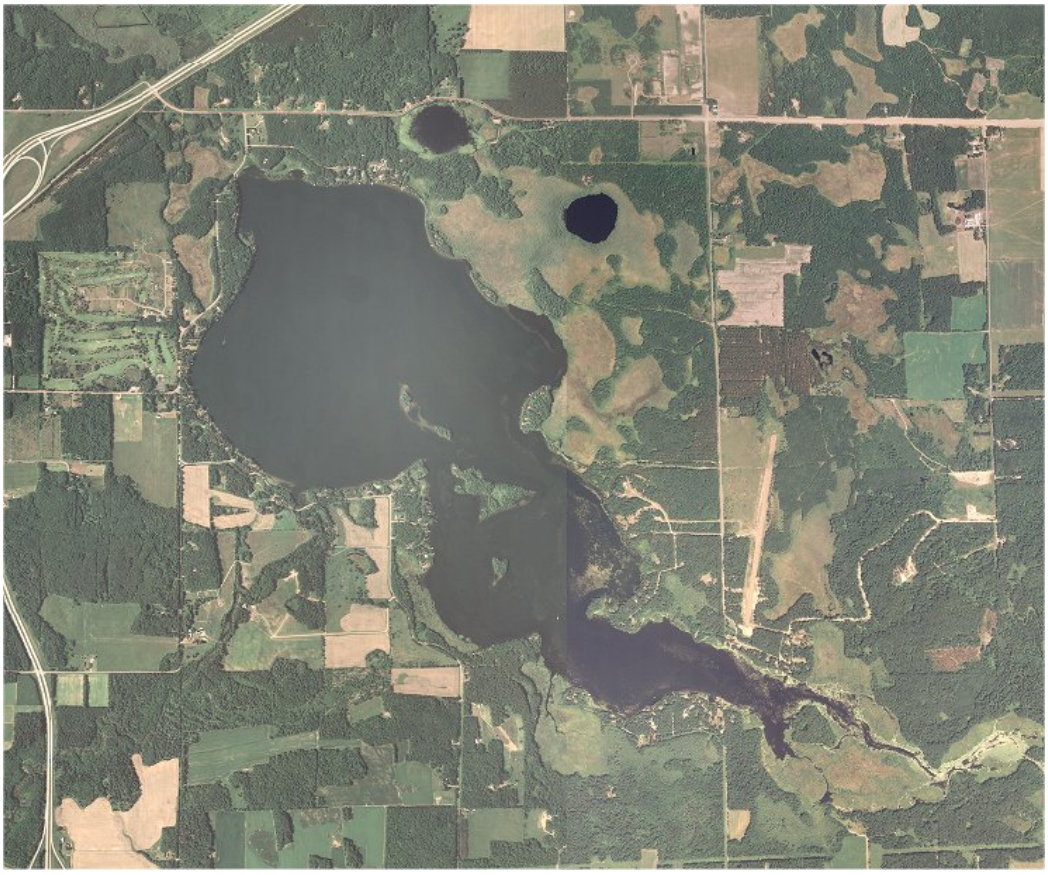
# LAKE WATERSHED MANAGEMENT PLAN
# FOR
# THE SPOONER LAKE DISTRICT



**Sponsored by:**

Spooner Lake Protection and Rehabilitation District and the Wisconsin Department of Natural Resources

**Assistance by:**

Cedar corporation

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## GLOSSARY

**Best Management Practice (BMP):** A practice or combination of practices that is determined to be most effective and practical (including technological, economic, and institutional considerations) means of controlling point and nonpoint pollutant levels compatible with environmental quality goals.

**Drainage Basin:** A geographic and hydrologic subunit of a watershed.

**Dry Detention Ponds:** A structural BMP or retrofit that consists of a large open depression that stores incoming storm water runoff while percolation occurs through the bottom and sides.

**EPA:** United States Environmental Protection Agency.

**Groundwater:** Subsurface water occupying the zone of saturation. In a strict sense, the term is applied only to water below the water table.

**Heavy Metals:** Metallic elements with high atomic weights (e.g. mercury, cadmium, etc.). They can damage living organisms at low concentrations and tend to accumulate in the food chain.

**Impervious Surface:** Hard surface that prevents and retards the entry of water into the soil mantle as natural conditions prior to development and/or a hard surface area that causes water to runoff the surface in greater quantities or at increased flow rates from the flow present under conditions prior to development. Common impervious surfaces include, but are not limited to rooftops, walkways, patios, driveways, parking lots, storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam, or other surfaces that similarly impede the natural infiltration of urban runoff.

**Infiltration:** The penetration of water through the ground surface into subsurface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

**Land Conversion:** A change in land use, function or purpose.

**Local Government:** Any County, City, or Town having its own incorporated government for local affairs.

**Nonpoint Source Pollution:** Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe.

**Pollution Prevention:** A management measure to prevent and reduce nonpoint source loadings generated from a variety or everyday activities within urban areas. These can include turf management, public education, ordinances, planning and zoning, pet waste control, and proper disposal of oil.

**Post-Development Peak Runoff:** Maximum instantaneous rate of flow during a storm, after development is complete.

**Pre-Development Peak Runoff:** Maximum instantaneous rate of flow during a storm prior to development activities.

**Removal Efficiency:** The capacity of a pollutant (sediment) control device to remove pollutants from wastewater or runoff.

**Retrofit:** The modification of an urban runoff management system in a previously developed area. This may include wet ponds, infiltration systems, wetland plantings, streambank stabilization, and other BMP techniques for improving water quality and creating aquatic habitat. A retrofit can consist of new BMP construction in a developing area, enhancing an older runoff management structure, or combining improvements and new construction.

**Runoff:** That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. Runoff can carry pollutants into receiving waters.

**Sedimentation Basins:** Sediment storage areas that may consist of wet detention basins or dry detention basins. Excavated areas with storage depression below the natural ground surface; creek, stream, channel or drainageway bottoms properly engineered and designed to trap and store sediment for future removal.

**Watershed:** A drainage area or basin where all land and water areas drain or flow toward a central collector such as a creek, stream, river or lake at a lower elevation.

**Wet Detention Ponds:** A structural BMP or retrofit that consists of a single permanent pool of water that stores and treats incoming storm water. Wet detention ponds usually have three to seven feet of standing water, allowing pollutants to settle, with a defined siltation/sedimentation pond and outlet structure.

# CHAPTER 1: INTRODUCTION

Spooner Lake is an invaluable water resource in the Washburn County community. Maintaining, protecting and enhancing the quality of the lake is crucial in sustaining the lakes natural beauty, water quality, and availability for recreational use.

The long-term management of Spooner Lake is a concern for the local community and the local county and state governments. Located in the Town of Spooner, Washburn County assists in protection of the Lake through County land and zoning regulations. They also have regulation of resources through the County Zoning Code and Lake Classification System. The Wisconsin DNR provides oversight through provision and regulation of State Administrative Codes. The DNR also provides funding opportunities to protect and enhance the State's natural resources. This project is supported in part through grants provided by the Wisconsin DNR and the U.S. Geological Survey.

Cedar Corporation, a Menomonie, WI, based engineering/environmental consulting firm, was hired by the Spooner Lake District in 2000 to assist in promoting water quality in the area. Cedar chose a holistic watershed approach as opposed to a simple lake/flowage approach to assess current and future conditions. This report documents the various information gained through multiple studies and assessments as well as continuing previous work. The intent is to provide a dynamic document that can be altered in the future as more information becomes available. Recommendations to implement water quality protection and improvement projects are presented in Chapter 9.

This work could not have been completed without the efforts and support of:

- the Board and members of the Spooner Lake District
- Volunteers from the Spooner Lake Area
- the Wisconsin DNR
- concerned citizens and local organizations

Spooner Lake in Washburn County, Wisconsin is located in the geographic area known as the Shell Lake and Upper Yellow River Watershed (SC15) of the St. Croix Basin. This watershed covers a portion of Washburn and Burnett Counties and is rich with natural resources, containing more than 53 lakes, including Shell Lake, which was designated as an "outstanding water resource," in the 1994 Water Quality Management Plan. Due to the numerous resources available for recreational purposes, Spooner Lake and other lakes in this area are experiencing increased development pressure from urban center residents. As a result, the potential impacts caused by non-point source pollution are increasing on these water bodies. Planning for the preservation and continued protection of lakes from this intense development pressure for lakeshore property will ensure the continued enjoyment of these natural resources in the future.

***The St. Croix Basin***

The St. Croix Basin extends from northwestern Wisconsin to northeastern Minnesota, encompassing the water sheds of the St. Croix and Namekagon Rivers. In 1968, under the National Wild and Scenic Rivers Act, the St. Croix River, including the Namekagon River, was designated as a National Scenic Riverway. The Wisconsin DNR adopted this surface water

designation as outstanding resource waters under the national wild and scenic rivers category of ch. NR 201.10(1)(a)1, Wis. Admin. Code. The Wisconsin section of the basin contains 22 watersheds covering an area of 4,165 square miles over nine counties (DNR 2002).

***The Upper St. Croix and Eau Claire Rivers Watershed***
Extending from Perch Lake to the northwest and Pavlas Lake to the southeast, the watershed covers approximately 166 square miles. This watershed is also split between two counties, Washburn and Burnett.

***Spooner Lake***
The water quality of Spooner Lake is currently considered to be good in terms of clarity (as verified though volunteer Secchi disc readings). This flow-through lake is relatively shallow, with a maximum depth of 17 feet and averages 6 to 8 feet deep. Spooner Lake has an approximate surface area of 1,092-acres. The location of this drainage impoundment is upstream from the City of Spooner on the Yellow River. The lake was first impounded with a wooden dam in 1876. It was replaced by a concrete dam in 1912, and has an estimated outlet flow of 25 cubic feet per second. The lake is a wildlife habitat to many different species, including Canadian Geese, which have been verified to be high contributors of fecal coliform contaminants (volunteer water quality tests). The lake's fishery consists of northern pike, largemouth bass, walleye, and pan fish. Aquatic vegetation growth has been a problem in the shallow, mucky areas of Spooner Lake for numerous years. In the past, lake drawdowns were regularly practiced to freeze and kill off the invasive vegetation, but consequently this practice caused an increase in fish winterkills. The vegetation problem still remains today. Decreases in the wild rice beds are caused by limiting factors of water level and water regime.

The high water levels observed in Spooner Lake favor the perennial vegetation over the annual wild rice plant, which is better supported in 3 feet of water or less and in mucky organic soils (as verified through a wild rice expert and wildlife biologist from the Great Lakes Indian Fish and Wildlife Commission who toured the area in 2001).

The Spooner Lake Planning Grant study encompassed all of Spooner Lake and contiguous shoreland properties in the Township of Spooner, portions of Washburn County and Crystal Brook which feeds the lake.

## 1.1. What is a "Watershed?"

Merriam-Webster's Dictionary defines a watershed as "a region or area bounded peripherally by a divide and draining ultimately to a particular water course or body of water." In fact, large watersheds are a combination of smaller or sub-watersheds. Delineation of watersheds is completed by the use of topographic maps. Finding the high point or ridgeline between lower areas defines the boundary of a watershed. Connecting these ridges and highpoints define or delineates the watershed area.

With the watershed defined, soils and land use within the watershed can be compiled and with the evaluation of precipitation and run off calculations, an assessment of the impacts of land use on the water quality within the watershed can be made. The advent of high speed computers and

complex mathematical algorithms accents this understanding by allowing the complex inter-relationship of water runoff and infiltration and nutrient (pollutant) loading to be calculated.

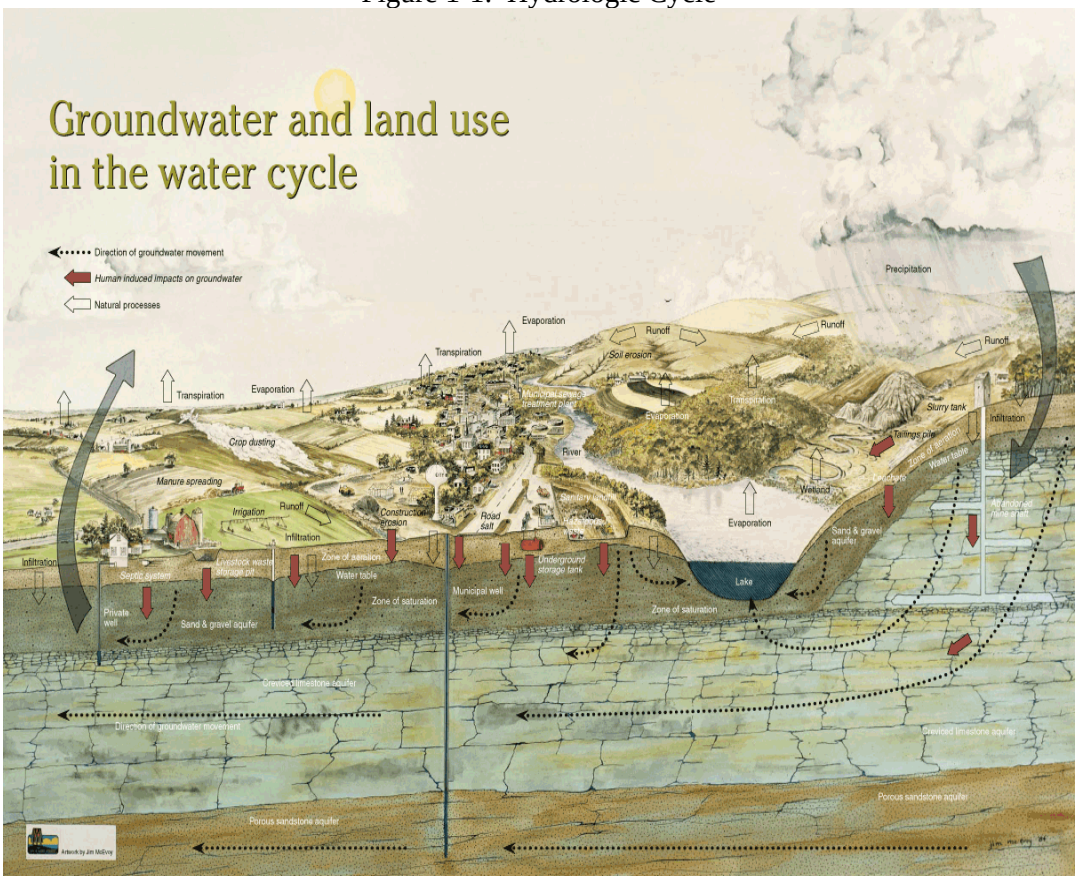
Accepting that man's imprint on the surface of the watershed affects the water quality draining from the watershed is a necessity in understanding the effects of water quality degradation in the water courses and basins receiving this water – our lakes, rivers and impoundments.

## 1.2. What is Runoff?

Rainfall and snow melt are generally termed "runoff" and either runs off the land or infiltrates into the subsurface. Urban storm water runoff is considered to be that precipitation or snowmelt water that is unable to infiltrate the Earth's surface, and enters urban storm water control systems. In the hydrologic cycle (Figure 1-1), runoff water is termed "overland flow." As land is developed, less land area is available for infiltration of storm water, thus runoff increases.

Runoff water drainage systems are incorporated in developed areas as a preventive action to minimize localized flooding. These drainage systems may discharge through an individual or local outfall to a surface water body or swale, or may runoff the land as overland flow. Runoff water quality, however, has not been much of a concern until the late 1980's. Early in the 1990's, the U.S. Environmental Protection Agency (EPA) defined contaminated surface runoff water as one of the greatest threats to our ecology. Significant legislation resulted from this concern.

Figure 1-1: Hydrologic Cycle



## 1.3. Runoff Water Regulation Driven by Water Quality

Runoff water has been targeted by the U.S. EPA as the major contributor to the degradation of surface water quality in our environment. In Wisconsin, the Department of Natural Resources (WDNR) regulates runoff water through Wisconsin Administrative Code (WAC) NR 151 and NR 216. Current regulations for the discharge of urban storm water are already in place for larger municipal separate storm sewer systems (or MS4s). These regulations have also been introduced in smaller "urban areas," which have been defined by EPA and WDNR as "an area with a population density of 1,000 or more per square mile, or an area of industrial or commercial uses, or an area that is surrounded by an area described in this definition" (WAC NR 155.12 (31)).

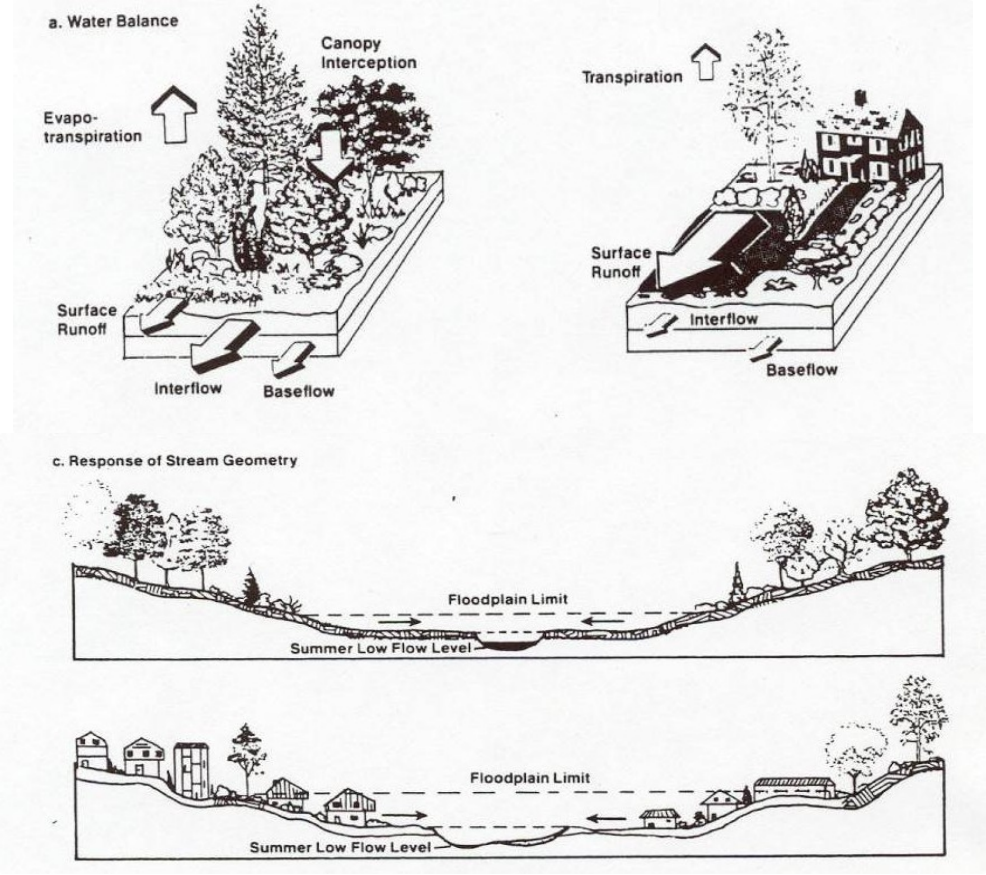
The Town of Spooner is not identified by the WDNR as a community that will be required to enact storm water management. However, in the interests of protecting and improving water quality in the Lake, the Spooner Lake District is pursuing the evaluation of watershed water quality and its affects on the lake water quality. The results of this effort will be shared with the Towns and communities in the watershed to develop the basis for local guidelines and ordinances in an effort to maintain and improve lake water quality.

## 1.4. Water Runoff Management

Traditionally, the objective of runoff water management has been flood or water quantity control, that is, to transport runoff as quickly as possible through the drainage system to prevent flooding and protect lives and property. Although public health and safety are still the most important goals, other objectives, such as the preservation of water quality, groundwater, and natural habitat, are also important. Existing flood and water quantity control methods are not always readily adaptable to meet these new requirements, because the historic methods contribute to increased downstream water quantity, generate water quality problems, and do not provide for habitat protection. Likewise, some recommended water quality and habitat solutions, such as naturally vegetated drainage ways, can contribute to upstream flooding problems by reducing the carrying capacity of the drainage conveyance.

Figure 1-2 shows the impacts of urbanization throughout a watershed and the increase in water runoff reflects the change in waterways that flow through an urbanized area. It is necessary to achieve a balance for both water quantity and water quality objectives. This balance is achievable through regional solutions, including effective land use planning to minimize impervious areas and preserve natural vegetation, and the protection of riparian areas along streams and lakes. Local ordinances and codes can be enforced to reduce impervious areas and increase vegetation by limiting the extent to which a site can be developed. Water quantity and water quality goals can also be met at the local level through proper construction site planning and appropriate design that carefully considers the various impacts of development and application of BMPs (Best Management Practices) to minimize water quality impacts. BMPs are recognized administrative and engineering devices that minimize the impacts of polluted runoff on receiving waters. BMPs have been developed for many common problematic situations and can be readily incorporated into lakefront and watershed wide development. Examples include shoreline buffers, reduced clean cutting along shoreline, limiting use of phosphorus fertilizers, etc.

**Figure 1-2: Water Balance, Stream Flow, and Stream Geometry; Source: Schueler, 1987**




### 1.4.a. Water Quantity

The quantity or volume of water runoff generated by varying land uses depends on three factors: (1) the intensity of a given runoff event; (2) the duration of the event; and most importantly (3) the amount of impervious area present. Impervious surfaces include asphalt and concrete, building rooftops, compacted soils, etc. As impervious surfaces increase with development, the intensity of runoff water increases and the water quality decreases, and therefore the runoff from increasingly developed areas has a serious impact on receiving waters. As shown in Figure 1-2, the natural water balance is disrupted when an area is developed. Compacted soils, paved surfaces, and buildings replace vegetation that once intercepted runoff, allowed it to infiltrate into the ground, and returned water to the atmosphere through evapotranspiration. Compacted soil surfaces, such as well-used pastures and compacted lawns, also reduce the infiltration capacity of soils as does asphalt and concrete surfaces. Snowmelt and heavy rain events on these compacted surfaces increase the chance of flooding. As the volume and flow rate (velocity) of the runoff increases, water reaches streams and lakes more quickly. The higher runoff volumes and rates lead to overland erosion, scouring or undercutting of stream banks, flooding, and loss of habitat. Less obvious is the, lack of replenishment of ground water supplies reduced quantity of groundwater to contribute base flow to streams, sustain lake levels, and maintain ground water elevation (essential for well supplies).

### 1.4.1. Water Quality

Land development practices adversely affect the quality of runoff water by increasing runoff volume which increases soil erosion and results in more rapid transfer of pollutants to receiving water. Development also increases the contribution of nutrients (phosphorous and nitrogen) through manure spreading, septic systems, fertilization, animal pasturing, etc. Surface water runoff collects and transports pollutants, including:

- *nutrients* such as phosphorus and nitrogen, which hasten the lake aging process (or eutrphication); this process naturally results in increased algae and plant growth
- *sediment* such as silt (fine particulates), sand, and gravel, which has the capacity to carry other pollutants and can smother fish eggs, also results in shallower lake water
- *bacteria and viruses* from humans and animals
- *organic chemicals*, such as pesticides and hydrocarbons (dissolved in water or adsorbed to the sediment)
- *heavy metals* such as lead, copper, zinc and cadmium, among others, that are usually adsorbed on the grains of sediment are redistributed in ponds and lakes after high runoff events

Sources of runoff water pollutants from developed areas include, but are not limited to:

- automobiles and related surfaces – roads, parking lots, service areas
- construction and new development activities
- atmospheric fallout from vehicle and industrial emissions
- dust from construction/logging/agricultural activities
- overuse and improper disposal of toxic chemicals, pesticides, herbicides, and fertilizers
- illegal discharges to storm sewer systems
- decaying plants and animal wastes from natural and agricultural sources
- disturbed or exposed soils

## 1.5. Objectives of Lake Watershed Management Planning

This Plan presents general *technical guidelines*. Specific conditions may require site-specific modifications of the practices described or an alternative practice that is approved by a local permitting authority. The Spooner Lake District Watershed Management Plan provides a discussion and plans for runoff water and lake water quality protection and improvements. The Plan is intended for water quality and quantity professionals as the community continues to develop within and beyond the local Watershed. We say beyond because this Plan considers only the local watershed for Spooner Lake.

## 1.6. Components of Watershed Planning (from *The Wisconsin Storm Water Manual*)

The Spooner Lake District is recommending the adoption of runoff water planning and controls with the presentation of this Plan to the local Townships.
The adoption of this Plan will require:

- Land Use Planning
- Performance or Design Criteria for Runoff Water Best Management Practices (BMPs)
- Financing Mechanisms
- Storm Water, Nutrient, and Erosion Control Ordinances

Before completing any component of the Plan, the Lake District recommends the Townships develop an outline for a Runoff Water Management Plan. There are four fundamental elements to consider when protecting human and environmental concerns:

- Flood Control
- Water Resource Protection
- Generic Nonpoint Source Pollutant Control
- Specific Nonpoint Source Pollutant Control

## 1.7. Updates to the Plan

The practice of lake watershed water quality management is quickly evolving and this Plan must be updated as new information is available. Design information for various BMPs (Best Management Practices) is expected to change as more people apply the practices and learn from their experience. New BMPs will be developed for specific situations that will improve runoff water quality. The Plan should be considered dynamic and regular updates incorporated.

# CHAPTER 2: PHYSICAL ENVIRONMENT

Spooner Lake is located approximately 114 miles northwest of the Twin Cities Metro Area. Due to the numerous resources available for recreational purposes, Spooner Lake and other lakes in this area are experiencing increased development pressure from those seeking greater recreational opportunities. As a result, the potential impacts caused by non-point source pollution are increasing on these water bodies. Planning for the preservation and continued protection of lakes from this intense development pressure of lakeshore property will ensure the continued enjoyment of these natural resources in the future.

Spooner Lake is a shallow flow-through lake, with a maximum depth of 17 feet and an average of 6 to 8 feet deep and an approximate surface area of 1,092-acres. The location of this drainage impoundment is upstream from the City of Spooner on the Yellow River. The lake was first impounded with a wooden dam in 1876. It was replaced by a concrete dam in 1912, and has an estimated outlet flow of 25 cubic feet per second.

Understanding Lake Watershed Management requires understanding the existing conditions and resources within the select watershed boundaries. Thus, understanding the physical environment and the history of the Spooner Lake Watershed is crucial in the development of policies and standards that best protect the resources of this Watershed while meeting the needs of local inhabitants.

Time and geologic processes (plate tectonics, glaciations, and erosion) have defined the physical environment of the Spooner Lake Watershed over the course of millions of years. The distribution of bedrock, unconsolidated (loose) sediments, landforms, and structural features in the watershed are the geologic backbone on which the biological and human environments exist. The characteristics of the physical environment ultimately determine the availability of natural resources, the susceptibility of resources to pollution, and success of organisms living in the watershed.

## 2.1. Geology

Cambian age (450-500 million years old) sandstone underlies a large portion of Washburn and surrounding counties including the Spooner Lake area. This sandstone, locally known as Mt. Simon Formation (designated Cm), is a whitish colored sandstone which was formed at a time when a vast shallow sea covered the level between what is now Wisconsin and Colorado. Beach front sand deposited during these times were buried and metamorphosed into sandstone. The Mt. Simon is characterized as a white silica sandstone with flecks of glauconite and interbedded with bands of green shale. Other deposits formed over the Mt. Simon and over time layers of other sandstone, limestone, and shale were laid down and eventually eroded as the glaciers moved back and forth over the land wearing the surface down to the current elevation of the Mt. Simon.

The most recent glacial age left deposits of 50 to 100 foot thick sediment pile overlying the bedrock in the region commonly called “till” or glacial till, these unconsolidated sediments area a mixture of the clay, sand, and gravel deposits that occurs during the retreat of the most recent glaciers. The deposits include erosional material from the glacial advance, melt water deposits from glacial rivers, etc.

Named the Copper Falls formation this gravelly sandy, reddish brown loam was deposited by glaciers advancing to the southwest. This deposit is several tens of feet thick in many areas and is present over most of northern and northwestern Wisconsin. In the Spooner Lake area this formation is approximately 100 feet thick.

## 2.2. Hydrogeology

Ground water in Spooner is directly influenced by the lakes and rivers and the tributaries that traverse the region.

The sensitivity of the ground water to surficial contamination is a function of the permeability of the surficial soils and underlying sediments and bedrock. The region is mapped as moderately to highly sensitive to ground water contamination. The presence of near surface sandy soils provides a surface readily capable of conducting surface water and dissolved contaminants to the ground water. The sandy soils also act as an excellent filter to remove inorganic and organic particulate matter (suspended solids) from the infiltrating surface waters.

The underlying sand and gravel of the Copper Falls formation and the Mt. Simon sandstone form two water bearing aquifers in the region. Most private water supply wells are found in the Copper Falls formation, while the deeper Mt. Simon formation is used for high capacity wells as would be found for municipal water supply and agricultural irrigation wells. Groundwater is moving generally to the west northwest in the region (toward the St. Croix River). Locally, however, the near surface water table reacts to topographic hills and valleys with ground water generally moving from high points to the valleys.

## 2.3. Soils

When bedrock and sediments are exposed on the Earth's surface, the rocks and minerals erode and decompose (weather). The most important product of this weathering process is soil, or veneer. The formation of soil and the soil type is dependent on five factors:

- Parent Material
- Time
- Climate
- Vegetation
- Topography

Over time, soils develop horizons (a vertical differentiation based on observable physical and chemical properties).

- The **O Horizon** is an accumulation of organic material on the soil surface characterized by decomposing plant material with little mineral content.

- The **A Horizon** (or top soil) is an accumulation of organic material, with a loose or open texture, and is leached of dissolved chemicals and fine particles.

- The **E Horizon** is a light-colored layer characterized by leaching of iron and aluminum with a lower organic content.

- The **B Horizon** is the horizon where the material leached from the A and E Horizons tends to accumulate.

- The **C Horizon** is made up of slightly weathered parent material that has not undergone leaching or accumulation.

Depending on the soil forming factors acting on a surface, some of the horizons may be poorly developed or missing; and removing, compacting, and/or mixing soil horizons dramatically alters the soil's ability to sustain vegetation.

Soil descriptions are based on their physical and chemical properties. Soil classification systems are used to group soils of similar properties and to provide a systematic means of mapping. For the purposes of this Management Plan, the soils of the watershed are classified by their hydrologic soil group (HSG). This classification system is based on infiltration rates (water movement into soil) and transmission (water movement through soil) rates. The HSG classification of a soil describes the potential of that soil type to produce runoff. In 1955, the USDA defined four hydrologic soil groups as:

- **Group A:** Well to excessively well drained soils such as sands and gravels. High infiltration rate even when thoroughly wetted. Transmission >0.30 inches per hour.

- **Group B**: Moderately well to well-drained soils such as sandy silty soils. Moderate infiltration rates when thoroughly wetted. Transmission between 0.15 and 0.30 inches per hour.

- **Group C**: Soils with an impeding layer to downward movement such as silty sands and silts. Low infiltration rates when thoroughly wetted. Transmission between 0.05 and 0.15 inches per hour.

- **Group D**: Soils which are almost impervious at or near the surface such as clay. Very low infiltration rates when thoroughly wetted. Transmission between 0 and 0.05 inches per hour.

- **Note**: Soils that do not meet the criteria of Group A, B, C, or D may be saturated and do not have an established rate of infiltration.

The relationship of a soil's hydrologic soil group to its landscape position is important in delineating wetlands and determining its susceptibility to erosion. Wetland, or former wetland, areas are characterized by hydric soils. Hydric soils are defined in the 1987 Army Corp of Engineers Wetland Delineation Manual (ACEWDM) as "soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation."

Soils with low infiltration rates (Group C and D) and flatter topography are more likely to form wetlands, but wetlands may also form where the water table is at or near the surface regardless of soil texture. Wetland hydrology is defined in the 1987 ACEWDM as "the sum total of wetland characteristics in areas that are inundated or have saturated soils for a sufficient duration to support hydrophytic vegetation." In order for wetland hydrology to be present, the area must be inundated or saturated to the surface for at least 5% of the growing season (consecutive days) in most years (>50%). From May 20 to September 23, the average growing season for Washburn County is 124 days (*Midwest Regional Climate Center*). Therefore, areas inundated or saturated for six or more consecutive days (5% of 124 equals 6.2) during the growing season during most years meets the definition of a wetland.

# CHAPTER 3: LAKE WATER QUALITY

An important tool in effective runoff water management is information of existing conditions, problems, and opportunities. This Lake Watershed Management Plan identifies local watershed and sub-watershed boundaries; and, natural and manmade drainage and storage features. The Plan describes the existing problems related to drainage, sedimentation, degradation of existing natural resources, and storm water quality. Based on existing and future land use conditions, the Plan proposes effective requirements for existing land uses, new developments, and remediation needs.

Strategies that address the area's unique climate, topography, natural resources, hydrogeology, and land use patterns are necessary. By making use of regulatory, land use planning, and educational approaches whenever feasible, rather than costly structural solutions, the Spooner Lake Watershed can greatly reduce the ultimate costs of implementing a Watershed Management Plan. Public education, policy, and programs can reduce discharges of nutrients, sediments, old motor oil, household wastes, litter, anti-freeze, deicing chemicals, yard fertilizers, agricultural herbicides, pesticides, and fertilizers. Education of the younger population will encourage the development of habits and practices to improve storm water runoff quality continually into the future.

Management techniques are similar from one part of the Watershed to another, but are accomplished with different methodologies. In new developments or redevelopment areas, the program emphasizes land use planning approaches using site plan and subdivision review to require specific storm water management actions. In existing rural and developed areas, the use of police and regulatory powers to abate, enjoin, or criminalize illicit discharges and the dumping of pollutants into the storm water system is crucial.

## 3.1. Lake Ecosystem

Stable ecosystems have great diversity and habitat. Water quality in a lake without wetlands, marshes, near shore shallow areas, or deep open water is more unstable than a lake with this diversity. However, as the years change, season-by-season, the diversity of the ecosystem naturally changes. While land use changes in the watershed, the effects of these changes may not be immediately seen in the lakes. The effects may take years, decades, or more before the negative impacts are realized.

Wisconsin lake shorelines were once natural with lush vegetation. Shoreline dwellings were sparse and considerably less modern than today; oars and manpower controlled boats; and a crowded lake meant seeing another person on the lake. A desire to have a place on a lake of such scenery and serenity soon became the beginning of the recent rush to acquire that refuge over the last 40 years. This rush to acquire that piece of serenity has resulted in many of the concerns discussed in this Lake Watershed Management Plan.

Living organisms around and in lakes require a special balanced habitat that provides food, shelter, oxygen, and other specific needs. "The margin of our water is the place where all life comes together…a bridge between two worlds. It is a place essential for plants and creatures to survive. As many as 90 percent of the living things in our lakes and rivers are found along their

shallow margins and shores." (Rideau Canal, Parks Canada). The littoral zone provides a nursery for fish, refuge from predators, and it intercepts nutrients.

## 3.2. Watershed Description

Wisconsin is blessed with the third largest concentration of fresh water glacial lakes on the planet; only Ontario and Alaska have more. About 75 percent of the precipitation that falls to our lakes and land re-enters back into the earth's atmosphere from evaporation and plant transpiration. On flat land or sandy areas, water infiltrates to the ground water and moves toward lakes and rivers and excess water runs off the land and enters the lakes and rivers. Lake levels fluctuate season-to-season in response to rainfall events, outside temperature, dams, etc. Such fluctuations are characteristic of normal lake systems.

Lake types are dependant upon the water source and types of outflow for the individual water body.

A. A lake fed by precipitation, with limited runoff and ground water, and has no stream outlet is called a seepage lake.

B. A lake fed by ground water, with limited precipitation and runoff, and has a stream outlet is called a ground water drainage lake.

C. A lake fed by precipitation, ground water, runoff, and is drained by a stream outlet is called a drainage lake.

D. A manmade lake created by damming a stream, which still allows it to drain, is called an impoundment.

**Table 3-1 . Sub-Watershed Areas**

| Sub-Watershed | Acres |
|---|---|
| A | 389 |
| B | 526 |
| C | 354 |
| D | 200 |
| E | 168 |
| F | 544 |
| G | 665 |
| H | 538 |
| I | 168 |
| J | 416 |
| K | 788 |
| L | 362 |
| M | 104 |
| N | 627 |
| O | 379 |
| P | 219 |
| Q | 321 |
| R | 544 |
| S | 500 |

Spooner Lake is classified as a drainage lake. The Lake is fed by the Crystal Brook to the south east and its outlet is the Yellow River to the southwest.

The Spooner Lake Watershed that contributes to the Lake is calculated to be 7,811 acres (land area) in size with 19 primary subwatersheds as identified in Table 3-1. These acreages include the lake surface areas. Of the 19 subwatersheds, only 9 of them are directly adjacent to Spooner Lake (shaded on Table 3-1) and make up over 50% (4,003 acres) of the total watershed area. Spooner Lake's surface area is 1,092 acres.

Runoff rates from natural landscapes are dependent on the slope of the topography, the absorption capacity of the soil and the evaporative uptake of lush vegetation. If best management practices are not in place, soil, water, nutrients, and other debris are collected by overland stormwater flow and carried to the lakes. The primary pollutant associated with forestry, agricultural, and development activities is eroding soil. The secondary pollutants

are nutrients, the increase of which in the lakes increases the viability of plant and algae life.

## 3.3. Oxygen Cycle

A healthy dissolved oxygen level for fish and plants is typically in the range of 7 to 11 mg/L (milligrams per liter). Dissolved oxygen (DO) is the measure of oxygen gas that is dissolved in water. Fish "breathe" oxygen just as land animals do. However, fish are able to absorb oxygen directly from the water into their bloodstream using gills, whereas land animals use lungs to absorb oxygen from the atmosphere. There are three main sources of oxygen in the aquatic environment: 1) direct diffusion from the atmosphere; 2) wind and wave action; and 3) photosynthesis. Of these, photosynthesis by aquatic plants and phytoplankton is the most important.

Oxygen, derived from photosynthesis, is produced during the day when sunlight shines on the plants in the water. Oxygen levels drop at night because respiration decreases and photosynthesis is not replenishing the oxygen level. These predictable changes in DO that occur every 24 hours are the 'diurnal oxygen cycle.'

In the fall, stratified lakes "turn over", mixing the lower and less oxygenated waters of the lake with the near surface higher oxygen content waters. With the onset of winter, lake water oxygen content will decline as decomposition of decaying plant life continues to absorb oxygen. If the ice is too thick and the decomposition rate is high, low DO levels in lake water can result in high fish mortality.

### 3.3.a. Mixing

Mixing of water in the lakes by wave action increases dissolved oxygen concentrations. The depth, size, and shape of the lake controls the ability for water to mix which also controls the mixing of the nutrients. In the summer, wind action readily mixes those topographically unprotected shallow lakes. Because Spooner Lake is rather shallow, mixing is an important contributor to dissolved oxygen levels.

### 3.3.b. Stratification

In deeper lakes, the water column can stratify in deeper lakes and usually forms three layers. The warm surface layer is called the epilimnion; oxygen is mixed from the atmosphere in this layer. The transition zone between warm surface water and cold, deep water is called the thermocline, or metalimnion. The cold bottom water is called the hypolimnion. Shallow lakes that experience regular mixing may not stratify. Deeper lakes that do not mix usually have low oxygen levels in the hypolimnion as a result of decomposition of decaying matter. As the oxygen becomes used up, this layer tends to trap and concentrate nutrients dissolved from bottom sediments by anaerobic processes. This stratification is usually well defined in deeper lakes.

### 3.3.c. Retention Time

A lake's size, water source, and watershed size determine the average length of time water remains in a lake, or the retention time. Another way to look at this would be to see how long it would take to fill a drained lake. The retention time for the Spooner Lake has yet to be calculated. However, considering the surface area, depth of the lake, and the outlet size and incoming water volume, one can readily conceive that the retention time is relatively short in this lake. The longer the retention time means that suspended solids and nutrients will be retained in the lake over longer periods, increasing the pollutant concentrations as additional nutrients and solids enter the lake.

## 3.4. Lake Water Quality

Lake water quality is almost synonymous with lake water clarity. The principal loading factors that results in decreased clarity are suspended solids and nutrients; increasing both factors decreases water clarity and water quality. Water quality is, however, a multi-faceted parameter consisting of the inter-relationships of water clarity, nutrient and sediment contributions from watershed sources, and water chemistry (pH, hardness, and alkalinity). The following briefly describes the role and importance of these factors in water quality.

### 3.4.a. Water Clarity

Two components determine water quality: materials dissolved in water and materials suspended in water (turbidity). Water quality can be relatively measured as water clarity. This measurement has been standardized (Table 3-3) with the use of a measuring device known as a Secchi disc. The standardized measurements are an indicator or measure of water clarity and can be compared to other chemical and physical properties of the lake and other lakes.

