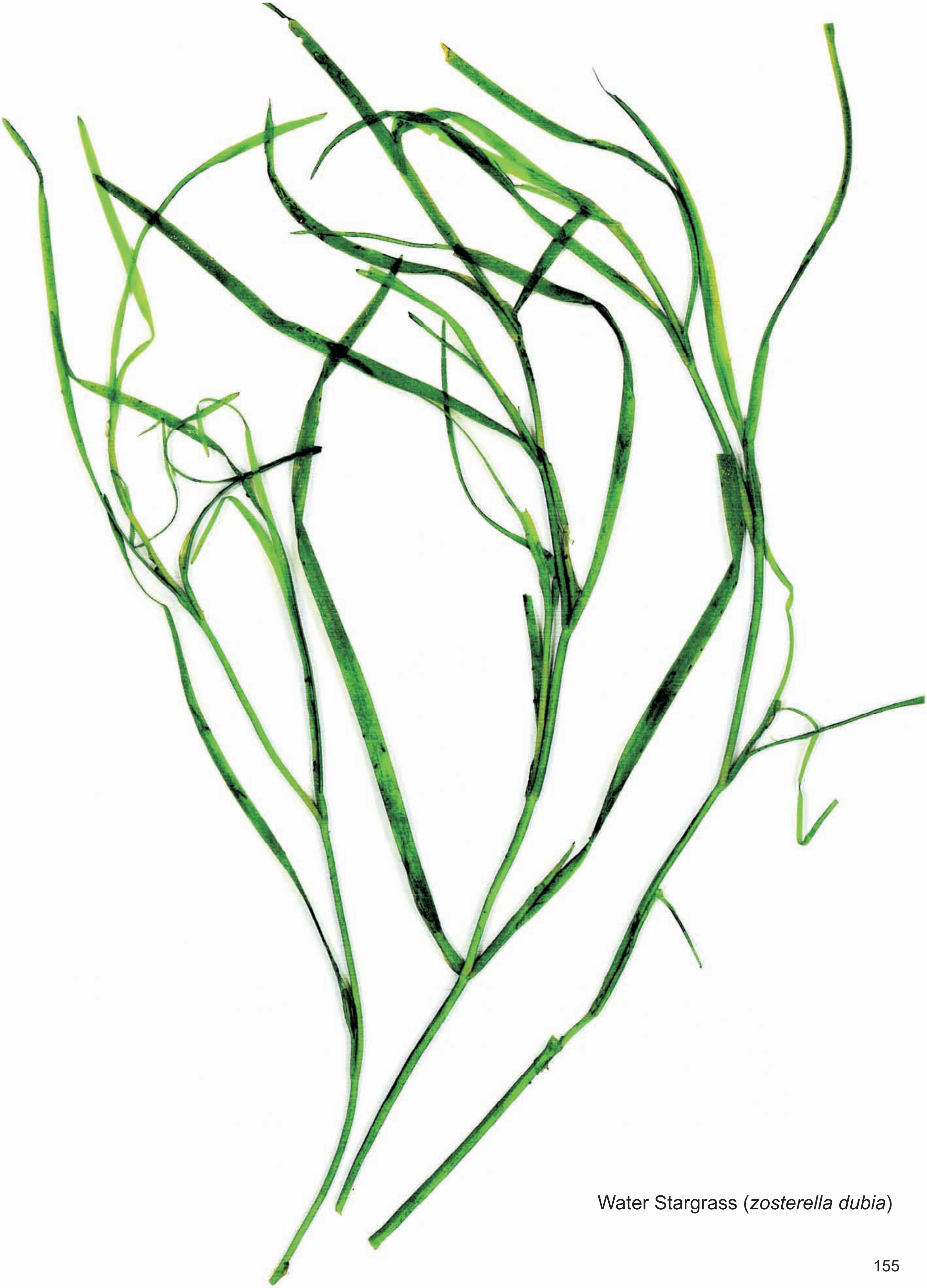
Needle Spike Rush (*ecleocharis acicularis*)

Spiny Naiad (*najas marina*)

White Water Crowfoot (*ranunculus longirostris*)

Variable Pondweed (*potamogeton gramineus*)

Water Bulrush (*scirpus subterminalis*)



Water Stargrass (*zosterella dubia*)

White-Stem Pondweed (*potamogeton praelongus*)

Yellow Water Lily (*nuphar variegatum*)

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## Appendix B

# WISCONSIN DEPARTMENT OF NATURAL RESOURCES SENSITIVE AREA ASSESSMENT SUMMARY FOR ASHIPPUN LAKE

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# AQUATIC PLANT MANAGEMENT

## SENSITIVE AREA ASSESSMENT SUMMARY

LAKE: ASHIPPUN COUNTY: WAUKESHA

DATE OF ASSESSMENT: JUNE 7, 1989

EXTENT OF SENSITIVE AREAS: The entire lake is sensitive with the exception of the developed shoreline. The developed shoreline is non-sensitive from the water's edge to a depth of 3 feet.

## RESOURCE VALUE

### WATER QUALITY

The water quality on Ashippun Lake is protected primarily through the adjacent wetlands on the northwest and west shoreline. The pothole wetland complex on the northwest corner of the lake is an extremely valuable complex. The wetlands function as a sediment and nutrient trap and protect the water quality. Existing aquatic vegetation also helps prevent shoreline erosion.

### WILDLIFE HABITAT

The habitat is unique to this region of the State. Aquatic and terrestrial furbearers use the area year round for food, shelter and to rear young. The area provides cover for smaller herons and bitterns. Waterfowl nest, feed and raise their broods. The area provides migrating waterfowl a place to rest and feed.

### FISHERIES

Spawning bluegills and white crappie were observed relatively close to urban development. Largemouth bass were also seen feeding on bluntnose minnows. The pothole wetland complex provides excellent spawning habitat for northern pike and a cover for largemouth bass. Bulrushes and other existing emergent vegetation provides good spawning and feeding habitat for black crappie and other fish species.

PLANTS

Protection of the existing, native plants is an important method to help diminish invasions by Eurasion milfoil and purple loosestrife. The native plants are less likely to become a nuisance, and are also a better food source and habitat.

Aquatic plants in Ashippun Lake consist of emergent, floating and submergent plants. The emergent plants noted were bulrushes, sedges, cattails, and pickerel weed. Floating plants consist of yellow and white water lily. Submergent plants include milfoil, pondweeds, elodea and chara.