A Secchi disc is an 8-inch diameter weighted, flat circular disc divided into four alternating black and white quadrants that can be lowered into a lake to visually measure water clarity. The depth at which the Secchi disc disappears can be related to the quantity of nutrients and type of algae present in the water column. Interpretation is relatively simple: the higher the readings, the clearer the lake. Cloud cover, sun's angle, and wave action affect this reading, so to properly correlate the collected data these measurements should be performed on calm, sunny days between 10:00 a.m. and 2:00 p.m.

**Table 3-2. Water Clarity Index**

| Water Clarity | Secchi Depth (ft) |
|---|---|
| Excellent | 32 |
| Very good | 20 |
| Good | 10 |
| Fair | 7 |
| Poor | 5 |
| Very Poor | 3 |

Modified from: Understanding Lake Data, Table 2, WDNR

### 3.4.b. Nutrients

Runoff that contains high concentrations of phosphorus and nitrogen can lead to increased plant growth and algae blooms in the receiving waters as the nutrients act as fertilizer. River impoundments have the greatest risk of increased rates of eutrophication

as they have substantial water runoff and stream volume input from upstream sources. In water systems in our region, phosphorus is considered the main nutrient controlling plant growth and algae blooms as nitrogen is readily available. Thus even small concentrations of phosphorous can readily generate algae blooms.

### 3.4.c. Trophic Status

Section 305b of the Clean Water Act requires each state to construct "fishable" and "swimmable" goals. Federal requirements in Section 314 of the Clean Water Act require all lakes of the nation be classified using a single criteria. Scientists have established such criteria to classify the nutrient state of each lake, recognizing that each is unique and at different levels of eutrophication.

Eutrophication is defined as the process by which lakes are enriched with nutrients, accumulated sediments, productive aquatic plants, and algae. Table 3-4 designates the Trophic State Index (TSI) value/ranges and descriptions of the trophic state of the water and example lakes.

At present there are many opinions being presented that would alter the correlation between TSI and water quality. In this text, this table presented by the WDNR, is used to describe the Trophic State of the Spooner Lake which is considered eutrophic with TSI values of 50 to 60.

**Table 3-3: Trophic State Index (TSI)**

| TSI Value | Water Quality Attributes | Fisheries, Recreation or Example Lakes |
|---|---|---|
| <30 | **Oligotrophic:** Clear water, oxygen through the year in the hypolimnion. Water supply may be suitable unfiltered. | Salmonid fisheries dominate. |
| 30-40 | Hypolimnia of shallower lakes may become anoxic during the summer. | Salmonid fisheries in deep lakes only. Example: Lake Superior (WDNR) |
| 40-50 | **Mesotrophic:** Water moderately clear but increasing probability of anoxia in hypolimnion during summer. Possible iron, manganese, taste and odor problems may worsen in water supply. Water turbidity requires filtration. | Walleye may predominate and hypolimnetic anoxia results in loss of salimonoids. |
| 50-60 | **Eutrophic:** Lower boundary of classic eutrophy. Decreased transparency, anoxic hypolimnion during the summer, macrophyte problems evident, warm water fisheries dominant. | Bass may dominate. |
| 60-70 | Dominance of blue-green algae, algal scums probable, extensive macrophyte problems. Possible episodes of severe taste and odor from water supply. Anoxic hypolimnion, water-water fisheries. | Nuisance macrophytes, algal scums and low transparency may discourage swimming and boating. |
| 70-80 | **Hypereutrophic:** Light limited productivity, dense algal blooms and macrophyte beds. | Lake Menomin & Tainter Lake, Dunn County, WI (WDNR). |
| >80 | Algal scums, few macrophytes, summer fishery kills. | Dominant rough fish. |

## 3.5. Carbonate System

Biological productivity, lake acid buffering capacity, and solubility of toxic chemicals are affected by a lake's carbonate system. Many naturally occurring chemicals of this system constantly change with sunlight, temperature, each wave, and different biological activity.

### 3.5.a. Lake pH

An important aspect of the carbonate system is the acidity of pH of the lake. The pH indicates the amount of available hydrogen ions ($H^+$) in water. The more acid (pH less than 7) the water, the more hydrogen ions are present. Basic or alkaline water has less hydrogen ions (pH greater than 7). Neutral water has a pH of 7.

The pH in Wisconsin lakes ranges from 4.5 in reducing lakes to 8.4 in hard water lakes. Rainfall also varies in pH from 4.4 in southeast Wisconsin to 5.0 in northern Wisconsin (WDNR). These ranges are deceiving, as acid levels change 10 times for every pH unit. Therefore, a lake with a pH of 7 is 10 times more acidic than a lake with a pH of 8 because there are 10 times as many hydrogen ions.

**Table 3-4 - Effects of Acidity on Fish Species**

| Water pH | Resulting Effect |
|---|---|
| 3.0 | Toxic to all fish |
| 3.5 | Perch disappear |
| 4.5 | Perch spawning inhibited |
| 4.7 | Brown bullhead, northern pike, pumpkinseed, rock bass, sunfish and white sucker disappear |
| 5.0 | Spawning inhibited in many fish |
| 5.2 | Burbot, lake trout, & walleye disappear |
| 5.5 | Smallmouth bass disappear |
| 5.8 | Lake trout spawning inhibited |
| 6.5 | Walleye spawning inhibited |

Source: Olszyk 1980

Most fish thrive in water within a range of 5 to 9 pH values. Moderately low pH doesn't usually harm fish, however, with lower pH concentrations; metals (such as aluminum, iron, mercury and zinc) become soluble and are released from the lake bottom sediments. Lakes that contain more acidic waters usually have tainted fish due to high levels of mercury or aluminum. When eagles, loons, osprey, or humans eat tainted fish, the metals accumulate in their bodies and can threaten their health. The relative affects of lake water acidity on fish species are given in Table 3-5. Note the sensitivity of the walleye fishery to a pH of 6.5 or less.

### 3.5.b. Alkalinity and Hardness

Alkalinity and hardness of lake water is affected by the quantities of impurities that dissolve or come in contact with lake water, soil minerals, and bedrock. Bicarbonate and carbonate are two alkaline compounds that act as acid buffers and are usually found combined with calcium (calcium carbonate: calcite or limestone) and magnesium (calcium magnesium carbonate: dolomite).

Much of northern Wisconsin contains glacial deposits that contain very little to no limestone. Therefore, these soils that have a higher sand content tend to have lower alkalinity and hardness values. However, if a lake receives groundwater through limestone bedrock, the water will have higher alkalinity and hardness. More fish and aquatic plants are produced in hard water lakes than soft water lakes.

**Table 3-5 Hardness Categorization**

| Total Hardness (mg/L $CaCO_3$) | Hardness Level |
|---|---|
| 0-60 | Soft |
| 60-120 | Moderately Hard |
| 120-180 | Hardness Level |
| > 180 | Very Hard |

## 3.6. Spooner Lake Water Quality

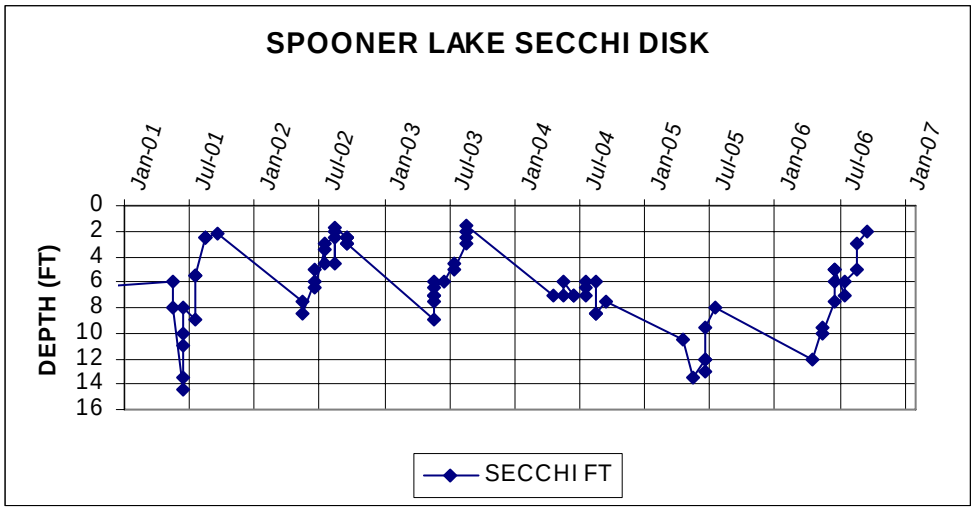
Lake water quality data (Secchi Depth, phosphorous concentration, temperature, and chlorophyll *'a'* data) has been collected from Spooner Lake for a few years. This data has been collected as part of the Association's Self-Help Monitoring program and the WDNR Basin Management projects. The data is available on the Internet through the DNR Storet Lake Water Quality database.

Table 3-6 Water Quality Data Collected in August 2004 - Deephole

| PARAMETER | RESULT | UNITS |
|---|---|---|
| TEMPERATURE - FIELD | 21.9 | C |
| CONDUCTIVITY FIELD | 171 | UMHOS/CM |
| DISSOLVED OXYGEN | 9.5 | MG/L |
| PH FIELD | 8.5 | SU |
| PHOSPHORUS TOTAL | 29 | ug/l |
| CHLOROPHYLL A | 6.95 | ug/l |
| SECCHI DEPTH - FEET | 7.1 | FT |

The compiled data is included in Tables 3-7, 3-8, and 3-9 and Figure 3-1. Table 3-7 presents the water quality data collected in 2004, Table 3-8 the Secchi Disk data, and 3-9 the dissolved oxygen concentration and temperature data. Figure 3-1 is the graph depicting the Secchi Depth readings between 2002 and 2006.

**Figure 3-1 Secchi Depth Readings**




A review of Table 3-8 indicates Secchi values ranging from 14.5 to 2 for Secchi Depth. Secchi Depth values decrease (indicating increased turbidity in the lake) in the summer months. Secchi Depth averages by year are 7.2 (2001), 4.0 (2002), 5.2 (2003), 7.0 (2004), 11.2 (2005), 6.5 (2006).

Table 3-7 Secchi Disk Data

| STORET STATION | SITE NAME | DATE | SECCHI FT | WATER LEVEL | CLARITY | COLOR |
|---|---|---|---|---|---|---|
| 663153 | DEEP HOLE | 7/15/1998 | 8 | - | - | - |
| | | | | | | |
| 663153 | DEEP HOLE | 5/9/2001 | 6 | Normal | Murky | Yellow |
| | | 5/13/2001 | 8 | Normal | Clear | Yellow |
| | | 6/3/2001 | 14.5 | Normal | Clear | Yellow |
| | | 6/11/2001 | 13.5 | Normal | Clear | Yellow |
| | | 6/18/2001 | 11 | Normal | Clear | Yellow |
| | | 6/26/2001 | 10 | Normal | Clear | Yellow |
| | | 6/30/2001 | 8 | Normal | Clear | Yellow |
| | | 7/1/2001 | 9 | Normal | Clear | Yellow |
| | | 7/22/2001 | 5.5 | Normal | Clear | Yellow |
| | | 7/29/2001 | 5.5 | Normal | Clear | Yellow |
| | | 8/11/2001 | 2.5 | Normal | Murky | Green |
| | | 8/19/2001 | 2.5 | Normal | Murky | Green |
| | | 8/26/2001 | 2.5 | Normal | Murky | Green |
| | | 9/2/2001 | 2.25 | Normal | Murky | Green |
| 663153 | DEEP HOLE | 5/13/2002 | 7.5 | Normal | Clear | Yellow |
| | | 5/15/2002 | 8.5 | Normal | Clear | Yellow |
| | | 6/1/2002 | 6 | Normal | Murky | Green |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 6/15/2002 | 5 | Normal | Murky | Green |
| | | 6/22/2002 | 6.5 | Normal | Murky | Yellow |
| | | 7/7/2002 | 3.5 | Normal | Murky | Yellow |
| | | 7/14/2002 | 4.5 | High | Murky | Yellow |
| | | 7/21/2002 | 3 | Normal | Murky | Green |
| | | 8/4/2002 | 2.5 | Normal | Murky | Green |
| | | 8/14/2002 | 4.5 | Normal | Murky | Green |
| | | 8/18/2002 | 2 | Normal | Murky | Green |
| | | 8/25/2002 | 1.75 | Normal | Murky | Green |
| | | 9/2/2002 | 2.5 | Normal | Murky | Yellow |
| | | 9/8/2002 | 2.5 | Normal | Murky | Yellow |
| | | 9/15/2002 | 2.5 | Normal | Murky | Yellow |
| | | 9/22/2002 | 3 | Normal | Murky | Brown |
| | | 9/29/2002 | 3 | Normal | Murky | Brown |
| | | | | | | |
| 663153 | DEEP HOLE | 5/5/2003 | 9 | Normal | Clear | Blue |
| | | 5/10/2003 | 7 | Normal | Clear | Yellow |
| | | 5/15/2003 | 7 | High | Clear | Yellow |
| | | 5/18/2003 | 7.5 | High | Clear | Yellow |
| | | 5/21/2003 | 6 | High | Clear | Yellow |
| | | 5/31/2003 | 6.5 | Normal | Clear | Yellow |
| | | 6/15/2003 | 6 | Normal | Clear | Yellow |
| | | 7/12/2003 | 4.5 | Normal | Clear | Yellow |
| | | 7/19/2003 | 5 | Normal | Clear | Yellow |
| | | 8/9/2003 | 3 | Normal | Clear | Yellow |
| | | 8/16/2003 | 2.5 | Normal | Murky | Yellow |
| | | 8/23/2003 | 2 | Normal | Murky | Green |
| | | 8/30/2003 | 1.5 | Normal | Murky | Green |
| | | | | | | |
| 663153 | DEEP HOLE | 4/24/2004 | 7 | Normal | Clear | Yellow |
| | | 5/15/2004 | 7 | Normal | Clear | Yellow |
| | | 5/30/2004 | 6 | Normal | Clear | Yellow |
| | | 6/13/2004 | 7 | Normal | Clear | Yellow |
| | | 6/15/2004 | 7 | Normal | Clear | Yellow |
| | | 7/8/2004 | 7 | Normal | Clear | Yellow |
| | | 7/15/2004 | 6.5 | Normal | Clear | Yellow |
| | | 7/31/2004 | 6 | Normal | Clear | Yellow |
| | | 8/6/2004 | 6 | Normal | Clear | Yellow |
| | | 8/14/2004 | 8.5 | Normal | Clear | Yellow |
| | | 8/21/2004 | 8.5 | Normal | Clear | Yellow |
| | | 9/5/2004 | 7.5 | Normal | Clear | Yellow |
| | | | | | | |
| 663153 | DEEP HOLE | 4/21/2005 | 10.5 | Normal | Clear | Yellow |
| | | 5/30/2005 | 13.5 | Normal | Clear | Yellow |
| | | 6/5/2005 | 12 | Normal | Clear | Yellow |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 6/12/2005 | 12 | Normal | Clear | Yellow |
| | | 6/19/2005 | 13 | Normal | Clear | Yellow |
| | | 6/25/2005 | 9.5 | Normal | Clear | Yellow |
| | | 7/15/2005 | 8 | Normal | Clear | Yellow |
| | | | | | | |
| 663153 | DEEP HOLE | 4/10/2006 | 12 | Normal | Clear | Yellow |
| | | 5/21/2006 | 9.5 | Normal | Clear | Yellow |
| | | 5/26/2006 | 10 | Normal | Clear | Yellow |
| | | 6/3/2006 | 7.5 | Normal | Clear | Yellow |
| | | 6/13/2006 | 5 | Normal | Clear | Yellow |
| | | 6/17/2006 | 6 | Normal | Clear | Yellow |
| | | 6/30/2006 | 5 | Low | Clear | Yellow |
| | | 7/14/2006 | 7 | Low | Clear | Yellow |
| | | 7/31/2006 | 6 | Normal | Clear | Yellow |
| | | 8/6/2006 | 5 | High | Clear | Yellow |
| | | 8/21/2006 | 3 | High | Murky | Green |
| | | 9/1/2006 | 2 | Normal | Murky | Green |
| | | | | | | |
| The Secchi Dissk did not HIT BOTTOM during these measurements | | | | | | |

Table 3-9 Dissolved Oxygen and Temperature vs Depth

| **SAMPLE DATE** | **DEPTH** feet | **TEMPERATURE OF WATER** Deg. C | **DISSOLVED OXYGEN** mg/l |
|---|---|---|---|
| 6/9/2004 | 3 | 22.0 | 9 |
| | 6 | 22.0 | 9 |
| | 9 | 22.0 | 9 |
| | 12 | 22.0 | 9.5 |
| | 15 | 21.0 | 5.5 |
| 6/21/2004 | 3 | 20.3 | 9 |
| | 6 | 20.3 | 9 |
| | 9 | 20.3 | 9 |
| | 12 | 20.1 | 8.6 |
| | 15 | 20.0 | 8.1 |
| 7/2/2004 | 3 | 21.5 | 10.8 |
| | 6 | 21.5 | 10.8 |
| | 9 | 21.0 | 8 |
| | 12 | 19.4 | 5.2 |
| | 15 | 19.2 | 4.2 |
| 7/12/2004 | 3 | 23.1 | 10.2 |
| | 6 | 22.8 | 9.6 |
| | 9 | 21.8 | 6.9 |
| | 12 | 20.7 | 3.7 |

| | | | |
|---|---|---|---|
| | 15 | 20.3 | 2.3 |
| 7/20/2004 | 3 | 25.7 | 10 |
| | 6 | 24.8 | 9.4 |
| | 9 | 24.6 | 9 |
| | 12 | 24.3 | 6.3 |
| | 15 | 23.5 | 0.7 |
| 7/28/2004 | 3 | 24.5 | 8.9 |
| | 6 | 24.5 | 9 |
| | 9 | 24.4 | 9 |
| | 12 | 24.3 | 8.9 |
| | 15 | - | - |
| 8/12/2004 | 3 | 17.6 | 8.8 |
| | 6 | 17.4 | 9 |
| | 9 | 17.4 | 8.7 |
| | 12 | 17.0 | 8.6 |
| | 15 | 17.0 | 8.8 |
| 8/25/2004 | 3 | 19.8 | 9.7 |
| | 6 | 19.7 | 9.4 |
| | 9 | 19.6 | 9.3 |
| | 12 | 19.6 | 9.1 |
| | 15 | 19.5 | 8.8 |

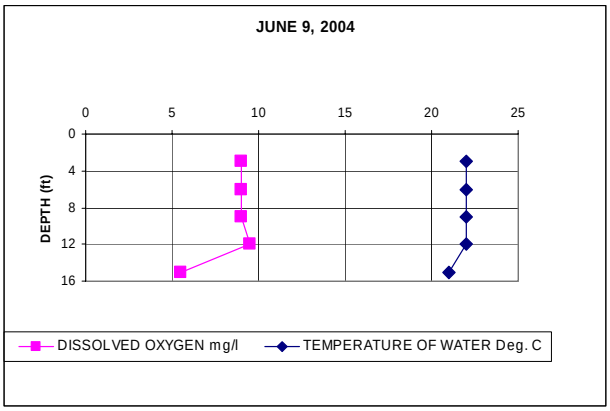
Presenting graphs of dissolved oxygen and temperature versus depth can be useful to detect the water layering or stratification discussed previously. Table 3-9 and Figure 3-2 presents year 2004 profiles for Spooner Lake. The profiles are presented chronologically from left to right, top to bottom. The data presents multiple profiles representing early, middle, and late summer measurements.

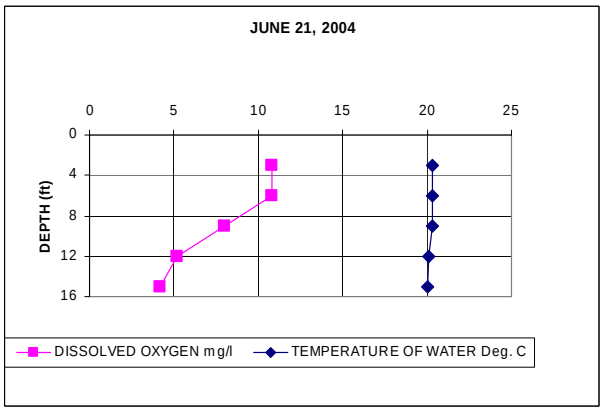
The early season measurements (June) identifies decreasing DO and temperatures with increasing depth. The profiles of the measurements in the early summer months reveal the development of stratification with a colder, near anoxic layer at depth in the middle of July. Anoxic is defined as DO with 0-1 mg/l. With the late summer/early fall turnover, one observes a return to a well mixed condition with similar temperatures with increasing depth and moderate (approximately 8 mg/L) dissolved oxygen concentrations as evidenced by the linear trends of DO and temperature with increasing depth in October.

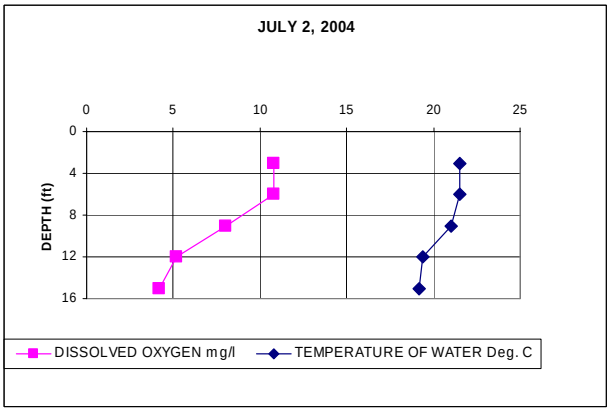
It is during the low oxygen, periods that phosphorous, chemically bonded to lake sediments, is released into the lake water by anaerobic biological activity in the bottom detritus. Aerobic decomposition slows with decreasing dissolved oxygen levels and anaerobic decomposition increases. The presence of the stratification observed in the 2004 data suggests that if bottom sampling is completed seasonally, and if water profile samples were collected from surface to the bottom of the lake, the concentrations of phosphorus would be reported at high concentrations in the bottom and deeper water samples in the summer months.

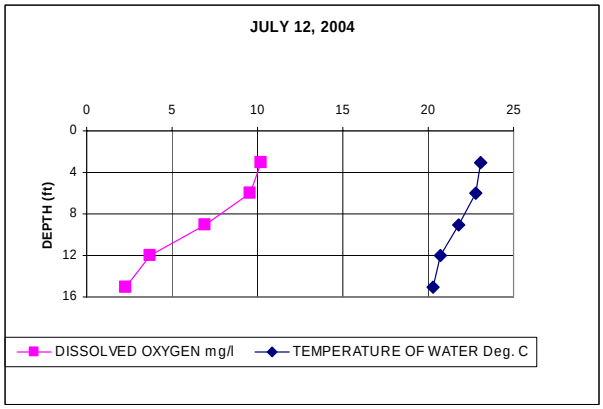
The presence of this phosphorus allows the lake to self fertilize during periods of turnover (typically in the fall), providing abundant nutrients for algae during the next growing season.

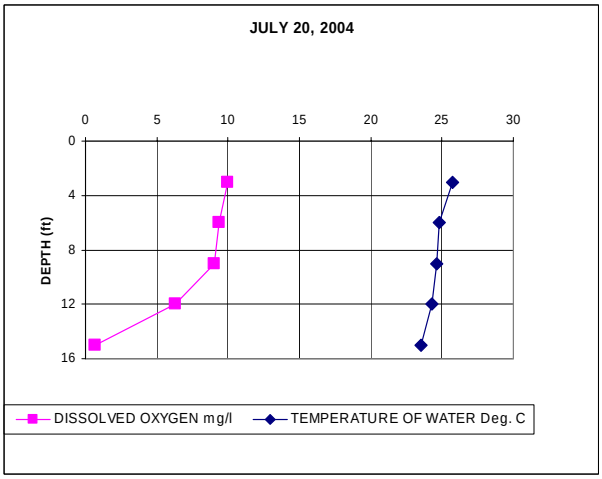
**Figure 3-2 Dissolved Oxygen and Temperature Profiles for 2006**

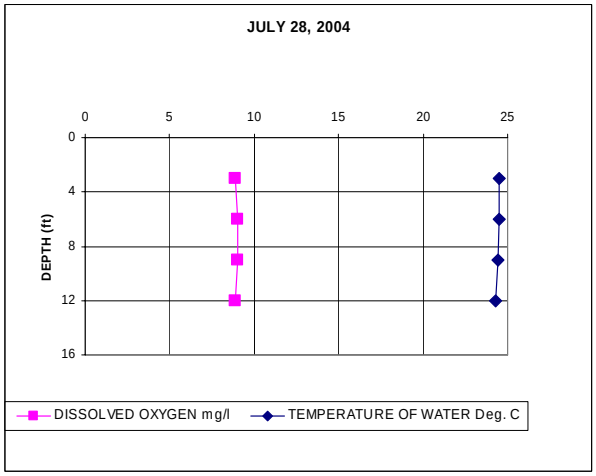


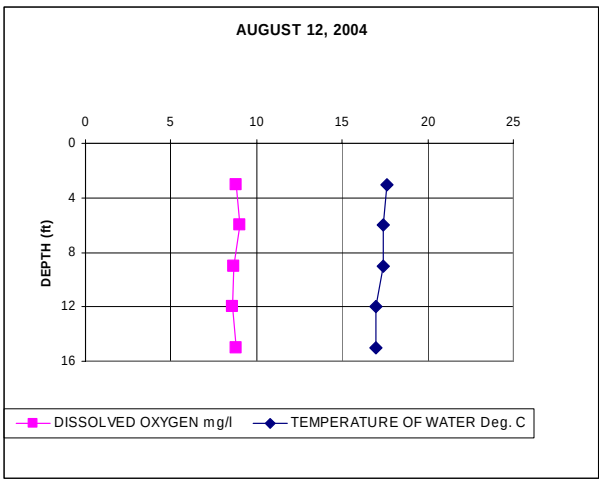



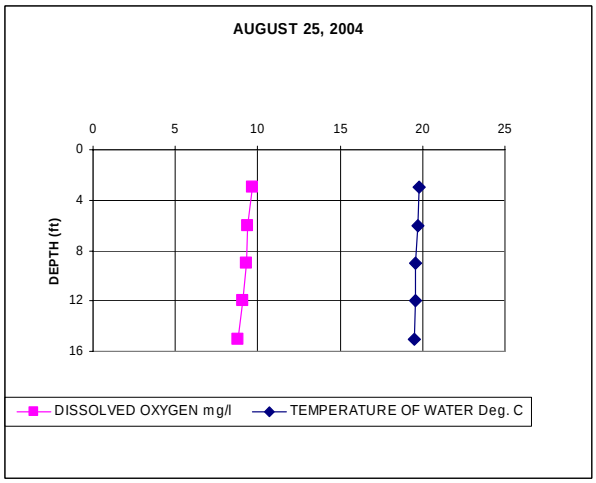






Spooner Lake has averaged a Secchi disk reading of 6.85 feet over the last six years which suggests a water clarity rating of fair to poor according to Table 3.3. On average, Secchi disk readings rapidly degrade over the summer indicating that the phosphorus concentrations are high enough to support algae growth during the summer months.

Current (Self Help Data – 2006) Trophic State Index (TSI) ranges from 41 ug/l taken in April 2006 to 67 ug/l taken on September 2006. This range is considered meso to eutrophic.

# CHAPTER 4: LAND USES AND WATERSHED IMPACTS

## 4.1. General

A watershed is a land surface in which the overland runoff can be traced to a predicted outlet; thus, the entire area of one watershed drains to one location in that watershed. The Spooner Lake Watershed (7,811 acres) has been divided into nineteen sub-watersheds, nine of which (4,003 acres) drain directly to Spooner Lake. The area is comprised of many more sub-watersheds; most of which ultimately outlet to ground water and/or Crystal Brook. The surface waters including ponds in this watershed comprise 1,144 acres of the watershed. There are also approximately 1,140 acres of wetlands in the watershed area as well.

The existing land use in the Spooner Lake watershed area is primarily forest and rural residential with the balance in recreational, single- and multiple-family residential and commercial activities. Each type of land use has different impacts on its portion of the watershed. Highly developed multi-residential, and commercial, areas have a larger percentage of impervious surfaces which create a greater quantity of high velocity runoff than properties that are less developed. To a lesser degree but also with the ability to negatively impact water quality are residential areas which have a percentage of impervious areas and lower rates of runoff water pollutants. Undeveloped woodland forests and grass lands create even less runoff than the developed areas due to greater infiltration and transpiration.

## 4.2. Statement of Problems

Runoff rates from natural landscapes such as wetlands, prairies, and woodlands are quite low due to the absorptive capacity of the soil and the evaporative uptake of lush vegetation. When surface runoff does occur, it is often temporarily stored in adjacent depressions and wetlands. During very wet periods, surface overflow leaves the landscape via small swales, ditches, and streams, eventually reaching large rivers and lakes.

Historically, many natural storage areas, swales, drainage ways, and wetlands have been completely eliminated by forestry, agricultural, and development practices. This results in increased downstream flooding by forcing more water into existing natural and constructed conveyance systems and floodplains. The effect of uncontrolled forestry, agricultural, and development practices is a substantial increase in the magnitude and duration of flooding and resultant flood damages. Increased runoff rates also promote the destabilization of downstream channels, causing stream bank erosion and increased water quality pollutant load discharges.

In addition to flooding and stream bank erosion problems, development runoff causes severe water quality problems in the form of nonpoint source pollution. Forestry and agricultural runoff is typically contaminated with sediment, phosphorus, bacteria, and nutrients. Residential runoff, especially from streets and parking lots, is contaminated with sediment, heavy metals, bacteria, nutrients, and petroleum byproducts. During construction, erosion from uncontrolled development sites contributes much larger quantities of sediment and pollutant discharges to storm water runoff. Storm water runoff pollutants degrade receiving rivers, lakes, streams, and creeks by killing sensitive aquatic life, encouraging the growth of non-native invasive vegetation, impairing aesthetic conditions, and making water recreation undesirable.

Daily drainage and water quality discharge problems are often highly visible and the public concerns ensure that these problems receive immediate attention. Long-term drainage and water quality discharge problems, on the other hand, often go unnoticed. The problems tend to intensify over a long period of time, and appear suddenly with a flood or recognized deterioration of water quality.

## 4.3. Land Use

Two planning periods were chosen to assess the land use and related storm water runoff hydrology within each sub-watershed. Land use characteristics were projected for both planning periods. The planning periods used correspond to Wiscland, 1993, and current land plans for the Towns of Trego, Spooner, Madge, Crystal for current land use (Map 4-1) and the land use and zoning maps from the aforementioned Towns for future (2025) projected land use.

### 4.3.a. Delineated Current Land Use (1993)

Existing land use conditions utilized in the preparation of the Spooner Lake District Watershed Management Plan water quantity and water quality modeling analyses are based on Wiscland (1993) and current land plans for the Towns of Trego, Spooner, Madge, Crystal.

### 4.3.b. Delineated Future Land Use (2025)

Proposed future land use conditions (Map 4-2) utilized for the preparation of the Spooner Lake District Watershed Management Plan water quantity and water quality modeling analyses were based on Towns of Trego, Spooner, Madge, and Crystal land use and Zoning Map and available information from Washburn County.

Tables 4-1 through 4-19 presents the land use area and percentages for Current and Future Land Uses by subwatershed.

Table 4-1 Subwatershed A Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| A | Forest | 319.26 | 82.18% | A | Forest | 319.26 | 82.18% |
| A | Grassland | 17.13 | 4.41% | A | Grassland | 17.13 | 4.41% |
| A | Open Water | 7.21 | 1.86% | A | Open Water | 7.21 | 1.86% |
| A | Rural Residential | 7.60 | 1.96% | A | Rural Residential | 7.60 | 1.96% |
| A | Wetland | 37.28 | 9.60% | A | Wetland | 37.28 | 9.60% |
| | Total | 388.48 | 100.00% | | Total | 388.48 | 100.00% |

Table 4-2 Subwatershed B Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| B | Forest | 417.64 | 79.41% | B | Forest | 417.64 | 79.41% |
| B | Grassland | 21.47 | 4.08% | B | Grassland | 21.47 | 4.08% |
| B | Open Water | 1.90 | 0.36% | B | Open Water | 1.90 | 0.36% |
| B | Wetland | 84.90 | 16.14% | B | Wetland | 84.90 | 16.14% |
| | Total | 525.91 | 100.00% | | Total | 525.91 | 100.00% |

Table 4-3 Subwatershed C Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| C | Forest | 333.08 | 94.14% | C | Forest | 333.08 | 94.14% |
| C | Grassland | 1.09 | 0.31% | C | Grassland | 1.09 | 0.31% |
| C | Open Water | 1.35 | 0.38% | C | Open Water | 1.35 | 0.38% |
| C | Wetland | 18.30 | 5.17% | C | Wetland | 18.30 | 5.17% |
| | Total | 353.82 | 100.00% | | Total | 353.82 | 100.00% |

Table 4-4 Subwatershed D Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| D | Forest | 177.04 | 88.71% | D | Forest | 177.04 | 88.71% |
| D | Grassland | 22.53 | 11.29% | D | Grassland | 22.53 | 11.29% |
| | Total | 199.57 | 100.00% | | Total | 199.57 | 100.00% |

Table 4-5 Subwatershed E Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| E | Agricultural | 9.46 | 5.62% | E | Agricultural | 9.46 | 5.62% |
| E | Forest | 129.36 | 76.92% | E | Forest | 129.36 | 76.92% |
| E | Grassland | 29.36 | 17.46% | E | Grassland | 29.36 | 17.46% |
| | Total | 168.18 | 100.00% | | Total | 168.18 | 100.00% |

Table 4-6 Subwatershed F Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| F | Agricultural | 40.86 | 7.51% | F | Agricultural | 40.86 | 7.51% |
| F | Forest | 410.60 | 75.46% | F | Forest | 410.60 | 75.46% |
| F | Grassland | 86.15 | 15.83% | F | Grassland | 86.15 | 15.83% |
| F | Open Water | 0.47 | 0.09% | F | Open Water | 0.47 | 0.09% |
| F | Wetland | 6.07 | 1.12% | F | Wetland | 6.07 | 1.12% |
| | Total | 544.15 | 100.00% | | Total | 544.15 | 100.00% |

Table 4-7 Subwatershed G Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| G | Agricultural | 66.04 | 9.93% | G | Agricultural | 64.79 | 9.74% |
| G | Forest | 308.47 | 46.39% | G | Forest | 255.06 | 38.36% |
| G | Grassland | 150.40 | 22.62% | G | Grassland | 140.33 | 21.10% |
| G | Open Water | 1.41 | 0.21% | G | Open Water | 1.41 | 0.21% |
| G | Rural Residential | 2.22 | 0.33% | G | Rural Residential | 38.12 | 5.73% |
| G | Single Family | 8.22 | 1.24% | G | Single Family | 37.05 | 5.57% |
| G | Wetland | 128.17 | 19.28% | G | Wetland | 128.17 | 19.28% |
| | Total | 664.93 | 100.00% | | Total | 664.93 | 100.00% |

Table 4-8 Subwatershed H Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| H | Agricultural | 121.31 | 22.55% | H | Agricultural | 121.31 | 22.55% |
| H | Forest | 179.39 | 33.34% | H | Forest | 179.39 | 33.34% |
| H | Grassland | 106.28 | 19.75% | H | Grassland | 106.28 | 19.75% |
| H | Open Water | 1.89 | 0.35% | H | Open Water | 1.89 | 0.35% |
| H | Single Family | 0.44 | 0.08% | H | Single Family | 0.44 | 0.08% |
| H | Wetland | 128.71 | 23.92% | H | Wetland | 128.71 | 23.92% |
| | Total | 538.02 | 100.00% | | Total | 538.02 | 100.00% |

Table 4-9 Subwatershed I Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| I | Agricultural | 5.22 | 3.11% | I | Agricultural | 5.22 | 3.11% |
| I | Forest | 103.98 | 61.98% | I | Forest | 103.98 | 61.98% |
| I | Grassland | 27.45 | 16.36% | I | Grassland | 27.45 | 16.36% |
| I | Open Water | 2.62 | 1.56% | I | Open Water | 2.62 | 1.56% |
| I | Wetland | 28.49 | 16.98% | I | Wetland | 28.49 | 16.98% |
| | Total | 167.76 | 100.00% | | Total | 167.76 | 100.00% |

Table 4-10 Subwatershed J Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| J | Agricultural | 1.85 | 0.44% | J | Agricultural | 1.85 | 0.44% |
| J | Forest | 297.14 | 71.36% | J | Forest | 276.90 | 66.50% |
| J | Grassland | 54.94 | 13.19% | J | Grassland | 38.81 | 9.32% |
| J | Open Water | 3.10 | 0.74% | J | Open Water | 3.10 | 0.74% |
| J | Wetland | 59.38 | 14.26% | J | Single Family | 36.37 | 8.73% |
| | Total | 416.41 | 100.00% | J | Wetland | 59.38 | 14.26% |
| | | | | | Total | 416.41 | 100.00% |

Table 4-11 Subwatershed K Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| K | Agricultural | 21.27 | 2.70% | K | Agricultural | 21.27 | 2.70% |
| K | Forest | 502.41 | 63.80% | K | Forest | 469.06 | 59.56% |
| K | Grassland | 101.50 | 12.89% | K | Grassland | 101.50 | 12.89% |
| K | Open Water | 5.05 | 0.64% | K | Open Water | 5.05 | 0.64% |
| K | Rural Residential | 7.35 | 0.93% | K | Rural Residential | 7.35 | 0.93% |
| K | Single Family | 10.00 | 1.27% | K | Single Family | 43.35 | 5.50% |
| K | Wetland | 139.95 | 17.77% | K | Wetland | 139.95 | 17.77% |
| | Total | 787.53 | 100.00% | | Total | 787.53 | 100.00% |

Table 4-12 Subwatershed L Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| L | Agricultural | 13.28 | 3.67% | L | Agricultural | 13.28 | 3.67% |
| L | Forest | 194.04 | 53.58% | L | Forest | 158.10 | 43.66% |
| L | Grassland | 24.81 | 6.85% | L | Grassland | 23.70 | 6.54% |
| L | Open Water | 1.33 | 0.37% | L | Open Water | 1.33 | 0.37% |
| L | Rural Residential | 19.56 | 5.40% | L | Rural Residential | 12.64 | 3.49% |
| L | Wetland | 109.13 | 30.13% | L | Single Family | 43.97 | 12.14% |
| | Total | 362.15 | 100.00% | L | Wetland | 109.13 | 30.13% |
| | | | | | Total | 362.15 | 100.00% |

Table 4-13 Subwatershed M Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| M | Agricultural | 21.39 | 20.51% | M | Agricultural | 21.39 | 20.51% |
| M | Commercial | 0.91 | 0.87% | M | Commercial | 0.91 | 0.87% |
| M | Forest | 6.24 | 5.98% | M | Forest | 4.48 | 4.30% |
| M | Grassland | 11.43 | 10.96% | M | Grassland | 11.43 | 10.96% |
| M | Open Water | 0.01 | 0.01% | M | Open Water | 0.01 | 0.01% |
| M | Single Family | 41.79 | 40.07% | M | Single Family | 43.55 | 41.76% |
| M | Wetland | 22.52 | 21.59% | M | Wetland | 22.52 | 21.59% |
| | Total | 104.29 | 100.00% | | Total | 104.29 | 100.00% |

Table 4-14 Subwatershed N Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| N | Agricultural | 159.45 | 25.45% | N | Agricultural | 56.75 | 9.06% |
| N | Commercial | 0.53 | 0.08% | N | Commercial | 226.42 | 36.14% |
| N | Forest | 202.16 | 32.26% | N | Forest | 121.88 | 19.45% |
| N | Grassland | 91.14 | 14.55% | N | Grassland | 44.55 | 7.11% |
| N | Open Water | 2.43 | 0.39% | N | Open Water | 2.13 | 0.34% |
| N | Recreation | 136.36 | 21.76% | N | Recreation | 136.36 | 21.76% |
| N | Rural Residential | 2.89 | 0.46% | N | Rural Residential | 0.89 | 0.14% |
| N | Single Family | 31.61 | 5.04% | N | Single Family | 37.59 | 6.00% |
| | Total | 626.57 | 100.00% | | Total | 626.57 | 100.00% |

Table 4-15 Subwatershed O Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| O | Agricultural | 48.90 | 12.91% | O | Agricultural | 19.20 | 5.07% |
| O | Forest | 123.65 | 32.64% | O | Commercial | 89.41 | 23.60% |
| O | Grassland | 80.88 | 21.35% | O | Forest | 50.31 | 13.28% |
| O | Rural Residential | 1.42 | 0.37% | O | Grassland | 40.74 | 10.75% |
| O | Single Family | 67.48 | 17.81% | O | Rural Residential | 1.42 | 0.37% |
| O | Wetland | 56.54 | 14.92% | O | Single Family | 121.25 | 32.00% |
| | Total | 378.87 | 100.00% | O | Wetland | 56.54 | 14.92% |
| | | | | | Total | 378.87 | 100.00% |

Table 4-16 Subwatershed P Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| P | Agricultural | 0.49 | 0.22% | P | Agricultural | 0.49 | 0.22% |
| P | Forest | 139.99 | 63.84% | P | Forest | 116.77 | 53.25% |
| P | Grassland | 3.54 | 1.61% | P | Grassland | 3.47 | 1.58% |
| P | Open Water | 19.97 | 9.11% | P | Open Water | 19.97 | 9.11% |
| P | Single Family | 6.82 | 3.11% | P | Single Family | 30.11 | 13.73% |
| P | Wetland | 48.47 | 22.10% | P | Wetland | 48.47 | 22.10% |
| | Total | 219.28 | 100.00% | | Total | 219.28 | 100.00% |

Table 4-17 Subwatershed Q Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| Q | Agricultural | 5.73 | 1.78% | Q | Agricultural | 5.73 | 1.78% |
| Q | Forest | 114.85 | 35.77% | Q | Forest | 114.85 | 35.77% |
| Q | Grassland | 15.98 | 4.98% | Q | Grassland | 15.98 | 4.98% |
| Q | Open Water | 10.33 | 3.22% | Q | Open Water | 10.33 | 3.22% |
| Q | Single Family | 0.75 | 0.23% | Q | Single Family | 0.75 | 0.23% |
| Q | Wetland | 173.45 | 54.02% | Q | Wetland | 173.45 | 54.02% |
| | Total | 321.09 | 100.00% | | Total | 321.09 | 100.00% |

Table 4-18 Subwatershed R Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| R | Agricultural | 115.48 | 21.24% | R | Agricultural | 115.48 | 21.24% |
| R | Forest | 264.83 | 48.71% | R | Forest | 264.83 | 48.71% |
| R | Grassland | 65.70 | 12.08% | R | Grassland | 65.70 | 12.08% |
| R | Single Family | 1.25 | 0.23% | R | Single Family | 1.25 | 0.23% |
| R | Wetland | 96.42 | 17.73% | R | Wetland | 96.42 | 17.73% |
| | Total | 543.68 | 100.00% | | Total | 543.68 | 100.00% |

Table 4-19 Subwatershed S Land Use

| Current | | | | Future | | | |
|---|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **Acreage** | **Percentage** | **Watershed** | **Land Use** | **Acreage** | **Percentage** |
| S | Agricultural | 117.93 | 23.56% | S | Agricultural | 117.93 | 23.56% |
| S | Commercial | 1.08 | 0.22% | S | Commercial | 1.08 | 0.22% |
| S | Forest | 233.15 | 46.59% | S | Forest | 233.15 | 46.59% |
| S | Grassland | 147.67 | 29.51% | S | Grassland | 147.67 | 29.51% |
| S | Single Family | 0.34 | 0.07% | S | Single Family | 0.34 | 0.07% |
| S | Wetland | 0.29 | 0.06% | S | Wetland | 0.29 | 0.06% |
| | Total | 500.46 | 100.00% | | Total | 500.46 | 100.00% |

### 4.3.c. Future Growth

The most significant findings of the land use study are:

- Current land use shows the watershed is comprised of over 5,500 acres of forest and grassland (70.6%).
- The principal development in the watershed is currently as single-family/rural residential.
- Future land use indicates that only 10% of the grasslands will be developed in the next 2 decades.
- Future land use is anticipated to be a mix of commercial (300 + additional acres) along U.S. Highway 53 and single family (200 + additional acres) homes throughout the watershed.