MANAGEMENT RECOMMENDATIONS
for
SENSITIVE AREAS

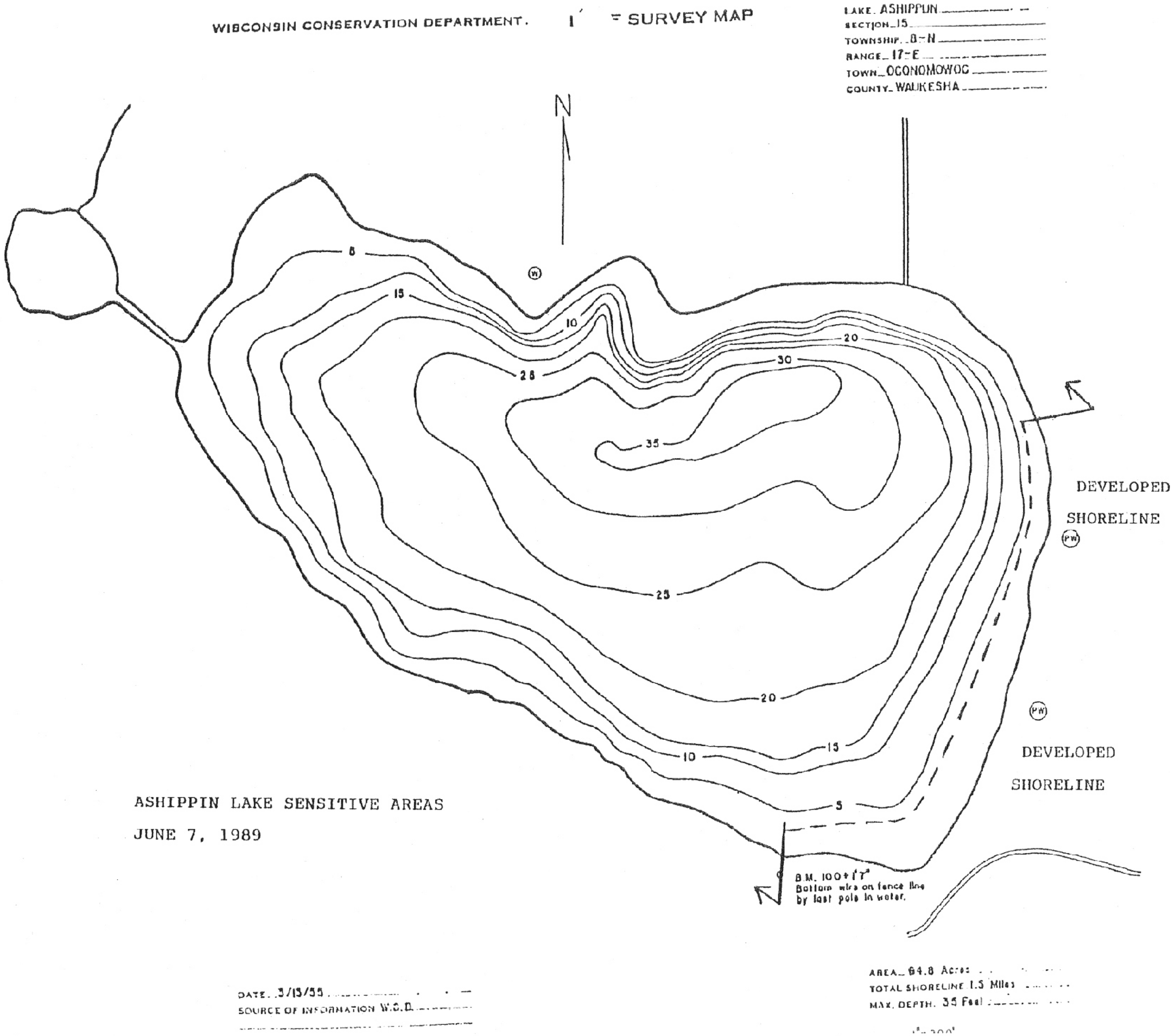
1. Chemical treatment allowed for purple loosestrife only.

2. Mechanical treatment allowed for purple loosestrife only.

3. None of the following inlake activities allowed:
   a. dredging
   b. pea gravel/sand blanket
   c. aquascreen
   d. seawalls

4. The following activities allowed with conditions:
   a. filling allowed at public boat launch only.
   b. boardwalks allowed for educational purposes only.
   c. wetland alterations must be consistant with county and federal laws.

GENERAL COMMENTS - Pothole wetland is extremely valuable.




ASHIPPIN LAKE SENSITIVE AREAS
JUNE 7, 1989

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## Appendix C

# SPECIAL-CONCERN AND STATE-ENDANGERED SPECIES OF FISH IN ASHIPPUN LAKE LOCALE

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**Figure C-1**

**SLENDER MADTOM (*Noturus exilis*)**


NOTE: This picture can be found at http://limnology.wisc.edu/research/newresearch.htm

*Source: Wisconsin Department of Natural Resources, University of Wisconsin Center for Limnology and Sea Grant Institute and SEWRPC.*

**Figure C-2**

**LEAST DARTER (*Etheostoma microperca*)**


NOTE: This picture can be found at http://limnology.wisc.edu/research/newresearch.htm

*Source: Wisconsin Department of Natural Resources, University of Wisconsin Center for Limnology and Sea Grant Institute and SEWRPC.*

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## Appendix D

# NONPOINT SOURCE POLLUTION CONTROL MEASURES

Nonpoint, or diffuse, sources of water pollution include urban sources such as runoff from residential, commercial, industrial, transportation, and recreational land uses; construction activities; and onsite sewage disposal systems and rural sources such as runoff from cropland, pasture, and woodland, atmospheric contributions, and livestock wastes. These sources of pollutants discharge to surface waters by direct overland drainage, by drainage through natural channels, by drainage through engineered stormwater drainage systems, and by deep percolation into the ground and subsequent return flow to the surface waters.

A summary of the methods and estimated effectiveness of nonpoint source water pollution control measures is set forth in Table D-1. These measures have been grouped for planning purposes into two categories: basic practices and additional. Application of the basic practices will have a variable effectiveness in terms of control level of pollution control depending upon the subwatershed area characteristics and the pollutant considered. The additional category of nonpoint source control measures has been subdivided into four subcategories based upon the relative effectiveness and costs of the measures. The first subcategory of practices can be expected to generally result in about a 25 percent reduction in pollutant runoff. The second and third subcategory of practices, when applied in combination with the minimum and additional practices, can be expected to generally result in up to a 75 percent reduction in pollutant runoff, respectively. The fourth subcategory would consist of all of the preceding practices, plus those additional practices that would be required to achieve a reduction in ultimate runoff of more than 75 percent.

Table D-1 sets forth the diffuse source control measures applicable to general land uses and diffuse source activities, along with the estimated maximum level of pollution reduction which may be expected upon implementation of the applicable measures. The table also includes information pertaining to the costs of developing the alternatives set forth in this chapter.[1] These various individual nonpoint source control practices are summarized by group in Table D-2.

Of the sets of practices recommended for various levels of diffuse source pollution control presented in Table D-2, not all practices are needed, applicable, or cost-effective for all watersheds, due to variations in pollutant loadings and land use and natural conditions among the watersheds. Therefore, it is recommended that the practices indicated as needed for nonpoint source pollutant control be refined by local level nonpoint source control practices planning, which would be analogous to sewerage facilities planning for point source pollution abatement. A locally prepared plan for nonpoint abatement measures should be better able to blend knowledge of current problems and practices with a quickly evolving technology to achieve a suitable, site-specific approach to pollution abatement.

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[1]*Costs are presented in more detail in SEWRPC Technical Report No. 31,* Costs of Urban Nonpoint Source Water Pollution Control Measures*, June 1991.*

## Table D-1

### GENERALIZED SUMMARY OF METHODS AND EFFECTIVENESS OF NONPOINT SOURCE WATER POLLUTION ABATEMENT

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Urban | Litter and pet waste control ordinance | Prevent the accumulation of litter and pet wastes on streets and residential, commercial, industrial, and recreational areas | 2 to 5 | Ordinance administration and enforcement costs are expected to be funded by violation penalties and related revenues |
| | Improved timing and efficiency of street sweeping, leaf collection and disposal, and catch basin cleaning | Improve the scheduling of these public works activities, modify work habits of personnel, and select equipment to maximize the effectiveness of these existing pollution control measures | 2 to 5 | No significant increase in current expenditures is expected |
| | Management of onsite sewage treatment systems | Regulate septic system installation, monitoring, location, and performance; replace failing systems with new septic systems or alternative treatment facilities; develop alternatives to septic systems; eliminate direct connections to drain tiles or ditches; dispose of septage at sewage treatment facility | 10 to 30 | Replace one-half of estimated existing failing septic systems with properly located and installed systems and replace one-half with alternative systems, such as mound systems or holding tanks; all existing and proposed onsite sewage treatment systems are assumed to be properly maintained; assume system life of 25 years. The estimated cost of a septic tank system is $5,000 to $6,000 and the cost of an alternative system is $10,000. The annual maintenance cost of a disposal system is $250. An in-ground pressure system is estimated to cost $6,000 to $10,000 with an annual operation and maintenance cost of $250. A holding tank would cost $5,500 to $6,500, with an annual operation and maintenance cost of $1,800 |
| | Increased street sweeping | On the average, sweep all streets in urban areas an equivalent of once or twice a week with vacuum street sweepers; require parking restrictions to permit access to curb areas; sweep all streets at least eight months per year; sweep commercial and industrial areas with greater frequency than residential areas | 30 to 50 | Estimate curb-miles based on land use, estimated street acreage, and Commission transportation planning standards; assume one street sweeper can sweep 2,000 curb-miles per year; assume sweeper life of 10 years; assume residential areas swept once weekly, commercial and industrial areas swept twice weekly. The cost of a vacuum street sweeper is approximately $120,000. The cost of the operation and maintenance of a sweeper is about $25 per curb-mile swept |
| | Increased leaf and clippings collection and disposal | Increase the frequency and efficiency of leaf collection procedures in fall; use vacuum cleaners to collect leaves; implement ordinances for leaves, clippings. and other organic debris to be mulched, composted, or bagged for pickup | 2 to 5 | Assume one equivalent mature tree per residence, plus five trees per acre in recreational areas; 75 pounds of leaves per tree; 20 percent of leaves in urban areas not currently disposed of properly. The cost of the collection of leaves in a vacuum sweeper and disposal is estimated at $180 to $200 per ton of leaves |
| | Increased catch basin cleaning | Increase frequency and efficiency of catch basin cleaning; clean at least twice per year using vacuum cleaners; catch basin installation in new urban development not recommended as a cost-effective practice for water quality improvement | 2 to 5 | Determine curb-miles for street sweeping; vary percent of urban areas served by catch basins by watershed from Commission inventory data; assume density of 10 catch basins per curb-mile; clean each basin twice annually by vacuum cleaner. The cost of cleaning a catch basin is approximately $10 |
| | Reduced use of deicing salt | Reduce use of deicing salt on streets; salt only intersections and problem areas; prevent excessive use of sand and other abrasives | Negligible for pollutants addressed in this plan, but helpful for reducing chlorides and associated damage to vegetation | Increased costs, such as for slower transportation movement, are expected to be offset by benefits, such as reduced automobile corrosion and damage to vegetation |
| | Improved street maintenance and refuse collection and disposal | Increase street maintenance and repairs; increase provision of trash receptacles in public areas; improve trash collection schedules; increase cleanup of parks and commercial centers | 2 to 5 | Increase current expenditures by approximately 15 percent |

## Table D-1 (continued)

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Urban (continued) | Parking lot stormwater temporary storage and treatment measures | Construct gravel-filled trenches, sediment basins, or similar measures to store temporarily the runoff from parking lots, rooftops, and other large impervious areas; if treatment is necessary, use a physical-chemical treatment measure, such as screens, dissolved air flotation, or a swirl concentrator | 5 to 10 | Design gravel-filled trenches for 24-hour, five-year recurrence interval storm; apply to off-street parking acreages. For treatment, assume four-hour detention time. The capital cost of stormwater detention and treatment facilities is estimated at $40,000 to $80,000 per acre of parking lot area, with an annual operation and maintenance cost of about $200 per acre |
| | Onsite storage—residential | Remove connections to sewer systems; construct onsite stormwater storage measures for subdivisions | 5 to 10 | Remove roof drains and other connections from sewer system wherever needed; use lawn aeration, if applicable; apply Dutch drain storage facilities to 15 percent of residences. The capital cost would approximate $500 per house, with an annual operation and maintenance cost of about $25 |
| | Stormwater Infiltration—urban | Construct gravel-filled trenches for areas of less than 10 acres or basins to collect and store temporarily stormwater runoff to reduce volume, provide groundwater recharge and augment low stream flows | 45 to 90 | Design gravel-filled trenches or basins to store the first 0.5 inch of runoff; provide at least a 25-foot grass buffer strip to reduce sediment loadings. The capital cost of stormwater infiltration is estimated at $12,000 for a six-foot-deep, 10-foot-wide trench, and at $70,000 for a one-acre basin, with an annual maintenance cost of about $10 to $350 for the trench and about $2,500 for the basin |
| | Stormwater storage—urban | Store stormwater runoff from urban land in surface storage basins or, where necessary, subsurface storage basins | 10 to 35 | Design all storage facilities for a 1.5-inch runoff event, which corresponds approximately to a five-year recurrence interval event, with a storm event being defined as a period of precipitation with a minimum antecedent and subsequent dry period of from 12 to 24 hours; apply subsurface storage tanks to intensively developed existing urban areas where suitable open land for surface storage is unavailable; design surface storage basins for proposed new urban land, existing urban land not storm sewered, and existing urban land where adequate open space is available at the storm sewer discharge site. The capital cost for stormwater storage would range from $35,000 to $110,000 per acre of basin, with an annual operation and maintenance cost of about $40 to $60 per acre |
| | Stormwater treatment | Provide physical-chemical treatment which includes screens, microstrainers, dissolved air flotation, swirl concentrator, or high-rate filtration, and/or disinfection, which may include chlorination, high-rate disinfection, or ozonation to stormwater following storage | 10 to 50 | To be applied only in combination with stormwater storage facilities above; general cost estimates for microstrainer treatment and ozonation were used; some costs were applied to existing urban land and proposed new urban development. Stormwater treatment has an estimated capital cost of from $900 to $7,000 per acre of tributary drainage area, with an average annual operation and maintenance cost of about $35 to $100 per acre |
| Rural | Conservation practices | Includes such practices as strip cropping, contour plowing, crop rotation, pasture management, critical area protection, grading and terracing, grassed waterways, diversions, woodlot management, fertilization and pesticide management, and chisel tillage | Up to 50 | Cost for Natural Resources Conservation Service (NRCS) recommended practices are applied to agricultural and related rural land; the distribution and extent of the various practices were determined from an examination of 56 existing farm plan designs within the Region. The capital cost of conservation practices ranges from $3,000 to $5,000 per acre of rural land, with an average annual operation and maintenance cost of from $5.00 to $10 per rural acre |