Table 4-20 Watershed Summary for Current and Future Land Uses

| | Current | | Future | |
|---|---|---|---|---|
| **Land Use** | **Acreage** | **Percentage** | **Acreage** | **Percentage** |
| Agricultural | 748.66 | 9.58% | 615.01 | 7.87% |
| Commercial | 2.52 | 0.03% | 317.82 | 4.07% |
| Forest | 4,457.28 | 57.06% | 4,135.74 | 52.95% |
| Grassland | 1,059.45 | 13.56% | 945.34 | 12.10% |
| Open Water | 59.07 | 0.76% | 58.77 | 0.75% |
| Recreation | 136.36 | 1.75% | 136.36 | 1.75% |
| Rural Residential | 41.04 | 0.53% | 68.02 | 0.87% |
| Single Family | 168.70 | 2.16% | 396.02 | 5.07% |
| Wetland | 1,138.07 | 14.57% | 1,138.07 | 14.57% |
| Total | 7,811.15 | 100.00% | 7,811.15 | 100.00% |

## 4.4. Land Use

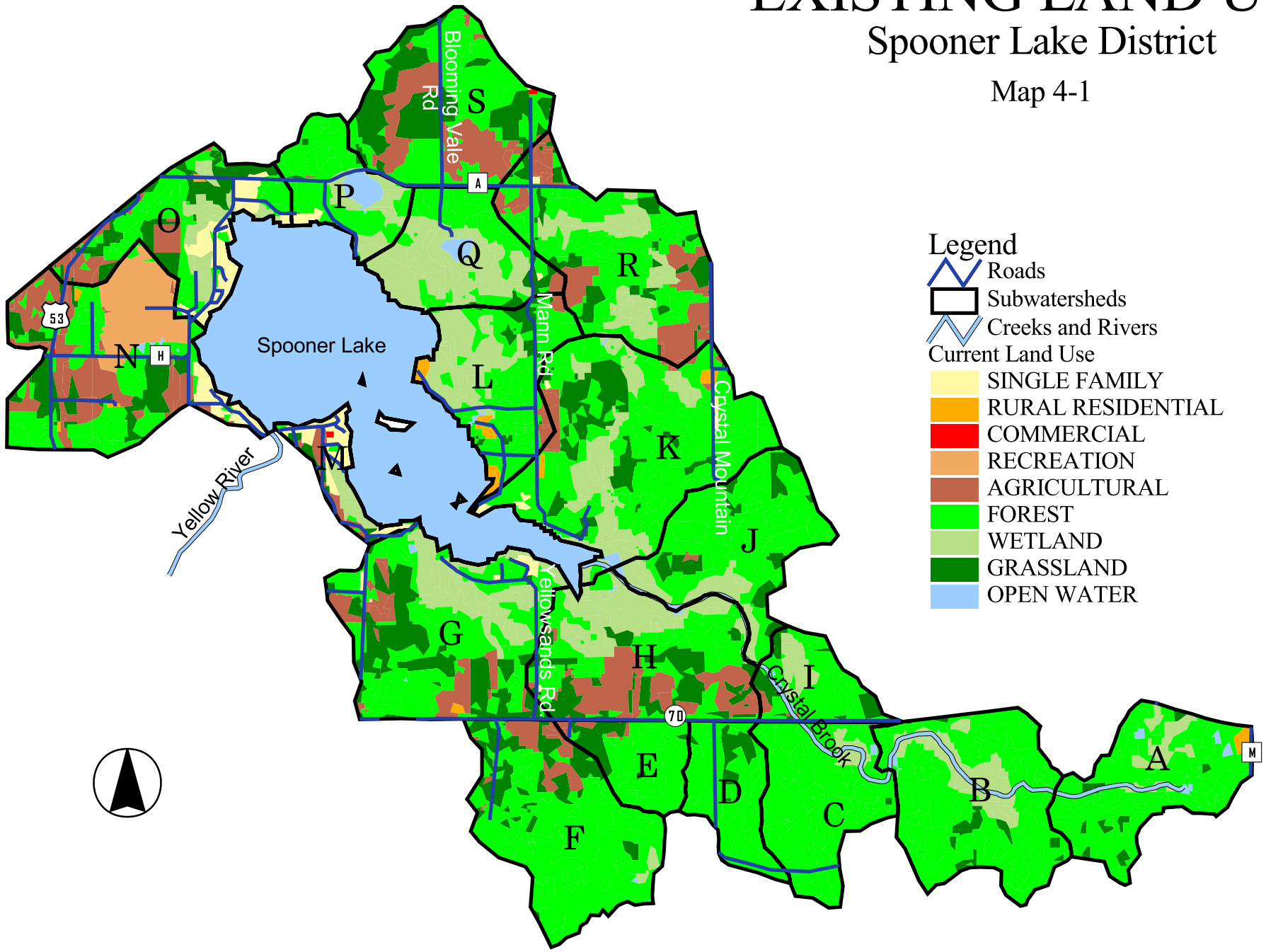
Continued development in the subwatershed area, particularly in areas adjacent to the lake and along swales and tributaries that feed the lake, have increased the speed of eutrophication of Spooner Lake. And continued uncontrolled surface water runoff from the existing developed areas will continue to degrade water quality. Table 4-20 summarizes the current and future land uses for the entire watershed area by land use.

The two subwatersheds that are the most densely developed in the future are O and N (See Map 4-3). Those two subwatersheds, account for over 99% of the future commercial and over 40% of the future single family residential land use of the entire watershed planning area. This area of the watershed planning area will have the greatest negative impact on water quality in regard to stormwater runoff.

# EXISTING LAND USE

## Spooner Lake District

Map 4-1

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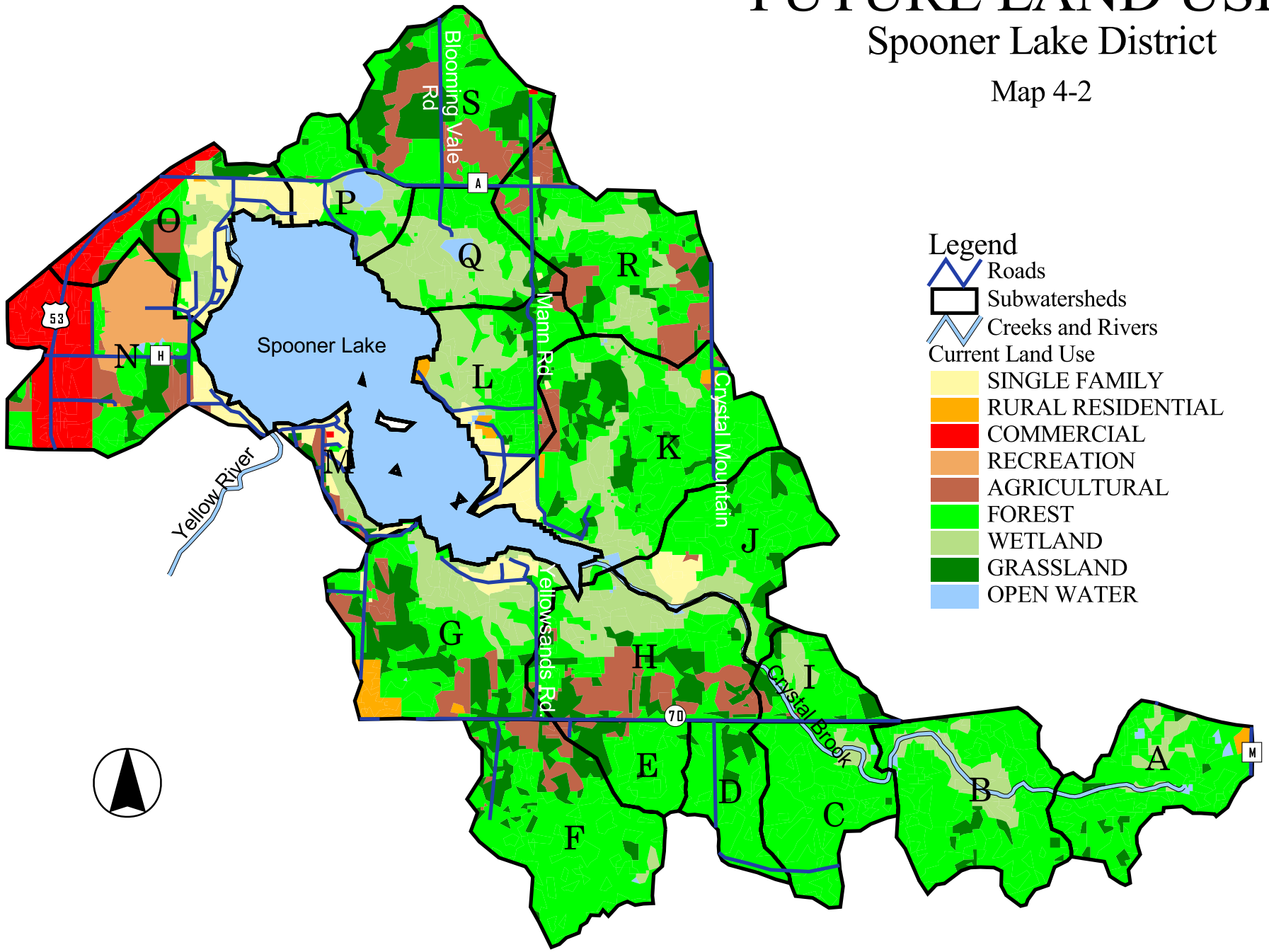
# FUTURE LAND USE

## Spooner Lake District

Map 4-2

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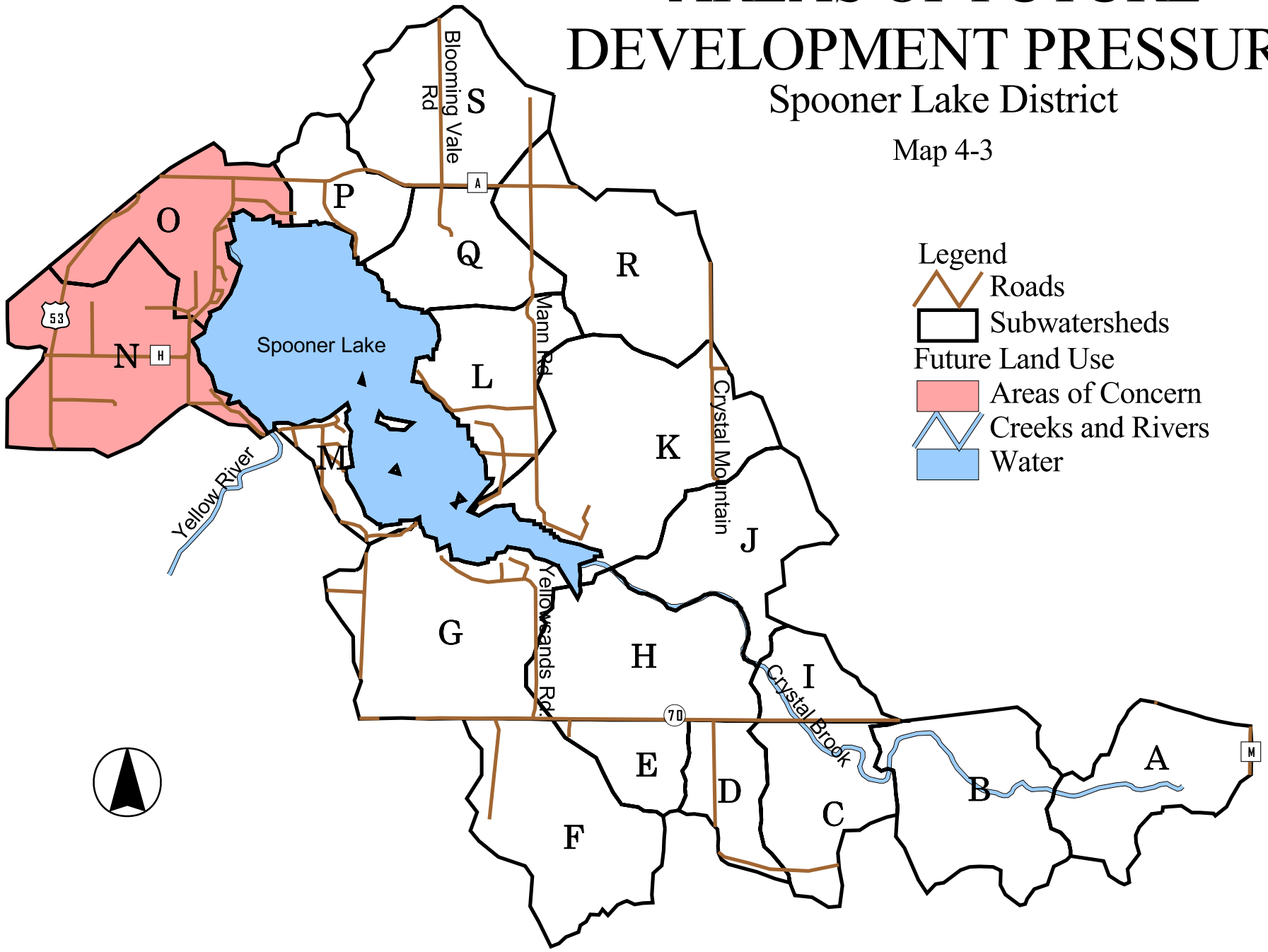
# AREAS OF FUTURE DEVELOPMENT PRESSURE

## Spooner Lake District

Map 4-3

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# CHAPTER 5: WATERSHED WATER MODELING

## 5.1. Storm Water Runoff

To provide a useful water quality planning document, an analysis using a computer model of the existing watershed system and existing conditions, and a model of the proposed future development must be conducted. It is important to assess both quantity (peak flows) and quality of the stormwater runoff to determine which areas of the watershed have the most impact on the lake. Watershed areas, land uses, and soils are all the necessary inputs used in the modeling.

### 5.1.a. Watersheds

Nineteen sub-watersheds (labeled A-S as shown in Map 5-1) delineate the area directly impacting the Spooner Lake. Hydrologic effects are influenced by tributary drainage areas, watershed shape, land use, soils, existing impoundment areas, and a variety of other factors.

The watershed delineation is based on a USGS topographic map with 10 foot contours. For modeling, the 10 foot contours were interpolated to a 2 foot contour interval. This means that smaller features existing in the landscape are not refined; the modeling is based on assumed contours and must be considered to provide generalized results.

### 5.1.b. Land Use

The land uses as defined in Chapter 4 (Map 4-1 & 4-2) are input into the water quantity models.

Although the future land use map for the Towns of Trego, Spooner, Madge, and Crystal were used as a starting point, the information was modified to fit the criteria for a more accurate land cover analysis. Some areas that had one house on large tracts of forested land (greater than five acres) are still considered forested because the water runoff from these areas will more consistent to that of forestland than that of residential land.

Aside from land use, it is important to consider the housing density throughout the watershed, and more specifically along the lakeshore. Higher density areas have more concentrated runoff that has an increased capacity to carry more nutrients and sediments into the lake. Because Spooner Lake is nearly entirely developed along the shoreline, this riparian area is a major contributor to sediment and nutrient loading.

### 5.1.c. Soils

To estimate the effect soil type has on land use in the sub-watersheds, each observed soil type must be characterized to define its Hydrologic Soil Group (HSG) (Map 5-2). The HSG (See page 2-3 for description of HSG soil types) distribution for soils in the Spooner Lake subwatersheds is summarized in Table 5-1. The Spooner Lake subwatersheds are dominated by sandy soils with high infiltration rates, which reduce the amount of pollutants transported to the lakes.

Table 5-1: HSG distribution for soils in the Spooner Lake Watershed Planning Area

| Lake | HSG A [%] | HSG B [%] | HSG C [%] | HSG D [%] |
|---|---|---|---|---|
| Spooner Lake Watershed | 52.11% | 22.95% | 8.62% | 14.4% |

## 5.2. Runoff Water Quantity

To calculate the runoff quantity, both manmade and natural features are considered. Land use, soils, overland drainage, and topography are modeled using "P-8 Urban Catchment System" version 2.4 to develop runoff quantity. P-8 stands for "Program for Predicting Polluting Particle Passage through Pits, Puddles, and Ponds", which more or less captures the basic features and functions of the model. P-8 is a computer aided design program designed to model the quality of storm water runoff and can also be used to estimate the quantity of stormwater runoff based on land use and soil types.

The procedure for calculating the storm water runoff quantity is as follows:

1. Delineate the overall lake watershed.
2. Delineate sub-watersheds for each lake that drains directly into the lake.
3. Identify existing and future land use within the watershed.
4. Identify the soils in the watershed.
5. Enter data into the P-8 model and calibrate the model.
6. Run the model for each sub-watershed to determine the quantity coming off the entire watershed planning area.

The system analysis is a technical analysis of water quantity at given rates of precipitation and incorporating computer modeling of the land use, storm water runoff, storm water conveyance systems, overland drainage, wetlands, lakes, ponds, streams, channels, and water quality, and drainage ways. The analysis is accomplished using standard hydrologic and hydraulic modeling methodologies for storm water runoff quantity that includes components such as pipe flow, overland flow, drainage ways, and pond storage of storm water.

Table 5-2 compares the acreage of each subwatershed to the amount of stormwater runoff from of both existing and future conditions. New development correlates to an increase in the amount of impervious surfaces. Adding impervious surfaces to a given area will increase the amount of runoff. Map 5-3 depicts where development is expected to increase the amount of stormwater runoff in the watershed by showing the difference in runoff amount between existing and future conditions. Subwatersheds N and O have the highest runoff quantity in both existing and future conditions as well has have the highest projected increase of runoff based on future land use.

Two P-8 models were completed: One for existing land use conditions (Year 2004) and one for future land use conditions (Year 2025). The results of the modeling are summarized in Table 5-2. The modeling results indicate some increase in watershed runoff from current to future development. This is to be expected as the predicted land use increase is of moderate impact (residential).

The impact of this data is not always clear to those in the watershed. Suffice it to say that the sandy soils and low development pressure in this region have reduced the impacts on local surface water quality when compared to other more populated areas in Wisconsin. However, lakeshore property near the Lake has a negative effect on water quality.

Table 5-2: Water Runoff Quantity for Each Subwatershed

| Current Land Use | | | Future Land Use | | | |
|---|---|---|---|---|---|---|
| WATER-SHED ID | AREA (Acres) | ACRE-FT | WATER SHED ID | AREA (Acres) | ACRE-FT | DIFFERENCE |
| **A** | 388.48 | 14.47 | **A** | 388.48 | 14.47 | 0.00 |
| **B** | 525.91 | 17.60 | **B** | 525.91 | 17.60 | 0.00 |
| **C** | 353.82 | 14.29 | **C** | 353.82 | 14.29 | 0.00 |
| **D** | 199.57 | 14.81 | **D** | 199.57 | 14.81 | 0.00 |
| **E** | 168.18 | 7.16 | **E** | 168.18 | 7.16 | 0.00 |
| **F** | 544.15 | 22.92 | **F** | 544.15 | 22.92 | 0.00 |
| **G** | 664.93 | 26.15 | **G** | 664.93 | 44.42 | 18.27 |
| **H** | 538.02 | 17.68 | **H** | 538.02 | 17.68 | 0.00 |
| **I** | 167.76 | 5.56 | **I** | 167.76 | 5.56 | 0.00 |
| **J** | 416.41 | 14.25 | **J** | 416.41 | 34.58 | 20.34 |
| **K** | 787.53 | 31.87 | **K** | 787.53 | 50.52 | 18.65 |
| **L** | 362.15 | 11.27 | **L** | 362.15 | 35.44 | 24.17 |
| **M** | 104.29 | 28.14 | **M** | 104.29 | 29.12 | 0.98 |
| **N** | 626.57 | 51.90 | **N** | 626.57 | 429.53 | 377.64 |
| **O** | 378.87 | 50.68 | **O** | 378.87 | 228.95 | 178.27 |
| **P** | 219.28 | 10.63 | **P** | 219.28 | 23.65 | 13.02 |
| **Q** | 321.09 | 19.43 | **Q** | 321.09 | 19.43 | 0.00 |
| **R** | 543.68 | 18.54 | **R** | 543.68 | 18.54 | 0.00 |
| **S** | 500.46 | 21.94 | **S** | 500.46 | 21.94 | 0.00 |
| **TOTALS** | 1,894.12 | 399.28 | **TOTALS** | 1,894.12 | 1,050.62 | 651.34 |

HydroCAD was also used to determine the peak flow for each subwatershed. HydroCAD is used to determine the rate at which water will flow during a 2-, 10-, 25-, and 100-year storm event. Subwatersheds with a high peak flow may be more susceptible to erosion. The subwatersheds with the highest peak flow during a 2-year storm event are Q, H, and D.

The term "100-year storm" does not refer to a rainfall event that occurs once every 100 years. Rather, in any given year, a 1 percent chance exists of a 100-year flood event occurring. A 25-year storm event occurs on average once in 25 years, or has a 4 percent probability of occurring or being exceeded in any given year; a 10-year storm has a 10 percent chance of occurring or being exceeded in any given year; a 2-year storm has a 50 percent chance of occurring or being exceeded in any given year. A storm event for some specified return period such as a 2-year or 100-year storm is frequently used in order to design storm water drainage systems, and is known

as the design storm for that system. Map 5-4 shows the peak runoff for each subwatershed for the 2-year storm event under current conditions. The subwatersheds with high peak flows from the 2-year storm are found in areas with steep slopes and poor soils. For example, subwatershed H has the highest modeled peak flow rate in the entire watershed. Subwatershed H is an area that has almost no development but is comprise mainly of soils with a hydric group B. Because B soils have a lower infiltration rate than A soils, this is likely the reason for the high peak flow rate. The two watersheds that have a significantly higher peak flow are H and F. Subwatershed H in adjacent to Crystal Brook and Spooner Lake, but doesn't have much for development. It does however have a significant amount of agricultural land which can be a source for significant erosion. Subwatershed F doesn't flow directly into Spooner Lake or any tributaries so therefore any peak flow will be subsided by the time it would reach areas nearer to those surface water resources. According to the modeling, the other subwatersheds don't appear to be contributing peak flows that would be of concern.

Table 5-3: Peak Flow for Each Sub-watershed

| WATERSHED ID | PEAK FLOW 2-YR [cfs] | PEAK FLOW 10-YR [cfs] | PEAK FLOW 25-YR [cfs] | PEAK FLOW 100-YR [cfs] |
|---|---|---|---|---|
| **A** | 0.00 | 1.03 | 2.38 | 11.05 |
| **B** | 0.00 | 1.28 | 2.98 | 12.91 |
| **C** | 19.89 | 95.02 | 131.86 | 236.02 |
| **D** | 13.40 | 66.52 | 92.81 | 166.19 |
| **E** | 15.68 | 85.05 | 119.19 | 214.13 |
| **F** | 27.27 | 126.73 | 175.99 | 315.51 |
| **G** | 0.00 | 2.08 | 4.69 | 20.06 |
| **H** | 33.51 | 139.60 | 189.77 | 326.82 |
| **I** | 0.00 | 0.42 | 0.96 | 5.20 |
| **J** | 0.00 | 0.74 | 1.84 | 9.00 |
| **K** | 0.00 | 1.88 | 4.36 | 18.90 |
| **L** | 0.00 | 0.99 | 2.29 | 11.00 |
| **M** | 0.91 | 14.97 | 24.64 | 55.44 |
| **N** | 0.55 | 11.84 | 21.47 | 57.41 |
| **O** | 0.01 | 4.46 | 9.04 | 29.26 |
| **P** | 0.00 | 0.60 | 1.42 | 7.72 |
| **Q** | 0.00 | 0.41 | 0.96 | 4.58 |
| **R** | 0.00 | 3.63 | 7.27 | 24.11 |
| **S** | 0.00 | 2.99 | 5.97 | 19.19 |

## 5.3. Runoff Water Quality

Water quality modeling for this lake management plan has been completed to identify the annual contribution of nutrients and sediments to the lakes. It should be apparent that the larger watersheds will contribute greater loading if all other parameters are similar. We do not attempt

to model the distribution of nutrients in the lake system itself. Additional, more involved studies of the nutrient and water balance would be necessary to understand this aspect of the system.

Modeling the quality of runoff water is completed using a combination of techniques. Rural areas with little presence of agriculture and urban development and with a low forecast for such development requires less sophisticated modeling tools than more complexly developed areas such as cities and high density rural residential/agricultural areas.

To calculate the runoff water pollutant loads generated in the Spooner Lake watershed, two different methods were used.

**Method 1:** Compare the Spooner Lake watershed to similar watersheds where water quality data already exists.

**Method 2:** Use the WiLMS software to calculate phosphorus loads to Spooner Lake from the surrounding watersheds.

### 5.3.a. Method 1:

Relatively recent water quality research has occurred in many watersheds. The Spooner Lake watershed was compared to such watersheds to identify the most similar watershed available. Results from research at Butternut Creek (Butternut Lake), Ashland/Price County [1] were used to estimate phosphorus and nitrogen loads from the watershed to the Lakes. Similarly, research from Little Balsam Creek, near Patzau, Douglas County [2] was used to estimate the sediment loads to the Lakes. Similar land use and soil types are the most important factor when deciding which basic watershed to use as a model for these calculations.

The research presents export coefficients (in terms of mass of pollutant per area per year) for the researched watersheds. These export coefficients were applied to the area of the Spooner Lake watershed to estimate the annual pollutant load to each lake. The results from Method 1 are presented in Table 5.3.

Table 5-4: Water Quality Results under Current Land Use Conditions from Method 1

| **Lake** | **Total Phosphorus** [lb/yr] | **Total Nitrogen** [lb/yr] | **Total Suspended Solids** [lb/yr] |
|---|---|---|---|
| Spooner | 1,325 | 6,169 | 768,918 |

Table 5-5: Water Quality Results under Future Land Use Conditions from Method 1

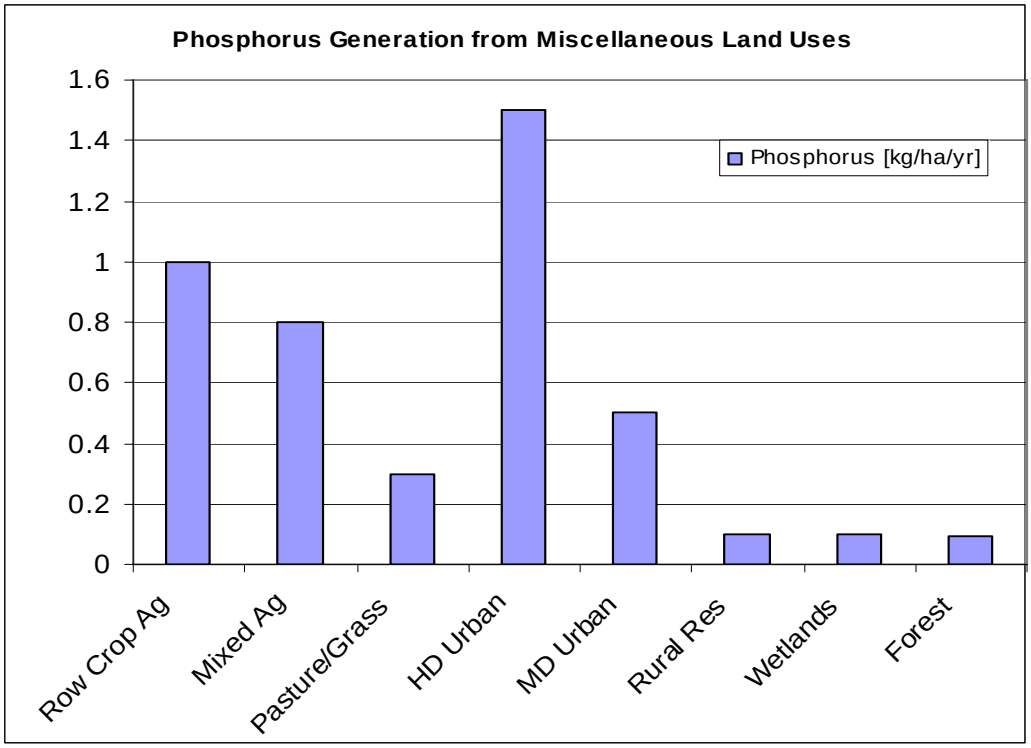
| **Lake** | **Total Phosphorus** [lb/yr] | **Total Nitrogen** [lb/yr] | **Total Suspended Solids** [lb/yr] |
|---|---|---|---|
| Spooner | 1,839 | 8,219 | 854,089 |

**5.3. b Method 2**:

WiLMS (Wisconsin Lake Modeling Suite), is a lake water quality-planning tool developed by WDNR, and was also used to calculate the phosphorus load to the Lake. The model uses an annual time step to predict the average total phosphorus loading to the watershed discharge point (in this case, Spooner Lake). It is the latter output that we are interested in for this phase of the water quality modeling.

The model is suitable for rural settings as opposed to other programs such as P8 and WinSLAMM which are more applicable for urban settings. Lake particulars, land use information, and WiLMS export coefficients are incorporated to calculate the phosphorus load to the Lake. Figure 5-1 illustrates the annual phosphorus loading from different land uses.

Figure 5-1: Phosphorus Generation from Miscellaneous Land Uses




The land uses presented in Tables 4-1 through 4-19 were used in the modeling. The results are presented in Table 5-5, and the WiLMS data sheets are included in Appendix A.

The model input data uses the existing default data sets for precipitation for Washburn County and the default export coefficients for specific land uses in the WiLMS model.

To estimate the contribution of septic systems, we have estimated numbers for septic systems, permanent residents, and seasonal residents were employed. There are a number of residences along the lakeshore. A survey was also sent out to 153 residences

during an earlier planning grant project. Of those returned, only 38% identified themselves as permanent residents. We use this number to determine the number of permanent residents and seasonal residents. Using this information as a starting point, the following assumptions on septic system use are made.

Assumption 1: 153 residences on Spooner Lake

Assumption 2: 58 permanent residences (based on survey responses)
95 seasonal residences (based on survey responses)

Assumption 3: 2.61 persons per permanent residence (U.S. Census)

Assumption 4: 2.61 persons per seasonal residence. Seasonal residents spend 0.5 years on site.

Septic System Per Capita Usage: (58 x 2.61) + (95 x 0.5 x 2.61) = 255 septic units

Assumption 5: Future non-point source loading is estimated at 50% through future BMP implementation.

Table 5-6 presents the "most likely" phosphorous loading for the Spooner Lake.

| Source | Current [lbs/yr] | Future [lbs/yr] |
|---|---|---|
| Non-point - Natural | 1,463.87 | 1,285.29 |
| Non-point – Human Impact | 68.34 | 454.15 |
| Lake Surface | 262.35 | 262.35 |
| Septic Tanks | 28.11 | 28.11 |
| | 1,822.67 | 2,029.91 |

## 5.4. Conclusions

As WiLMS is assumed to provide a more accurate phosphorus loading estimate than Method 1, and since the actual land use in the Spooner Lake watershed is used in the WiLMS calculation, then the WiLMS phosphorus loading estimate should be used as a future reference in the Spooner Lake planning process. Table 5-6 presents the final results for annual pollutant loading to the Lakes. Note that the Total Phosphorous Loading reported here DOES NOT include the Lake Surface Precipitation of Phosphorous.

Table 5-7: Final water quality results for the Spooner Lake Watershed Planning Area.

| **Lake** | **Total Phosphorus** [lb/yr] | **Total Nitrogen** [lb/yr] | **Total Suspended Solids** [lb/yr] |
|---|---|---|---|
| Spooner Lake | 1,823 | 6,047 | 760,278 |

It should be noted that the water quality modeling is used here to predict the nutrient and sediment loading from the watershed to the lake. As Spooner Lake is connected, there will also

be a transfer of "pollutant loads" from Crystal Brook to Spooner Lake within the lake system. These affects are not taken into account in this modeling scenario as the purpose of this plan is to address watershed water quality concerns before they enter the lake system and not predict phosphorous concentrations in the lake. The impact of human development in the Spooner Lake watershed is estimated to be 18% of the phosphorous loading (runoff and septic system modeling) to the lakes currently, but that is expected to increase (potentially 35%) as commercial development continues along U.S. Highway 53. Caution must be applied in these conclusions. The watershed contribution modeling is at a very early stage and refinement of the model is warranted considering the limited data input at this time.

This modeling effort describes a significant contribution of watershed generated phosphorous to the Lakes. Effective measures are necessary to reduce this pollutant loading. These include the introduction of BMPs to reduce the overland non-point source runoff as well as address septic systems. The septic system contribution must be considered as an estimate at this time due to the numerous assumptions employed, therefore, we would recommend a Septic System survey to be completed for the lake. Once completed the phosphorous loading for the septic systems can be recalculated.

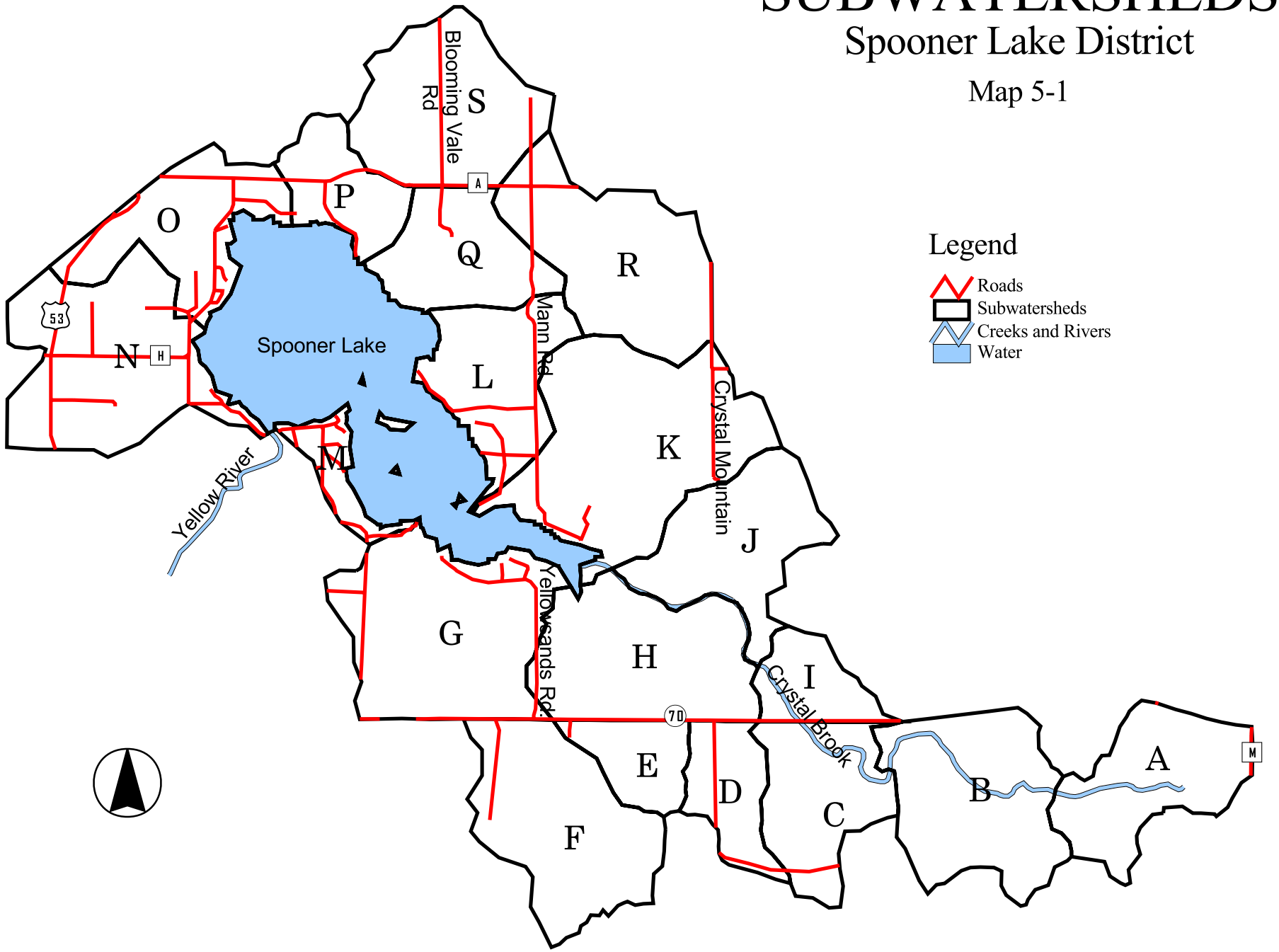
For Permanent and Seasonal residences alike on the lake and in the watershed determine:

1. The number of persons per household, seasonal persons and time spent per year per resident.
2. Age of each septic system.
3. Develop phosphorous retention values based on soil type and septic system age.