## Table D-1 (continued)

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Rural (continued) | Animal waste control system | Construct streambank fencing and crossovers to prevent access of all livestock to waterways; construct a runoff control system or a manure storage facility, as needed, for major livestock operations; prevent improper applications of manure on frozen ground, near surface drainageways, and on steep slopes; incorporate manure into soil | 50 to 75 | Cost estimated per animal unit; animal waste storage (liquid and slurry tank for costing purposes) facilities are recommended for all major animal operations within 500 feet of surface water and located in areas identified as having relatively high potential for severe pollution problems. Runoff control systems recommended for all other major animal operations. It is recognized that dry manure stacking facilities are significantly less expensive than liquid and slurry storage tanks and may be adequate waste storage systems in many instances. The estimated capital cost and average operation and maintenance cost of a runoff control system is $100 per animal unit and $25 per animal unit, respectively. The capital cost of a liquid and slurry storage facility is about $1,000 per animal unit, with an annual operation and maintenance cost of about $75 per unit. An animal unit is the weight equivalent of a 1,000-pound cow |
| | Base-of-slope detention storage | Store runoff from agricultural land to allow solids to settle out and reduce peak runoff rates. Berms could be constructed parallel to streams | 50 to 75 | Construct a low earthen berm at the base of agricultural fields, along the edge of a floodplain, wetland, or other sensitive area, design for 24-hour, 10-year recurrence interval storm; berm height about four feet. Apply where needed in addition to basic conservation practices; repair berm every 10 years and remove sediment and spread on land. The estimated capital cost of base-of-slope detention storage would be $500 per tributary acre, with an annual operation and maintenance cost of $25 per acre |
| | Bench terraces | Construct bench terraces, thereby reducing the need for many other conservation practices on sloping agricultural land | 75 to 90 | Apply to all appropriate agricultural lands for a maximum level of pollution control. Utilization of this practice would exclude installation of many basic conservation practices and base-of-slope detention storage. The capital cost of bench terraces is estimated at $1,500 per acre, with an annual operation and maintenance cost of $100 per acre |
| Urban and Rural | Public education programs | Conduct regional and county-level public education programs to inform the public and provide technical information on the need for proper land management practices on private land, the recommendations for management programs, and the effects of implemented measures; develop local awareness programs for citizens and public works officials; develop local contract and education efforts | Indeterminate | For first 10 years, includes cost of one person, materials, and support for each 25,000 population. Thereafter, the same cost can be applied for every 50,000 population. The cost of one person, materials, and support is estimated at $55,000 per year |
| | Construction erosion control practices | Construct temporary sediment basins; install straw bale dikes; use fiber mats, mulching, and seeding; install slope drains to stabilize steep slopes; construct temporary diversion swales or berms upslope from the project | 20 to 40 | Assume acreage under construction is the average annual incremental increase in urban acreage; apply costs for a typical erosion control program for a construction site. The estimated capital cost and operation and maintenance cost for construction erosion control is $250 to $5,500 and $250 to $1,500 per acre under construction, respectively |
| | Materials storage and runoff control facilities | Enclose industrial storage sites with diversion; divert runoff to acceptable outlet or storage facility; enclose salt piles and other large storage sites in crib and dome structures | 5 to 10 | Assume 40 percent of industrial areas are used for storage and to be enclosed by diversions; assume existing salt storage piles enclosed by cribs and dome structures. The estimated capital cost of industrial runoff control is $2,500 per acre of industrial land. Material storage control costs are estimated at $75 per ton of material |

**Table D-1 (continued)**

| Applicable Land Use | Control Measures[a] | Summary Description | Approximate Percent Reduction of Released Pollutants[b] | Assumptions for Costing Purposes |
|---|---|---|---|---|
| Urban and Rural (continued) | Stream protection measures | Provide vegetative buffer zones along streams to filter direct pollutant runoff to the stream; construct streambank protection measures, such as rock riprap, brush mats, tree revetment, jacks, and jetted willow poles, where needed | 5 to 10 | Apply a 50-foot-wide vegetative buffer zone on each side of 15 percent of the stream length; apply streambank protection measures to 5 percent of the stream length. Vegetative buffer zones are estimated to cost $21,200 per mile of stream and streambank protection measures cost about $37,000 per stream mile |
| | Pesticide and fertilizer application restrictions | Match application rate to need; eliminate excessive applications and applications near or into surface water drainageways | 0 to 3 | Cost included in public education program |
| | Critical area protection | Emphasize control of areas bordering lakes and streams; correct obvious erosion and other pollution source problems | Indeterminate | Indeterminate |

[a]*Not all control measures are required for each subwatershed. The characteristics of the watershed, the estimated required level of pollution reduction needed to meet the applicable water quality standards, and other factors will influence the selection and estimation of costs of specific practices for any one subwatershed. Although the control measures costed represent the recommended practices developed at the regional level on the basis of the best available information, the local implementation process should provide more detailed data and identify more efficient and effective sets of practices to apply to local conditions.*

[b]*The approximate effectiveness refers to the estimated amount of pollution produced by the contributing category (urban or rural) that could be expected to be reduced by the implementation of the practice. The effectiveness rates would vary greatly depending on the characteristics of the watershed and individual diffuse sources. It should be further noted that practices can have only a "sequential" effect, since the percent pollution reduction of a second practice can only be applied against the residual pollutant load which is not controlled by the first practice. For example. two practices of 50 percent effectiveness would achieve a theoretical total effectiveness of only 75 percent control of the initial load. Further, the general levels of effectiveness reported in the table are not necessarily the same for all pollutants associated with each source. Some pollutants are transported by dissolving in water and others by attaching to solids in the water; the methods summarized here reflect typical pollutant removal levels.*

[c]*For highly urbanized areas which require retrofitting of facilities into developed areas, the costs can range from $400,000 to $1,000,000 per acre of storage.*

*Source: SEWRPC.*

**Table D-2**

**ALTERNATIVE GROUPS OF DIFFUSE SOURCE WATER POLLUTION CONTROL MEASURES PROPOSED FOR STREAMS AND LAKE WATER QUALITY MANAGEMENT**

| Pollution Control Category | Level of Pollution[a] Control | Practices to Control Diffuse Source Pollution from Urban Areas[b] | Practices to Control Diffuse Source Pollution from Rural Areas[a] |
|---|---|---|---|
| Basic Practices | Variable | Construction erosion control; onsite sewage disposal system management; streambank erosion control | Streambank erosion control |
| | 25 percent | Public education programs; litter and pet waste control; restricted use of fertilizers and pesticides; construction erosion control; critical areas protection; improved timing and efficiency of street sweeping, leaf collection, and catch basin cleaning; material storage facilities and runoff control | Public education programs; fertilizer and pesticide management; critical area protection; crop residue management; chisel tillage; pasture management; contour plowing; livestock waste control |
| Additional Diffuse Source Control Practices[c] | 50 percent | Above, plus: Increased street sweeping; improved street maintenance and refuse collection and disposal; increased catch basin cleaning; stream protection; increased leaf and vegetation debris collection and disposal; stormwater storage; stormwater infiltration | Above, plus: crop rotation; contour strip-cropping; grass waterways; diversions; wind erosion controls; terraces; stream protection |
| | 75 percent | Above, plus: An additional increase in street sweeping, stormwater storage and infiltration; additional parking lot stormwater runoff storage and treatment | Above, plus: Base-of-slope detention storage |
| | More than 75 percent | Above, plus: Urban stormwater treatment with physical-chemical and/or disinfection treatment measures | Bench terraces[b] |

[a]*Groups of practices are presented here for general analysis purposes only. Not all practices are applicable to, or recommended for, all lake and stream tributary watersheds. For costing purposes, construction erosion control practices, public education programs, and material storage facilities and runoff controls are considered urban control measures and stream protection is considered a rural control measure.*

[b]*The provision of bench terraces would exclude most basic conversation practices and base-of-slope detention storage facilities.*

[c]*In addition to diffuse source control measures, lake rehabilitation techniques may be required to satisfy lake water quality standards.*

*Source: SEWRPC.*

## Appendix E

# TOWN OF OCONOMOWOC RECREATIONAL BOATING ORDINANCES APPLICABLE TO ASHIPPUN LAKE

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| 30.544 | Inspection of boats purchased out-of-state |
| 30.547 | Penalty |
| 30.549 | Transfer of ownership of boats with a certificate of title, certificate of number or registration |
| 30.55 | Notice of abandonment or destruction of boat or change of address |
| 30.553 | Sharing boat title records |
| 30.60 | Classification of motorboats |
| 30.61 | Lighting equipment |
| 30.62 | Other equipment |
| 30.63 | Sale and use of certain outboard motors restricted |
| 30.635 | Motorboat prohibition |
| 30.64 | Patrol boats |
| 30.65 | Traffic rules |
| 30.66 | Speed restrictions |
| 30.67 | Accidents and accident reports |
| 30.675 | Distress signal flag |
| 30.68 | Prohibited operation |
| 30.681 | Intoxicating boating |
| 30.682 | Preliminary breath screening test |
| 30.683 | Implied consent |
| 30.684 | Chemical tests |
| 30.686 | Report arrest to department |
| 30.687 | Officer's action after arrest for violating intoxicated boating law |
| 30.69 | Water skiing |
| 30.70 | Skin diving |
| 30.71 | Boats equipped with toilets |

(4) DEFINITIONS.

*DESIGNATED ANCHORAGE:* An area of water established and marked as an anchorage by lawful authority.

*HOUSEBOAT:* A boat on which a toilet or food preparation facilities exist or on which persons are living, sleeping or camping.

*PUBLIC ACCESS:* Any access to the water by means of public property.

*NAVIGATION LANE:* An area designated by authorized aids to navigation.

*SEALED OR INOPERATIVE TOILETS OR HEADS:* Being plugged from the outside of the hull in such a manner that the plug cannot be removed from the inside of the boat.

*SLOW-NO-WAKE:* The slowest possible speed so as to maintain steerage.

*SWIMMING ZONE:* An authorized area marked by regulatory markers to designate a swimming area.

(5) SPEED RESTRICTIONS.

(a) General Limits.

1. No person shall operate a boat at a speed in excess of 10 mph from sunset each day until 8:00 a.m. the following morning.

2. No person shall operate a boat at a speed in excess of 40 mph on Okauchee Lake and Upper Oconomowoc Lake.

3. No person shall operate a boat a speed in excess of 30 miles per hour on Ashippun Lake. (Cr. #3-18-96)

(b) Special Limits.

1. No person shall, at any time operate a boat in excess of slow-no-wake in an area from a shore to shore line in Little Okauchee Lake, such line to be parallel to and 300′ southwest of the Lake Drive bridge and extending eastward to the mouth of the channel (entrance to Big Okauchee Lake), Bay Five, Park Bay, Pickerel Bay, and in the channel between Little Okauchee and Upper Oconomowoc Lakes.

## 20.01 OKAUCHEE LAKE, GARVIN LAKE, UPPER OCONOMOWOC LAKE, ASHIPPUN LAKE AND FLORENCE LAKE.

(1) INTENT. The intent of this section is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public rights and interest and the capability of the water resource.

(2) APPLICABILITY AND ENFORCEMENT. (Am. 06/02/86) The provisions of this section are adopted in the interest of public health and safety and shall apply to persons, vehicles, boats and other objects upon, in and under the waters and ice of the Okauchee Lake and Garvin Lake within the jurisdictions of the Town of Oconomowoc and Merton, which are all such municipalities surrounding, riparian to and having jurisdiction over Okauchee Lake, and of Upper Oconomowoc Lake, Ashippun Lake and Florence Lake within the jurisdiction of the Town of Oconomowoc, which is the only municipality surrounding, riparian to and having jurisdiction over such lakes.

(3) STATE BOATING AND WATER SAFETY LAWS ADOPTED. (Rep. & recr. 01/06/98) The following statutory provisions describing and defining regulations with respect to water traffic, boats, boating and related water activities in the following enumerated sections of the statutes, exclusive of any provisions therein relating to the penalties to be imposed or the punishment for violation of such statutes, are hereby adopted and by reference made a part of this section as if fully set forth herein:

| | |
|---|---|
| 30.50 | Definitions |
| 30.501 | Capacity plates on boats |
| 30.505 | Certificate of number system to conform to federal system |
| 30.51 | Certificate of number and registration; requirements; exemptions |
| 30.52 | Certificate of number and registration; application; certification and registration period; fees; issuance |
| 30.523 | Certification or registration card to be on board; display of stickers or decals and identification number |
| 30.53 | Certificate of origin; requirements; contents |
| 30.531 | Certificate of title; requirements; exemptions |
| 30.533 | Application for certificate of title; hull and engine identification numbers |
| 30.537 | Certificate of title; issuance, records, fees |
| 30.539 | Contents of certificate of title |
| 30.54 | Lost, stolen or mutilated certificates |
| 30.541 | Transfers of boat titles |
| 30.543 | Report of stolen or abandoned boats |

2. No person shall, at any time, operate a boat in excess of a slow-no-wake speed in the area north of an east-west line, such line being 100′ south of the mouth of the Oconomowoc River in the northeast portion of Okauchee Lake.

3. No person shall, at any time, operate a boat in excess of a slow-no-wake speed in the mouth of the southwest bay of Upper Oconomowoc Lake. A slow-no-wake sign and buoy shall be placed in such location on the lake as to be observed by an ordinarily prudent person and at a specified distance north and south of the area to which this subparagraph applies. (Cr. 5/1/89)

4. No person shall, at any time, operate a boat in excess of a slow-no-wake speed in Martinique Bay on Okauchee Lake. A slow-no-wake sign and buoy shall be placed in such a location at the mouth of Martinique Bay as to be observed by an ordinarily prudent person. (Cr. #3-18-96)

5. No person may operate or use a motor boat or personal watercraft repeatedly in a circuitous course with a diameter of less than 200′ at a speed in excess of slow-no-wake speed (Okauchee Lake, Upper Oconomowoc Lake, Florence Lake and Ashippun Lake). (Cr. #5-6-96)

6. No person may operate or use a motor boat or personal watercraft repeatedly in a circuitous course with a diameter of less than 200 feet at a speed in excess of slow-no-wake speed (Okauchee Lake and Upper Oconomowoc Lake). (Cr. #5-6-96)

(6) CAPACITY RESTRICTIONS. No person shall operate or loan, rent or permit a boat to leave the place where it is customarily kept for operation on the waters covered by this section with more passengers or cargo than a safe load.