# SUBWATERSHEDS

## Spooner Lake District

Map 5-1

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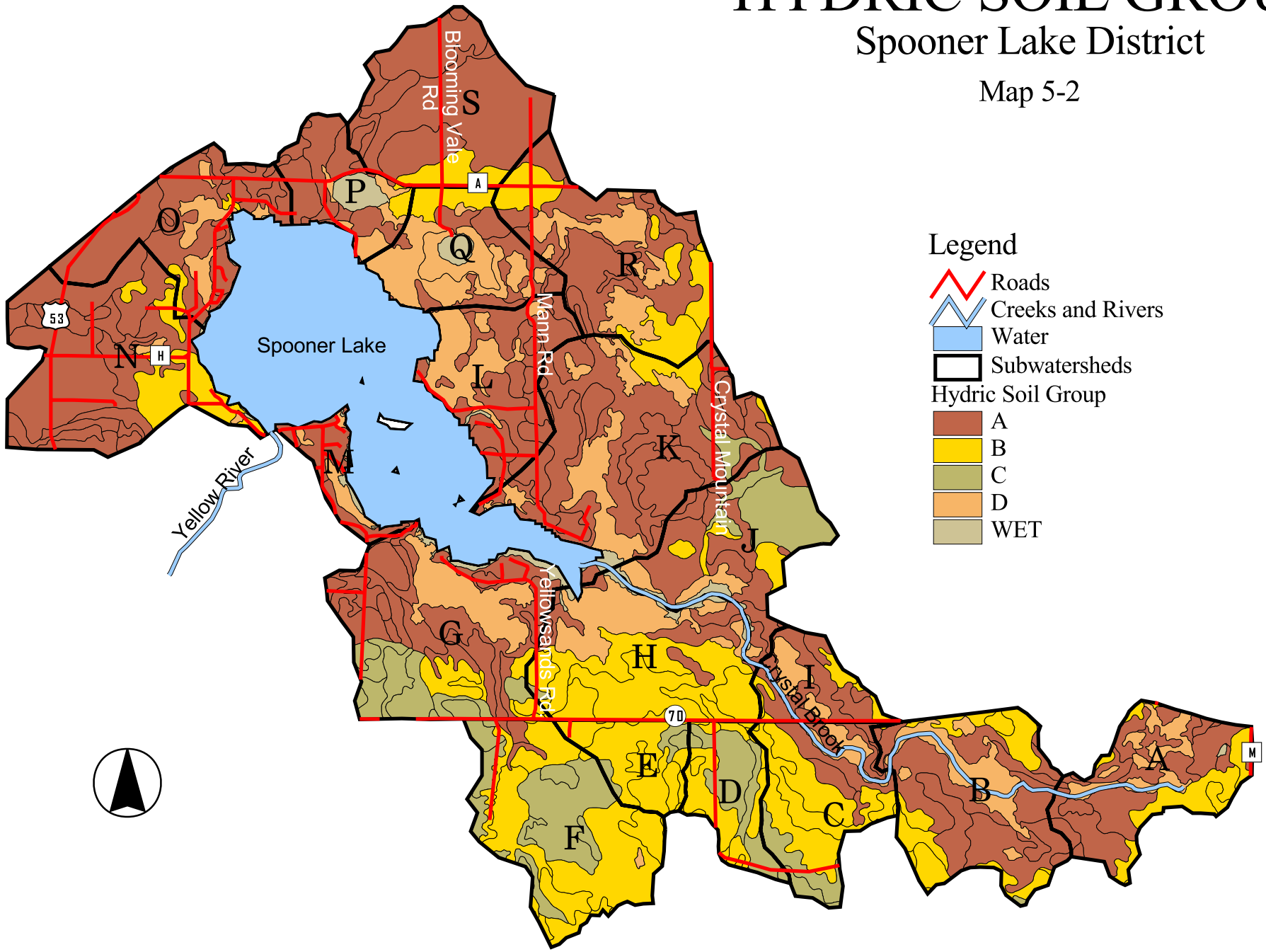
# HYDRIC SOIL GROUP

## Spooner Lake District

Map 5-2

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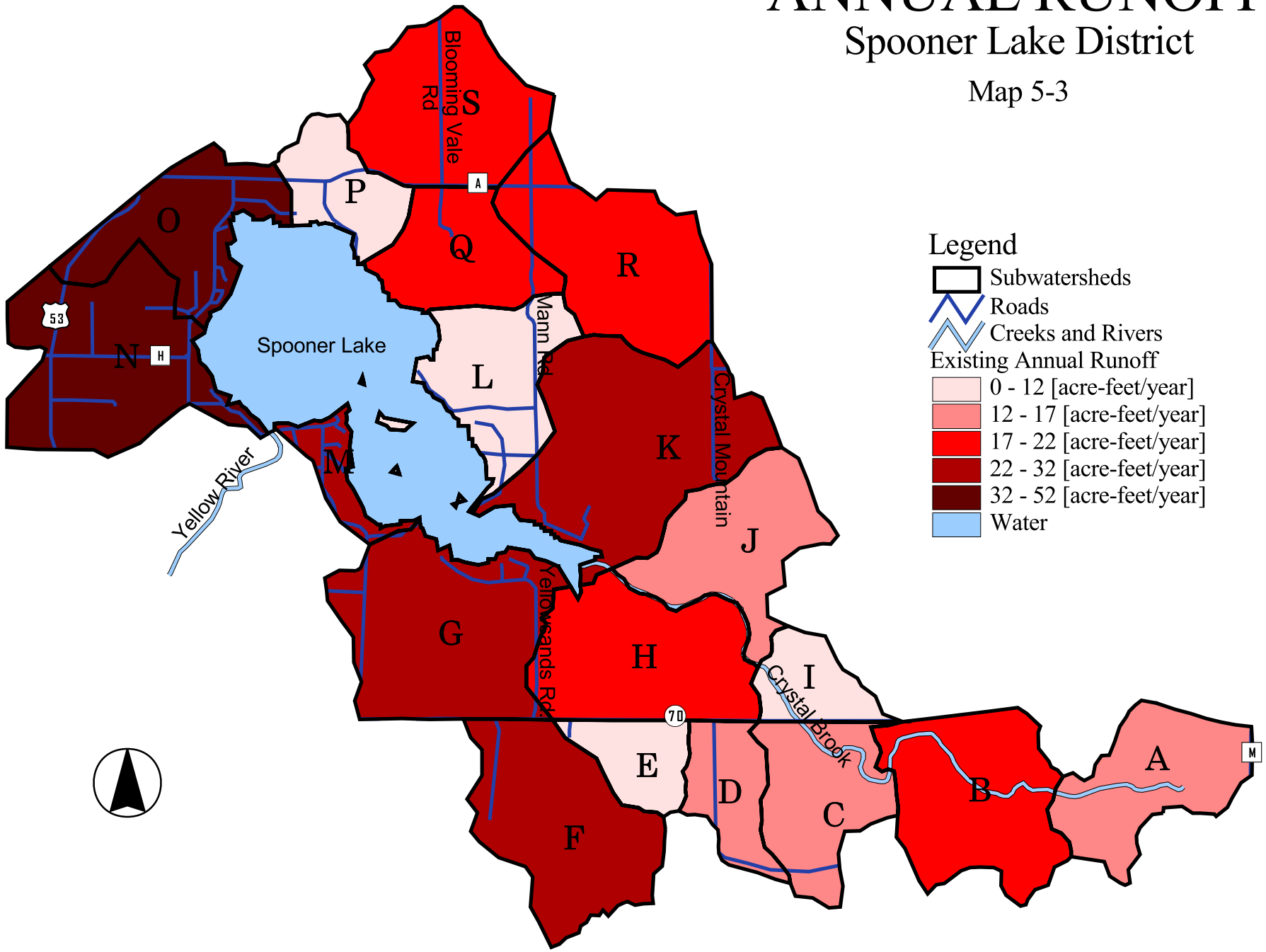
# ANNUAL RUNOFF

## Spooner Lake District

Map 5-3

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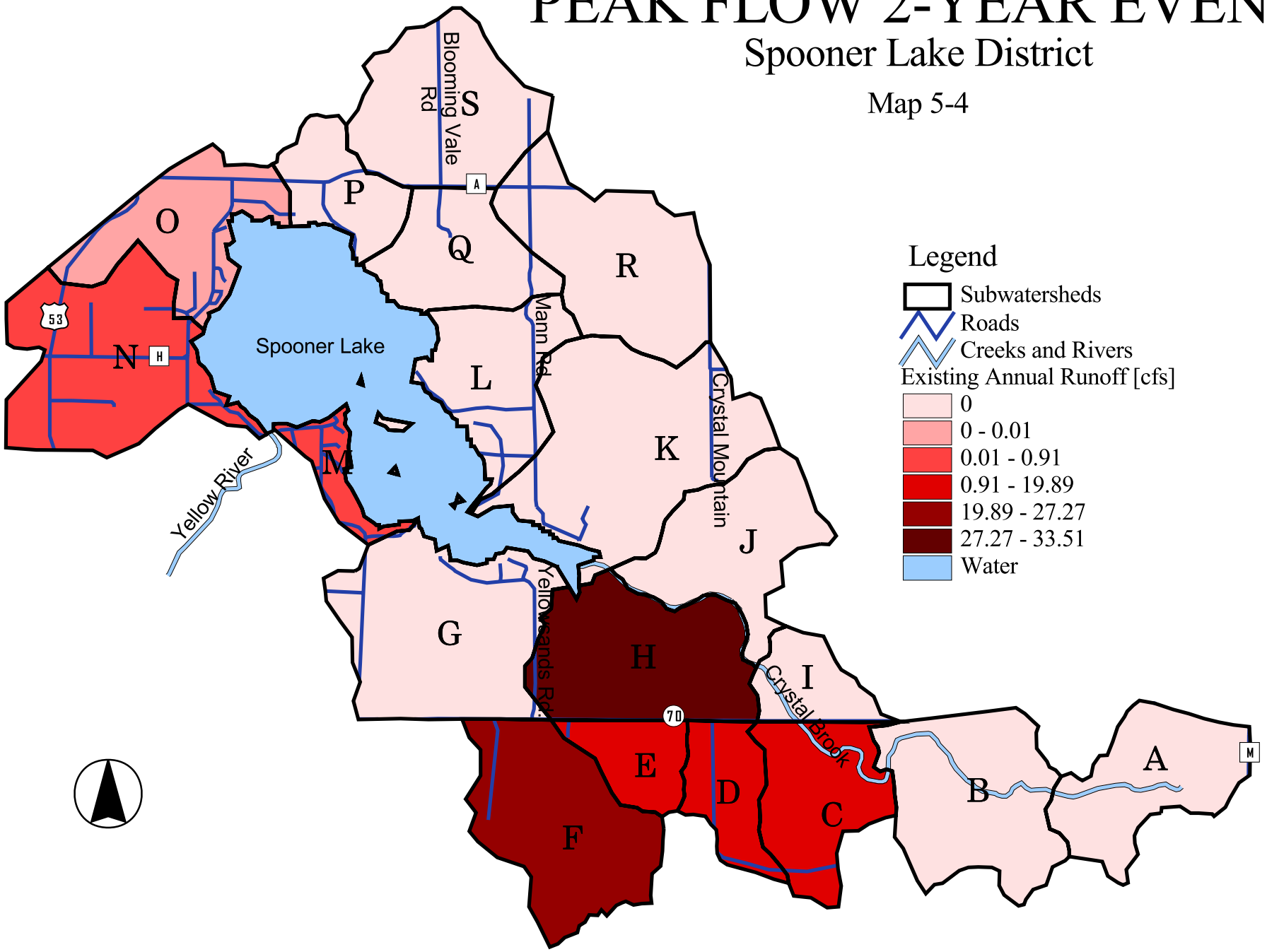
# PEAK FLOW 2-YEAR EVENT

## Spooner Lake District

Map 5-4

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# CHAPTER 6: PROBLEMS AND SOURCES

## 6.1. Property Owners

Issues that are primarily the result of residential development that affect the lake's water quality are described below:

### 6.1.a. Residences

Residential development, especially along the lakeshore, contributes to increased stormwater runoff. Stormwater flows over impervious surfaces such as rooftops, paths, and driveways. Impervious surfaces increase the velocity of stormwater and restrict infiltration. Most homes have rain gutters that channel the stormwater into a few drains increasing the runoff velocity which in turn increases the erosive force of the stormwater runoff. Manicured bluegrass lawns sloping to the water's edge once considered the norm increase the transport of nutrients to the lake.

### 6.1.b. Fertilizer Use

When property owners fertilize their lawns, especially lawns that are adjacent to the lakeshore, much of the nutrients from the fertilizer are carried away by stormwater runoff and deposited into the lake. These nutrients are a major source of water quality degradation as evidenced by increased algae and decreased water clarity.

### 6.1.c. Shoreland Restoration

With development along the shorelines, the desire to view the pristine waters of the lakes resulted in a desire by residential developments that offered broad views of the lakes. These areas were typically dedicated to biological monocultures of grasses with some flowering plants and trees with removal of vital shoreline habitat. Lawn mowing and urban style landscaping is common place as is the application of fertilizers, herbicides, and pesticides.

Shorelines that were once anchored by littoral vegetation, fallen trees, and natural gravel deposits have been altered by removal of aquatic plants and woody debris to make way for docks, boat lifts, and boat houses. Gravel deposits were moved to create sandy bathing beaches. Removal of these materials has affected aquatic habitats that have altered the species and the diversity of the fauna in the lakes.

These activities further result in the ability of shoreland runoff waters to collect and deposit nutrients and sediments directly into the lakes. These pollutants are now causing siltation of once shallow bay areas and the growth of aquatic plants and algae in the lakes. The problem is exacerbated by the century old deposition of the organic matter in the lakes following the logging era which continue to provide additional nutrients to the lake water from the lake bottom sediments when the lakes are stratified during the summer months.

Shoreline buffers are a restoration activity that can reduce the continued migration of sediment and nutrients from the shoreland to the lakes. There are a number of developed parcels along the shoreline that lack adequate vegetative cover.

### 6.1.d. Septic Systems

There are approximately 153 or so residences on Spooner Lake that have septic systems. Septic systems can contribute nutrients to the lake through ground water if a failure occurs, or if they are not properly maintained. Abnormal nutrient levels have entered the lake in the recent past from the well-documented 41 non-compliant lakeshore septic systems discovered in 1992. However, according to the survey a majority of the septic systems are less than 10 years old.

## 6.2. Bird Waste

A significant and growing flock of Canadian Geese uses the lake each year to rear young. When this flock is congregated in small areas like bluegrass lawns or resident feeding stations, their fecal deposits can have a significant impact on sediment nutrients and resultant plant growth at the localized site. Lakeshore residents need reliable information and BMPs in dealing with Canadian Geese.

In 1984, a turkey farm existed on the banks of Crystal Brook. The waste from these practices may also have had a significant effect on the nutrient load of Spooner Lake.

## 6.3. Erosion and Sediment Control

In developed areas of Spooner, runoff water frequently contains substantial quantities of sediments. This is due to impervious surfaces, construction grading, and inadequate erosion control practices. Erosion in agricultural and logging areas and developments comes in the form of gullied waterways, riled and gullied slopes, undercut pavements and pipelines, and lost topsoil.

The natural processes of erosion, transport, and deposition of sediments have occurred throughout geological times and have shaped the landscape of the Watershed. Eroded soil is considered the largest pollutant of surface waters in the United States. Sediment transport affects water quality and its suitability for other uses, including: consumption, industrial use, recreation, wildlife and ecological sustainability. The source of most sediment transported by swales, channels, drainage ways, rivers, creeks, and storm sewers to receiving water bodies is soil eroded from upland areas. Erosion often causes serious damage to agricultural land by reducing the fertility and productivity of soils.

Problems associated with deposition of sediments vary. Sediment deposition in stream channels reduces the flood carrying capacity, which results in greater flood damage to adjacent properties. Receiving water bodies trap the incoming sediment load and flood risks increase due to a build up of sediment deposits along the lake and stream bed. Accumulation of sediments upstream depends on the stream slope, the sediment size distribution, and the water-level fluctuations in the receiving water body. Streams, drainage ways, and channels with minimal slopes carrying

large quantities of sediment result in aggradations many miles upstream of the receiving water body. Receiving water body sedimentation results in loss of storage capacity for flood control.

Human activities typically increase the rate of erosion over the normal or geologic erosion rate. The erodibility of natural soils may be altered when the soil's natural condition is disturbed by plowing, tillage, and construction type activities. *Erosion rates accelerated due to human activities can be more than 100 times greater than geologic erosion rates of 0.10 ton/acre-year. Erosion rates of grazed areas can exceed 5-tons/acre-year, and we can expect average values of 30 to 50 tons/acre-year during urban construction development when the soil is not vegetated and it is consistently reworked.* Human activities also influence the natural characteristics of channel flows through channel stabilization and installed hydraulic structures.

### 6.3.a Sources of Sediment

#### i. Urban and Rural Areas

Both rural and urban areas contribute sediment loads. Soil erosion is one of the primary sources of sediment. The concentration of sediment is generally lower in low and medium density residential urban runoff than in rural runoff. However, the total amount of sediment from low and medium density residential urban areas is comparable to rural areas since more water runs off man-made impervious surfaces in developed areas.

#### ii. Construction and Manufacturing Sites

Although existing urban areas such as parking lots and street surfaces are important sources of sediment, by far the highest amounts of sediment come from areas under construction. Studies and research estimate that an average unprotected acre of land under construction delivers 60,000 pounds (30 tons) of sediment per year to downstream waterways. This is about 60 times more than any other land use.

Two factors account for the importance of construction sites as sediment sources:

1. High Erosion Rates
2. Rapid Delivery Rates

*Typical erosion rates for unprotected construction sites are 30 to 50 tons per acre per year compared to one to three tons per acre per year for cropland or low density residential areas.*

Construction sites have high erosion rates because they are typically stripped of vegetation and topsoil for long periods of time. More importantly, construction sites have higher delivery rates compared to cropland. During the first phase of construction, the land is graded and ditches or storm sewers are installed to provide good drainage ways. Unfortunately, this efficient drainage system does not allow sediments to settle out. While some of the sediment from croplands is

filtered out by ground cover, or deposited in a low spot of on the next field downhill, most soil erosion from a construction site gets delivered directly to the wetlands, and Spooner Lake.

Possible future development may take place on the northwest side of the lake beyond the golf course. During the construction processes it is vitally important that Best Management Practices are being followed to reduce the amount of potential erosion reaching Spooner Lake.

Chapter 9 provides reference to a proposed Storm Water Management Ordinance for protection of the area's unique natural resources by minimizing the amount of sediment carried by runoff or discharged from construction sites to the drainage ways, perennial waters, and wetlands within the Spooner Lake Watershed Planning Area.

### iii. Shoreline and Stream Channel Erosion

Shoreline erosion can be significant in lakes and watersheds with changes in flow volume. Shoreline erosion rates can be determined by comparison to earlier shoreline photographs. Shoreline erosion rates can be measured by comparing channel positions from a pair of recent aerial photographs to an old set of aerial photographs. Stabilizing that tributary would reduce the amount of sediment being carried into that channel.

### iv. Changes in Flow

From the beginning of farming and construction, urbanization and agricultural practices dramatically change the cycle of water movement. Clearing land removes much of the vegetated cover that intercepts rainfall before it reaches the ground. Once the trees and grasses are gone, less water is returned to the air through evaporation or transpiration (loss of water vapor from plants). Instead, rain falls directly on the exposed soil.

As farming, construction, and land disturbing activity proceeds, soil conditions also change. During construction, topsoil is usually stripped away and heavy construction equipment compacts the remaining subsoil that limits infiltration. More water runs off the compacted subsoil rather than percolating down to recharge groundwater supplies. The elevation of the shallow ground water is significant because it supplies much of the base flow in drainage ways between storms.

Runoff water problems continue after developers and builders complete construction. Water runs off hard (impervious) surfaces such as compacted soils, parking lots, buildings, and streets, picking up speed and carrying sediments and pollutants along the way. Developers and builders can help mitigate potential damage by spreading topsoil and planting grass vegetation as soon as practical

after land disturbing activities to allow the soil to regain its ability to soak up and infiltrate storm water runoff.

Sediment and pollutant loading will increase as the effects of development on storm water are realized. These effects include:

- Peak Discharge: After farming and development, peak stream flows are two to five times higher than they were before farming and development. Consequently, the frequency and severity of flooding and sedimentation increases. A stream that once overflowed its banks once every two years may now flood three or four times per year. When the banks overflow, sediments are deposited within the flood plain or transported downstream.

- Volume: The volume of runoff increases about 50 percent in a moderately developed or altered watershed.

- Timing: Urban and farm drainage systems are so efficient that the time required for runoff to reach the stream can decrease as much as 50 percent. This results in high flows compressed into a shorter period of time. The river, wetlands, creeks, drainage ways, and channels are "flashy" because water levels rise and fall very quickly in response to storms.

- Velocity: Flow velocity increases in the wetlands, creeks, drainage ways, river, and channels during storms because peak discharges are higher and new drainage systems are smooth and efficient.

- Base Flow: Stream flow is reduced by farming and development activities. Portions of channels and drainage ways that were once wet and flowed year-round become seasonally dry.

The dramatic flow changes in the drainage ways, channels, wetlands, creeks, rivers, and lakes, have extensive consequences in terms of flooding patterns, stream flow channel erosion, and ecological and wildlife habitat degradation.

## 6.4. Sedimentation

There are numerous causes of sedimentation including runoff from urban areas, highways, roads, and residential runoff from lakeshore owners. Each of these issues should be addressed in order to reduce the negative impacts development has on water quality. Sedimentation often results in poor water quality, an increase in plant growth, shallow lakes, and smaller fish populations. Unless something is done to alter the current course of lake and surrounding watershed planning area, Spooner Lake will likely no longer be the desirable recreation and wildlife habitat that it is currently.

## 6.5. Aquatic Plant Growth

Excessive perennial weed growth in recent years has coincided with winter fish and frog kills during severe winters. Partial winterkills invariably happen in the northern arm of

the lake that is isolated from oxygenated water flowing in from Crystal Brook and out the Yellow River. The District Board lacks a mechanism to monitor winter dissolved oxygen data that could be used to guide timely management decisions to counteract anoxic conditions and impending fish kills. As development has increased, so has aquatic plant growth. While certain levels of aquatic plants are desirable for water quality, the current level is excessive and seen as a nuisance.

## 6.6. Water Level

Water levels have remained artificially static since 1945 when the City of Spooner stopped using the lake for a waterhead source to generate electricity. These stable levels have encouraged the explosive growth of perennial aquatic vegetation, often less desirable or non-native forms that have become invasive and overrun native vegetation. Much of the disappearing native vegetation has been historically valuable in maintaining healthy fish, wildlife, and even human populations. The almost complete disappearance of native wild rice from the lake is an example of the overwhelming macrophyte changes wrought by artificially high and static water levels, and by excessive nutrient loads.

# CHAPTER 7: COMMUNITY SURVEY

## 7.1. Executive Summary

In 2002, 153 anonymous District surveys were sent out through the U.S. Postal Service to those who lived around Spooner Lake. Fifty-four percent (54%) of the surveys were returned by August 2002. This response rate is very high for a mailed survey. This survey is as well received as this one, which is evidence of the care and concern that a broad spectrum of the population has for the Spooner Lake community. Some 250 surveys were sent to four different resorts for visitors to fill out as they stayed at the resorts. The visitor return rates showed that 44 were received from Spooner Lake District Board Resorts, 35 from Pine Harbor Resort, 5 from Laconia Resort, and 4 from Ma & Pas' Resort. A total of 88 visitor surveys were returned by August 30, 2002.

## 7.2. Methodology

The survey was designed to provide information on the recreational use of Spooner Lake. Questions were asked about the frequency of visits and duration of residency, recreational use of the lakes, perceived water quality, the efforts of the District, and opinions on the priority of issues concerning the lakes.

Using the U.S. Postal Service was determined to be the best method of district survey distribution and collection. The surveys were mailed out on June 28, 2002, and began receiving responses on July 4, 2002. All surveys returned from July 4, 2002 through August 28, 2002 were used to compile this report.

One hundred and fifty-three (153) district surveys were sent out to residents/addresses located around Spooner Lake's shoreline and within the red boundary as shown on Map 7-1. Out of these surveys, 54% (N=83) of the surveys were returned and analyzed. Eighty-three (83) surveys were analyzed, while seventeen (17) came back labeled as "undeliverable".

## 7.3. District Results

The District's survey results are highlighted in this section. A sample of the Community Survey that also shows the tallied results is included as Appendix B, and detailed survey responses with charts, graphs, text and written comments can be found in the "Spooner Lake District & Visitor Survey Report."

Overall the survey results indicate:

1. Twenty-nine percent (29%) of respondents have been a Spooner Lake shoreline owner over 20 years (N=25).

2. About 1/3 of the homes (33%) were built after 1978.

3. Permanent residents and owners who spend weekends and an occasional week is when most (57.4%) spend time at their home on Spooner Lake.

4. The community around Spooner Lake feels that the lake is neither over nor under utilized during the summer months.

5. The community around Spooner Lake also feels that the lake is neither over nor under utilized during the winter months.

6. Thirty-two respondents (37%) said they would not support a "quiet time" (slow-no wake) on their lake.

7. The lake area invites a variety of recreational uses, and in the last 12 months, the respondents were apart of activities that include:
    a. Twenty-three percent picnicked at Spooner Lake or used the park areas within the last 12 months.
    b. Sixty-four percent swam in Spooner Lake in the last 12 months.
    c. Thirty-one percent of the respondents went biking.
    d. Fifty-nine percent went walking/jogging more than six times.
    e. Forty-four percent went canoeing/kayaking.
    f. Twenty-six percent went hiking on nature trails.
    g. Fifteen percent camped in area parks.
    h. Eighty-three percent boated on the lake.
    i. Eighty-three percent fished from the lake shoreline.
    j. Eighty-seven percent fished from boats.
    k. Forty-one percent fished during the winter.
    l. Seventy percent respondents relaxed and enjoyed the scenery.
    m. Twenty-six percent used snowmobiles in the area.
    n. Thirty-eight percent water-ski on the lake.
    o. Ten percent jet skied on the lake.
    p. Twenty-one percent winter ski in the area.

8. In response to general questions about lake management issues, the respondents indicated:
    a. Thirty-three percent agree that the lake is an important resource for the community.
    b. Fifty-two percent agree and are neutral that there is not a lot of litter noticed around the lake.
    c. Fifty-four percent agree that additional controls over the use of personal watercraft as required.
    d. Thirty-four percent agree that the city/county does a good job in maintaining the park areas that surround the lake.
    e. Sixteen percent believe there has been some improvement in water quality.
    f. There is a mixed response to limiting the size (horsepower) of boat motors on the lake.

g. Eighteen percent believe there has been a reduction in the weed population in the lake.
h. Eighty-two percent agree the District should continue their efforts to control weeds within Spooner Lake.
i. Sixty-three percent want to continue to be allowed to use snowmobiles on the lake.
j. Forty-nine percent agree Canadian geese environmentally impact the water quality of the lake.
k. Sixty-two percent agree the WDNR should increase Canadian geese bag limit around the lake.
l. Sixty-two percent agree the WDNR should look into impacts on lakes from winter fishing practices.

9. Few respondents (11.5%, N=10) reported that they use Spooner Lake the less than they did five years ago.

10. The most common watercraft used on Spooner Lake is a fishing boat, with pontoons and canoes/kayaks as next most common watercraft.

11. Forty-six percent of respondents felt that water quality greatly affected their decision to visit or use Spooner Lake.

12. Based on their use of the Spooner Lake in the past season, thirty-three percent rated the appearance of the lake water as good to very good.

13. The majority of the respondents (45%, N=39) reported that the quality of fishing in Spooner Lake is about the same, with forty-one percent of the respondents feel the quality is worse.

14. Rating the appearance of the lakes in this past season:
    a. Forty-six percent rated the appearance as the same as earlier in the year.
    b. Fifty-eight percent rated the appearance as the same as the previous year.
    c. Thirty-one percent rated the appearance as slightly worse and thirty percent rated the appearance as the same as the previous five years.
    d. Twenty-six percent rated the appearance as slightly worse as the previous ten years.

18. On the issues that the District Board should focus their time and efforts:
    a. Providing educational information on issues is a moderate to average priority.
    b. Organizing social events in the summer is a below average priority.
    c. A study of the fish populations and stocking the lakes with fish (as appropriate) is a high priority.
    d. “Adopting” the roads around the lakes and help keeping them litter-free is an average priority.
    e. Working toward implementation of the recommendations of the lake management plan is a high priority.

19. On the importance of providing certain information:
    a. Water quality is a high priority
    b. Environmental issues is a high priority
    c. Zoning is a high priority
    d. Boating regulations and safety is a high to average priority
    e. Fishing is a moderate to high priority
    f. Hunting is a below average priority
    g. Winter sport safety is an average priority
    h. Local, county, and state government actions that affect shore owners is a high priority
    i. WDNR news is a average priority
    j. Actions taken by the Town Board is a high priority

20. The top five items that respondents feel are the most significant water quality problems facing the lakes include:
    a. Weed growth
    b. Algae growth
    c. Failing/faulty septic systems
    d. Chemical/fertilizer runoff from cropland
    e. Chemical/nutrient runoff from lawns

21. The three organizations/persons held to be most responsible for water quality improvements of the lakes are:
    a. Lake District
    b. State of Wisconsin
    c. County Government

## 7.4. Visitor Results

The visitor's survey results are highlighted in this section. The visitor resort that participated the most (50%) in the Spooner Lake Visitor Survey were those visitors of the District Board Resorts.

Overall the survey results indicate:

1. While staying at a local resort 99% (N=87) of visitors have visited Spooner Lake whereas 71% (N=62) have visited the Town of Spooner.

2. For those who haven't visited any of the lake/park within the last 2 years, most of those respondents didn't have a response to when they last visited the area.

3. The visitors did not give a reason why the respondents haven't visited the lakes or park areas within the past two years.

4. If the community member does not have a residence on one of the lakes, most visitors have been visiting the lakes for over 20 years (51%, N=45).

5. For those who do not have a residence on the lake, most (31%, N=27) drive over 500 miles to Spooner Lake. The second highest category of visitors (30%, N=26) drive between 301 to 400 miles to visit the Spooner Lake.

6. The visitors of Spooner Lake feel that the lake is neither over nor under utilized.

7. Thirty-one respondents (35%) said they would not support a "quiet time" (slow-no wake) on their lakes.

8. Recreational uses the lakes area in the last 12 months by the visitors include:
    a. Thirty-six percent picnicked at Spooner Lake or the park area within the last 12 months.
    b. Sixty-six percent swam in the Spooner Lake more than 6 times in the last 12 months.
    c. Thirty percent of the respondents went biking.
    d. Seventy-nine percent went walking/jogging more than six times.
    e. Eighty-eight percent went canoeing/kayaking.
    f. Thirty-seven percent went hiking on nature trails.
    g. Twenty-two percent camped in area parks.
    h. Ninety-five percent boated on Spooner Lake.
    i. Eighty-four percent fished from the lake shoreline.
    j. Ninety-four percent fished from boats.
    k. Seventy-seven percent never fished during the winter.
    l. Eighty-four percent respondents relaxed and enjoyed the scenery more than six times.
    m. Seventy-six percent never used snowmobiles in the area.
    n. Fifty percent water-ski on the lakes.
    o. Seventy-four percent never jet skied on the lake.
    p. Seventy-two percent never winter ski in the area.

9. In response to general questions about lake management issues, the visitors indicated:
    a. Sixty-nine percent strongly agree that the lake is an important resource for the community.
    b. Forty-six percent disagree that litter is noticed frequently around Spooner Lake.
    c. Thirty-one percent agree that additional controls over the use of personal watercraft are required.
    d. Forty-three percent agree that the State does a good job in maintaining the park areas and access points that surround the lake.
    e. Thirty-two percent are neutral to the idea that there has been some improvement in Spooner Lake water quality.
    f. There is a mixed response to limiting the size (horsepower) of boat motors on the lakes. However, most (25%) strongly disagree with this idea.
    g. Thirty-six percent believe there has been a reduction in the weed population in Spooner Lake.

h. Eighty percent agree and strongly agree with the District's efforts to control weeds in Spooner Lake.
i. Thirty-three percent feel Canadian geese are environmentally impacting the lake.
j. Thirty-three percent agree an increased bag limit for Canadian geese is an appropriate control method.

10. The majority of respondents (77%, N=68) reported that they use the Spooner Lake the same as they did five years ago.

11. The most common watercraft used on Spooner Lake is a fishing boat, with pontoons and ski/speed boats as next most common water craft.

12. Forty-three percent of visitors felt that water quality greatly affected their decision to visit or use of Spooner Lake.

13. Based on last season, the visitors rate the appearance of Spooner Lake to be good.

14. The visitor's fishing quality rating compared to the last visit was worse (48%).

15. Rating the appearance of the lakes in this past season:
    a. Forty-three percent didn't know how to rate the appearance compared to earlier in the year.
    b. Thirty-nine percent rated the appearance as the same as the previous year.
    c. Thirty-three percent rated the appearance as the same as the previous five years.
    d. Twenty-three percent rated the appearance as the same as the previous ten years.

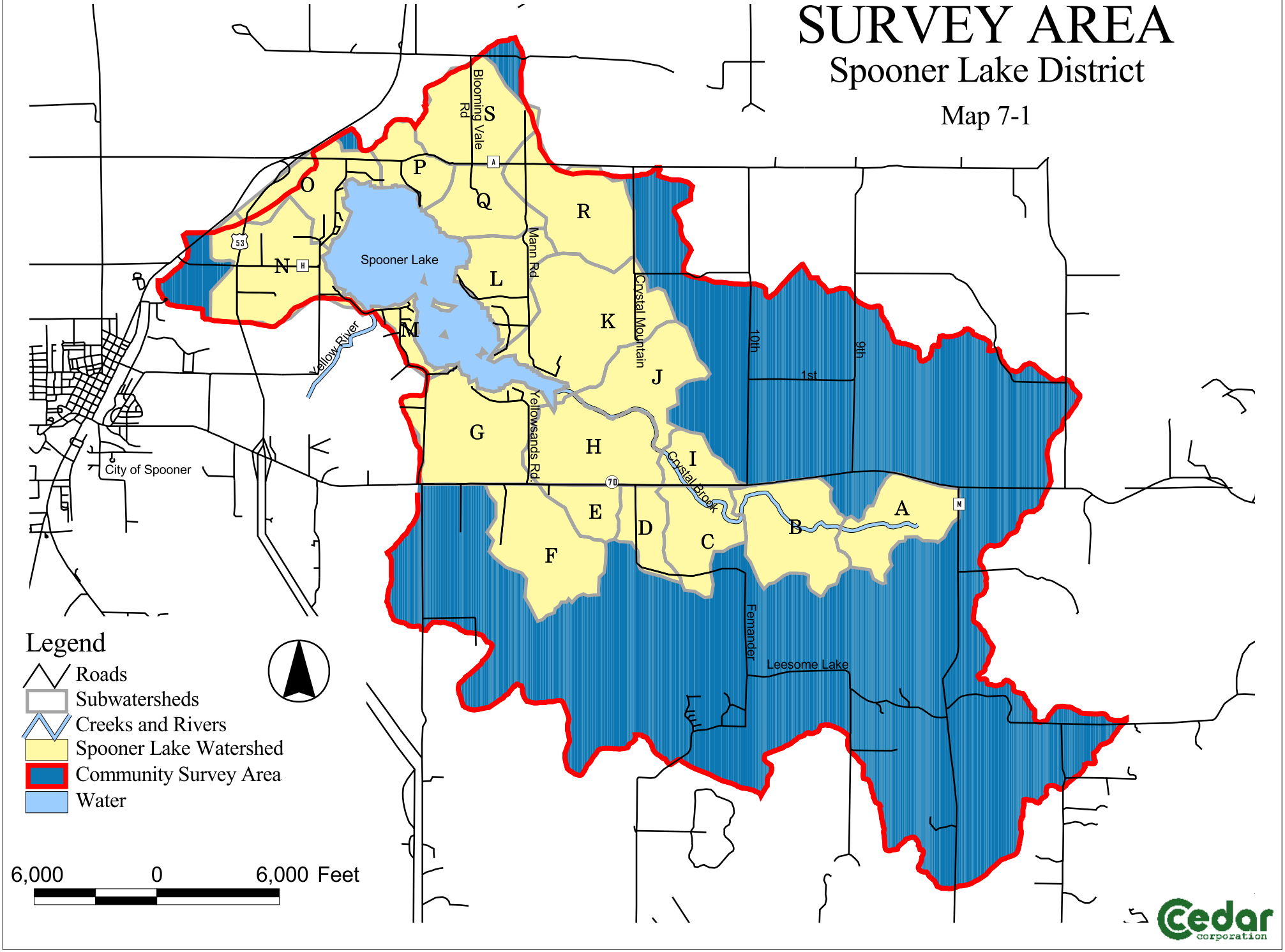
16. Eighty-one percent did not have household members belonging to any group or organization that used Spooner Lake in the past 12 months.

20. The top five reasons why people visit Spooner Lake are:
    a. Fishing
    b. Swimming
    c. Boating
    d. Resort Accommodations
    **e.** Lack of Development

# SURVEY AREA

## Spooner Lake District

Map 7-1



# CHAPTER 8: REGULATIONS AND EXISTING INFORMATION

## 8.1. Ordinances

Stormwater related ordinances are non-structural BMPs. They are simple, cost effective ways to develop areas with appropriate considerations to protecting the lake via stormwater management. Basically, enacting stormwater management ordinances provides an effective way to require private developers to manage stormwater. There are three main ordinances that communities should consider for implementation to best protect the quality of water in nearby lakes. Those are Construction Site Erosion Control, Stormwater Management, and Phosphorus Free Fertilizer.

The first two are stormwater related ordinances that the Town of Spooner could pass sometime in the near future. The first one is the construction erosion control ordinance that requires a specific erosion preventative measures be installed on construction sites as development occurs. The second one is a post construction stormwater management ordinance that requires developers to control runoff from their property after it has been developed.

The ordinances encompass the construction and post-construction phases of new development and redevelopment areas, as well as certain requirements for developed urban areas. The standards are intended to protect water quality of Spooner Lake by minimizing the amount of sediment and other non-point source pollutants that enters the Lake.

The standard for construction sites requires implementation of an erosion and sediment control plan using Best Management Practices (BMPs) that, by design, reduce to the maximum extent practicable (MEP) 80 percent of the sediment load on an average annual basis.

The post-construction site performance standards set a minimum level of control of runoff pollution from construction sites after construction is completed and final stabilization has occurred. They apply to sites subject to the construction site erosion control standard, with some specific exceptions. The State of Wisconsin currently has minimum standards established in NR 151. Below is a summary of the NR 151 standards:

> NR 151.11 sets forth the construction site erosion control performance standards that construction projects that disturb more than 1 acre of land must follow. Primarily, it requires the following items be address:
>
> 1. A written erosion control plan must be prepared by the design engineer.
> 2. Reduce sediment load by 80%.
> 3. Prevent tracking from the construction site (install tracking pads).
> 4. Prevent discharge of sediment during de-watering operations (install filters in discharge lines).
> 5. Protect storm sewer inlets from sediment (install inlet protection).
>
> * Note: There are several exemptions, exceptions and exclusions that exist within the code.

NR 151.12 sets forth the post-construction performance standards that construction projects that disturb more than 1 acre of land must follow. Primarily, it requires the following items be addressed:

1. A written storm water management plan must be prepared by the design engineer.
2. Water Quality: Suspended solids removal of 80% (new development) or 40% (redevelopment).
3. Peak Discharge: Match post-construction peak discharge rate to the pre-development peak discharge rate for the 2-year storm event.
4. Infiltration: Infiltrate 25% of the 2-year storm event (residential) or 10% of the 2-year storm event (non-residential).
   * Note: There are several exemptions, exceptions and exclusions that exist within the code.

Until specifics of any construction project are known, primarily if they would meet any of the exemptions, exceptions and/or exclusions, specific requirements for the project are impossible to determine and will be established on a case by case basis and will depend greatly on the site of the project.

The third ordinance is a phosphorus free fertilizer ordinance. Putting a phosphorus free fertilizer ordinance can also reduce the amount of nutrients that reach the lake. Phosphorus is often a limiting nutrient in lakes meaning any additional phosphorus will cause an increase in algal and plant growth. Implementing a phosphorus free fertilizer ordinance will reduce a source of unnecessary phosphorus in the watershed. Phosphorus free fertilizers are becoming more readily available and their use should be considered by all landowners near the lakeshore before an ordinance is required.

Draft samples of each of the aforementioned ordinances can be found in Appendix C.

## 8.2. Zoning Regulations

Around lakes in Wisconsin there are typically multiple levels of zoning for a landowner to be accountable. In the Town of Spooner, within 1,000 feet of Spooner Lake, landowners are responsible for both the District regulations from the County Zoning Ordinance, and the Shoreline Zoning regulations. Landowners must always abide by the more restrictive ordinance.

Spooner is a Class 1 lake which is the least restrictive of all the classes in Washburn County. Below are the Class 1 development standards that apply to Spooner Lake:

| **Lake Classification** | **Waterfront Lot Width per Single Family Unit** | **Minimum Lot Area** | **Minimum Shoreline Setback** | **Vegetation Removal** | **Minimum Side Yard Setback** | **Minimum Rear Yard Setback** |
|---|---|---|---|---|---|---|
| Class 1 | 150 feet | 30,000 sq. ft. | 75 feet | 30 foot limited removal corridor within 50 feet of OHWM | 10 feet One side<br><br>30 feet Total both sides | 40 feet |

The Washburn County Land and Water Resource Management Plan summarizes shoreland zoning for Washburn County below:

"The purpose of the shorelands regulations is to insure the proper management and development of the shorelands of all navigable lakes, ponds, flowages, rivers and streams in the unincorporated areas of Washburn County. The shorelands areas are those lands with 1,000 feet of the ordinary high-water mark of any navigable lake, pond, or flowage, and the lands with 300 feet of the ordinary high-water mark of any navigable river or stream, or to the landward side of the floodplain, whichever is greater.