(7) STATIONARY OBJECTS. (a) Reflectors Required. All piers, rafts, ski jumps or other stationary objects, extending into and/or located upon the waters covered by this section, shall have red reflector signals on each side thereof and in the case of piers, such reflectors shall be not less than 3' from the outer limits thereof and shall be at least 3" in diameter.

(b) Permits Required. No water ski jump shall be placed upon the waters covered by this section at any time unless a permit is obtained from the Water Safety Patrol. No raft or other stationary object shall be placed more than 100' from the shore unless a permit is obtained from the Water Safety Patrol.

(c) Issuance. A permit issued under this section shall specify the location of the ski jump, raft or other structure and in the case of ski jumps, the area of water to be used by users of such jump. Permits shall be issued only if in the opinion of the Water Safety Patrol, the proposed use of the water and location of the structure is such so as not to interfere with or obstruct navigation and other uses of the water.

(8) PROHIBITED OPERATION. (a) Intoxicated Person not to Ride in Boats. No person shall permit any person who is so intoxicated or under the influence of a controlled substance so as to be unable to provide for his own safety, to be a passenger in a boat operated by him, except in case of an emergency.

(b) Safe Operation Required. No person shall operate, direct or handle a boat in such manner as to unreasonably annoy, unnecessarily frighten or endanger the occupants of his or other boats.

(c) Noise Levels. 1. Maximum Noise Levels for Operation. a. No person may operate a motor boat powered by an engine manufactured before January 1, 1978, in such a manner as to exceed a noise level of 86 measured on an "A" weighted decibel scale measured at a distance of 50' from the motor boat.

b. No person may operate a motor boat powered by an engine manufactured on or after January 1, 1978, and before January 1, 1982, in such a manner as to exceed a noise level of 84 measured on an "A" weighted decibel scale measured at a distance of 50' from the motor boat.

c. No person may operate a motor boat powered by an engine manufactured on or after January 1, 1982, in such a manner as to exceed a noise level of 82 measured on an "A" weighted scale measured at a distance of 50′ from the motor boat.

2. *Tampering.* No person may move or alter any part of a marine engine, its propellation unit or its enclosure or modify the mounting of a marine engine on a boat in such a manner as to exceed the noise levels prescribed under sub-par. 1. above.

3. *Exemption for Regattas.* This section does not apply to a motorboat while competing in a race conducted under a permit issued by the Town, nor does it apply to a boat designed and intended solely for racing, while the boat is operated incidentally to the tuning up of the boat and engine for the race.

(d) Motor Limitation on Ashippun Lake. (Cr. #3-18-96) No person may operate a motor boat powered by an internal combustion engine on Ashippun Lake in an area described as the "west end channel" which leads from Ashippun Lake to the Ashippun River. This prohibition shall extend from the mouth of the west end channel northwesterly to the Ashippun River. Electric motors only may be used in this restricted zone. A sign and buoy shall be placed in the mouth of said channel in such location and so marked as to be observed by an ordinarily prudent person.

(e) Upper Oconomowoc Lake Dam Restrictions. (Cr. #3-18-96) No person shall swim or fish from the Upper Oconomowoc Lake dam, which empties into the Oconomowoc River, nor may any person occupying a boat on Upper Oconomowoc Lake fish over the Upper Oconomowoc Lake dam into the waters of the Oconomowoc River.

(9) ADDITIONAL TRAFFIC RULES. In addition to the traffic rules in §30.65, Wis. Stats., adopted in sub. (3), the following rule shall apply to boats using the waters covered by this section:

(a) Right-of-Way at Docks, Piers and Wharves. Boats leaving or departing from pier, dock or wharf shall have the right-of-way over all other watercraft approaching such dock, pier or wharf.

(b) Right-of-Way of Sailboats. Boats propelled entirely by muscular power shall yield the right-of-way to sailboats when necessary to avoid risk of collision.

(10) SWIMMING REGULATIONS.

(a) From Boats. No person shall swim from any unmanned boat unless such boat is anchored.

(b) Distance from Shore. No person shall swim more than 150′ from the shore unless in a designated swimming zone or when accompanied by a competent person in a boat.

(c) Hours Limited. No person shall swim more than 150′ from the shore line between sunset and sunrise.

(11) LITTERING AND POLLUTING PROHIBITED.

(a) Refuse. No person shall deposit, place or throw any cans, paper, bottles, debris, refuse, garbage, solid or liquid waste, into the water of any lake covered by this section.

(b) Toilets and Heads. The toilet of any boat, the nautical term for which is "head", must be plugged from the outside of the hull in such manner that the plug cannot be removed from the inside of the boat.

(12) RACES, REGATTAS, SPORTING EVENTS AND EXHIBITIONS. (a) Permit Required. No person shall direct or participate in any boat race, regatta, water ski meet or other water sporting events or exhibition unless such event has been authorized and a permit issued therefor by the Water Safety Patrol.

(b) Permit. A permit issued under this section shall specify the course or area of water to be used by participants in such event and the permittee shall be required to place markers, flags or buoys approved by the Water Safety Patrol, designating the specified area. Permits shall be issued only if in the opinion of the Water Safety Patrol, the proposed use of the water can be carried on safely and without danger to or substantial obstruction of other watercraft or persons using the lakes. Permits shall be valid only for the hours and area specified thereon.

(c) Right-of-Way of Participants. Boats and participants in any such permitted events shall have the right-of-way on the marked area and no other person shall obstruct such area during the race or event or interfere therewith.

(13) MARKERS AND NAVIGATION AIDS; POSTING ORDINANCE. (a) Navigation Aids. The Water Safety Patrol is authorized and directed to place and maintain suitable markers, navigation aids and signs in such water areas as shall be appropriate to advise the public of the provisions of this section and to post and maintain a copy of this section at all public access points on waters covered by this section.

(b) Standard Markers. All markers placed by the Water Safety Patrol or any other person upon the waters covered by this section shall comply with the regulations of the Department of Natural Resources.

(c) Interference with Markers Prohibited. No person shall without authority remove, damage or destroy or moor or attach any watercraft to any buoy, beacon or marker placed on the waters of any lake covered by this section, by the authority of the United States, State, County or Town or by any private person, pursuant to the provisions of this section.

(d) Marking Required for Restricted Areas. Any person operating a business, or any association, corporation, organization of lot owners or groups of persons who allow the public or members to swim from shore line under his or its control, shall mark the intended restricted area to be used for swimming. Marking shall be with appropriate "regulatory restricted activity area markers".

(14) NAVIGATION LANES. (Cr. 6/2/86) Pursuant to §30.74 (2), Wis. Stats., the following designated area is established as a navigation lane and mooring of boats is hereby prohibited in such area:

> An area in the channel between Steinmeyers Island and the east shore of Okauchee Lake, extending 480' north to south and 75' east to west located between lines extending from the northeast and southeast corner of such island due east to the east shore of Okauchee Lake.

(15) HOUSEBOATS. (Ren. MSC '87) No person shall use any houseboat as a place of residence on Okauchee Lake, Upper Oconomowoc Lake, Ashippun Lake or Florence Lake.

(16) DRIVING AUTOMOBILES OR OTHER MOTOR DRIVEN VEHICLES ON THE ICE; FISHERIES. (Ren. MSC '87) (a) Vehicles on Ice Prohibited. No person shall operate an automobile on the ice of Ashippun or Florence Lakes.

(b) Safe Operation. No person shall use or operate any automobile or other motor driven vehicle on ice in any manner so as to endanger persons engaged in skating or in any other winter sport or recreation activity upon the ice, or so as to endanger property belonging to others, and no person shall, while using or operating any automobile upon the ice, tow, pull or push any person on skates, sleds, skis, toboggan or device or thing of any kind designated or utilized to carry or support one or more persons.

(c) Speed. No person shall use or operate any automobile on the ice at a speed in excess of 10 mph.

(d) Hours. 1. No person shall use or operate any automobile on the ice between 9:30 p.m. and 6 a.m.

2. No person shall use or operate any other motor driven vehicle on the ice between 1:30 a.m. and 6 a.m.

(e) Races, Time Trials, Sporting Events, Exhibitions and Fisheries. 1. Permit Required. No person shall sponsor, direct or participate in any race, time trial, sporting event, exhibition or fisherie upon the ice, unless such event has been authorized and a permit issued therefor by the Town Board.

2. Permit. A permit issued under this section shall specify the course or area of ice to be used by participants in such event and the permittee shall be required to place markers or flags approved by the Town Board, designating the specified area. The Town Board shall refer all such applications to the Police Department for investigation, report and recommendation, and the permits shall be issued only if, in the opinion of the Police Department, the proposed use of the ice can be carried on safely without danger to or substantial obstruction to other persons using the ice. Permits shall be valid only for the hours and area specified thereon.

3. Right-of-Way of Participants. Participants in any such permitted events shall have the right-of-way on the marked area and no other person shall obstruct such area during the event or interfere with the participants.

4. Cleanup. The permittee shall be required to remove all debris from the designated area immediately following the termination of the event. The Town Board may require a bond so as to insure satisfactory cleanup.

5. Police. The permittee shall be required to provide adequate and proper policing during the event, including control of vehicular parking.

(f) Definitions. The word automobile, as used in this section, shall be construed to mean all motor vehicles of the type and kind permitted to be operated on the highways in the State. Motor driven vehicle, as used in this section, shall be construed to mean any kind of device or thing designed or utilized for propulsion or movement upon the ice using a motor, whether of internal combustion design or not, including snowmobiles.

(g) Risk and Liability. All traffic on the icebound waters of the lakes to which this section applies, shall be at the risk of the traveller as set forth in §30.81(3), Wis. Stats., and nothing in this section shall be construed as rendering the enacting authority liable for any accident to those engaged in permitted traffic while this section is in effect.

(h) No person shall operate a motor boat towing a person on water skis, aquaplane or similar device, including any form of "tubing," on Ashippun Lake nor shall any person engage in water skiing, aquaplaning or similar activity, including any form of "tubing," on Ashippun Lake in other than a counter-clockwise direction. (Cr. #3-18-96)

(17) WATER SKIING. (Ren. MSC '87) In addition to the rules contained in §30.69, Wis. Stats., the following rules shall control water skiing on the waters covered by this section.

(a) No person shall operate a motor boat and tow any person upon water skis or other similar device in the following designated area of Okauchee Lake: an area from a shore-to-shore line in Little Okauchee Lake, such line to be parallel to and 300' southwest of the Lake Dr. bridge extending eastward under the bridge and eastward to the mouth of the channel (entrance to Big Okauchee Lake), Bay Five, Park Bay, Pickerel Bay and Tierney Bay. (Am. 5/18/87)

(b) No person shall operate a motor boat towing a person on water skis, aquaplane or similar device, nor shall any person engage in water skiing, aquaplaning or similar activity, at any time from sunset to 8 a.m. the following morning.

(c) Garvin Lake is less than 50 acres in size and comes under the limitations of §30.635, Wis. Stats. Water skiing is prohibited on Garvin Lake. (Cr. 6/2/86)

20.02 **WATER TRAFFIC, BOATS, BOATING AND RELATED WATER ACTIVITIES ON LAC LA BELLE.**

(1) APPLICABILITY AND ENFORCEMENT.

(a) Applicability. The provisions of this section are adopted in the interest of public health and safety and shall apply to persons, vehicles, boats and other objects upon, in and under the waters and ice of Lac La Belle within the jurisdictions of the City, Village and Town above-named, which are all such municipalities surrounding, riparian to and having jurisdiction over such lake.

(b) Enforcement. This section shall be enforced by the officers, employees and agents of the respective law enforcement agencies of any or all of the municipalities having jurisdiction over such lake.

(2) STATE BOATING AND WATER SAFETY LAWS, ORDERS AND RULES ADOPTED.

(a) State Statutes Adopted. Section 20.01(3) of this chapter shall apply to this section.

(b) Administrative Code Provisions Adopted. All rules and orders created by the Wisconsin Department of Natural Resources designated NR, Wis. Adm. Code, modifying or supplementing the provisions adopted in par. (a) above or which may be adopted or made in the future are hereby incorporated in and made a part of this section by reference to the same as if they are or were to be set out herein verbatim.

(3) SPEED LIMITS.

(a) Generally. (Cr. 06/1/92) Speed of motorboats on Lac LaBelle shall not exceed 10 mph between sunset one day and sunrise the following day.

(b) Special Limits. (Cr. 05/7/90) No person shall at any time operate a boat in excess of slow-no-wake in an area from a shore to shore line in Lac LaBelle, such line to be parallel to and approximately 1,000′ north of the City beach, extending east and west from a point on the shore of property located at 326 N. Lake Rd. to a point on the shore of property located at 259 Woodland Ln. The area in which this special speed limit shall apply lies between the aforementioned line and the south shore of Lac LaBelle and shall include the entire width of the bay as well as the channel circling the island located at the southwest corner of such bay.

(4) EMERGENCY SLOW NO WAKE SPEED AT TIMES OF HIGH WATER. (Cr. #5/7/01)

(a) Definitions.

1. *High water* means when the waters of Lac LaBelle exceed an elevation of 852.20 feet as based upon the USGS benchmark or 3.27 feet measured at the fourth bay from West Wisconsin Avenue down from the top of the existing concrete abutment of the Lac LaBelle Dam (outlet of Lac LaBelle) and/or when the Mayor of the City, Town Chairman of the Town of Oconomowoc, or Village President of the Village of Lac LaBelle determines conditions warrant declaring that an emergency exists requiring reduced boat speed. When the high water elevation has been reached, either the Mayor, Town Chairman or Village President may make the high water declaration.

2. *Slow no wake* has the meaning specified in §30.50(12), Wis. Stats.

3. *Motor boat* has the meaning specified in §30.50(6), Wis. Stats.

(b) Slow No Wake Speed Required. No person shall operate a motor boat at a speed in excess of slow no wake on Lac LaBelle for a period commencing 2 hours after a high water condition has been declared until the declaration of a high water condition is repealed.

(c) Notice. Notice of a high water condition shall be posted at the public launch site and by publication of a notice in both the Oconomowoc Enterprise and Focus and by public service announcements on radio and television. Posted notice shall state the time of the declaration of a high water condition.