Amendments to the Washburn County Shoreland Zoning Ordinance were made in 1998. The 1998 amendments established a lakes classification system with varying set backs and lot widths for each of three lake classes. Standards for vegetative buffers were strengthened significantly to limit removal of vegetation and to require restoration of vegetation when land use permits are obtained within the shoreland zone. The Land and Water Conservation Department assists with the development of vegetation restoration plans. Keyhole development, where several back lots have access through a single lakeshore lot, was also disallowed in the ordinance revisions. The ordinance specifies best management practices for construction site erosion control where land disturbing activities expose more than 2000 square feet.

The County Zoning Administrator administers and enforces the provisions of the zoning ordinance including shoreland zoning. The Zoning Administrator may inspect properties and may revoke permits and issue cease and desist orders. The Washburn County Board of Adjustments hears and decides appeals to zoning administration and enforcement."

## 8.3. Sensitive Areas Survey

The DNR conducted the sensitive area surveys on Spooner Lake in the summer of 2000 and generated the attached report. The report titled "Spooner Lake Sensitive Area Survey Report and Management Guidelines" designates nine sites (Map 8-1) as "sensitive" around the lakeshore and primarily in those areas adjacent to wetlands or having low human development density or desire. The areas are considered sensitive due to the numerous and varied plant and animal species present. These areas are considered prime fish habitat and spawning areas. Wildlife are reliant on this area for habitat. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat. The report describes each site and lists the resources available. Below is a list of the sites described in the study with a brief description of the area:

Site A: Sensitive area A is located at the mouth of the Yellow River. This sensitive area covers approximately 600 feet of shoreline extending out as far as 200 feet in shallower shoreline areas. This area provides habitat for bass and panfish and sucker species for spawning, feeding, protection and as a nursery for young.

Site B: Sensitive area B is located approximately 400 feet to the East of Sensitive Area A and covers 600 feet of shoreline extending out as far as 200 feet. This area provides habitat for large mouth bass and northern pike. These species will use the area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Site C: Sensitive area C is located on the western shore of Spooner Lake midway down the shoreline. The area covers approximately 400 feet of shoreline extending out 100 feet. This area provides habitat for panfish and northern pike. These species will use the area for spawning, feeding, protection and a nursery for young. This area also provides important habitat for forage species.

Site D: Sensitive area D is located in the southwestern shore of Spooner Lake. This area covers approximately 1,400 feet of shoreline extending out 200 feet. This area provides important habitat for panfish, bass, and northern pike. Northern pike will use this are for spawning. Small mouth bass and panfish will use this area for feeding and protective cover. This are also important provides habitat for forage species.

Site E: Sensitive area E is located on the southern shore of Spooner Lake. This area covers approximately 800 feet of shoreline extending out 200 feet. This area provides important habitat for panfish, bass, and northern pike. Northern pike and panfish will use this are for spawning, feeding, protection and a nursery for young. Large mouth bass will use this area for feeding, protection and a nursery for young. This are also important provides habitat for forage species.

Site F: Sensitive are F is located on the southeastern shore of Spooner Lake. This area covers approximately 2,400 feet of shoreline extending out 150 feet. This area provides important habitat for panfish, bass, and northern pike. Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and a nursery for young. This area also provides important habitat for forage species.

Site G: Sensitive area G is located on the eastern shore of Spooner Lake midway down the shoreline. This area covers approximately 500 feet of shoreline extending out 100 feet. This area provides important habitat for panfish, bass, and northern pike. Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and a nursery for young. This area also provides important habitat for forage species.

Site H: Sensitive area G is located on the eastern shore of Spooner Lake north of sensitive area F. This area covers 1,100 feet of shoreline extending out 100 feet. This area provides important habitat for panfish, bass, and northern pike. Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and a nursery for young. This area also provides important habitat for forage species.

Site I: Sensitive area I is located on the northern shore of Spooner Lake. This area covers approximately 1,200 feet of shoreline extending out 100 feet. Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and a nursery for young. This area also provides important habitat for forage species.

## 8.4. Aquatic Plant Management Plan

In the summer of 2006 the Spooner Lake District hired Harmony Environmental; Amery, WI; to complete two macrophyte surveys on Spooner Lake. The macrophyte surveys and aquatic plant management plan were completed according to guidelines of the "Aquatic Plant Management in Wisconsin" document which has been compiled by members of the Wisconsin Department of Natural Resources and the University of Wisconsin Extension Lakes Program.

The early season survey was completed in June 2006 and it focused only on *Potamogeton crispus* (curly leaf pondweed), which is a non native invasive specie. This survey was completed in June as the curly leaf pondweed generally tends to die of in July. The late season survey was completed in late July 2006 sampling 696 points. All plants were accounted for during the late season macrophyte survey from each sampling point if they were on the hand tossed rake or visually observed within six feet of the boat. Of the 696 points only seven did not have any plant growth, which indicates Spooner Lake has a "plant coverage" of 99%.

Below is a list of goals taken from the Aquatic Plant Management Plan:

Goal 1: Maintain present native plant community and preserve important floating and emergent beds at a non-nuisance level.

Goal 2: Restore native shoreline vegetation.

Goal 3: Preserve and/or enhance water quality.

Goal 4: Contain and reduce curly leaf pondweed in East Bay (inflow) and stop/monitor potential spreading to other areas of lake.

Goal 5: Reduce nuisance levels of macrophytes (native and non-native) in East Bay (near inflow).

Goal 6: Reduce filamentous algae in East Bay while monitoring remaining lake.

Goal 7: Prevent introduction of new invasive species such as Eurasian Water Milfoil (EWM).

Goal 8: Establish a rapid response plan to a new introduction of invasive species.

Recommendations from the Plan are outlined in Chapter 9.

## 8.5. Washburn County Resource Management Plan

The Washburn County Resource Management Plan was established to assist the Washburn County Land and Water Department in its efforts to protect and improve land and water resources in Washburn County. The Goals, Objectives, and Activities outlined in this plan will guide the Land and Water Conservation Department through 2009. Below is a list of the stated goals in the plan:

Goal 1: Protect and restore aquatic and near shore fish and wildlife habitats and encourage their appreciation.

Goal 2: Protect and enhance lakes, streams, and wetlands by managing nutrient and sediment inputs.

Goal 3: Balance outdoor water and shoreland experiences to minimize conflicts among users and impacts to the natural environment.

Goal 4: Protect groundwater quality to supply clean water for drinking and recharging lakes and streams.

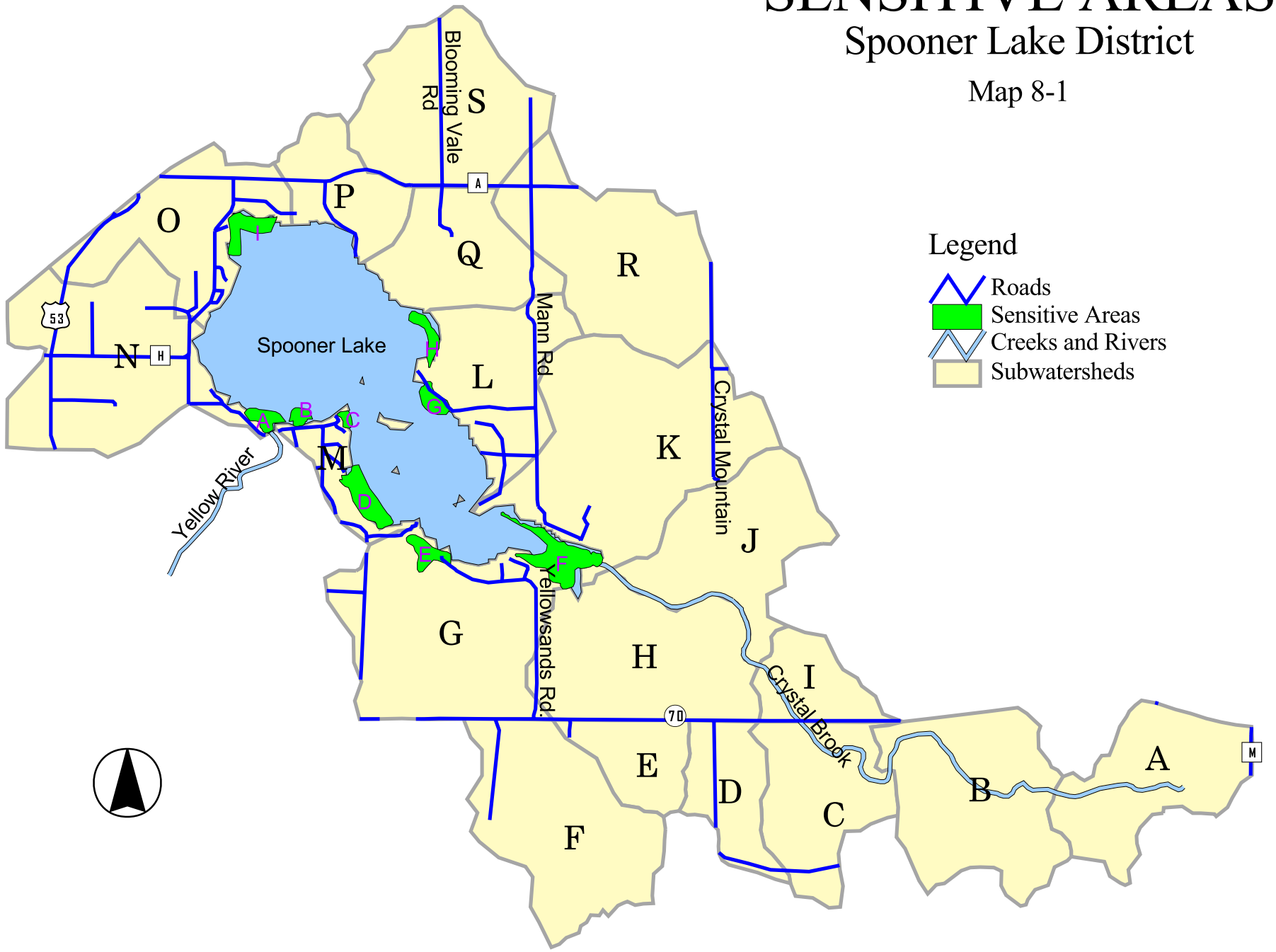
Goal 5: Preserve and protect natural areas and agricultural lands from the negative impacts of development.

The Objectives and Activities are listed in Appendix D.

# SENSITIVE AREAS

## Spooner Lake District

Map 8-1




Cedar corporation

# CHAPTER 9: WATERSHED WATER QUALITY RECOMMENDATIONS

Perhaps the most difficult task is the ongoing development and continuation of an information and education program to promote and foster an awareness of water quality concerns among residents and non-residents of the region. Individuals, local government, and area businesses alike need to assume an increasing responsibility for protecting water quality of the area lakes. This chapter outlines some methods to promote water quality protection.

This report documents that a variety of factors affect the water quality of the lakes. These include nonpoint source pollutants – primarily sediments and nutrients (phosphorous and nitrogen), groundwater, precipitation, and background or natural sources. Similar lakes in this region have the appearance of being healthy but all lakes should be considered fragile. Visual inspection alone does not demonstrate an accurate level of water quality. Spooner Lake as a whole is considered eutrophic. Thus, the District Board, its members, the surrounding populace, and visitors to the Lake all need to be sensitive to the existing water quality. Initially they should be encouraged to adopt those necessary measures to be protective of the water quality of Spooner Lake. Ordinances requiring water quality improvements must be enacted and enforced if the lake water quality is to be protected.

Best Management Practices (BMPs) are measures intended to reduce or mitigate storm water runoff water quantity and water quality concerns to the maximum extent practical.

Recommendations are characterized into the three main issues relating to Spooner Lake and its water quality; the watershed, the riparian zone, and the aquatic macrophytes. Some of these recommendations may fit into more than one category.

## 9.1. Watershed Water Quality Recommendations

Spooner Lake is just a reflection of the life within its watershed. Improving the quality of the conditions of the watershed and limit the amount of water carrying contaminants and nutrients that reach the Lake is important as this action reduces water quality degradation.

### 9.1.a. Conservation Easements

Develop a program to implement conservation easements over wetlands and grass swales that includes an established buffered area to protect those areas from harmful activities such as development.

The first step in this process is to identify all the wetlands and grass swales. Wetlands should then be delineated and mapped. Once the wetlands are delineated, property owners should be identified and educated on the importance of developing a conservation easement on those areas to ensure protection of the resources and of the water quality.

A similar program should be implemented for navigable streams and major drainage corridors. The district should map the streams and drainage corridors in the watershed and seek conservation easements from the property owners.

All property owners in the watershed area should be educated in water quality concerns and the importance of compliance with the Federal Clean Water Act and Wisconsin State DNR requirements.

### 9.1.b. Stormwater Ordinances

Stormwater related ordinances are considered non-structural BMPs. These are simple, cost effective ways to ensure that development occurs with appropriate considerations to stormwater management. The standards are intended to protect water quality by minimizing the amount of sediment and other non-point source pollutants that enter waterways.

A Construction Erosion Control Ordinance requires a specific erosion preventative measures to be installed on construction sites as development occurs. Another one is the Post Construction Stormwater Management Ordinance that requires property developers to control runoff from their property after it has been developed. Together these ordinances encompass the construction and post-construction phases of new development and redevelopment areas.

The standard for construction sites requires implementation of an erosion and sediment control plan using Best Management Practices (BMPs) that, by design, reduce to the maximum extent practicable (MEP) 80 percent of the sediment load on an average annual basis.

The post-construction site performance standards set a minimum level of control of runoff pollution from construction sites after construction is completed and final stabilization has occurred. They apply to sites subject to the construction site erosion control standard, with some specific exceptions. A written storm water management plan must be developed and implemented for each site and must incorporate the performance standards.

The following information lists some of the important aspects of the Post Construction Stormwater Management Ordinance that the DNR enforces. Passing these ordinances will help enforce what the DNR regulates:

- Developer must have a written stormwater management plan for each post construction site for future development
- The Town Staff, with assistance from the Town Engineer, will review development to make sure they meet the guidelines of the ordinance
- For new development, TSS load should be reduced by 80% to the maximum extent practical compared to no runoff management controls
- For infill development, TSS load should be reduced by 40% to the maximum extent practical compared to no runoff management controls
- Ordinance will promote infiltration where available
- The Town Staff, with assistance from the Town Engineer, may establish on-site stormwater management requirements less stringent based on site specific situations

- There should be a maintenance and monitoring agreement between the developer and the Town
- Post-development flow must not exceed the runoff volume and peak flow rate for pre-development conditions for 2, 10, & 100 year specified rainfall events

### 9.1.c. Constructed Storm Water Treatment Wetlands

Constructed storm water wetland systems incorporate natural wetland functions to aid in peak flow reductions and pollutant removal from storm water runoff. These BMPs contain shallow pools that enhance growing conditions for marsh plants to maximize pollutant removal. Constructed storm water wetlands can also provide for quantity control of storm water by providing significant volume storage of ponded water above the permanent pool elevation.

### 9.1.d. Streambank Stabilization and Shoreline Rehabilitation

Streambank erosion is a serious problem along many waterways in Wisconsin. There are two distinct aspects of the streambank that need to be addressed when considering rehabilitation. The first area is upland of the bank and usually requires re-vegetation to stabilize the banks. The second area is at the toe of the bank and usually requires slowing down the velocity of the water reaching the streambank.

Some of the symptoms of streambank erosion are falling or leaning trees, scouring on both banks, exposed tree roots, fracture lines along top of bank, and exposed infrastructure. Areas that exhibit these symptoms should be considered priority when looking into protecting the streambanks.

Techniques to stabilize streambanks reduce velocity of the flowing water, increase the resistance of the bank to erosional forces, and use vegetation to stabilize and control erosion problems near streambanks and their immediate upslope, or combining options.

## 9.2. Riparian Zone Recommendations

Below is a list of recommendations that property owners could follow to reduce their negative effect on Spooner Lake.

### 9.2.a. Reduce/Change Fertilizer Usage

Soil test lawns and add only the necessary fertilizers. Encourage Washburn County or the Town of Spooner to implement by ordinance that only no or low phosphorous fertilizers can be used in the Spooner Lake watershed area. Other communities have instituted such an ordinance and local stores only supply this type of fertilizer. For example, Minnesota currently has a 0% phosphorus regulation for the Twin Cities metro area and 3% phosphorus for all greater Minnesota. In Wisconsin, more counties and communities have ordinances that do not allow the sale of fertilizer containing phosphorus. See Appendix C for a sample phosphorus free fertilizer ordinance.

### 9.2.b. Shoreland Restoration

The reconstruction of a barren or monoculture shoreline with native plant life and infiltration areas is an important step in reducing the sediment and nutrient loading from shoreland properties. Implementing the County determined setback on existing properties dependent on the Lake Classification is considered one of the most important activities as the current state of the lakes can be greatly affected by watershed practices. Protection of the lake water quality is, therefore, dependent on controlling erosion and water flow in the watershed.

Fecal matter from geese has been a problem for Spooner Lake water quality in the past. Heavy concentrations of goose droppings can over fertilize lawns and contribute to excessive algae growth in lakes that can result in fish kills. Vegetative buffers restrict the access of geese onto lakeshore property owners. If enough riparian owners have buffers, geese would likely move on to a more desirable location where access to the shoreland is easier.

### 9.2.c. Septic Systems

Highly permeable sands and gravels allow the untreated nutrients in wastewater to migrate quickly through the sub surface to ground water. As ground water has little treatment or capture capability for nutrients, these pollutants migrate with ground water flow into local receiving waters (streams, tributaries, and lakes). Regular pumping of septic systems is recommended to improve performance and to reduce overloading of the drain field with nutrients. An overlapping regulation to address the so-called "grandfathered" septic systems is highly recommended to address pumping and other maintenance issues.

One recommendation for the short term is to request Washburn County to conduct a sanitary survey that would provide an inventory of the age of septic systems within the watershed planning area. The County does have a program that requires each new septic system to be pumped every three years.

### 9.2.d. Reduce Phosphate Soap Usage

Examine the labels of your household cleansers and reduce your reliance on those cleaners that have phosphates in them. For example, automatic dishwashing soap cubes contain as much as 9% phosphates for each application. The wastewater created from kitchen uses is directed to septic systems thus discharging soluble phosphorous directly to ground water. It is important to educate residents and property owners within and around the Spooner Lake area regarding the amount of phosphates in soaps and what types of soap have low or no amount of phosphate. The Spooner Lake District should coordinate efforts with the Town to provide educational material through fliers, Town and County website, or encourage the local newspapers to run press releases regarding these and other issues that effect water quality.

### 9.2.e. Redirect Storm Water from Gutters, Driveways, and other Impervious Surfaces

Direct runoff from well maintained and fertilized shoreland lawns is a key contributor to dissolved phosphorus concentrations in lakes. It is effective control for each property owner to direct water from impervious surfaces such as roofs and driveways toward infiltration areas, such as rain gardens and forested areas. Considerable assistance in the form of designs, recommendations, and financial assistance is available from local greenhouses, DNR, Washburn County, UW-Extension offices, and others as you develop site specific shoreland runoff controls.

### 9.2.f. Shoreline Erosion

Protecting your shoreline from erosion is a state regulated activity. The erosion of the shoreline is most likely directly associated with the past removal of trees and shrubs, bushes, etc that were naturally protecting the bank from erosion. Re-establishing the shoreline buffer is an important step in stopping erosion, but continued wave action at the exposed lake bank may be causing bank slumping. Riprap placement along the shoreline used with other biological tools.

### 9.2.g. Shoreline Inventory

It is recommended that a shoreline buffer survey be completed on Spooner Lake. Having a shoreline buffer inventory for the entire watershed area would allow the property owners to see which areas may need additional vegetative buffers to assist in the protection of water quality.

### 9.2.h. Encourage Lake Shoreline Improvement Projects

Encourage shoreline improvement projects including demonstration plots, County or Town tax credits, etc. County and UW-Extension agents can provide assistance in demonstration of the appropriate techniques needed.

### 9.2.i. Private Housekeeping Program

Encourage residents to implement local BMPs such as Rain Gardens, Swales, Filter Strips, Roof Runoff Diversions, etc. on their property that improve Lake Water quality. The Spooner Lake District could provide educational material to the local property owners in order to inform them of the benefits of keeping their stormwater on site and allowing it to infiltrate. The Town, Lake District, and County could work together to form a program to purchase rain barrels for local residents willing to use them on their property.

## 9.3. Macrophyte Recommendations

The Aquatic Plant Management Plan, Spooner Lake, Washburn County Wisconsin provides a detailed list of recommendations related to the management of aquatic plant species. The information provided in this section is taken from that Plan.

### 9.3.a. Education and Information

Aquatic plants in Spooner Lake provide key habitat for a diverse fish population. They also provide a reduction in shoreline erosion in some key areas. Although many have expressed interest in significantly reducing the plant density in Spooner Lake, it is important to understand that these plants play an important role in the lake ecosystem. If the reduction of aquatic plants should occur, it is important that this is done in a systematic approach. Residents who believe they have nuisance levels of plant calling for management should consult the Spooner Lake District about this issue. Reducing the plant community too much could lead to very adverse affects in Spooner Lake.

Another important message will be to discourage boating disturbance within 200 feet of the shoreline. Although this is a no-wake zone according to state regulation, many boaters still travel close to the shoreline. This activity is strongly discouraged for the following reasons:

- Boats may uproot native plants and break aquatic plants into fragments
- Bare substrate is more likely to be colonized by non-native species
- Plant fragments contribute phosphorus to the water as they decay
- Curly leaf pondweed fragments broken up by boat propellers may root and encourage further uncontrolled spread of this invasive plant.

Education will be provided to riparian owners about shoreline restoration. The Spooner Lake District will work with Washburn County and riparian owners in restoration implementation through cost sharing and technical assistance to restore a maximum number of developed lots. The District may secure financing through grants to help facilitate restoration projects.

### 9.3.b. Protect Native Shoreline Vegetation

Due to fairly high development and the large number of residences that have disturbed native shorelines, it is important to work to restore these shoreline areas to native vegetation. This can be done through education discussing the importance of native vegetation shorelines and encouraging the implementation of restoration practices.

Maintain the present native plant community in the main portion of Spooner Lake. There will be no chemical application or harvesting except for treatment of invasive species in these areas or should nuisance levels occur and require management. In addition, the District will encourage riparian owners leave native plant stands undisturbed through education efforts.

Expanded self-help monitoring, including measurements of chlorophyll-a, total phosphorus, and Secchi depth during growing season months will be implemented.

### 9.3.c. Enhance and/or Protect Water Quality

Spooner Lake is a eutrophic lake. However, the water clarity has been fairly high considering the nutrients available to the lake. This may be due to the fact that there is extensive aquatic plant growth in the lake, removing many nutrients. Therefore, the plant community may be contributing to this higher water clarity. Furthermore, if natural shoreline vegetation is restored in areas where there are lawns and infiltration practices are implemented, the runoff quantity and nutrient loading can be reduced.

### 9.3.d. Contain and Reduce Curly Leaf Pondweed

Chemically treat one small stand of curly leaf pondweed that is less than 5 acres and fulfills the density definition and area of concern outside of the management area. This treatment will then be evaluated on its effectiveness. If effective, similar treatments may be considered in areas that qualify based on density/nuisance definitions. The treatment(s) will be early season (based on water temperature) and reoccurring up to 3 years to account for turion production. The chemical used will be Endothall and will be applied with water temperatures near 55-59 degrees F (or based on recommendations if necessary).

The management of curly leaf pondweed stands will be clearly communicated to Spooner Lake residents through meetings and written communication. Proper notification as required by the Wisconsin DNR will be carried out.

Curly leaf pondweed will be monitored annually. This monitoring can establish changes in the coverage and density of curly throughout Spooner Lake. It will also help evaluate the effectiveness of any curly leaf pondweed management.

### 9.3.e. Reduce Nuisance Levels of Macrophytes

Aquatic plants can create nuisances for residents attempting to swim and boat from the shoreline. It is important that riparian owners are aware of importance of native aquatic plants and complete removal can be a high risk. Important habitat can be lost as well as increased chance of colonization by invasive, non-native species.

Create a navigational channel through the East Bay management area. The channel may be up to 50 feet wide and may follow established map of a main channel and three secondary channels only. Less treatment is an option. Treatment may be done up to two times each summer, depending on status of the channel. The channel will be marked with buoys.

### 9.3.f. Reduce Filamentous Algae in East Bay and Monitor Remaining Lake

It is natural to have filamentous algae in lakes. The excessive growth is a response to increased nutrients, namely phosphorus, in the lake. Since they do not root, they absorb these nutrients directly from the water. If filamentous algae did not absorb these

nutrients, the nutrients would be available for unicellular algae, leading to decreased water clarity. Therefore, nutrient reduction is important for management.

### 9.3.g. Prevent Introduction of New Invasive Species

Like any other lake in Wisconsin with a public landing, Spooner Lake has a threat of invasion by exotic species. However, no coordinated prevention effort is in place. Lakeshore resident and lake user education will help reduce the risk of an invasive species introduction. Furthermore, pubic access inspections and education would help alleviate this risk too. There are many educational materials available from public sources. Eurasian watermilfoil prevention signs are in place, but identification signs should also be considered.

The Clean Boats/Clean Waters program, developed by the University of Wisconsin Extension, should be implemented. This program involves education as well as periodic access inspections. The goal is to educate all lake users about the importance of keeping invasive species out of the lake.

Gather and assemble public information materials about Eurasian watermilfoil prevention for distribution to Spooner Lake residents. Information will be provided and presented at annual meetings and newsletters.

Implement a Clean Boats/ Clean Waters program for Spooner Lake. This will include public access education and inspection.

Monitor for the presence of Eurasian watermilfoil and other aquatic invasive species. The areas around public boat landings will be the focal points for monitoring, as these are the most likely introduction sites. The area near the inflow will be a third focal point as this could be another introduction site. Areas where northern watermilfoil has been sampled should also be monitored as Eurasian watermilfoil tends to grow in similar habitats. Lake residents will be encouraged to learn to identify Eurasian watermilfoil and, and purple loosestrife and establish a contact for verification of identification.

Conduct a whole lake macrophyte survey every 3-5 years. This survey will follow the DNR guidelines and use the point intercept method of data collection.

### 9.3.f. Establish a Rapid Response Plan to a New Introduction of Invasive, Non-Native Species.

Eurasian watermilfoil monitoring program will be implemented for detection and rapid response if an invasion is discovered. The Spooner Lake District will maintain a reserve budget (or a plan to secure funds) to respond to a Eurasian watermilfoil infestation quickly. A file with rapid response steps and AIS rapid response grant application materials will be created and held by the District's president.

The rapid response action plan will consist of the following steps:

- Positive identification of invasive species (contact designated local plant identification expert and DNR).
- Notify DNR aquatic plant management specialists of positive identification.
- Carry out response plan using one or more of the following methods:
    a. Hand pulling (with diver if needed)
    b. Herbicide use (permits required)
- Notify residents of positive invasive species identification and location.
- Carefully monitor infested area and nearby for effectiveness of control methods.
- Repeat controls as needed.

## 9.4. District Activities

Very few if any of these recommendations can be achieved without participation efforts from the District. Below is a list of recommendation that can be completed as a large group effort.

### 9.4.a. Invasive Species Management

- Assist Wisconsin DNR with aquatic invasive species inspections on the Lake and at boat landings.

- Develop an updated Aquatic Plant Management Plan that meets the latest criteria set by the DNR to describe problem species and areas of interest.

- Incorporate aquatic invasive species programs in the Aquatic Plant Management Plan.

### 9.4.b. Water Quality Study Programs

- Continue an annual water quality monitoring program.

### 9.4.c. Government Policies

- As State, County, and Town transportation departments minimize the use of road salt, an increase in sand content is common. Alternative de-icing compounds should be considered in areas served by bridges over the Lakes, and related tributaries, swales, etc., boat landings, culverts or storm water outfalls, and other areas of high salt-use. Snow disposal areas should not drain directly into lakes or streams. The Wisconsin Department of Transportation should work with the Towns to explore the best method for ensuring safe roads, minimal salt usage, and minimum impact to the Lakes.

- Utility and Highway Corridors:
    - Proper route selection.
    - Encourage runoff from roads to be directed to sedimentation traps or water-quality pre-treatment ponds before runoff reaches the lakes.
    - Require Wisconsin DOT construction contractors to follow Wisconsin DNR NR 151 runoff management ordinances for future construction. Encourage

the use of BMPs to trap road runoff for pretreatment before entering the Lakes.
- Don't dump sand on the waterfront.
- Local emergency officials should be prepared either as first responders or have readily available information to protect ground and surface water resources from spill contamination (i.e. gasoline, etc.). Spill preparedness should include adequate training and equipment, such as containment booms and spill absorbents. Emergency response consultants can assist fire fighters and emergency crews in spill contingency planning.

- Share information pertaining to water quality studies and activities with the Town of Spooner, Washburn County, DNR, and WisDOT.

- Continue to look for ways to include the Town in watershed water quality improvement activities such as monitoring water quality, assisting with local BMPs, providing test areas and monitoring of various vegetative buffering techniques, and

### 9.4.d. Regional Partnerships

- Work with groups and building more partnerships will help implement more BMP practices throughout the Spooner Lake Watershed Planning Area. Partnership development with District members in the Lakes and adjoining watersheds is highly encouraged. Partnerships with related Townships and Counties, Natural Resource Conservation Service, UW-Extension, Wisconsin DNR Forestry and Water Quality, and others should be developed.

- Develop local, Town, and County ordinances to help reduce the degradation of the watershed waters from nonpoint source pollution. Ordinances provide the legal frame work for requiring suitable management practices to control nonpoint source pollution. Adopting erosion control and storm water management ordinances (these are Lake Protection grant eligible activities) can specify performance standards, specific BMP, or limit peak runoff flow. In future years, as more land is developed, managing runoff to protect water quality will become increasingly important and the ability to control runoff will be limited if the proper ordinances are not in effect.

- Various Wisconsin communities are using erosion control and storm water management ordinances to regulate pollution prevention for both water quality and water quantity objectives. A comprehensive storm water management ordinance can provide assurance that future growth will not be significantly detrimental to water resources in the lake watershed. To assist in ordinance creation, the Wisconsin DNR has developed model ordinances that can be adopted or used as a starting point in creation of Town's own ordinance. Ordinances will consider runoff volumes, property size, pollutant loads, etc.

- Financing ordinance administration to avoid over burdening taxpayers is recognized as a major concern in ordinance adoption. Developing financing alternatives and administrative strategies may reveal acceptable costs for enacting an erosion control and/or storm water management ordinance.

### 9.4.e. Implementation Committee

Recommendations are an important aspect of lake planning. It can only be accomplished if there are people to implement the recommendations of the plan. Once the plan has been approved it is important to establish a committee to take on the responsibility of implementing the recommendations.

### 9.4.f. Volunteer Water Quality Monitoring

The District has been involved for a number of years in the DNR's Self Help program. This program provides a database of water quality information for thousands of lakes across the state. Now that Spooner Lake has a baseline of water quality data from previous planning projects, it is important to continue to collect information to see how the water quality properties change over the years. This task cannot be completed without a coordinated effort of volunteers.

## 9.5. Forest Land Management

- Require reforestation of deforested lands.
- Follow Wisconsin DNR Forestry Best Management Practices.
- Leave timber on steep slopes.
- When crossing streams and gully areas, build bridges per Wisconsin DNR Forestry Best Management Practices and uphold NR 151 Runoff Management rules.
- If timber is harvested on steep slopes, it should be performed between January and March to ensure frozen ground conditions that will reduce erosion as a result of the logging activity. Leave the stumps to help maintain the soil texture and minimize erosion.

## 9.6. Funding Options

Implementing projects to help improve the water quality and reduce the amount of further degradation can be a significant cost. There are a number of mechanisms in place to help ease the ease the financial burden on the local residents. A variety of options the Spooner Lake District may want to consider when implementing projects to help protect the Lake are described.

### 9.6.a. Development Charges

As land is developed or built upon, surface stormwater runoff and pollution loading increases. Administrative and capital costs can be recovered at the time of building permit issuance or land development approval. A city, town, or village can require dedication of land for ponding or drainage purposes.

Impact fees are contributions paid by public facility users who create a need for increased capacity in the public facility. These fees are authorized under the requirements of Section 66.617 of Wisconsin State Statutes.

These charges are designed so developers will pay the "fair share" of the cost of constructing on-site and regional stormwater management BMP improvements. Stormwater management BMP improvements are characteristically designed to last twenty years or more. The requirement that owners of future developed properties enjoy the benefits of the improvements at no incremental cost is often considered inequitable. The use of system development charges can provide important revenue source flexibility.

### 9.6.b. *Fee-In Lieu of* On-site Detention/Retention and Other BMPs

*In-lieu of* fees are a regulatory requirement that provides developers the option to construct on-site stormwater runoff detention/retention facilities in accordance with the established design criteria or pay a fee into a fund dedicated to the construction of an off-site regional detention stormwater management facility serving multiple properties. The approach encourages the siting and construction of more regional versus on-site facilities. *Fee-in-lieu of* programs are effective in guiding development patterns within a watershed and are a tool to encourage comprehensive stormwater planning.

*Fee-in-lieu of* procedures have a downside. Since construction timing and cash flow are critical, the usual fee for a single development property may not be large enough to fund the construction of an entire regional facility. Therefore, either multiple developments must occur simultaneously in a given area to generate enough revenue to fund the construction of a regional facility, or the project must be funded up-front from other sources. Service charges and borrowing from other funds can provide the necessary initial resources for construction. These funds can then be repaid by future in-lieu of fees.

### 9.6.c. Grants

Historically, local governments have experienced infrastructure funding support from state and federal government agencies in the form of direct grants in aid, interagency loans, and more. It is important to assess likely trends regarding federal/state assistance for stormwater management financing. Future trends within our state and national budget indicate that future available funding through the grant process is unknown; it is possible that these funding options could be eliminated due to state and federal budget issues.

The State of Wisconsin has reviewed the need to improve stormwater management and water quality need based projects under the Clean Water Fund. The review first led to projects that were under the Clean Water Fund low interest loan program. This program has been used for years to finance projects, such as wastewater treatment plant upgrades.

The State has taken another step forward to improve stormwater management and water quality planning by developing the WAC NR 155 Urban Nonpoint Source and Stormwater Construction, Planning and Land Acquisition grant program. Currently, the

WDNR is reviewing the WAC NR 216 to update various items, including the list of communities that will need a permit for stormwater discharges.

State grants are available to assist in surface water management and abatement of nonpoint source pollution. However, it is generally not good financial practice to rely totally on grants for a service program. This source of revenue is not dependable and requires constant speculation as to its availability. The program is also very competitive and many groups are all vying for limited monies. Grants are useful but should only be used to supplement a planned local revenue source.

Examples of some available grants include:

**i. Wisconsin Department of Natural Resources (WDNR)**

Additional information on the following programs can be found at http://www.dnr.state.wi.us/.

The Wisconsin DNR Lake Grants are influenced by the Wisconsin gas tax revenue. Despite the budgetary changes and cutbacks, the lake grant funding increased from $2.6 to $3.1 million dollars annually.

**Aquatic Invasive Species Grants**

The DNR has recently developed (2005) an Aquatic Invasive Species grant program to assist in a state/local partnership to control aquatic invasive species. These grants require a 50% local share match and are available to units of government and lake protection and rehabilitation districts, qualified lake associations, qualified river management organizations, nonprofit conservation organizations, and qualified school districts. Eligible planning project activities include:

- Education, Prevention, and Planning
- Early Detection and Rapid Response to control the spread of aquatic invasive species
- Controlling Established Infestations
- Watercraft inspections
- Investigation of control methods or prevention techniques.

**Lake Planning Grants**

Lake planning grants provide funding for the lake management planning process. Qualified applicants are Wisconsin counties, towns, villages, cities, qualified lake associations, town sanitary districts, lake districts, other governmental units as defined in Ch. 66.299, Wisconsin Statutes, tribal units of government, qualified nonprofit conservation organizations. These grants are offered twice annually (February 1 and August 1) for extensive studies and technical planning and there are large and small scale grants.

- Small scale lake planning grants of up to $3,000 are available for obtaining and disseminating basic lake information, conducting education projects, and developing management goals. These grants are ideal for applicants who are just beginning the planning process, education processes, or for activities that supplement an existing plan.
- Large scale lake planning grants up to $10,000 per project (maximum 2 projects per application cycle) are available for larger projects. The intent of a large-scale program is to conduct technical studies to help develop elements of or complete comprehensive management plans.

- The WDNR typically pays for 75% of the projects costs through grant cost share payments not to exceed $10,000 and the applicant local share is 25% (up to $3,333). These are competitive grants as they are typically over subscribed.

**Lake Protection and Classification Grants**

Lake protection grants provide funding for implementing the recommendations of a management plan. As one progresses from planning to implementation, the costs and the time involved increases. Because implementation is more expensive, protection grants are available for up to $200,000 per project, except that grants for regulation or ordinance development projects are limited to $50,000.

Grants are based on 75% of the total eligible project costs and capped at the maximum grant amount mentioned earlier. Grants are awarded annually and a priority project list is prepared each year on a state-wide basis. The grant deadline is May 1.

Activities that are acceptable for funding include purchasing property or easements which contribute to the protection or improvement of the natural ecosystem and water quality of a lake; restoring wetlands or lands draining to wetlands; and developing regulations and ordinances to protect lakes (stormwater and construction site erosion control) and the educational activities necessary for these regulations to be implemented.

**Runoff Management Grants**

The DNR offers financial assistance for local efforts to control nonpoint source pollution. These grants support both the implementation of source-area controls to prevent runoff contamination and the installation of treatment systems to remove pollutants from runoff. The main goal of these nonpoint grants is to improve the quality of Wisconsin's water resources by decreasing the impacts of nonpoint pollution. These grants are as follows:

- **Targeted Runoff Management (TRM) Grant Program**

TRM grants are competitive financial awards to support small-scale, short-term projects that are completed by local governmental units within 24 months of the start of the grant period. Both urban and rural projects can be funded through a TRM Grant.

Depending on eligibility of a project, the maximum cost-share rate available to TRM grant recipients is 70% of eligible costs, with the total of state funding not to exceed $150,000 in state funding.

- Project selection is competitive and is scored based on fiscal accountability, water quality priorities, local support, pollution control, and other factors. Some examples include: easements, land acquisitions, stream bank protection projects, wetland construction, detention ponds, design of BMP projects for construction, some cropland protection, and livestock waste management practices. Selected engineering design of structural practices are eligible for cost sharing.

**Stewardship Grant Program**

The WDNR provides funding for stewardship projects such as the following:

- Land acquisition
- Trails
- Restrooms
- Parking lots
- Picnic areas
- Handicap accessibility modifications

Application deadline is May 1 each year. Grants are extremely competitive. The WDNR uses a detailed point system to fund the project and land acquisition projects score the highest.

### *ii.* State Land Trusts and Stewardship Programs

This voluntary program includes a stream bank component and an urban river component. Funds are available to public entities and provide non-profit organizations for property purchases from willing sellers, fencing, easements and public fishing areas.

To date, Wisconsin's land trusts have been awarded $25 million in matching funds through the Warren Knowles-Gaylord Nelson Stewardship Fund. These funds have been matched dollar-for-dollar in federal and private funds and land donations from landowners. In addition, land trusts take on the permanent management responsibility of these lands and each project has clear public support in the community. The West Wisconsin Land Trust is local (Menomonie).

### *iii.* River Country Resource Conservation & Development Council, Inc. (RC & D)

The council is a non-profit organization representing 12 counties in rural development issues. It consists of one individual from each county board and one at-large member. The council receives funding from a base grant from the USDA, however being a non-profit organization, RC & D is able to obtain monies from other grant sources. RC & D has limited matching funds available for erosion control projects. Most often these monies are administered through the county Soil and Water Conservation District. The team is currently focused on assisting the implementation of buffer strips to aid in erosion control projects.

### *iv.* FEMA Funds

- Funding to re-map floodplains is available through FEMA, but funding is limited.

- If an area has been declared for emergency assistance through FEMA, the representatives will assist the communities through the special 406 Hazard Mitigation Funds.

### *v.* Washburn County Programs

- The Washburn County Land & Water Conservation Department provides technical and financial assistance for designing and installing shoreline restorations.

- The new County Shoreline Zoning Ordinance was approved by the County Board in the Fall of 1999. The ordinance requires that anyone newly developing, or expanding existing shoreline property in Washburn County must keep or restore a natural shoreline. The specifics vary by lake-class, however the basics are the same in that landowners must leave a buffer of natural vegetation between the lakeshore and their dwelling. A 30ft. viewing corridor is allowed through which landowners can enjoy a partially screened view of the lake.

  The Zoning Department refers shoreline property owners obtaining building permits to the Land & Water Conservation Department for assistance in complying with the Ordinance.

- The Washburn County Land & Water Quality Improvement Program is focused on water quality improvement through the reduction of nutrient and sediment delivery to area water resources. Essentially, this program is the implementation phase of the County Land & Water Resource Management Plan.

Through the funding associated with the Plan, the county is able to provide cost-share dollars as well as technical assistance to eligible landowners in order to install Best Management Practices that benefit water quality. Some eligible Best Management Practices Include:

- Barnyard runoff control systems
- Diversions and drop spillway structures (rock and sod chutes)
- Grassed Waterways
- Shoreline Protection
- Vegetated Buffers
- Nutrient Management Planning
- Wetland Restorations

## 9.7. Information and Education

Public involvement and input is, quite possibly, the most important aspect of this plan. If the public does not understand the goals and reasoning behind the proposed recommendations and changes, the chance of sustained action and support for lake watershed management is reduced dramatically. Simply put, the success of the Spooner Lake District to implement the recommendations herein relies almost solely on the effort to educate and involve the public on the issue of stormwater runoff management.

### 9.7.a. Target Audiences

Many different groups need to be included in the Education and Information Program for it to be effective. Examples of groups that should be included are:

- Public Officials/Policy Making Bodies
- Residents
- Elementary/Middle/High School Students
- Business and Industry
- Homebuilders and Developers
- Property Owners

Each group has a different view of managing the watershed. Some may know very little about it, such as the elementary school students and layperson. Some may be initially against recommendations provided in this plan. The goal of this section of the plan is to incorporate all of the different approaches needed to properly address each group and educate them to the importance of lake watershed management and implementation of the recommendations herein.

### 9.7.b. Public Officials/Policy Making Bodies

Both Washburn County and Town of Spooner have supported past lake planning efforts. It is important that the Spooner Lake District continue to have an open dialog with these entities regarding water quality issues. The District may want to provide occasional

updates water quality issues and any implementation projects that may be going on in the watershed areas.

### 9.7.c. Elementary, Middle and High School Students

Perhaps the most important audience for education is Elementary, Middle, and High School students. These groups can be the most willing to learn about stormwater runoff and experience shows that educated students will attempt to educate their parents and develop into education and information leaders.

Teachers could:

- Include lake watershed management into their lesson plans.
- Plan a visit from a Town official or other professional volunteer to discuss stormwater issues and how they pertain to water quality.
- Coordinate an outfall and stream sampling and monitoring program with the Town of Spooner.
- Utilize available educational programs on water quality to emphasize the need to sustain high quality surface and groundwater within the Town .

Students could:

- Create flyers or posters to be used in a community education campaign.
- Survey their parents and neighbors about their knowledge of watersheds and how they function and compile the information with their classmates.
- Write articles or letters to the editor highlighting the impact stormwater and various activities harm water quality.
- Assist the Town with long-term testing and monitoring program.

Of course, there are countless other creative options available to include students in the education and information phase of the plan implementation recommendations.

### 9.7.d. Residents

The primary concern of most adult residents will be the costs for implementation and the proposed creation of a Lake District as a funding source. Therefore, the primary information and educational campaign for this group should focus on the benefits of implementation of the recommended improvements, costs of improvements, and creative funding and financing sources available.

Some methods of informing adult residents would be:

- Letters or Flyers
- Inserts into Utility Bills
- Newspaper articles
- Surveys
- Public Meetings
- Seminars
- Demonstration Projects

### 9.7.e. Business and Industry

Businesses and industries are excellent locations to post information that will reach a large number of people. The Town of Spooner has a number of businesses located near Spooner Lake. It would be incredibly beneficial to post information regarding lake watershed management in a public location with high pedestrian traffic, such as at the lunch room or at the entrance or lobby of any retail or service business. This would expose the information to a large number of individuals without incurring high printing and postage costs.

Some communities have requested sellers of phosphorus-based fertilizer to post a "kind reminder" next to such products informing them of the non-phosphorus or organic-based choices. In the same vein, lawn care professionals might be a good means to distribute information about non-phosphorus and organic based fertilizers to their customers.

### 9.7.f. Homebuilders, Developers, and Real Estate Businesses

Professionals in the business of land development, real estate, and disturbance are another main group that should be targeted for information purposes. Development and enforcement of a Construction Erosion Control Ordinance and proposed Stormwater Management Ordinance is vitally important to the success of the proposed Best Management Practices. For instance, a subdivision designed and constructed in strict accordance with the provisions herein can still be a major source of flooding and sedimentation downstream if construction erosion control and post construction stormwater management facilities are not properly designed and installed. Homebuilders may not know that silt fence, aggregate tracking pads, and other single site erosion control methods and properly designed and sited stormwater management facilities can be relatively inexpensive to install and maintain prior to home and building construction.

Methods of disseminating information to this group of individuals may include:

- Letters/Flyers
- Fact Sheets
- Newspaper articles
- Public Meetings
- Seminars
- Ordinances

### 9.7.g. Property Owners

It is important to have private land owners participate in protecting the water quality of Spooner Lake. It is important that everyone do their part to control the stormwater runoff coming from their property where feasible. There are a number of activities an individual land owner can do to mitigate much of the stormwater runoff issues coming off their property. Some stormwater runoff mitigation opportunities include planting a rain garden, using rain barrels, and raking and removal of grass clippings and leaves. These

are just a few of the many options property owners have to help reduce the negative impacts that their property has on surface waters.

## 9.8. Summary

The Town of Spooner has a vested interest in ensuring the increased understanding and acceptance of lake water quality issues by watershed residents. In targeting various and diverse groups of public officials, staff, residents, businesses, farmers, and developers, it is hoped that all segments of the community are exposed to at least a portion of the educational material regarding the importance of lake watershed management benefits.

Chapter 9 outlines a variety of recommendations for the District to address in order to improve the conditions and water quality of the Lake. Below is a list of the top priorities that the District should consider addressing first:

| Activity | Time | Responsibility |
|---|---|---|
| 1. Information and Education on water quality and aquatic plants | Summer 2007; Annual and ongoing meetings | Spooner Lake District and Consultant |
| 2. Navigational channel through management area | Summer 2007; Annually | Spooner Lake District; Consultant; Applicator |
| 3. Filamentous Algae Monitoring | Summer 2007; ongoing | Spooner Lake District volunteers |
| 4. Expanded Self Help | Summer 2007; ongoing | Spooner Lake District; Consultant; WDNR |
| 5. Clean Boats/Clean Waters | Spring 2007 | Spooner Lake District; Consultant; UW Extension |
| 6. Curly Leaf Pondweed | April/May 2007; Annually | Spooner Lake District; Consultant; Applicator |
| 7. Redirect Stormwater | Summer 2008 | Property Owners |
| 8. Ordinances | Winter 2007 | Spooner Lake District; Consultant; WDNR |
| 9. Conservation Easements | Spring 2008 | Spooner Lake District; Consultant |
| 10. Septic Systems | Summer 2008 | Spooner Lake District; Washburn County; Consultant |
| 11. Shoreline Survey Inventory | Summer 2008 | Spooner Lake District; Consultant |
| 12. Shoreland Restoration | Summer 2008; Annually | Property Owners |
| 13. Whole Lake Plant Survey | June/July 2009-2011 | Consultant |

# Appendix A
# WiLMS Modeling Reports

**Date: 5/9/2007 Scenario: 26**

Lake Id: Spooner Existing

Watershed Id: SC15

**Hydrologic and Morphometric Data**

Tributary Drainage Area: 7811.0 acre
Total Unit Runoff: 11.80 in.
Annual Runoff Volume: 7680.8 acre-ft
Lake Surface Area <As>: 1092.0 acre
Lake Volume <V>: 7644.0 acre-ft
Lake Mean Depth <z>: 7.0 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 8154.0 acre-ft/year
Areal Water Load <qs>: 7.5 ft/year
Lake Flushing Rate <p>: 1.07 1/year
Water Residence Time: 0.94 year
Observed spring overturn total phosphorus (SPO): 0.0 mg/m^3
Observed growing season mean phosphorus (GSM): 0.0 mg/m^3
% Phosphorus Reduction: 0%

**NON-POINT SOURCE DATA**

| Land Use | Acre | Low | Most Likely | High | Loading % | Low | Most Likely | High |
|---|---|---|---|---|---|---|---|---|
| | (ac) | Loading (kg/ha-year) | | | | Loading (kg/year) | | |
| Row Crop AG | 0.0 | 0.50 | 1.50 | 3.00 | 0.0 | 0 | 0 | 0 |
| Mixed AG | 748.7 | 0.80 | 1.00 | 1.40 | 36.6 | 242 | 303 | 424 |
| Pasture/Grass | 1059.5 | 0.10 | 0.30 | 0.50 | 15.5 | 43 | 129 | 214 |
| HD Urban | 2.5 | 1.00 | 1.30 | 2.00 | 0.2 | 1 | 1 | 2 |
| MD Urban | 168.7 | 0.40 | 0.09 | 0.80 | 0.7 | 27 | 6 | 55 |
| Rural Residential | 41.0 | 0.05 | 0.10 | 0.25 | 0.2 | 1 | 2 | 4 |
| Wetlands | 1138.1 | 0.10 | 0.10 | 0.10 | 5.6 | 46 | 46 | 46 |
| Forest | 4457.3 | 0.05 | 0.10 | 0.18 | 21.8 | 90 | 180 | 325 |
| Recreation GC | 136.4 | 0.20 | 0.40 | 1.00 | 2.7 | 11 | 22 | 55 |
| Open Water | 58.8 | 0.10 | 0.27 | 1.00 | 0.8 | 2 | 6 | 24 |
| Lake Surface | 1092.0 | 0.10 | 0.27 | 1.00 | 14.4 | 44 | 119 | 442 |

**POINT SOURCE DATA**

| Point Sources | Water Load (m^3/year) | Low (kg/year) | Most Likely (kg/year) | High (kg/year) | Loading % |
|---|---|---|---|---|---|
| User Defined 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**SEPTIC TANK DATA**

| Description | | Low | Most Likely | High | Loading % |
|---|---|---|---|---|---|
| Septic Tank Output (kg/capita-year) | | 0.30 | 0.50 | 0.80 | |
| # capita-years | 255.0 | | | | |
| % Phosphorous Retained by Soil | | 98.0 | 90.0 | 80.0 | |
| Septic Tank Loading (kg/year) | | 1.53 | 12.75 | 40.80 | 1.5 |

**TOTALS DATA**

| Description | Low | Most Likely | High | Loading % |
|---|---|---|---|---|
| Total Loading (lb) | 1124.0 | 1824.9 | 3597.6 | 100.0 |
| Total Loading (kg) | 509.8 | 827.8 | 1631.9 | 100.0 |
| Areal Loading (lb/ac-year) | 1.03 | 1.67 | 3.29 | |
| Areal Loading (mg/m^2-year) | 115.37 | 187.31 | 369.27 | |

**Date: 5/9/2007 Scenario: 27**

Lake Id: Spooner Future

Watershed Id: SC15

**Hydrologic and Morphometric Data**

Tributary Drainage Area: 7811.0 acre
Total Unit Runoff: 11.80 in.
Annual Runoff Volume: 7680.8 acre-ft
Lake Surface Area <As>: 1092.0 acre
Lake Volume <V>: 7644.0 acre-ft
Lake Mean Depth <z>: 7.0 ft
Precipitation - Evaporation: 5.2 in.
Hydraulic Loading: 8154.0 acre-ft/year
Areal Water Load <qs>: 7.5 ft/year
Lake Flushing Rate <p>: 1.07 1/year
Water Residence Time: 0.94 year
Observed spring overturn total phosphorus (SPO): 0.0 mg/m^3
Observed growing season mean phosphorus (GSM): 0.0 mg/m^3
% Phosphorus Reduction: 0%

**NON-POINT SOURCE DATA**

| Land Use | Acre | Low | Most Likely | High | Loading % | Low | Most Likely | High |
|---|---|---|---|---|---|---|---|---|
| | (ac) | Loading (kg/ha-year) | | | | Loading (kg/year) | | |
| Row Crop AG | 0.0 | 0.50 | 1.50 | 3.00 | 0.0 | 0 | 0 | 0 |
| Mixed AG | 615.0 | 0.80 | 1.00 | 1.40 | 27.0 | 199 | 249 | 348 |
| Pasture/Grass | 945.3 | 0.10 | 0.30 | 0.50 | 12.4 | 38 | 115 | 191 |
| HD Urban | 317.8 | 1.00 | 1.30 | 2.00 | 18.1 | 129 | 167 | 257 |
| MD Urban | 396.0 | 0.40 | 0.09 | 0.80 | 1.6 | 64 | 14 | 128 |
| Rural Residential | 68.0 | 0.05 | 0.10 | 0.25 | 0.3 | 1 | 3 | 7 |
| Wetlands | 1138.1 | 0.10 | 0.10 | 0.10 | 5.0 | 46 | 46 | 46 |
| Forest | 4135.7 | 0.05 | 0.10 | 0.18 | 18.2 | 84 | 167 | 301 |
| Recreation GC | 136.4 | 0.20 | 0.40 | 1.00 | 2.4 | 11 | 22 | 55 |
| Open Water | 58.6 | 0.10 | 0.27 | 1.00 | 0.7 | 2 | 6 | 24 |
| Lake Surface | 1092.0 | 0.10 | 0.27 | 1.00 | 12.9 | 44 | 119 | 442 |

**POINT SOURCE DATA**

| Point Sources | Water Load (m^3/year) | Low (kg/year) | Most Likely (kg/year) | High (kg/year) | Loading % |
|---|---|---|---|---|---|
| User Defined 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| User Defined 6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**SEPTIC TANK DATA**

| Description | | Low | Most Likely | High | Loading % |
|---|---|---|---|---|---|
| Septic Tank Output (kg/capita-year) | | 0.30 | 0.50 | 0.80 | |
| # capita-years | 255.0 | | | | |
| % Phosphorous Retained by Soil | | 98.0 | 90.0 | 80.0 | |
| Septic Tank Loading (kg/year) | | 1.53 | 12.75 | 40.80 | 1.4 |

**TOTALS DATA**

| Description | Low | Most Likely | High | Loading % |
|---|---|---|---|---|
| Total Loading (lb) | 1367.6 | 2032.7 | 4058.8 | 100.0 |
| Total Loading (kg) | 620.4 | 922.0 | 1841.1 | 100.0 |
| Areal Loading (lb/ac-year) | 1.25 | 1.86 | 3.72 | |
| Areal Loading (mg/m^2-year) | 140.38 | 208.65 | 416.61 | |

# Appendix B
# Tabulated Community Survey





# Spooner Lake District Survey

The Spooner Lake District is conducting a survey to assess the present, plan for the future recreational use, and to assess the perceptions of Spooner Lake. The information gained from this survey will be used by the Spooner Lake District and its supporters to help determine future use of the lake and improvements that should be undertaken. They want your input, too!

The Spooner Lake District has hired Cedar Corporation of Menomonie to assist with this survey. In order to keep responses confidential, Cedar Corporation will tabulate the survey responses, and will provide the Spooner Lake District with a summary of the anonymous responses. You can help our community a great deal by filling out this questionnaire and **returning it in the enclosed postage-paid envelope by August 15, 2002**.

Thank you for your participation,
SPOONER LAKE DISTRICT

1. How long have you been a Spooner Lake shoreland owner?

1.__0__Less than 1 year
2.__8__1-5 years
3.__17__6-10 years
4.__21__11-15 years
5.__16__16-20 years
6.__25___Over 20 years
7.__0__Haven't visited

2. To the best of your knowledge, when was your home built?

1.__10__Before 1940
2.__12__1940-1949
3.__14__1950-1959
4.__15__1960-1978
5.__29__After 1978

3. How much time do you spend at your home on the lake?

1.__25__Permanent resident
2.__20__Seasonal Resident
3.__25__Weekends and an occasional week
4.__14__Other

4. What is your opinion on the current utilization of the lake during the summer months?

1.__62__The lake is currently used at about the right level
2.__7___The lake is under-utilized at the current time.
3.__6___The lake is over-utilized at the current time.
4.__12__I don't have an opinion.

5. What is your opinion on the current utilization of the lake during the winter months?

1.__33__The lake is currently used at about the right level
2.__9___The lake is under-utilized at the current time.
3.__14__The lake is over-utilized at the current time.
4.__31__I don't have an opinion.

6. If you would support a "quiet time" (slow-no wake) on your lake, what hours would you most like to have designated as "quiet?"

1.__7___4:00 p.m.-10:00 a.m.
2.__6___5:00 p.m.-9:00 a.m.
3.__10__6:00 p.m.-8:00 a.m.
4.__8___7:00 p.m.-7:00a.m.
5.__21__Other: See District Survey Comments
6.__32__Would not support

7. In the past twelve months, please indicate how many times you or any member of your household participated in any of the following activities while either using Spooner Lake or the park areas (please circle the appropriate response for each item).

| | NEVER | ONCE or TWICE | THREE to SIX TIMES | MORE THAN SIX TIMES |
|---|---|---|---|---|
| a. Go to parks/picnicking | 1 - 54 | 2 - 10 | 3 - 2 | 4 - 8 |
| b. Swimming | 1 - 22 | 2 - 8 | 3 - 14 | 4 - 34 |
| c. Biking | 1 - 49 | 2 - 8 | 3 - 8 | 4 - 11 |
| d. Walking/jogging | 1 - 14 | 2 - 10 | 3 - 5 | 4 - 51 |
| e. Canoeing/kayaking | 1 - 39 | 2 - 17 | 3 - 6 | 4 - 15 |
| f. Hiking nature trails | 1 - 52 | 2 - 11 | 3 - 6 | 4 - 6 |
| g. Camping | 1 - 63 | 2 - 5 | 3 - 2 | 4 - 6 |
| h. Boating | 1 - 6 | 2 - 4 | 3 - 5 | 4 - 63 |
| i. Fishing along shore | 1 - 10 | 2 - 12 | 3 - 9 | 4 - 51 |
| j. Fishing in a boat | 1 - 7 | 2 - 6 | 3 - 9 | 4 - 61 |
| k. Ice fishing | 1 - 44 | 2 - 14 | 3 - 5 | 4 - 17 |
| l. Relaxing/enjoying scenery | 1 - 3 | 2 - 1 | 3 - 3 | 4 - 72 |
| m. Snowmobiling | 1 - 56 | 2 - 7 | 3 - 3 | 4 - 13 |
| n. Water skiing | 1 - 45 | 2 - 5 | 3 - 9 | 4 - 19 |
| o. Jet skiing | 1 - 69 | 2 - 5 | 3 - 1 | 4 - 3 |
| p. Winter skiing/activities | 1 - 57 | 2 - 7 | 3 - 3 | 4 - 8 |

q. Other (please list and indicate how often) _____

8. Please indicate your opinions about the following statements concerning Spooner Lake (circle one response for each statement).

a. Spooner Lake is an important resource for the Town of Spponer Lake and District communities.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 49 | 26 | 4 | 1 | 1 | 4 |

b. I have noticed quite a bit of litter around the shoreline of the LAKE.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 3 | 17 | 25 | 29 | 6 | 6 |

c. I would like to see some control over use of personal watercraft.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 21 | 26 | 16 | 10 | 10 | 3 |

d. The State does a good job in maintaining the park area/access points that surround the LAKE.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 3 | 27 | 18 | 16 | 7 | 14 |

e. I feel that the quality or cleanliness of the water in the LAKE has gotten better in recent years.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 1 | 13 | 17 | 35 | 13 | 7 |

f. There should be a limit on the maximum horsepower and type of motor (inboard/outboard, 2 stroke/4 stroke) used to power boats.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 10 | 19 | 23 | 17 | 16 | 1 |

g. I feel that there has been a reduction in the amount of weeds in the LAKE in recent years.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 4 | 14 | 12 | 31 | 21 | 4 |

h. I support the Lake District in their efforts to control weeds within the LAKE.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 32 | 39 | 6 | 2 | 4 | 3 |

i. I feel that the policy of allowing snowmobiles to drive on the LAKE in the winter should be continued.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 19 | 36 | 19 | 4 | 3 | 4 |

j. I believe the geese are having an environmental impact on the water quality of the Lake.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 15 | 28 | 18 | 11 | 1 | 13 |

k. Currently set at one goose per person, I believe the bag limit on Canadian geese that can be hunted around Spooner Lake should be increased.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 18 | 36 | 15 | 8 | 0 | 8 |

l. I feel the DNR should look into whether the lake is affected by oil, transmission fluid, antifreeze, and other litter from winter ice fishers.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 22 | 32 | 19 | 6 | 3 | 4 |

9. Do you currently use Spooner Lake more or less than you did 5 years ago?

1.__35__More 2.__10__Less 3.__41___Same

10. If you use a watercraft on Spooner Lake, what type is it? (Check all that apply.)

1.__52__Fishing boat 3.__20__Ski/speed boat 5.__26__Canoe/kayak
2.__48__Pontoon 4.__4___Jet ski 6.__5___Other

11. To what extent does water quality affect your decision to use Spooner Lake?

1.__14__Little to no effect 2.__31__Some effect 3.__40__Great effect

12. Based on your use of Spooner Lake this past season, how would you rate the appearance of the lake water?

1.__5___Very poor 3.__32__Fair 5.__4___Very good
2.__14__Poor 4.__25__Good 6.__6___Didn't use the lake

13. Do you believe the quality of fishing in Spooner Lake to be better, worse, or about the same as 10 years ago?

1.__4___Better 3.__36__Worse 5.__39__About the Same

14. How would you rate the appearance of the lake you used this past season compared to the time periods shown below? (Please circle one response for each time period.)

a. Earlier this year:
1. Much worse 5 2.Slightly worse 18 3.About the same 40 4.Slightly better 11 5.Much better 4

b. Last year:
1. Much worse 6 2.Slightly worse 12 3.About the same 50 4.Slightly better 8 5.Much better 3

c. In past 5 years:
1. Much worse 6 2.Slightly worse 27 3.About the same 26 4.Slightly better 15 5.Much better 2

d. In past 10 years:
1. Much worse 10 2.Slightly worse 23 3.About the same 20 4.Slightly better 12 5.Much better 5

15. List three things that you like **most** about Spooner Lake or the area immediately surrounding the lake:
    1. _____See District Survey Comments_____
    2. _____
    3. _____

16. List three things that you like **least** about Spooner Lake or the area immediately surrounding the lake:
    1. _____See District Survey Comments_____
    2. _____
    3. _____

17. If you could make one improvement to Spooner Lake, or the area immediately surrounding the lake, what would it be?
    _____See District Survey Comments_____
    _____
    _____

Using the key below for QUESTIONS 18 and 19, please indicate your priority for each item listed:

1 = High priority  2 = Moderate priority  3 = Average priority  4 = Below average priority

18. Where would you like the District's Board to focus more attention?

    a.__3___To provide you with educational information on issues (environmental, boating, fishing, hunting, water safety, WDNR news, property taxes, winter sport opportunities, etc.).

    b.__4___Organize social events in the summer.

    c.__1___Study the fish populations and have the lakes stocked with fish, as appropriate.

    d.__3___"Adopt" the roads around the lakes and organize groups of shore owners to pick up litter twice a year.

    e.__1___Work towards preparation of lake management plan.

    f._____Other: _See District Survey Comments_____

19. How important to you is education/information on the following topics?

    a.__1__Water quality

    b.__1__Environmental issues

    c.__1___Zoning

    d.__1___Boating regulations and safety

    e.__1___Fishing

    f.__4___Hunting

    g.__3___Water sport safety

    h.__1___Local, county, state government actions, which affect us as shore owners

    i.__3___WDNR news

    j.__1___ Property taxes

    k.__1___Zoning reclassification applications

20. Please check the top three items you feel are the MOST significant water quality problems facing Spooner Lake.

a.__15__ Soil erosion and sedimentation
b.__24__Chemical/fertilizer runoff from crop land
c.__15__ Fish kills
d.__5___Soil erosion and sedimentation from development
e.__23__Chemical runoff from lawns
f.__25__ Failing private wastewater treatment systems
g.__5___Animal wastes
h.__4___Water craft
i.__62__ Weed growth
j.__45__ Algae growth
k.__2___Littering
l.__3___ Household hazardous waste
m.__3___Other (identify)___See District Survey Comments_____

21. Please check the top three organizations/persons you feel should be responsible for water quality improvements of Spooner Lake.

a.__43__State Government
b.__40__County Government
c.__14__Federal Government
d.__31__Lake Users
e.__18__Watershed Residents
f.__34__Lakeshore Owners
g.__50__Lake District
h.__4__Other (identify)_____

22. Please include any other comments or suggestions you would like to make:
_____See District Survey Comments_____

_____

_____

_____

_____

_____

_____

*The Spooner Lake District thanks you for your participation in this survey.*

# Spooner Lake Visitor Survey

The Spooner Lake District is conducting a survey to assess the present, plan for the future recreational use, and to assess the perceptions of Spooner Lake. Due to the numerous resources available for recreational purposes, Spooner Lake and other lakes in this area are experiencing increased development pressure from urban center residents. As a result, the potential impacts caused by nonpoint source pollution are increasing on this water body. Planning for the preservation and continued protection of the lake, the Spooner Lake District is committed to improving the water quality, fish and wildlife habitat, and recreational use of Spooner Lake.

Through their past efforts of lake draw downs, weed harvesting, and chemical treatment of channels to try and eliminate the invasive vegetation; the volunteer lake sediment, water clarity, and water qualitiy monitoring; and the early 1990 septic system evaluation of shore owners' property, the Spooner Lake District has been historically practicing a proactive approach in trying to clean up and protect their natural resource single-handedly. The information gained from this survey will be used by the Spooner Lake District and its supporters to help determine future use of the lake and improvements that should be undertaken. They want visitor input, too!

The Spooner Lake District has hired Cedar Corporation of Menomonie to assist with this survey. In order to keep responses confidential, Cedar Corporation will tabulate the survey responses, and will provide the Spooner Lake District with a summary of the anonymous responses. You can help our community a great deal by filling out this questionnaire and **returning it in the attached envelope to the resort manager**. The resort manager will mail completed surveys to Cedar Corporation on a monthly basis until August 15.

Thank you for your participation,
SPOONER LAKE DISTRICT

__44_ Orange: Spooner Lake District Board Resorts __4__ Blue: Ma & Pa's Resort
__35_ Yellow: Pine Harbor Resort __5__ Pink: Laconia Resort

1. Please check the lake, park area, or Town you, any member of your household, or accompanied visitor have visited while staying at the resort (check all that apply).

   1.__87__Spooner Lake 2.__62__Town of Spooner Lake 3.__0___None

2. If you checked "None" for Question 1, when did you last visit the lake or park area?

   1.__2___2-3 years ago 2.__0___4 years ago 3.__0___5 or more years ago

3. If you haven't visited the lake, park areas, or Town within the past two years, please indicate why:

   1.__0___Don't know what is available there.
   2.__0___They're too far away.
   3.__1___I'm/we're too busy.
   4.__1___I'm/we're not interested in going there.
   5.__0___Health/aging issues make it difficult to go there.
   6.__0___It is too crowded.
   7.__0___I/we like other lakes better.
   8.__2___Other (please list)__Please see Visitor Comments._____

4. Please indicate the number of years you have been visiting the lake or Town:

   1.__1___Less than 1 year 3.__16__6-10 years 5.__7___16-20 years 7.__1___First visit
   2.__8___1-5 years 4.__10__11-15 years 6.__45__Over 20 years

5. Please indicate the distance you travel to visit Spooner Lake:

   1._variety of answers, please see charts___miles ; 26 commute 301-400 mi, 27 commute over 500 mi

6. What is your opinion on the current utilization of the lake during your visit this summer?

   1.__62__The lake is currently used at about the right level 3.__12__The lake is over-utilized at the current time.
   2.__8___The lake is under-utilized at the current time. 4.__5___I don't have an opinion.

7. If you would support a "quiet time" (slow-no wake) on Spooner Lake, what hours would you most like to have designated as "quiet?"

1.__4___4:00 p.m.-10:00 a.m.
2.__7___5:00 p.m.-9:00 a.m.
3.__11__6:00 p.m.-8:00 a.m.
4.__12__7:00 p.m.-7:00a.m.
5.__18__Other_____
6.__31__Would not support

8. During your visits to Spooner Lake, please indicate how many times you, any member of your household, or accompanied visitor participated in any of the following activities while either using Spooner Lake or the park areas (please circle the appropriate response for each item).

| | NEVER | ONCE or TWICE | THREE to SIX TIMES | MORE THAN SIX TIMES |
|---|---|---|---|---|
| a. Go to parks/picnicking | 1-42 | 2-20 | 3-3 | 4-9 |
| b. Swimming | 1-5 | 2-10 | 3-9 | 4-58 |
| c. Biking | 1-47 | 2-11 | 3-8 | 4-7 |
| d. Walking/jogging | 1-11 | 2-19 | 3-18 | 4-32 |
| e. Canoeing/kayaking | 1-39 | 2-15 | 3-6 | 4-16 |
| f. Hiking nature trails | 1-46 | 2-14 | 3-7 | 4-8 |
| g. Camping | 1-56 | 2-7 | 3-3 | 4-9 |
| h. Boating | 1-0 | 2-5 | 3-4 | 4-75 |
| i. Fishing along shore | 1-8 | 2-6 | 3-7 | 4-61 |
| j. Fishing in a boat | 1-2 | 2-4 | 3-3 | 4-74 |
| k. Ice fishing | 1-68 | 2-4 | 3-0 | 4-5 |
| l. Relaxing/enjoying scenery | 1-2 | 2-3 | 3-6 | 4-74 |
| m. Snowmobiling | 1-67 | 2-8 | 3-0 | 4-1 |
| n. Water skiing | 1-32 | 2-15 | 3-9 | 4-20 |
| o. Jet skiing | 1-65 | 2-2 | 3-2 | 4-6 |
| p. Winter skiing/activities | 1-63 | 2-5 | 3-3 | 4-3 |

q. Other (please list and indicate how often) _____

9. Please indicate your opinions about the following statements concerning Spooner Lake (circle one response for each statement).

a. Spooner Lake is an important resource for the Town of Spooner Lake and District communities.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 61 | 20 | 2 | 0 | 3 | 1 |

b. I have noticed quite a bit of litter around the shoreline of the LAKE.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 5 | 10 | 12 | 40 | 19 | 1 |

c. I would like to see some control over use of personal watercraft.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 16 | 27 | 22 | 9 | 10 | 1 |

d. The State does a good job in maintaining the park area/access points that surround the LAKE.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 11 | 38 | 14 | 5 | 0 | 19 |

e. I feel that the quality or cleanliness of the water in the LAKE has gotten better in recent years.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 0 | 23 | 28 | 21 | 9 | 5 |

f. There should be a limit on the maximum horsepower and type of motor (inboard/outboard, 2 stroke/4 stroke) used to power boats.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 14 | 17 | 17 | 12 | 22 | 4 |

g. I feel that there is a problem with the amount of weeds in the LAKE.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 33 | 25 | 12 | 8 | 5 | 1 |

h. I support the Lake District in their efforts to control weeds within the LAKE.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 34 | 36 | 8 | 3 | 2 | 2 |

i. I believe the geese are having an environmental impact on the water quality of the Lake.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 16 | 29 | 17 | 6 | 5 | 13 |

j. Currently set at one goose per person, I believe the bag limit on Canadian geese that can be hunted around Spooner Lake should be increased.

| 1.Strongly agree | 2.Agree | 3.Neutral | 4.Disagree | 5.Strongly disagree | 6.Don't know |
|---|---|---|---|---|---|
| 19 | 26 | 13 | 2 | 3 | 23 |

10. What is the frequency of your visits to Spooner Lake this year compared to 5 years ago?

1.__8____More frequently - Why?_____
2.__6____Less frequently - Why?_____
3.__68___Same
4.__2____This year is the first time I/we visited Spooner Lake

11. If you use a watercraft on Spooner Lake, what type is it? (Check all that apply.)

| | | |
|---|---|---|
| 1.__76__Fishing boat | 3.__21__Ski/speed boat | 5.__19__Canoe/kayak |
| 2.__21__Pontoon | 4.__8___Jet ski | 6.__5___Other |

12. To what extent does water quality affect your decision to visit or use Spooner Lake?

1.__19__Little to no effect 2.__29__Some effect 3.__38__Great effect

13. Based on your use of Spooner Lake this past season, how would you rate the appearance of the lake water?

| | | |
|---|---|---|
| 1.__4___Very poor | 3.__27__Fair | 5.__10__Very good |
| 2.__10__Poor | 4.__35__Good | 6.__0___Didn't use the lake |

14. Do you believe the quality of fishing in Spooner Lake to be better, worse, or about the same as your last visit?

1.__4___Better 2.__42__Worse 3.__30__About the same 4.__10__Don't know

15. How would you rate the appearance of the lake you visited/used this past season compared to the time periods shown below? (Please circle one response for each time period.)

a. Earlier this year:

| 1. Much worse | 2.Slightly worse | 3.About the same | 4.Slightly better | 5.Much better | 6.Don't know |
|---|---|---|---|---|---|
| 2 | 9 | 17 | 5 | 1 | 38 |

b. Last year:

| 1. Much worse | 2.Slightly worse | 3.About the same | 4.Slightly better | 5.Much better | 6.Don't know |
|---|---|---|---|---|---|
| 3 | 21 | 34 | 14 | 3 | 7 |

c. In past 5 years:

| 1. Much worse | 2.Slightly worse | 3.About the same | 4.Slightly better | 5.Much better | 6.Don't know |
|---|---|---|---|---|---|
| 10 | 13 | 29 | 20 | 4 | 8 |

d. In past 10 years:

| 1. Much worse | 2.Slightly worse | 3.About the same | 4.Slightly better | 5.Much better | 6.Don't know |
|---|---|---|---|---|---|
| 10 | 13 | 21 | 12 | 10 | 14 |

16. Do you or any member of your household, or accompanied visitor, belong to any group or organization that uses Spooner Lake?

1.__13__Yes If yes, what is the name of the organizaton(s)? _____
2.__71__No _____

17. List three things that you like **most** about Spooner Lake or the area immediately surrounding the lake:

I. _____See Visitor Survey Comments_____
2. _____
3. _____

18. List three things that you like **least** about Spooner Lake or the area immediately surrounding the lake:

I. _____See Visitor Survey Comments_____
2. _____
3. _____

19. If you could make one improvement to Spooner Lake, or the area immediately surrounding the lake, what would it be?

_____See Visitor Survey Comments_____
_____
_____

20. Why did you choose Spooner Lake to visit? (Check all that apply.)

a.__40__Easy to get to
b.__15__Launch ramp facilities
c.__53__Resort accommodations (price, comfort, etc.)
d.__71__Fishing
e.__54__Boating
f.__55__Swimming
g.__33__Water quality
h.__49__Proximity to the Town of Spooner (i.e. shopping)
i.__52__ Lack of development
j.__23__ Proximity to golf facility

21. Please include any other comments or suggestions you would like to make:

_____See Visitor Survey Comments_____
_____
_____
_____

*The Spooner Lake District thanks you for your participation in this survey.*

# Appendix C
# Proposed Ordinances

**CONSTRUCTION SITE EROSION CONTROL ZONING ORDINANCE**

**TABLE OF CONTENTS**

**CONSTRUCTION SITE EROSION CONTROL ZONING ORDINANCE**

**AN ORDINANCE TO CREATE CHAPTER ELEVEN OF THE ORDINANCE CODE OF THE TOWN OF SPOONER RELATING TO THE CONTROL OF CONSTRUCTION SITE EROSION RESULTING FROM LAND DISTURBING CONSTRUCTION ACTIVITIES**

**FOREWORD.**

The intent of this ordinance is to require use of best management practices to reduce the amount of sediment and other pollutants resulting from land disturbing construction activities on sites that do not include the construction of a building and is otherwise regulated by the Wisconsin Department of Commerce in s. COMM 21.125 or COMM 50.115, Wis. Adm. Code. Use of this ordinance will foster consistent, statewide application of the construction site performance standards for new development and redevelopment contained in subchapters III and IV of ch. NR 151, Wis. Adm. Code.

The Town of Spooner of the [name of municipality] does hereby ordain that Chapter Eleven of the ordinance code for the Town of Spooner is created to read as follows:

## CHAPTER 11
## CONSTRUCTION SITE EROSION

### 11.01 AUTHORITY.

(1) This ordinance is adopted under the authority granted by s. 60.627, Wis. Stats. This ordinance supersedes all provisions of an ordinance previously enacted under s. 60.62, Wis. Stats., that relate to construction site erosion control. Except as otherwise specified in s. 60.627, Wis. Stats., applies to this ordinance and to any amendments to this ordinance.

(2) The provisions of this ordinance are deemed not to limit any other lawful regulatory powers of the same governing body.

(3) The Town of Spooner hereby designates the Town Engineer to administer and enforce the provisions of this ordinance.

(4) The requirements of this ordinance do not pre-empt more stringent erosion and sediment control requirements that may be imposed by any of the following:

(a) Wisconsin Department of Natural Resources administrative rules, permits or approvals including those authorized under ss. 281.16 and 283.33, Wis. Stats.

(b) Targeted non-agricultural performance standards promulgated in rules by the Wisconsin Department of Natural Resources under s. NR 151.004, Wis. Adm. Code.

### 11.02 FINDINGS OF FACT.

The Town of Spooner finds that runoff from land disturbing construction activity carries a significant amount of sediment and other pollutants to the waters of the state in the Town of Spooner.

### 11.03 PURPOSE.

It is the purpose of this ordinance to further the maintenance of safe and healthful conditions; prevent and control water pollution; prevent and control soil erosion; protect spawning grounds, fish and aquatic life; control building sites, placement of structures and land uses; preserve ground cover and scenic beauty; and promote sound economic growth, by minimizing the amount of sediment and other pollutants carried by runoff or discharged from land disturbing construction activity to waters of the state in the Town of Spooner.

**11.04 APPLICABILITY AND JURISDICTION.**

(1) APPLICABILITY.

(a) This ordinance applies to the following land disturbing construction activities except as provided under sub. (b):

1. A construction site, which has 5 or more acres of land disturbing construction activity.
2. A construction site, which has one or more acres of land disturbing construction activity after March 10, 2003.

(b) This ordinance does not apply to the following:

1. Land disturbing construction activity that includes the construction of a building and is otherwise regulated by the Wisconsin Department of Commerce under s. COMM 21.125 or COMM 50.115, Wis. Adm. Code.
2. A construction project that is exempted by federal statutes or regulations from the requirement to have a national pollutant discharge elimination system permit issued under chapter 40, Code of Federal Regulations, part 122, for land disturbing construction activity.
3. Nonpoint discharges from agricultural facilities and practices.
4. Nonpoint discharges from silviculture activities.
5. Routine maintenance for project sites under 5 acres of land disturbance if performed to maintain the original line and grade, hydraulic capacity or original purpose of the facility.

(c) Notwithstanding the applicability requirements in paragraph (a), this ordinance applies to construction sites of any size that, in the opinion of the Town Engineer, are likely to result in runoff that exceeds the safe capacity of the existing drainage facilities or receiving body of water, that causes undue channel erosion, that increases water pollution by scouring or the transportation of particulate matter or that endangers property or public safety.

(2) JURISDICTION.

This ordinance applies to land disturbing construction activity on construction sites located within the boundaries and jurisdiction of the Town of Spooner.

(3) EXCLUSIONS.

This ordinance is not applicable to activities conducted by a state agency, as defined under s. 227.01 (1), Wis. Stats., but also including the office of district attorney, which is subject to the state plan promulgated or a memorandum of understanding entered into under s. 281.33 (2), Wis. Stats.

**11.05 DEFINITIONS.**

(1) “Administering authority” means a governmental employee, or a regional planning commission empowered under s. 60.627, Wis. Stats., that is designated by the Town of Spooner to administer this ordinance.

(2) “Agricultural facilities and practices ” has the meaning in s. 281.16(1), Wis. Stats.

(3) “Average annual rainfall” means a calendar year of precipitation, excluding snow, which is considered typical.

(4) "Best management practice” or “BMP” means structural or non-structural measures, practices, techniques or devices employed to avoid or minimize soil, sediment or pollutants carried in runoff to waters of the state.

(5) “Business day” means a day the office of the Town Engineer is routinely and customarily open for business.

(6) “Cease and desist order” means a court-issued order to halt land disturbing construction activity that is being conducted without the required permit.

(7) “Construction site” means an area upon which one or more land disturbing construction activities occur, including areas that are part of a larger common plan of development or sale where multiple separate and distinct land disturbing construction activities may be taking place at different times on different schedules but under one plan.

(8) “Division of land” means the creation from one parcel of five (5) or more parcels or building sites of three (3) or fewer acres each in area where such creation occurs at one time or through the successive partition within a 5 year period.

(9) “Erosion” means the process by which the land’s surface is worn away by the action of wind, water, ice or gravity.

(10) “Erosion and sediment control plan” means a comprehensive plan developed to address pollution caused by erosion and sedimentation of soil particles or rock fragments during construction.