**20.025 MARY LANE COURT ACCESS RULES.** (Cr. #8-17-98)

(1) DEFINED. The Mary Lane Court access area is defined as the Mary Lane Court road end, extending from the end of the asphalt pavement to the shore of Lac LaBelle.

(2) REGULATIONS. The following regulations are hereby imposed on the use of the Mary Lane Court/Lac LaBelle access area. No person shall make use of the Mary Lane Court access to Lac LaBelle in violation of the following rules and regulations.

(a) Hours. The Mary Lane Court access to Lac LaBelle shall be closed between the hours of 8:00 p.m. and 8:00 a.m.

(b) Launching of Watercraft. No person shall launch or cause to be launched any motorboat from the Mary Lane Court access. Nonmotorized boats may be launched from the Mary Lane Court access. "Motorboat" and "nonmotorized boat" shall have the meanings set forth in §30.50(6) and (7), Wis. Stats. The definition of motorboat includes "personal watercraft" as defined in §30.50(9d).

(c) No person shall take upon the Mary Lane Court access point any glass receptacle or any glass object.

(d) Barbecue grills are not allowed in the Mary Lane Court access area.

(e) Littering. No person shall throw upon the Mary Lane Court access area any waste or refuse, nor shall any person leave upon such area any food, food scraps, paper, container, carton, towels or any other article or object of any kind.

(f) Supervision. No person shall allow a child of an age of five years or less to use the Mary Lane Court access area unless accompanied by a parent or adult over the age of 16 years.

(g) Vehicles Prohibited. No person shall operate or park any vehicle beyond the terminus of the asphalt pavement of Mary Lane Court. "Vehicle" has the meaning given in §340.01(74), Wis. Stats. A snow-mobile is not considered a vehicle. Snowmobiles and all-terrain vehicles may use the Mary Lane Court access point as an access to Lac LaBelle. All-terrain vehicles are given the meaning set forth in §340.01(2g), Wis. Stats.

(h) Pets. No person shall cause or permit any pet to run loose on the Mary Lane Court access area.

**20.026 JAECKLES BOULEVARD ACCESS RULES.** (Cr. #07/08/99)

(1) DEFINED. The Jaeckles Boulevard access area is defined as Jaeckles Boulevard extending from the Town of Summit boundary to the shore of Okauchee Lake, bounded on the west by Lot 1, Schimmel's Subdivision, and bounded on the east by Lot 21, Schimmel's Subdivision.

(2) REGULATIONS. The following regulations are hereby imposed on the use of the Jaeckles Boulevard access area: no person shall make use of the Jaeckles Boulevard access to Okauchee Lake in violation of the following rules and regulations.

(a) Hours. The Jaeckles Boulevard access to Okauchee Lake shall be closed between the hours of 9:00 p.m. and 8:00 a.m.

(b) Launching of Watercraft. No person shall launch or cause to be launched any motorboat from the Jaeckles Boulevard access. No person shall land and remove any motorboat from Okauchee Lake onto the Jaeckles Boulevard access. Nonmotorized boats may be launched from the Jaeckles Boulevard access. "Motorboat" and "nonmotorized boat" shall have the meanings set forth in §30.50(6) and (7), Wis. Stats. The definition of "motorboat" includes "personal watercraft" as defined in §30.50(9d).

(c) Glass Prohibited. No person shall take upon the Jaeckles Boulevard access area any glass receptacle or any glass object.

(d) Barbecue Grills Prohibited. Barbecue grills are not allowed in the Jaeckles Boulevard access area.

(e) Littering. No person shall throw upon the Jaeckles Boulevard access area any waste or refuse, nor shall any person leave upon such area any food, food scraps, paper, container, carton, towels or any other article or object of any kind.

(f) Supervision. No person shall allow a child of the age of five years or less to use the Jaeckles Boulevard access area unless accompanied by a parent or adult over the age of 16 years.

(g) Vehicles Prohibited. No person shall operate or park any vehicle on the access area north of the north line of Jaeckles Drive. "Vehicle" has the meaning given in §340.01(74), Wis. Stats. A snowmobile is not considered a vehicle. Snowmobiles and all-terrain vehicles may use the Jaeckles Boulevard access point as an access to Okauchee Lake. "All-terrain vehicles" are given the meaning in §340.01(2g), Wis. Stats.

(h) Pets. No person shall cause or permit any pet to run loose on the Jaeckles Boulevard access area.

**20.027 LAKE PARK HEIGHTS SUBDIVISION/LINDY LANE ACCESS RULES.** (Cr. 04-19-04)

(1) ACCESS DEFINED. The Lake Park Heights Subdivision 10-foot wide access strip to Okauchee Lake lying between Lot 26 and Lot 1 of Certified Survey Map No. 7775 located at the far west end of Lake Park Heights Subdivision extending from Lindy Lane to the shore of Okauchee Lake.

(2) REGULATIONS. The following regulations are hereby imposed on the use of said 10-foot wide access strip. No person shall make use of that access strip to Okauchee Lake in violation of the following rules and regulations.

(a) Hours. The aforementioned access to Okauchee Lake shall be closed between the hours of 8:00 p.m. and 8:00 a.m.

(b) Launching of Watercraft. No person shall launch or cause to be launched any motorboat from the aforementioned access. No person shall land and remove any motorboat from Okauchee Lake onto the aforementioned access. Nonmotorized boats may be launched from this access. "Motorboat" and "nonmotorized boat" shall have the meanings set forth in § 30.50(6) and (7), Wis. Stats. The definition of "motorboat" includes "personal watercraft" as defined in § 30.50(9d).

(c) Glass Prohibited. No persona shall take upon the subject access area any glass receptacle or glass object.

(d) Barbecue Grills Prohibited. Barbecue grills are not allowed in the subject access area.

(e) Littering. No person shall throw upon the subject access area any waste or refuse, nor shall any person leave upon such area any food, food scraps, paper, container, towels or any other article or object of any kind.

(f) Supervision. No person shall allow a child of the age of five years or less to use the subject access area unless accompanied by a parent or adult over the age of 16 years.

(g) Vehicles Prohibited. No person shall operate or park any vehicle on the access area. "Vehicle" has the meaning given in § 340.01(74), Wis. Stats. Further, no snowmobile or all-terrain vehicle may use the subject access area. "All-terrain vehicles" are given the meaning in § 340.01(2g), Wis. Stats.

(h) Pets. No person shall cause or permit any pet to run loose on the subject access area.

## 20.03 SWIMMING AND DIVING FROM LAKE DRIVE BRIDGE AND UPPER OCONOMOWOC LAKE DAM AND DEFACING PUBLIC PROPERTY PROHIBITED.

(1) No person shall swim or dive from the Lake Drive Bridge or the Upper Oconomowoc Lake Dam or mark, deface, injure or tamper with such bridge or dam, or appurtenances thereof, or signs, notices or placards placed thereon or adjacent thereto by the Town authorities.

(2) No person, other than authorized Town personnel, shall go upon the Upper Oconomowoc Lake Dam for any purpose.

## 20.05 PENALTY.

Except as otherwise provided, any person found to be in violation of any provision of this chapter or any rule or order promulgated hereunder shall be subject to a penalty as provided in §25.04 of this Code.