(11) “Extraterritorial” means the unincorporated area within 3 miles of the corporate limits of a first, second, or third class city, or within 1.5 miles of a fourth class city or village.

(12) “Final stabilization” means that all land disturbing construction activities at the construction site have been completed and that a uniform perennial vegetative cover has been established, with a density of at least 70 percent of the cover, for the unpaved areas and areas not covered by

permanent structures, or that employ equivalent permanent stabilization measures.

(13) “Governing body” means town board of supervisors, county board of supervisors, city council, village board of trustees or village council.

(14) “Land disturbing construction activity” means any man-made alteration of the land surface resulting in a change in the topography or existing vegetative or non-vegetative soil cover, that may result in runoff and lead to an increase in soil erosion and movement of sediment into waters of the state. Land disturbing construction activity includes clearing and grubbing, demolition, excavating, pit trench dewatering, filling and grading activities.

(15) “MEP” or “maximum extent practicable” means a level of implementing best management practices in order to achieve a performance standard specified in this chapter which takes into account the best available technology, cost effectiveness and other competing issues such as human safety and welfare, endangered and threatened resources, historic properties and geographic features. MEP allows flexibility in the way to meet the performance standards and may vary based on the performance standard and site conditions.

(16) “Performance standard” means a narrative or measurable number specifying the minimum acceptable outcome for a facility or practice.

(17) “Permit” means a written authorization made by the Town Engineer to the applicant to conduct land disturbing construction activity or to discharge post-construction runoff to waters of the state.

(18) “Pollutant” has the meaning given in s. 283.01 (13), Wis. Stats.

(19) “Pollution” has the meaning given in s. 281.01 (10), Wis. Stats.

(20) “Responsible party” means any entity holding fee title to the property or performing services to meet the performance standards of this ordinance through a contract or other agreement.

(21) “Runoff” means storm water or precipitation including rain, snow or ice melt or similar water that moves on the land surface via sheet or channelized flow.

(22) “Sediment” means settleable solid material that is transported by runoff, suspended within runoff or deposited by runoff away from its original location.

(23) “Separate storm sewer” means a conveyance or system of conveyances including roads with drainage systems, streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all of the following criteria:

(a) Is designed or used for collecting water or conveying runoff.

(b) Is not part of a combined sewer system.

(c) Is not draining to a storm water treatment device or system.

(d) Discharges directly or indirectly to waters of the state.

(24) “Site” means the entire area included in the legal description of the land on which the land disturbing construction activity is proposed in the permit application.

(25) “Stop work order” means an order issued by the Town Engineer which requires that all construction activity on the site be stopped.

(26) "Technical standard" means a document that specifies design, predicted performance and operation and maintenance specifications for a material, device or method.

(27) “Waters of the state” has the meaning given in s. 281.01 (18), Wis. Stats.

**11.06 TECHNICAL STANDARDS.**

(1) DESIGN CRITERIA, STANDARDS AND SPECIFICATIONS. All BMPs required to comply with this ordinance shall meet the design criteria, standards and specifications based on any of the following:

(a) Applicable design criteria, standards and specifications identified in the *Wisconsin Construction Site Best Management Practice Handbook,* WDNR Pub. WR-222 November 1993 Revision.

(b) Other design guidance and technical standards identified or developed by the Wisconsin Department of Natural Resources under subchapter V of chapter NR 151, Wis. Adm. Code.

(c) For this ordinance, average annual basis is calculated using the appropriate annual rainfall or runoff factor, also referred to as the R factor, or an equivalent design storm using a type II distribution, with consideration given to the geographic location of the site and the period of disturbance.

(2) OTHER STANDARDS. Other technical standards not identified or developed in sub. (1), may be used provided that the methods have been approved by the Town Engineer.

**11.07 PERFORMANCE STANDARDS.**

(1) RESPONSIBLE PARTY. The responsible party shall implement an erosion and sediment control plan, developed in accordance with 11.09, that incorporates the requirements of this section.

(2) PLAN. A written plan shall be developed in accordance with 11.09 and implemented for each construction site.

(3) EROSION AND OTHER POLLUTANT CONTROL REQUIREMENTS. The plan required under sub. (2) shall include the following:

(a) BMPs that, by design, achieve to the maximum extent practicable, a reduction of 80% of the sediment load carried in runoff, on an average annual basis, as compared with no sediment or erosion controls until the construction site has undergone final stabilization. No person shall be required to exceed an 80% sediment reduction to meet the

requirements of this paragraph. Erosion and sediment control BMPs may be used alone or in combination to meet the requirements of this paragraph. Credit toward meeting the sediment reduction shall be given for limiting the duration or area, or both, of land disturbing construction activity, or other appropriate mechanism.

(b) Notwithstanding par. (a), if BMPs cannot be designed and implemented to reduce the sediment load by 80%, on an average annual basis, the plan shall include a written and site-specific explanation as to why the 80% reduction goal is not attainable and the sediment load shall be reduced to the maximum extent practicable.

(c) Where appropriate, the plan shall include sediment controls to do all of the following to the maximum extent practicable:

1. Prevent tracking of sediment from the construction site onto roads and other paved surfaces.
2. Prevent the discharge of sediment as part of site de-watering.
3. Protect the separate storm drain inlet structure from receiving sediment.

(d) The use, storage and disposal of chemicals, cement and other compounds and materials used on the construction site shall be managed during the construction period, to prevent their entrance into waters of the state. However, projects that require the placement of these materials in waters of the state, such as constructing bridge footings or BMP installations, are not prohibited by this paragraph.

(4) LOCATION. The BMPs used to comply with this section shall be located prior to runoff entering waters of the state.

(5) ALTERNATE REQUIREMENTS. The Town Engineer may establish storm water management requirements more stringent than those set forth in this section if the Town Engineer determines that an added level of protection is needed for sensitive resources.

**11.08 PERMITTING REQUIREMENTS, PROCEDURES AND FEES.**

(1) PERMIT REQUIRED. No responsible party may commence a land disturbing construction activity subject to this ordinance without receiving prior approval of an erosion and sediment control plan for the site and a permit from the Town Engineer.

(2) PERMIT APPLICATION AND FEES. At least one responsible party desiring to undertake a land disturbing construction activity subject to this ordinance shall submit an application for a permit and an erosion and sediment control plan that meets the requirements of 11.09 and shall pay an application fee of one hundred ($25) to the Town Engineer. By submitting an application, the

applicant is authorizing the Town Engineer to enter the site to obtain information required for the review of the erosion and sediment control plan.

(3) REVIEW AND APPROVAL OF PERMIT APPLICATION. The Town Engineer shall review any permit application that is submitted with an erosion and sediment control plan, and the required fee. The following approval procedure shall be used:

(a) Within fifteen (15) business days of the receipt of a complete permit application, as required by sub. (2), the Town Engineer shall inform the applicant whether the application and plan are approved or disapproved based on the requirements of this ordinance.

(b) If the permit application and plan are approved, the Town Engineer shall issue the permit.

(c) If the permit application or plan is disapproved, the Town Engineer shall state in writing the reasons for disapproval.

(d) The Town Engineer may request additional information from the applicant. If additional information is submitted, the Town Engineer shall have five (5) business days from the date the additional information is received to inform the applicant that the plan is either approved or disapproved.

(e) Failure by the Town Engineer to inform the permit applicant of a decision within thirty (30) business days of a required submittal shall be deemed to mean approval of the submittal and the applicant may proceed as if a permit had been issued.

(4) SURETY BOND. As a condition of approval and issuance of the permit, the Town Engineer may require the applicant to deposit a surety bond or irrevocable letter of credit to guarantee a good faith execution of the approved erosion control plan and any permit conditions.

(5) PERMIT REQUIREMENTS. All permits shall require the responsible party to:

(a) Notify the Town Engineer within 48 hours of commencing any land disturbing construction activity.

(b) Notify the Town Engineer of completion of any BMPs within 14 days after their installation.

(c) Obtain permission in writing from the Town Engineer prior to any modification pursuant to 11.09(3) of the erosion and sediment control plan.

(d) Install all BMPs as identified in the approved erosion and sediment control plan.

(e) Maintain all road drainage systems, stormwater drainage systems, BMPs and other facilities identified in the erosion and sediment control plan.

(f) Repair any siltation or erosion damage to adjoining surfaces and drainage ways resulting from land disturbing construction activities and document repairs in a site erosion control log.

(g) Inspect the BMPs within 24 hours after each rain of 0.5 inches or more which results in runoff during active construction periods, and at least once each week, make needed repairs and document the findings of the inspections in a site erosion control log with the date of inspection, the name of the person conducting the inspection, and a description of the present phase of the construction at the site.

(h) Allow the Town Engineer to enter the site for the purpose of inspecting compliance with the erosion and sediment control plan or for performing any work necessary to bring the site into compliance with the control plan. Keep a copy of the erosion and sediment control plan at the construction site.

(6) PERMIT CONDITIONS. Permits issued under this section may include conditions established by Town Engineer in addition to the requirements set forth in sub. (5), where needed to assure compliance with the performance standards in 11.07.

(7) PERMIT DURATION. Permits issued under this section shall be valid for a period of 180 days, or the length of the building permit or other construction authorizations, whichever is longer, from the date of issuance. The Town Engineer may extend the period one or more times for up to an additional 180 days. The Town Engineer may require additional BMPs as a condition of the extension if they are necessary to meet the requirements of this ordinance.

(8) MAINTENANCE. The responsible party throughout the duration of the construction activities shall maintain all BMPs necessary to meet the requirements of this ordinance until the site has undergone final stabilization.

**11.09 EROSION AND SEDIMENT CONTROL PLAN, STATEMENT, AND AMENDMENTS.**

(1) EROSION AND SEDIMENT CONTROL PLAN.

(a) An erosion and sediment control plan shall be prepared and submitted to the Town Engineer.

(b) The erosion and sediment control plan shall be designed to meet the performance standards in 11.07 and other requirements of this ordinance.

(c) The erosion and sediment control plan shall address pollution caused by soil erosion and sedimentation during construction and up to final stabilization of the site. The erosion and sediment control plan shall include, at a minimum, the following items:

1. The name(s) and address(es) of the owner or developer of the site, and of any consulting firm retained by the applicant, together with the name of the

applicant's principal contact at such firm. The application shall also include start and end dates for construction.

2. Description of the site and the nature of the construction activity, including representation of the limits of land disturbance on a United States Geological Service 7.5 minute series topographic map.
3. A sequence of construction of the development site, including stripping and clearing; rough grading; construction of utilities, infrastructure, and buildings; and final grading and landscaping. Sequencing shall identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, areas of clearing, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation.
4. Estimates of the total area of the site and the total area of the site that is expected to be disturbed by construction activities.
5. Estimates, including calculations, if any, of the runoff coefficient of the site before and after construction activities are completed.
6. Calculations to show the expected percent reduction in the average annual sediment load carried in runoff as compared to no sediment or erosion controls.
7. Existing data describing the surface soil as well as subsoils.
8. Depth to groundwater, as indicated by Natural Resources Conservation Service soil information where available.
9. Name of the immediate named receiving water from the United States Geological Service 7.5 minute series topographic maps.

(d) The erosion and sediment control plan shall include a site map. The site map shall include the following items and shall be at a scale not greater than 100 feet per inch and at a contour interval not to exceed five feet.

1. Existing topography, vegetative cover, natural and engineered drainage systems, roads and surface waters. Lakes, streams, wetlands, channels, ditches and other watercourses on and immediately adjacent to the site shall be shown. Any identified 100-year flood plains, flood fringes and floodways shall also be shown.
2. Boundaries of the construction site.
3. Drainage patterns and approximate slopes anticipated after major grading activities.
4. Areas of soil disturbance.
5. Location of major structural and non-structural controls identified in the plan.
6. Location of areas where stabilization practices will be employed.
7. Areas which will be vegetated following construction.

8. Areal extent of wetland acreage on the site and locations where storm water is discharged to a surface water or wetland.
9. Locations of all surface waters and wetlands within one mile of the construction site.
10. An alphanumeric or equivalent grid overlying the entire construction site map.

(e) Each erosion and sediment control plan shall include a description of appropriate controls and measures that will be performed at the site to prevent pollutants from reaching waters of the state. The plan shall clearly describe the appropriate control measures for each major activity and the timing during the construction process that the measures will be implemented. The description of erosion controls shall include, when appropriate, the following minimum requirements:

1. Description of interim and permanent stabilization practices, including a practice implementation schedule. Site plans shall ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized.
2. Description of structural practices to divert flow away from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from the site. Unless otherwise specifically approved in writing by the Town Engineer, structural measures shall be installed on upland soils.
3. Management of overland flow at all sites, unless otherwise controlled by outfall controls.
4. Trapping of sediment in channelized flow.
5. Staging construction to limit bare areas subject to erosion.
6. Protection of downslope drainage inlets where they occur.
7. Minimization of tracking at all sites.
8. Clean up of off-site sediment deposits.
9. Proper disposal of building and waste materials at all sites.
10. Stabilization of drainage ways.
11. Control of soil erosion from dirt stockpiles.
12. Installation of permanent stabilization practices as soon as possible after final grading.
13. Minimization of dust to the maximum extent practicable.

(f) The erosion and sediment control plan shall require that velocity dissipation devices be placed at discharge locations and along the length of any outfall channel, as necessary, to provide a non-erosive flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

(2) EROSION AND SEDIMENT CONTROL PLAN STATEMENT. For each construction site identified under 11.04 (1)(c), an erosion and sediment control plan statement shall be prepared. This statement shall be submitted to the Town Engineer. The control plan statement shall briefly describe the site, including a site map. Further, it shall also include the best management practices that will be used to meet the requirements of the ordinance, including the site development schedule.

(3) AMENDMENTS. The applicant shall amend the plan if any of the following occur:

(a) There is a change in design, construction, operation or maintenance at the site which has the reasonable potential for the discharge of pollutants to waters of the state and which has not otherwise been addressed in the plan.

(b) The actions required by the plan fail to reduce the impacts of pollutants carried by construction site runoff.

(c) The Town Engineer notifies the applicant of changes needed in the plan.

**11.10 FEE SCHEDULE.**

The fees referred to in other sections of this ordinance shall be established by the Town Engineer and may from time to time be modified by resolution. A schedule of the fees established by the Town Engineer shall be available for review in the Town Hall.

**11.11 INSPECTION.**

If land disturbing construction activities are being carried out without a permit required by this ordinance, the Town Engineer may enter the land pursuant to the provisions of ss. 66.0119(1), (2), and (3), Wis. Stats.

**11.12 ENFORCEMENT.**

(1) The Town Engineer may post a stop-work order if any of the following occurs:

(a) Any land disturbing construction activity regulated under this ordinance is being undertaken without a permit.

(b) The erosion and sediment control plan is not being implemented in a good faith manner.

(c) The conditions of the permit are not being met.

(2) If the responsible party does not cease activity as required in a stop-work order posted under this section or fails to comply with the erosion and sediment control plan or permit conditions, the Town Engineer may revoke the permit.

(3) If the responsible party, where no permit has been issued, does not cease the activity after being notified by the Town Engineer, or if a responsible party violates a stop-work order posted under sub. (1), the Town Engineer may request the town attorney to obtain a cease and desist order in any court with jurisdiction.

(4) The board of appeals may retract the stop-work order issued under sub. (1) or the permit revocation under sub. (2).

(5) After posting a stop-work order under sub. (1), the Town Engineer may issue a notice of intent to the responsible party of its intent to perform work necessary to comply with this ordinance. The Town Engineer may go on the land and commence the work after issuing the notice of intent. The costs of the work performed under this subsection by the Town Engineer, plus interest at the rate authorized by Town Board of Spooner shall be billed to the responsible party. In the event a responsible party fails to pay the amount due, the clerk shall enter the amount due on the tax rolls and collect as a special assessment against the property pursuant to subch. VII of ch. 66, Wis. Stats.

(6) Any person violating any of the provisions of this ordinance shall be subject to a forfeiture of not less than twenty-five ($25) nor more than one thousand ($1,000) and the costs of prosecution for each violation. Each day a violation exists shall constitute a separate offense.

(7) Compliance with the provisions of this ordinance may also be enforced by injunction in any court with jurisdiction. It shall not be necessary to prosecute for forfeiture or a cease and desist order before resorting to injunctional proceedings.

**11.13 APPEALS.**

(1) BOARD OF APPEALS. The board of appeals created pursuant to section eleven (11) of the town's ordinance pursuant to 60.65, Wis. Stats.:

(a) Shall hear and decide appeals where it is alleged that there is error in any order, decision or determination made by the Town Engineer in administering this ordinance except for cease and desist orders obtained under 11.12 (3).

(b) Upon appeal, may authorize variances from the provisions of this ordinance which are not contrary to the public interest and where owing to special conditions a literal enforcement of the provisions of the ordinance will result in unnecessary hardship; and

(c) Shall use the rules, procedures, duties and powers authorized by statute in hearing and deciding appeals and authorizing variances.

(2) WHO MAY APPEAL. Appeals to the board of appeals may be taken by any aggrieved person or by any office, department, board, or bureau of the Town of Spooner affected by any decision of the Town Engineer.

**11.14 SEVERABILITY.**

If a court of competent jurisdiction judges any section, clause, provision or portion of this ordinance unconstitutional or invalid, the remainder of the ordinance shall remain in force and not be affected by such judgment.

**11.15 EFFECTIVE DATE.**

This ordinance shall be in force and effect from and after its adoption and publication. The above and foregoing ordinance was duly adopted by the Town Board of the Town of Spooner on the [number] day of [month], [year].

Approved: _____

Attested _____

Published on [day, month, and year].

**POST-CONSTRUCTION STORM WATER MANAGEMENT ZONING ORDINANCE**

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**POST-CONSTRUCTION STORM WATER MANAGEMENT ZONING ORDINANCE**

**FOREWORD.**

The intent of this ordinance is to reduce the amount of post-construction storm water and associated pollutants reaching waters of the state. Use of this ordinance by municipalities will foster the consistent statewide application of post-construction performance standards for new development and redevelopment contained in subchapters III and IV of chapter NR 151, Wis. Adm. Code.

The Town of Spooner does hereby ordain that Chapter 10 of the Code of Ordinances of the Town of Spooner is created to read as follows:

## CHAPTER 10
## POST-CONSTRUCTION STORM WATER MANAGEMENT

### 10.01 AUTHORITY.

(1) This ordinance is adopted by the Town of Spooner under the authority granted by s. 60.627, Wis. Stats. This ordinance supersedes all provisions of an ordinance previously enacted under s. 60.62, Wis. Stats., that relate to storm water management regulations. Except as otherwise specified in s. 60.627, Wis. Stats., s. 60.62, Wis. Stats., applies to this ordinance and to any amendments to this ordinance.

(2) The provisions of this ordinance are deemed not to limit any other lawful regulatory powers of the same governing body.

(3) The Town of Spooner hereby designates the Town Engineer to administer and enforce the provisions of this ordinance.

(4) The requirements of this ordinance do not pre-empt more stringent storm water management requirements that may be imposed by any of the following:
   (a) Wisconsin Department of Natural Resources administrative rules, permits or approvals including those authorized under ss. 281.16 and 283.33, Wis. Stats.
   (b) Targeted non-agricultural performance standards promulgated in rules by the Wisconsin Department of Natural Resources under s. NR 151.004, Wis. Adm. Code.

### 10.02 FINDINGS OF FACT.

The Town of Spooner finds that uncontrolled, post-construction runoff has a significant impact upon water resources and the health, safety and general welfare of the community and diminishes the public enjoyment and use of natural resources. Specifically, uncontrolled post-construction runoff can:

(1) Degrade physical stream habitat by increasing stream bank erosion, increasing streambed scour, diminishing groundwater recharge, diminishing stream base flows and increasing stream temperature.

(2) Diminish the capacity of lakes and streams to support fish, aquatic life, recreational and water supply uses by increasing pollutant loading of sediment, suspended solids, nutrients, heavy metals, bacteria, pathogens and other urban pollutants.

(3) Alter wetland communities by changing wetland hydrology and by increasing pollutant loads.

(4) Reduce the quality of groundwater by increasing pollutant loading.

(5) Threaten public health, safety, property and general welfare by overtaxing storm sewers, drainage ways, and other minor drainage facilities.

(6) Threaten public health, safety, property and general welfare by increasing major flood peaks and volumes.

(7) Undermine floodplain management efforts by increasing the incidence and levels of flooding.

**10.03 PURPOSE AND INTENT.**

(1) PURPOSE. The general purpose of this ordinance is to establish long-term, post-construction runoff management requirements that will diminish the threats to public health, safety, welfare and the aquatic environment. Specific purposes are to:

(a) Further the maintenance of safe and healthful conditions.

(b) Prevent and control the adverse effects of storm water; prevent and control soil erosion; prevent and control water pollution; protect spawning grounds, fish and aquatic life; control building sites, placement of structures and land uses; preserve ground cover and scenic beauty; and promote sound economic growth.

(c) Control exceedance of the safe capacity of existing drainage facilities and receiving water bodies; prevent undue channel erosion; control increases in the scouring and transportation of particulate matter; and prevent conditions that endanger downstream property.

(2) INTENT. It is the intent of the Town of Spooner that this ordinance regulates post-construction storm water discharges to waters of the state. This ordinance may be applied on a site-by-site basis. The Town of Spooner recognizes, however, that the preferred method of achieving the storm water performance standards set forth in this ordinance is through the preparation and implementation of comprehensive, systems-level storm water management plans that cover hydrologic units, such as watersheds, on a municipal and regional scale. Such plans may prescribe regional storm water devices, practices or systems, any of which may be designed to treat runoff from more than one site prior to discharge to waters of the state. Where such plans are in conformance with the performance standards developed under s. 281.16, Wis. Stats., for regional storm water management measures and have been approved by the Town of Spooner, it

is the intent of this ordinance that the approved plan be used to identify post-construction management measures acceptable for the community.

**10.04 APPLICABILITY AND JURISDICTION.**

(1) APPLICABILITY.

(a) Where not otherwise limited by law, this ordinance applies after final stabilization to a site of land disturbing construction activity meeting any of the criteria in this paragraph, unless the site is otherwise exempt under paragraph (b).

1. A post construction site that had 5 or more acres of land disturbing construction activity.
2. A post-development construction site that had one or more acres of land disturbing construction activity after March 10, 2003.

(b) A site that meets any of the criteria in this paragraph is exempt from the requirements of this ordinance.

1. A redevelopment post-construction site with no increase in exposed parking lots or roads.
2. A post-construction site with less than 10% connected imperviousness based on complete development of the post-construction site, provided the cumulative area of all parking lots and rooftops is less than one acre.
3. Nonpoint discharges from agricultural facilities and practices.
4. Nonpoint discharges from silviculture activities.
5. Routine maintenance for project sites under 5 acres of land disturbance if performed to maintain the original line and grade, hydraulic capacity or original purpose of the facility.
6. Underground utility construction such as water, sewer and fiberoptic lines. This exemption does not apply to the construction of any above ground structures associated with utility construction.

(c) Notwithstanding the applicability requirements in paragraph (a), this ordinance applies to post-construction sites of any size that, in the opinion of the Town Engineer, is likely to result in runoff that exceeds the safe capacity of the existing drainage facilities or receiving body of water, that causes undue channel erosion, that increases water pollution by scouring or the transportation of particulate matter or that endangers property or public safety.

(2) JURISDICTION.

This ordinance applies to post construction sites within the boundaries and jurisdiction of the Town of Spooner.

(3) EXCLUSIONS.

This ordinance is not applicable to activities conducted by a state agency, as defined under s. 227.01 (1), Wis. Stats., but also including the office of district attorney, which is subject to the state plan promulgated or a memorandum of understanding entered into under s. 281.33 (2), Wis. Stats.

**10.05 DEFINITIONS.**

(1) "Administering authority" means a governmental employee, or a regional planning commission empowered under s. 60.627, Wis. Stats., that is designated by the Town of Spooner to administer this ordinance.

(2) "Agricultural facilities and practices" has the meaning given in s. 281.16, Wis. Stats.

(3) "Average annual rainfall" means a calendar year of precipitation, excluding snow, which is considered typical.

(4) "Best management practice" or "BMP" means structural or non-structural measures, practices, techniques or devices employed to avoid or minimize sediment or pollutants carried in runoff to waters of the state.

(5) "Business day" means a day the office of the Town Engineer is routinely and customarily open for business.

(6) "Cease and desist order" means a court-issued order to halt land disturbing construction activity that is being conducted without the required permit.

(7) "Combined sewer system" means a system for conveying both sanitary sewage and storm water runoff.

(8) "Connected imperviousness" means an impervious surface that is directly connected to a separate storm sewer or water of the state via an impervious flow path.

(9) "Design storm" means a hypothetical discrete rainstorm characterized by a specific duration, temporal distribution, rainfall intensity, return frequency, and total depth of rainfall.

(10) "Development" means residential, commercial, industrial or institutional land uses and associated roads.

(11) "Division of land" means the creation from one parcel of five (5) or more parcels or building sites of three (3) or fewer acres each in area where such creation occurs at one time or through the successive partition within a 5 year period.

(12) “Effective infiltration area” means the area of the infiltration system that is used to infiltrate runoff and does not include the area used for site access, berms or pretreatment.

(13) “Erosion” means the process by which the land’s surface is worn away by the action of wind, water, ice or gravity.

(14) "Exceptional resource waters" means waters listed in s. NR 102.11, Wis. Adm. Code.

(15) “Extraterritorial” means the unincorporated area within 3 miles of the corporate limits of a first, second, or third class city, or within 1.5 miles of a fourth class city or village.

(16) "Final stabilization" means that all land disturbing construction activities at the construction site have been completed and that a uniform, perennial, vegetative cover has been established, with a density of at least 70% of the cover, for the unpaved areas and areas not covered by permanent structures, or employment of equivalent permanent stabilization measures.

(17) “Financial guarantee” means a performance bond, maintenance bond, surety bond, irrevocable letter of credit, or similar guarantees submitted to the Town Engineer by the responsible party to assure that requirements of the ordinance are carried out in compliance with the storm water management plan.

(18) “Governing body” means town board of supervisors.

(19) “Impervious surface” means an area that releases as runoff all or a large portion of the precipitation that falls on it, except for frozen soil. Rooftops, sidewalks, driveways, parking lots and streets are examples of areas that typically are impervious.

(20) “In-fill area” means an undeveloped area of land located within existing development.

(21) “Infiltration” means the entry of precipitation or runoff into or through the soil.

(22) “Infiltration system” means a device or practice such as a basin, trench, rain garden or swale designed specifically to encourage infiltration, but does not include natural infiltration in pervious surfaces such as lawns, redirecting of rooftop downspouts onto lawns or minimal infiltration from practices, such as swales or road side channels designed for conveyance and pollutant removal only.

(23) “Karst feature” means an area or surficial geologic feature subject to bedrock dissolution so that it is likely to provide a conduit to groundwater, and may include caves, enlarged fractures, mine features, exposed bedrock surfaces, sinkholes, springs, seeps or swallets.

(24) “Land disturbing construction activity” means any man-made alteration of the land surface resulting in a change in the topography or existing vegetative or non-vegetative soil cover, that may result in runoff and lead to an increase in soil erosion and movement of sediment into waters of the state. Land disturbing construction activity includes clearing and grubbing, demolition, excavating, pit trench dewatering, filling and grading activities.

(25) “Maintenance agreement” means a legal document that provides for long-term maintenance of storm water management practices.

(26) “MEP” or “maximum extent practicable” means a level of implementing best management practices in order to achieve a performance standard specified in this ordinance which takes into account the best available technology, cost effectiveness and other competing issues such as human safety and welfare, endangered and threatened resources, historic properties and geographic features. MEP allows flexibility in the way to meet the performance standards and may vary based on the performance standard and site conditions.

(27) “New development” means development resulting from the conversion of previously undeveloped land or agricultural land uses.

(28) “Off-site” means located outside the property boundary described in the permit application.

(29) “On-site” means located within the property boundary described in the permit application.

(30) "Ordinary high-water mark" has the meaning given in s. NR 115.03(6), Wis. Adm. Code.

(31) “Outstanding resource waters” means waters listed in s. NR 102.10, Wis. Adm. Code.

(32) “Percent fines” means the percentage of a given sample of soil, which passes through a # 200 sieve.

(33) “Performance standard” means a narrative or measurable number specifying the minimum acceptable outcome for a facility or practice.

(34) “Permit” means a written authorization made by the Town Engineer to the applicant to conduct land disturbing construction activity or to discharge post-construction runoff to waters of the state.

(35) “Permit administration fee” means a sum of money paid to the Town Engineer by the permit applicant for the purpose of recouping the expenses incurred by the authority in administering the permit.

(36) “Pervious surface” means an area that releases as runoff a small portion of the precipitation that falls on it. Lawns, gardens, parks, forests or other similar vegetated areas are examples of surfaces that typically are pervious.

(37) “Pollutant” has the meaning given in s. 283.01(13), Wis. Stats.

(38) “Pollution” has the meaning given in s. 281.01(10), Wis. Stats.

(39) “Post-construction site" means a construction site following the completion of land disturbing construction activity and final site stabilization.

(40) “Pre-development condition” means the extent and distribution of land cover types present before the initiation of land disturbing construction activity, assuming that all land uses prior to development activity are managed in an environmentally sound manner.

(41) “Preventive action limit” has the meaning given in s. NR 140.05(17), Wis. Adm. Code.

(42) "Redevelopment ” means areas where development is replacing older development.

(43) “Responsible party” means any entity holding fee title to the property or other person contracted or obligated by other agreement to implement and maintain post-construction storm water BMPs.

(44) “Runoff” means storm water or precipitation including rain, snow or ice melt or similar water that moves on the land surface via sheet or channelized flow.

(45) “Separate storm sewer” means a conveyance or system of conveyances including roads with drainage systems, streets, catch basins, curbs, gutters, ditches, constructed channels or storm drains, which meets all of the following criteria:

(a) Is designed or used for collecting water or conveying runoff.

(b) Is not part of a combined sewer system.

(c) Is not draining to a storm water treatment device or system.

(d) Discharges directly or indirectly to waters of the state.

(46) “Site” means the entire area included in the legal description of the land on which the land disturbing construction activity occurred.

(47) “Stop work order” means an order issued by the Town Engineer which requires that all construction activity on the site be stopped.

(48) “Storm water management plan” means a comprehensive plan designed to reduce the discharge of pollutants from storm water after the site has under gone final stabilization following completion of the construction activity.

(49) “Storm water management system plan” is a comprehensive plan designed to reduce the discharge of runoff and pollutants from hydrologic units on a regional or municipal scale.

(50) "Technical standard" means a document that specifies design, predicted performance and operation and maintenance specifications for a material, device or method.

(51) “Top of the channel” means an edge, or point on the landscape, landward from the ordinary high-water mark of a surface water of the state, where the slope of the land begins to be less than 12% continually for at least 50 feet. If the slope of the land is 12% or less continually for the initial 50 feet, landward from the ordinary high-water mark, the top of the channel is the ordinary high-water mark.

(52) “TR-55” means the United States Department of Agriculture, Natural Resources Conservation Service (previously Soil Conservation Service), Urban Hydrology for Small Watersheds, Second Edition, Technical Release 55, June 1986.

(53) “Type II distribution” means a rainfall type curve as established in the “United States Department of Agriculture, Soil Conservation Service, Technical Paper 149, published 1973”. The Type II curve is applicable to all of Wisconsin and represents the most intense storm pattern.

(54) “Waters of the state” has the meaning given in s. 281.01 (18), Wis. Stats.

**10.06 TECHNICAL STANDARDS.**

The following methods shall be used in designing the water quality, peak flow shaving and infiltration components of storm water practices needed to meet the water quality standards of this ordinance:

(1) Technical standards identified, developed or disseminated by the Wisconsin Department of Natural Resources under subchapter V of chapter NR 151, Wis. Adm. Code.

(2) Where technical standards have not been identified or developed by the Wisconsin Department of Natural Resources, other technical standards may be used provided that the methods have been approved by the Town Engineer.

(3) In this ordinance, the following year and location have been selected as average annual rainfall(s): Duluth, 1975 (Mar. 24 –Nov. 19)]

**10.07 PERFORMANCE STANDARDS.**

(1) RESPONSIBLE PARTY. The responsible party shall implement a post-construction storm water management plan that incorporates the requirements of this section.

(2) PLAN. A written storm water management plan in accordance with 10.09 shall be developed and implemented for each post-construction site.

(3) REQUIREMENTS. The plan required under sub. (2) shall include the following:

(a) TOTAL SUSPENDED SOLIDS. BMPs shall be designed, installed and maintained to control total suspended solids carried in runoff from the post-construction site as follows:

1. For new development, by design, reduce to the maximum extent practicable, the total suspended solids load by 80%, based on the average annual rainfall, as compared to no runoff management controls. No person shall be required to exceed an 80% total suspended solids reduction to meet the requirements of this subdivision.
2. For redevelopment, by design, reduce to the maximum extent practicable, the total suspended solids load by 40%, based on the average annual rainfall, as compared to no runoff management controls. No person shall be required to exceed a 40% total suspended solids reduction to meet the requirements of this subdivision.
3. For in-fill development under 5 acres that occurs within 10 years after the effective date of this rule …[revisor insert date], by design, reduce to the maximum extent practicable, the total suspended solids load by 40%, based on an average annual rainfall, as compared to no runoff management controls. No person shall be required to exceed a 40% total suspended solids reduction to meet the requirements of this subdivision.
4. For in-fill development that occurs 10 or more years after the effective date of this rule…[revisor insert date], by design, reduce to the maximum extent practicable, the total suspended solids load by 80%, based on an average annual rainfall, as compared to no runoff management controls. No person shall be required to

exceed an 80% total suspended solids reduction to meet the requirements of this subdivision.

5. Notwithstanding subds. 1. to 4., if the design cannot achieve the applicable total suspended solids reduction specified, the storm water management plan shall include a written and site-specific explanation why that level of reduction is not attained and the total suspended solids load shall be reduced to the maximum extent practicable.

(b) PEAK DISCHARGE.

1. By design, BMPs shall be employed to maintain or reduce the peak runoff discharge rates, to the maximum extent practicable, as compared to pre-development conditions for the 2-year, 24-hour design storm applicable to the post-construction site. Pre-development conditions shall assume "good hydrologic conditions" for appropriate land covers as identified in TR-55 or an equivalent methodology. The meaning of "hydrologic soil group" and "runoff curve number" are as determined in TR-55. However, when pre-development land cover is cropland, rather than using TR-55 values for cropland, the runoff curve numbers in Table 1 shall be used.

| Table 1 – Maximum Pre-Development Runoff Curve Numbers for Cropland Areas | | | | |
|---|---|---|---|---|
| Hydrologic Soil Group | A | B | C | D |
| Runoff Curve Number | 56 | 70 | 79 | 83 |

2. This subsection of the ordinance does not apply to any of the following:
   a. A post-construction site where the change in hydrology due to development does not increase the existing surface water elevation at any point within the downstream receiving water by more than 0.01 of a foot for the 2-year, 24-hour storm event.
   b. A redevelopment post-construction site.
   c. An in-fill development area less than 5 acres.

(c) INFILTRATION. BMPs shall be designed, installed, and maintained to infiltrate runoff to the maximum extent practicable in accordance with the following, except as provided in subds. 5. through 8.

1. For residential developments one of the following shall be met:
   a. Infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 90% of the pre-development infiltration volume, based on an average annual rainfall. However, when designing

appropriate infiltration systems to meet this requirement, no more than 1% of the project site is required as an effective infiltration area.

b. Infiltrate 25% of the post-development runoff from the 2 year -24 hour design storm with a type II distribution. Separate curve numbers for pervious and impervious surfaces shall be used to calculate runoff volumes and not composite curve numbers as defined in TR-55. However, when designing appropriate infiltration systems to meet this requirement, no more than 1% of the project site is required as an effective infiltration area.

2. For non-residential development, including commercial, industrial and institutional development, one of the following shall be met:

a. Infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 60% of the pre-development infiltration volume, based on an average annual rainfall. However, when designing appropriate infiltration systems to meet this requirement, no more than 2% of the project site is required as an effective infiltration area.

b. Infiltrate 10% of the runoff from the 2 year - 24 hour design storm with a type II distribution. Separate curve numbers for pervious and impervious surfaces shall be used to calculate runoff volumes, and not composite curve numbers as defined in TR-55. However, when designing appropriate infiltration systems to meet this requirement, no more than 2% of the project site is required as an effective infiltration area.

3. Pre-development condition shall be the same as in par. (b).

4. Before infiltrating runoff, pretreatment shall be required for parking lot runoff and for runoff from new road construction in commercial, industrial and institutional areas that will enter an infiltration system. The pretreatment shall be designed to protect the infiltration system from clogging prior to scheduled maintenance and to protect groundwater quality in accordance with subd. 8. Pretreatment options may include, but are not limited to, oil/grease separation, sedimentation, biofiltration, filtration, swales or filter strips.

5. Exclusions. The runoff from the following areas are prohibited from meeting the requirements of this paragraph:

a. Areas associated with tier 1 industrial facilities identified in s. NR 216.21(2)(a), Wis. Adm. Code, including storage, loading, rooftop and parking.

b. Storage and loading areas of tier 2 industrial facilities identified in s. NR 216.21(2)(b), Wis. Adm. Code.

c. Fueling and vehicle maintenance areas.

d. Areas within 1000 feet upgradient or within 100 feet downgradient of karst features.

e. Areas with less than 3 feet separation distance from the bottom of the infiltration system to the elevation of seasonal high groundwater or the top of bedrock, except this subd. 5.e. does not prohibit infiltration of roof runoff.

f. Areas with runoff from industrial, commercial and institutional parking lots and roads and residential arterial roads with less than 5 feet separation distance from the bottom of the infiltration system to the elevation of seasonal high groundwater or the top of bedrock.

g. Areas within 400 feet of a community water system well as specified in s. NR 811.16(4), Wis. Adm. Code, or within 100 feet of a private well as specified in s. NR 812.08(4), Wis. Adm. Code, for runoff infiltrated from commercial, industrial and institutional land uses or regional devices for residential development.

h. Areas where contaminants of concern, as defined in s. NR 720.03(2), Wis. Adm. Code are present in the soil through which infiltration will occur.

i. Any area where the soil does not exhibit one of the following soil characteristics between the bottom of the infiltration system and the seasonal high groundwater and top of bedrock: at least a 3-foot soil layer with 20% fines or greater; or at least a 5-foot soil layer with 10% fines or greater. This does not apply where the soil medium within the infiltration system provides an equivalent level of protection. This subd. 5.i. does not prohibit infiltration of roof runoff.

6. Exemptions. The following are not required to meet the requirements of this paragraph:

a. Areas where the infiltration rate of the soil is less than 0.6 inches/hour measured at the site.

b. Parking areas and access roads less than 5,000 square feet for commercial and industrial development.

c. Redevelopment post-construction sites.

d. In-fill development areas less than 5 acres.

e. Infiltration areas during periods when the soil on the site is frozen.

f. Roads in commercial, industrial and institutional land uses, and arterial residential roads.

7. Where alternate uses of runoff are employed, such as for toilet flushing, laundry or irrigation, such alternate use shall be given equal credit toward the infiltration volume required by this paragraph.

8. a. Infiltration systems designed in accordance with this paragraph shall, to the extent technically and economically feasible, minimize the level of pollutants infiltrating to groundwater and shall maintain compliance with the preventive action limit at a point of standards application in accordance with ch. NR 140, Wis. Adm. Code. However, if site specific information indicates that compliance with a preventive action limit is not achievable, the infiltration BMP may not be installed or shall be modified to prevent infiltration to the maximum extent practicable.

b. Notwithstanding subd. par. a., the discharge from BMPs shall remain below the enforcement standard at the point of standards application.

(d) PROTECTIVE AREAS.

1. "Protective area" means an area of land that commences at the top of the channel of lakes, streams and rivers, or at the delineated boundary of wetlands, and that is the greatest of the following widths, as measured horizontally from the top of the channel or delineated wetland boundary to the closest impervious surface. However, in this paragraph, "protective area" does not include any area of land adjacent to any stream enclosed within a pipe or culvert, such that runoff cannot enter the enclosure at this location.

a. For outstanding resource waters and exceptional resource waters, and for wetlands in areas of special natural resource interest as specified in s. NR 103.04, 75 feet.

b. For perennial and intermittent streams identified on a United States geological survey 7.5-minute series topographic map, or a county soil survey map, whichever is more current, 50 feet.

c. For lakes, 50 feet.

d. For highly susceptible wetlands, 50 feet. Highly susceptible wetlands include the following types: fens, sedge meadows, bogs, low prairies, conifer swamps, shrub swamps, other forested wetlands, fresh wet meadows, shallow marshes, deep marshes and seasonally flooded basins. Wetland boundary delineations shall be made in accordance with s. NR 103.08(1m). This paragraph does not apply to wetlands that have been completely filled in accordance with all applicable state and federal regulations. The protective area for wetlands that have been partially filled in accordance with all applicable state and federal regulations shall be measured from the wetland boundary delineation after fill has been placed.

e. For less susceptible wetlands, 10 percent of the average wetland width, but no less than 10 feet nor more than 30 feet. Less susceptible wetlands include degraded wetlands dominated by invasive species such as reed canary grass.

f. In subd. 1.a., d. and e., determinations of the extent of the protective area adjacent to wetlands shall be made on the basis of the sensitivity and runoff susceptibility of the wetland in accordance with the standards and criteria in s. NR 103.03.

g. For concentrated flow channels with drainage areas greater than 130 acres, 10 feet.

2. This paragraph applies to post-construction sites located within a protective area, except those areas exempted pursuant to subd. 4.

3. The following requirements shall be met:

a. Impervious surfaces shall be kept out of the protective area to the maximum extent practicable. The storm water management plan shall contain a written site-specific explanation for any parts of the protective area that are disturbed during construction.

b. Where land disturbing construction activity occurs within a protective area, and where no impervious surface is present, adequate sod or self-sustaining vegetative cover of 70% or greater shall be established and maintained. The adequate sod or self-sustaining vegetative cover shall be sufficient to provide for bank stability, maintenance of fish habitat and filtering of pollutants from upslope overland flow areas under sheet flow

conditions. Non-vegetative materials, such as rock riprap, may be employed on the bank as necessary to prevent erosion, such as on steep slopes or where high velocity flows occur.

c. Best management practices such as filter strips, swales, or wet detention basins, that are designed to control pollutants from non-point sources may be located in the protective area.

4. This paragraph does not apply to:

a. Redevelopment post-construction sites.

b. In-fill development areas less than 5 acres.

c. Structures that cross or access surface waters such as boat landings, bridges and culverts.

d. Structures constructed in accordance with s. 59.692(1v), Wis. Stats.

e. Post-construction sites from which runoff does not enter the surface water, except to the extent that vegetative ground cover is necessary to maintain bank stability.

(e) FUELING AND VEHICLE MAINTENANCE AREAS. Fueling and vehicle maintenance areas shall, to the maximum extent practicable, have BMPs designed, installed and maintained to reduce petroleum within runoff, such that the runoff that enters waters of the state contains no visible petroleum sheen.

(f) SWALE TREATMENT FOR TRANSPORTATION FACILITIES.

1. Applicability. Except as provided in subd. 2., transportation facilities that use swales for runoff conveyance and pollutant removal meet all of the requirements of this section, if the swales are designed to the maximum extent practicable to do all of the following:

a. Be vegetated. However, where appropriate, non-vegetative measures may be employed to prevent erosion or provide for runoff treatment, such as rock riprap stabilization or check dams.

b. Carry runoff through a swale for 200 feet or more in length that is designed with a flow velocity no greater than 1.5 feet per second for the peak flow generated using either a 2-year, 24-hour design storm or a 2-year storm with a duration equal to the time of concentration as appropriate. If a swale of 200 feet in length cannot be designed with a flow velocity of 1.5 feet per second or less, then the flow velocity shall be reduced to the maximum extent practicable.

2. Exemptions. The Town Engineer may, consistent with water quality standards, require other provisions of this section be met on a transportation facility with an average daily travel of vehicles greater than 2500 and where the initial surface water of the state that the runoff directly enters is any of the following:
   a. An outstanding resource water.
   b. An exceptional resource water.
   c. Waters listed in s. 303(d) of the federal clean water act that are identified as impaired in whole or in part, due to nonpoint source impacts.
   d. Waters where targeted performance standards are developed under s. NR 151.004, Wis. Adm. Code, to meet water quality standards.

(4) GENERAL CONSIDERATIONS FOR ON-SITE AND OFF-SITE STORM WATER MANAGEMENT MEASURES. The following considerations shall be observed in managing runoff:

(a) Natural topography and land cover features such as natural swales, natural depressions, native soil infiltrating capacity, and natural groundwater recharge areas shall be preserved and used, to the extent possible, to meet the requirements of this section.

(b) Emergency overland flow for all storm water facilities shall be provided to prevent exceeding the safe capacity of downstream drainage facilities and prevent endangerment of downstream property or public safety.

(5) LOCATION AND REGIONAL TREATMENT OPTION.

(a) The BMPs may be located on-site or off-site as part of a regional storm water device, practice or system.

(b) Post-construction runoff within a non-navigable surface water that flows into a BMP, such as a wet detention pond, is not required to meet the performance standards of this ordinance. Post-construction BMPs may be located in non-navigable surface waters.

(c) Except as allowed under par. (d), post-construction runoff from new development shall meet the post-construction performance standards prior to entering a navigable surface water.

(d) Post-construction runoff from any development within a navigable surface water that flows into a BMP is not required to meet the performance standards of this ordinance if:

1. The BMP was constructed prior to the effective date of this ordinance and the BMP either received a permit issued under ch. 30, Stats., or the BMP did not require a ch. 30, Wis. Stats., permit; and

2. The BMP is designed to provide runoff treatment from future upland development.

(e) Runoff from existing development, redevelopment and in-fill areas shall meet the post-construction performance standards in accordance with this paragraph.

1. To the maximum extent practicable, BMPs shall be located to treat runoff prior to discharge to navigable surface waters.
2. Post-construction BMPs for such runoff may be located in a navigable surface water if allowable under all other applicable federal, state and local regulations such as ch. NR 103, Wis. Adm. Code and ch. 30, Wis. Stats.

(f) The discharge of runoff from a BMP, such as a wet detention pond, or after a series of such BMPs is subject to this chapter.

(g) The Town Engineer may approve off-site management measures provided that all of the following conditions are met:

1. The Town Engineer determines that the post-construction runoff is covered by a storm water management system plan that is approved by the Town of Spooner and that contains management requirements consistent with the purpose and intent of this ordinance.
2. The off-site facility meets all of the following conditions:
   a. The facility is in place.
   b. The facility is designed and adequately sized to provide a level of storm water control equal to or greater than that which would be afforded by on-site practices meeting the performance standards of this ordinance.
   c. The facility has a legally obligated entity responsible for its long-term operation and maintenance.

(h) Where a regional treatment option exists such that the Town Engineer exempts the applicant from all or part of the minimum on-site storm water management requirements, the applicant shall be required to pay a fee in an amount determined in negotiation with the Town Engineer. In determining the fee for post-construction runoff, the Town Engineer shall consider an equitable distribution of the cost for land, engineering design, construction, and maintenance of the regional treatment option.

(6) ALTERNATE REQUIREMENTS. The Town Engineer may establish storm water management requirements more stringent than those set forth in this section if the Town Engineer determines that an added level of protection is needed to protect sensitive resources.

**10.08 PERMITTING REQUIREMENTS, PROCEDURES AND FEES.**

(1) PERMIT REQUIRED. No responsible party may undertake a land disturbing construction activity without receiving a post-construction runoff permit from the Town Engineer prior to commencing the proposed activity.

(2) PERMIT APPLICATION AND FEES. Unless specifically excluded by this ordinance, any responsible party desiring a permit shall submit to the Town Engineer a permit application made on a form provided by the Town Engineer for that purpose.

(a) Unless otherwise excepted by this ordinance, a permit application must be accompanied by a storm water management plan, a maintenance agreement and a non-refundable permit administration fee.

(b) The storm water management plan shall be prepared to meet the requirements of S10.07 and 09, the maintenance agreement shall be prepared to meet the requirements of 10.10, the financial guarantee shall meet the requirements of 10.11, and fees shall be those established by the Town of Spooner as set forth in 10.12.

(3) REVIEW AND APPROVAL OF PERMIT APPLICATION. The Town Engineer shall review any permit application that is submitted with a storm water management plan, maintenance agreement, and the required fee. The following approval procedure shall be used:

(a) Within fifteen (15) business days of the receipt of a complete permit application, including all items as required by sub. (2), the Town Engineer shall inform the applicant whether the application, plan and maintenance agreement are approved or disapproved based on the requirements of this ordinance.

(b) If the storm water permit application, plan and maintenance agreement are approved, or if an agreed upon payment of fees in lieu of storm water management practices is made, the Town Engineer shall issue the permit.

(c) If the storm water permit application, plan or maintenance agreement is disapproved, the Town Engineer shall detail in writing the reasons for disapproval.

(d) The Town Engineer may request additional information from the applicant. If additional information is submitted, the Town Engineer shall have fifteen (15) business days from the date the additional information is received to inform the applicant that the plan and maintenance agreement are either approved or disapproved.

(e) Failure by the Town Engineer to inform the permit applicant of a decision within thirty (30) business days of a required submittal shall be deemed to mean approval of the submittal and the applicant may proceed as if a permit had been issued.

(4) PERMIT REQUIREMENTS. All permits issued under this ordinance shall be subject to the following conditions, and holders of permits issued under this ordinance shall be deemed to have accepted these conditions. The Town Engineer may suspend or revoke a permit for violation of a permit condition, following written notification of the responsible party. An action by the Town Engineer to suspend or revoke this permit may be appealed in accordance with 10.14.

(a) Compliance with this permit does not relieve the responsible party of the responsibility to comply with other applicable federal, state, and local laws and regulations.

(b) The responsible party shall design and install all structural and non-structural storm water management measures in accordance with the approved storm water management plan and this permit.

(c) The responsible party shall notify the Town Engineer at least five (5) business days before commencing any work in conjunction with the storm water management plan, and within five (5) business days upon completion of the storm water management practices. If required as a special condition under sub. (5), the responsible party shall make additional notification according to a schedule set forth by the Town Engineer so that practice installations can be inspected during construction.

(d) Practice installations required as part of this ordinance shall be certified "as built" by a licensed professional engineer. Completed storm water management practices must pass a final inspection by the Town Engineer or its designee to determine if they are in accordance with the approved storm water management plan and ordinance. The Town Engineer or its designee shall notify the responsible party in writing of any changes required in such practices to bring them into compliance with the conditions of this permit.

(e) The responsible party shall notify the Town Engineer of any significant modifications it intends to make to an approved storm water management plan. The Town Engineer may require that the proposed modifications be submitted to it for approval prior to incorporation into the storm water management plan and execution by the responsible party.

(f) The responsible party shall maintain all storm water management practices in accordance with the storm water management plan until the practices either become the responsibility of the Town of Spooner, or are transferred to subsequent private owners as specified in the approved maintenance agreement.

(g) The responsible party authorizes the Town Engineer to perform any work or operations necessary to bring storm water management measures into conformance with the approved storm water management plan, and consents to a special assessment or charge against the property as authorized under subch. VII of ch. 66, Wis. Stats., or to charging such costs against the financial guarantee posted under 10.11.

(h) If so directed by the Town Engineer, the responsible party shall repair at the responsible party's own expense all damage to adjoining municipal facilities and drainage ways caused by runoff, where such damage is caused by activities that are not in compliance with the approved storm water management plan.

(i) The responsible party shall permit property access to the Town Engineer or its designee for the purpose of inspecting the property for compliance with the approved storm water management plan and this permit.

(j) Where site development or redevelopment involves changes in direction, increases in peak rate and/or total volume of runoff from a site, the Town Engineer may require the responsible party to make appropriate legal arrangements with affected property owners concerning the prevention of endangerment to property or public safety.

(k) The responsible party is subject to the enforcement actions and penalties detailed in 10.13, if the responsible party fails to comply with the terms of this permit.

(5) PERMIT CONDITIONS. Permits issued under this subsection may include conditions established by Town Engineer in addition to the requirements needed to meet the performance standards in 10.07 or a financial guarantee as provided for in 10.11.

(6) PERMIT DURATION. Permits issued under this section shall be valid from the date of issuance through the date the Town Engineer notifies the responsible party that all storm water management practices have passed the final inspection required under sub. (4)(d).

**10.09 STORM WATER MANAGEMENT PLAN.**

(1) PLAN REQUIREMENTS. The storm water management plan required under 10.08 (2) shall contain at a minimum the following information:

(a) Name, address, and telephone number for the following or their designees: landowner; developer; project engineer for practice design and certification; person(s) responsible for installation of storm water management practices; and person(s) responsible for maintenance of storm water management practices prior to the transfer, if any, of maintenance responsibility to another party.

(b) A proper legal description of the property proposed to be developed, referenced to the U.S. Public Land Survey system or to block and lot numbers within a recorded land subdivision plat.

(c) Pre-development site conditions, including:

1. One or more site maps at a scale of not less than 1 inch equals one hundred (100) feet. The site maps shall show the following: site location and legal

property description; predominant soil types and hydrologic soil groups; existing cover type and condition; topographic contours of the site at a scale not to exceed one hundred (100) feet; topography and drainage network including enough of the contiguous properties to show runoff patterns onto, through, and from the site; watercourses that may affect or be affected by runoff from the site; flow path and direction for all storm water conveyance sections; watershed boundaries used in hydrology determinations to show compliance with performance standards; lakes, streams, wetlands, channels, ditches, and other watercourses on and immediately adjacent to the site; limits of the 100 year floodplain; location of wells and wellhead protection areas covering the project area and delineated pursuant to s. NR 811.16, Wis. Adm. Code.

2. Hydrology and pollutant loading computations as needed to show compliance with performance standards. All major assumptions used in developing input parameters shall be clearly stated. The geographic areas used in making the calculations shall be clearly cross-referenced to the required map(s).

(d) Post-development site conditions, including:

1. Explanation of the provisions to preserve and use natural topography and land cover features to minimize changes in peak flow runoff rates and volumes to surface waters and wetlands.
2. Explanation of any restrictions on storm water management measures in the development area imposed by wellhead protection plans and ordinances.
3. One or more site maps at a scale of not less than 1 inch equals one hundred (100) feet showing the following: post-construction pervious areas including vegetative cover type and condition; impervious surfaces including all buildings, structures, and pavement; post-construction topographic contours of the site at a scale not to exceed one hundred (100) feet; post-construction drainage network including enough of the contiguous properties to show runoff patterns onto, through, and from the site; locations and dimensions of drainage easements; locations of maintenance easements specified in the maintenance agreement; flow path and direction for all storm water conveyance sections; location and type of all storm water management conveyance and treatment practices, including the on-site and off-site tributary drainage area; location and type of conveyance system that will carry runoff from the drainage and treatment practices to the nearest adequate outlet such as a curbed street, storm drain, or natural drainage way; watershed boundaries used in hydrology and pollutant loading calculations

and any changes to lakes, streams, wetlands, channels, ditches, and other watercourses on and immediately adjacent to the site.

4. Hydrology and pollutant loading computations as needed to show compliance with performance standards. The computations shall be made for each discharge point in the development, and the geographic areas used in making the calculations shall be clearly cross-referenced to the required map(s).

5. Results of investigations of soils and groundwater required for the placement and design of storm water management measures. Detailed drawings including cross-sections and profiles of all permanent storm water conveyance and treatment practices.

(e) A description and installation schedule for the storm water management practices needed to meet the performance standards in 10.07.

(f) A maintenance plan developed for the life of each storm water management practice including the required maintenance activities and maintenance activity schedule.

(g) Cost estimates for the construction, operation, and maintenance of each storm water management practice.

(h) Other information requested in writing by the Town Engineer to determine compliance of the proposed storm water management measures with the provisions of this ordinance.

(i) All site investigations, plans, designs, computations, and drawings shall be certified by the Town Engineer to be prepared in accordance with accepted engineering practice and requirements of this ordinance.

(2) ALTERNATE REQUIREMENTS. The Town Engineer may prescribe alternative submittal requirements for applicants seeking an exemption to on-site storm water management performance standards under 10.07 (5).

**10.10 MAINTENANCE AGREEMENT.**

(1) MAINTENANCE AGREEMENT REQUIRED. The maintenance agreement required under 10.08 (2) for storm water management practices shall be an agreement between the Town Engineer and the responsible party to provide for maintenance of storm water practices beyond the duration period of this permit. The maintenance agreement shall be filed with the County Register of Deeds as a property deed restriction so that it is binding upon all subsequent owners of the land served by the storm water management practices.

(2) AGREEMENT PROVISIONS. The maintenance agreement shall contain the following information and provisions and be consistent with the maintenance plan required by 10.09(1)(f):

(a) Identification of the storm water facilities and designation of the drainage area served by the facilities.

(b) A schedule for regular maintenance of each aspect of the storm water management system consistent with the storm water management plan required under 10.08 (2).

(c) Identification of the responsible party(s), organization or city, county, town or village responsible for long term maintenance of the storm water management practices identified in the storm water management plan required under 10.08 (2).

(d) Requirement that the responsible party(s), organization, or city, county, town or village shall maintain storm water management practices in accordance with the schedule included in par. (b).

(e) Authorization for the Town Engineer to access the property to conduct inspections of storm water management practices as necessary to ascertain that the practices are being maintained and operated in accordance with the agreement.

(f) A requirement on the Town Engineer to maintain public records of the results of the site inspections, to inform the responsible party responsible for maintenance of the inspection results, and to specifically indicate any corrective actions required to bring the storm water management practice into proper working condition.

(g) Agreement that the party designated under par. (c), as responsible for long term maintenance of the storm water management practices, shall be notified by the Town Engineer of maintenance problems which require correction. The specified corrective actions shall be undertaken within a reasonable time frame as set by the Town Engineer.

(h) Authorization of the Town Engineer to perform the corrected actions identified in the inspection report if the responsible party designated under par. (c) does not make the required corrections in the specified time period. The Town Engineer shall enter the amount due on the tax rolls and collect the money as a special charge against the property pursuant to subch. VII of ch. 66, Wis. Stats.

**10.11 FINANCIAL GUARANTEE.**

(1) ESTABLISHMENT OF THE GUARANTEE. The Town Engineer may require the submittal of a financial guarantee, the form and type of which shall be acceptable to the Town Engineer. The financial guarantee shall be in an amount determined by the Town Engineer to be the estimated cost of construction and the estimated cost of maintenance of the storm water management practices during the period which the designated party in the maintenance agreement has maintenance responsibility. The financial guarantee shall give the Town Engineer the authorization to use the funds to complete the storm water management practices if the responsible party defaults or does not properly implement the approved storm water management

plan, upon written notice to the responsible party by the Town Engineer that the requirements of this ordinance have not been met.

(2) CONDITIONS FOR RELEASE. Conditions for the release of the financial guarantee are as follows:

(a) The Town Engineer shall release the portion of the financial guarantee established under this section, less any costs incurred by the Town Engineer to complete installation of practices, upon submission of "as built plans" by a licensed professional engineer. The Town Engineer may make provisions for a partial pro-rata release of the financial guarantee based on the completion of various development stages.

(b) The Town Engineer shall release the portion of the financial guarantee established under this section to assure maintenance of storm water practices, less any costs incurred by the Town Engineer, at such time that the responsibility for practice maintenance is passed on to another entity via an approved maintenance agreement.

**10.12 FEE SCHEDULE.**

The fees referred to in other sections of this ordinance shall be established by the Town Engineer and may from time to time be modified by resolution. A schedule of the fees established by the Town Engineer shall be available for review in the Town Hall.

**10.13 ENFORCEMENT.**

(1) Any land disturbing construction activity or post-construction runoff initiated after the effective date of this ordinance by any person, firm, association, or corporation subject to the ordinance provisions shall be deemed a violation unless conducted in accordance with the requirements of this ordinance.

(2) The Town Engineer shall notify the responsible party by certified mail of any non-complying land disturbing construction activity or post-construction runoff. The notice shall describe the nature of the violation, remedial actions needed, a schedule for remedial action, and additional enforcement action which may be taken.

(3) Upon receipt of written notification from the Town Engineer under sub. (2), the responsible party shall correct work that does not comply with the storm water management plan or other provisions of this permit. The responsible party shall make corrections as necessary to meet the specifications and schedule set forth by the Town Engineer in the notice.

(4) If the violations to a permit issued pursuant to this ordinance are likely to result in damage to properties, public facilities, or waters of the state, the Town Engineer may enter the land and take emergency actions necessary to prevent such damage. The costs incurred by the Town Engineer plus interest and legal costs shall be billed to the responsible party.

(5) The Town Engineer is authorized to post a stop work order on all land disturbing construction activity that is in violation of this ordinance, or to request the Town's Attorney to obtain a cease and desist order in any court with jurisdiction.

(6) The Town Engineer may revoke a permit issued under this ordinance for non-compliance with ordinance provisions.

(7) Any permit revocation, stop work order, or cease and desist order shall remain in effect unless retracted by the Town Engineer or by a court with jurisdiction.

(8) The Town Engineer is authorized to refer any violation of this ordinance, or of a stop work order or cease and desist order issued pursuant to this ordinance, to the Town's Attorney for the commencement of further legal proceedings in any court with jurisdiction.

(9) Any person, firm, association, or corporation who does not comply with the provisions of this ordinance shall be subject to a forfeiture of not less than one hundred (100) dollars or more than one hundred (100) dollars per offense, together with the costs of prosecution. Each day that the violation exists shall constitute a separate offense.

(10) Compliance with the provisions of this ordinance may also be enforced by injunction in any court with jurisdiction. It shall not be necessary to prosecute for forfeiture or a cease and desist order before resorting to injunctional proceedings.

(11) When the Town Engineer determines that the holder of a permit issued pursuant to this ordinance has failed to follow practices set forth in the storm water management plan, or has failed to comply with schedules set forth in said storm water management plan, the Town Engineer or a party designated by the Town Engineer may enter upon the land and perform the work or other operations necessary to bring the condition of said lands into conformance with requirements of the approved plan. The Town Engineer shall keep a detailed accounting of the costs and expenses of performing this work. These costs and expenses shall be deducted from any financial security posted pursuant to 10.11 of this ordinance. Where such a security has not been

established, or where such a security is insufficient to cover these costs, the costs and expenses shall be entered on the tax roll as a special charge against the property and collected with any other taxes levied thereon for the year in which the work is completed.

**10.14 APPEALS.**

(1) BOARD OF APPEALS. The board of appeals, created pursuant to section 10 of the Town of Spooner ordinances pursuant to 60.65, Wis. Stats, shall hear and decide appeals where it is alleged that there is error in any order, decision or determination made by the Town Engineer in administering this ordinance. The board shall also use the rules, procedures, duties, and powers authorized by statute in hearing and deciding appeals. Upon appeal, the board may authorize variances from the provisions of this ordinance that are not contrary to the public interest, and where owing to special conditions a literal enforcement of the ordinance will result in unnecessary hardship.

(2) WHO MAY APPEAL. Appeals to the board of appeals may be taken by any aggrieved person or by an officer, department, board, or bureau of the Town of Spooner affected by any decision of the Town Engineer.

**10.15 SEVERABILITY.**

If any section, clause, provision or portion of this ordinance is judged unconstitutional or invalid by a court of competent jurisdiction, the remainder of the ordinance shall remain in force and not be affected by such judgment.

**10.16 EFFECTIVE DATE.**

This ordinance shall be in force and effect from and after its adoption and publication. The above and foregoing ordinance was duly adopted by the Town of Spooner on the _____day of _____, 2007.

Approved: _____

Attested _____

Published on [day, month, year].

**TOWN OF SPOONER**
**CHAPTER 12**

**ESTABLISHING REGULATIONS FOR LAWN FERTILIZER APPLICATION AND SALE**



**12.01 AUTHORITY.** This chapter is recommended by the Town of Spooner Plan Commission and adopted by the Town of Spooner Board under the authority of s. 60.627, Wis. Stats.

**12.02 PURPOSE AND INTENT.** The Town of Spooner's Board finds that the Town of Spooner's lakes and streams are a natural asset, which enhance the environmental, recreational, cultural and economic resources of the area and contribute to the general health and welfare of the public. The Board further finds that regulating the amount of nutrients and contaminants, including phosphorus contained in fertilizer, entering the lakes will improve and maintain lake water quality.

**12.03 APPLICABILITY.**

**(1)** This ordinance applies in all areas of the Town of Spooner.

**12.04 DEFINITIONS.**

**(1)** *Agricultural use* has the meaning set forth in sec. 10.01(2a).

**(2)** *Fertilizer* has the meaning set forth in sec. 94.64(1)(e), Wis. Stats.

**(3)** *Lawn fertilizer* means any fertilizer, whether distributed by property owner, renter or commercial entity, distributed for nonagricultural use, such as for lawns, golf courses, parks and cemeteries. *Lawn fertilizer* does not include fertilizer products intended primarily for garden and indoor plant application.

**12.05 REGULATION OF THE USE AND APPLICATION OF LAWN FERTILIZER.**

**(1)** Effective _____, ____, no person shall apply any lawn fertilizer within the Town of Spooner that is labeled as containing more than 0.5% phosphorus or other compound containing phosphorus, such as phosphate, except as provided in section 12.06.

**(2)** No lawn fertilizer shall be applied when the ground is frozen.

**(3)** No person shall apply fertilizer to any impervious surface including parking lots, roadways, and sidewalks. If such application occurs, the fertilizer must be immediately contained and either legally applied to turf or placed in an appropriate container.

**12.06 EXEMPTIONS.** The prohibition against the use of fertilizer under section 12.05 shall not apply to:

**(1)** Newly established turf or lawn areas during their first growing season.

**(2)** Turf or lawn areas that soil tests, performed within the past three years by a state certified soil testing laboratory, confirm are below phosphorus levels established by the University of Wisconsin Extension Service. The lawn fertilizer application shall not contain an amount of phosphorus exceeding the amount and rate of application recommended in the soil test evaluation.

**(3)** Agricultural uses, vegetable and flower gardens, or application to trees or shrubs.

**(4)** Yard waste compost, biosolids or other similar materials that are primarily organic in nature and are applied to improve the physical condition of the soil.

**12.07 SALE OF FERTILIZER CONTAINING PHOSPHORUS. (1)** Effective _____, 200_, no person shall sell or offer for sale any lawn fertilizer within the Town of Spooner that is labeled as containing more than 0.5% phosphorus, or other compound containing phosphorus, such as phosphate, except such

fertilizer may be sold for use as provided in section 12.06.

**(2)** Effective _____, 200_, no person shall display lawn fertilizer containing phosphorus. Signs may be posted advising customers that lawn fertilizer containing phosphorus is available upon request for uses permitted by s. 12.06. 12.01 – 12.07(2)

**(3)** Effective _____, 200_, a sign containing the regulations set forth in this ordinance and the effects of phosphorus on the Town of Spooner's waters must be prominently displayed where lawn fertilizers are sold.

**12.08 ENFORCEMENT.** Violations of this ordinance will be enforced by the Environmental Health Section of the Public Health Division, Department of Human Services.

**12.09 PENALTY.** Any person who violates section 12.05 in the application of fertilizer at his or her residence shall be subject to a forfeiture of $25 per violation. Any commercial fertilizer applicator, residential or commercial developer, industrial or commercial owner, or other person who violates section 12.05, and any person who violates section 12.07, shall be subject to a forfeiture of $50 for the first violation within a twelve month period, $150 for the second violation within a twelve month period, and $300 for the third and each subsequent violation within a twelve month period.

**12.10 SEVERABILITY CLAUSE.** If any section, provision or portion of this ordinance is ruled invalid by a court, the remainder of the ordinance shall not for that reason be rendered ineffective or invalid.

**12.11 EFFECTIVE DATE** This ordinance shall be in force and effective from after its adoption and publication. The above foregoing ordinance was duly adopted by the Town of Spooner Board on the _____ day of _____, 200_.

APPROVED: _____

ATTESTED: _____

PUBLISHED: _____

# Appendix D
# Washburn County Objectives

## Objectives and activities

An implementation strategy is provided for each goal in the following section. The objectives are the detailed and readily measurable steps toward reaching each goal. Activities provide the means for reaching the objectives.

### Goal I

### Protect and restore aquatic and near shore fish and wildlife habitats and encourage their appreciation.

### Objectives

A. Minimize disturbance to aquatic and near shore habitat.
B. Identify and protect critical aquatic and wetland habitat corridors and other environmentally sensitive areas.
C. Protect wild lake and river shorelines.
D. Eradicate and/or control exotic plant and animal species.
E. Restore wetland habitat.

### Activities[11] (related objectives in parentheses)

1. **Implement educational strategy activities. (A – E)**
2. **Provide technical assistance and cost sharing (as appropriate) to implement shoreline buffer and construction site erosion control requirements in the shoreland zoning ordinance. (A, B, D)**
3. **Encourage and assist lake organizations in pursuing lake management plans and lake protection projects. (A, B)**
4. Encourage land conservancy tools and use incentives to compensate landowners for protecting and restoring near shore and other important habitat and environmental corridors. (A, B, C)
5. Provide technical assistance and serve as an advisor for town and county comprehensive planning. (A - D)
6. Participate in exotic species prevention efforts. (D)
7. Utilize cost share programs and provide technical assistance to restore wetlands. (E)

### Evaluation Methods (responsible party)

Loon nesting success (*Project Loon Watch* volunteers)
National frog and toad survey (volunteers)
Aerial photography to track changes in aquatic plant beds and shoreline vegetation (Washburn Land Information)
Aquatic plant sensitive areas (DNR)
Habitat inventories of streams and lakes (DNR)
Track plan activities (LWCD)

[11] Activities are listed in priority order with the highest priority activities in bold.

*AQUATIC AND NEAR SHORE HABITAT EDUCATIONAL STRATEGY*

## Educational Objectives

ED1. Increase landowner understanding of the significance of habitat elements in the water and near the shore and the means to protect them.

## Target Audience

Shoreland property owners
Resort owners
Landscapers and contractors
Lake users
Federal, state, county, and township staff and elected officials
Judges, district attorneys, and corporation councils
Media contacts
Realtors
School children
Youth organizations: 4-H, boy scouts, girl scouts, etc.
Civic organizations

## Messages

- Techniques and assistance are available for restoring shoreline habitat.
- Shoreline and aquatic habitat are being lost rapidly; now is the best time to begin protection and restoration efforts.
- Shoreline and aquatic habitats are home to a diverse variety of creatures; if we preserve their homes, we can enjoy their presence.
- Aquatic insects are a critical part of the food chain.
- We are protecting shoreline and aquatic habitats for future generations to experience.
- Shoreline regulations are in place to protect habitat for fish and wildlife, stabilize the shoreline, limit visual impacts of development, etc..
- Regulations and their enforcement do not always adequately protect habitat.
- Cost sharing is available to restore wetlands.
- Wetlands provide critical wildlife habitat - give specific examples of wetland types and the habitat element they provide (e.g., small wetland pools for amphibian reproduction).
- Protecting wetlands in their natural state is very important; functions and values can not be completely replaced with restoration.

## Educational Activities

1. Outreach to all shoreland landowners: develop shoreland property owners guidebook, support neighbor-to neighbor contacts, recognize good stewardship, compile and distribute information regarding shoreland restoration techniques and assistance available.
2. Shoreland habitat activities for schools and children.
3. Exotic species eradication training and education.
4. Sigurd Olson Institute Project Loon Watch or similar program to train landowners to appreciate loons and their habitat and to verify program success.
5. Shoreland restoration demonstration sites.
6. Outreach on importance of effective regulations and enforcement: workshops, demonstrations, visual presentations that target government and judicial staff and elected officials.

## Goal II
## Protect and enhance lakes, streams, and wetlands by managing nutrient and sediment inputs.

### Objectives

A. Control watershed sources of nutrients and sediment especially from waterfront property, forestry practices, priority agricultural areas,[12] and roads.

B. Obtain compliance with the state agricultural performance standards.

C. Establish buffers of vegetation next to lakes, streams, and wetlands on waterfront property and priority agricultural areas.

### Activities[13]

1. **Utilize/administer cost share programs to establish best management practices to reduce nutrient and sediment sources. (A - C)**
2. **Implement educational strategy activities. (A – C)**
3. **Enforce construction site erosion control requirements for single family dwellings and assist DNR with road construction erosion control regulations. (A)**
4. **Implement the agricultural performance standards strategy with information, inventory, cost sharing, technical assistance, and enforcement (if necessary). Emphasize priority farms as described in Appendix A. (A - C)**
5. Revise and enforce the Washburn County Animal Waste Ordinance to incorporate the agricultural performance standards. (B)
6. Emphasize standards that protect water resources from the impacts of development especially during regulation revision and implementation. (A – C)
7. Investigate the possibility of a county-sponsored cost share program for agriculture and residential shoreland best management practices. (A - C)

### Evaluation Methods (responsible party)

Self-help monitoring -Secchi disk data (lake volunteers with DNR assistance)
Water quality monitoring (DNR)
Inventory existing animal waste facilities; identify facilities out of compliance with the agricultural performance standards. (Washburn LWCD)
Annual transect survey (Washburn LWCD)
Conservation plan annual status review (Washburn LWCD)
Track plan activities (Washburn LWCD)

[12] Priority agricultural areas are described on page 25 for soil erosion control and in Appendix A for implementation of the agricultural performance standards.
[13] Activities are listed in priority order with the highest priority activities in bold.

*NUTRIENT AND SEDIMENT EDUCATIONAL STRATEGY*

## Target Audience

Shoreland property owners, lake associations and districts
Farm owners and operators, cranberry growers
Golf course owners/superintendents
Excavating and home building contractors, landscapers
County and town road departments
Foresters and loggers, Wisconsin County Forestry Association
Municipalities (stormwater management)
Youth (beginner training for ATV, boating, snowmobile, hunter safety), schools
Media - local papers, area television

## Messages

- Phosphorus is the limiting nutrient that fuels algae blooms in lakes.
- Sediment smothers aquatic habitat and carries phosphorus.
- Managing on-farm nutrients saves money and protects water resources.
- Lawns generally do not need phosphorus fertilizer. Phosphorus should not be used next to water.
- Protect the integrity and value of vegetative buffers to limit nutrients and sediment entering the water.
- Native plants can be used attractively and effectively in landscaping projects.
- Construction site erosion is significant and preventable (include highway construction projects, construction planning, erosion control techniques, etc.).
- Stormwater stenciling - this drain flows to the lake or river.
- School curriculums can be targeted at specific resource issues, conservation issues, stewardship, etc.
- Privately owned wastewater treatment systems (septic systems) must be maintained properly to reduce leaching of pollutants.
- Increased impervious surfaces mean increased runoff and pollutant loading to water bodies.
- Stormwater detention can reduce the impacts of development

## Educational Activities

1. Erosion control/road building workshop for town officials.
2. Distribute information about forestry best management practices; highlight example BMPs at Wisconsin County Forestry Association tour in Washburn County.
3. Volunteer secchi disk monitoring to involve lake property owners and track progress.
4. Outreach to all shoreland landowners: develop shoreland property owners guidebook, support neighbor-to neighbor contacts, compile and distribute information regarding: importance of buffers of vegetation next to water, septic system maintenance, shoreline stabilization alternatives, residential fertilizer use (promote zero phosphorus), buffer zones/no-mow zones (demonstration areas on public properties)
5. Youth education
6. Educational needs assessment (questionnaire, workshops)
7. Storm drain stenciling (youth project within municipalities)
8. Speech, poster contests, soil judging
9. Teach ethics of operation of snowmobiles, ATVs, and boats at ATV, boating, snowmobile, hunter safety courses.
10. School sponsored water quality monitoring
11. Annual conservation awards
12. Farm demonstration projects and outreach (farmer - to - farmer) stressing conservation tillage and nutrient management
13. Promote financial incentive programs for installation of best management practices.

## Goal III
## Balance outdoor water and shoreland experiences to minimize conflicts among users and impacts to the natural environment.

### Objectives

A. Minimize conflicts among various lake users.

B. Minimize disturbance from water recreation to breeding, nesting, and brooding areas.

C. Obtain greater compliance with existing rules and regulations.

### Activities[14]

1. **Implement educational strategy activities. (A, B, C)**
2. Consider, evaluate, and recommend new regulations pertaining to water use. Base regulations on criteria such as lake size, lakeshore development, water quality, fish and wildlife species use, and sensitivity to disturbance. (A, B)
3. Research/document human impacts on water and shoreland habitat and quality. (B)

### Evaluation Methods (responsible party)

Enforcement actions taken regarding use regulations (lake organizations)
Regulations development (towns and lake districts)
Research project results (varies)
Track plan activities (Washburn LWCD)

[14] Activities are listed in priority order with the highest priority activities highlighted.

## *MINIMIZE USER CONFLICTS EDUCATIONAL STRATEGY*

### Educational Objectives

ED1. Foster understanding and appreciation of ethical use of the natural shoreland environment through active discussion and education.

### Target Audience

Shoreland property owners
Resort owners
Lake users
Federal, state, county, township staff and elected officials
Judges, district attorneys, corporation councils
Media contacts
Realtors
School children
Youth organizations: 4-H, boy scouts, girl scouts, etc.
Civic organizations

### Messages

- Respect other user groups and activities.
- Recreational activities in and near the water can negatively impact shoreland habitat.
- Identify the conflicts and user impacts.
- Improve the understanding of and respect for existing rules and regulations.
- Promote the importance of good stewardship of natural resources.
- Public trust doctrine – our waters are public resources.

### Educational Activities

**1.** Provide education about use regulations; include components of the laws and why they are in place.
2. Encourage the establishment of lake organizations by providing funding and assistance with organizing.
3. Provide outreach to landowners on both organized and unorganized lakes.
4. Assist lake organizations and landowners on unorganized lakes in mediating conflicts related to lake use.
5. Encourage cooperation between shoreline property owners and state, Federal, and local government agencies
6. Place signs at public access points. Stress respect for other users and respect for wildlife and shoreland habitats.
7. Encourage participation in UW-Extension's Adopt-A-Lake program.

## Goal IV
## Protect groundwater quality to supply clean water for drinking and recharging lakes and streams.

### Objectives

A. Nitrate test results for drinking water wells are below the drinking water standard of 10 ppm and less than twenty percent of results are above the preventative action limit of 2 ppm.
B. Unused wells are abandoned properly.
C. Drinking water is free from bacterial contamination.

### Activities[15]

1. **Implement educational strategy activities. (A – C)**
2. **Review reclamation plans for proper closure of nonmetallic mining operations. (A, C)**
3. Promote and implement cost sharing for well abandonment and manure pit closure. (A – C)
4. Offer well testing and referrals. (A, C)Map groundwater flow and identify important groundwater recharge areas where groundwater concerns are identified. (A – C)

### Evaluation Methods (responsible party)

Well water test results (landowner, UWEX)
Wells properly abandoned (NRCS and Washburn LWCD)
Track plan activities (Washburn LWCD)

[15] Activities are listed in priority order with the highest priority activities in bold.

## *GROUNDWATER QUALITY EDUCATIONAL STRATEGY*

### Educational Objectives

ED1. Audience will learn how their actions affect their own drinking water.
ED2. Homeowners will assess what they need to do to protect their drinking water quality.
ED3. Audience (private and commercial) will learn to dispose of chemicals properly.

### Target Audience

Homeowners
Landlords and renters
Underground storage tank owners: gas stations, highway departments, commercial septic system owners
Youth groups

### Messages

- Your activities on the land affect your drinking water quality and may impact lake water quality.
- Do you know what you have and where it is? (well, drainfield, tanks, etc.)
- Substitute natural organic materials for harsh chemicals.
- Flushing a chemical down the drain does not make it disappear.
- Clean sweep programs provide a disposal alternative for hazardous chemicals.
- Contaminated groundwater is very difficult to clean up (describe contaminants, residence time, cost of clean up)

### Educational Activities

1. Educate landowners about appropriate private on-site wastewater treatment (septic) system maintenance and operation.
2. Develop a groundwater quality protection education program.
   Coordinate resources available for groundwater protection
   Groundwater model for schools
   List of contaminated sites; tie to general groundwater protection
   Provide information about groundwater testing services.
3. Demonstrate and provide information about proper well abandonment.
4. Provide information about well design standards and the state well code.
5. Encourage testing of private wells.
6. Provide school teacher and youth group leader training on in-service days, or leader training sessions.
7. Encourage removal of residential underground storage tanks.

## Goal V
## Preserve and protect natural areas and agricultural lands from the negative impacts of development.

### Objectives

A. Maintain natural lands in public ownership.
B. Use voluntary measures to keep natural areas and farmland undeveloped.
C. Discourage high-density development next to and in environmentally sensitive areas and active farmland.
D. Encourage "clustered housing development" in order to preserve open space in rural areas.

### Activities[16]

1. **Complete priority activities (1-4) outlined in the educational strategy. (A, B, C, D)**
2. **Assist public and private efforts to use voluntary tools such as conservation easements and land purchases to preserve high priority lands. (B)**
3. Review proposed subdivision and other permitted impacts on identified habitat corridors and provide comments to the zoning department. (C)
4. Support the habitat protection goals contained in the Washburn County Forest Plan and extend concepts to privately owned land. (A)
5. Rank farmland for protection. (B)

### Evaluation Methods (responsible party)

Acres protected (land trust or lake organization)

[16] Activities are listed in priority order with the highest priority activities in bold.

## *LAND USE EDUCATIONAL STRATEGY*

### Target Audience

General public
Youth
Agricultural producers
Waterfront property owners
County board committees
Zoning department
Town boards
Builders associations, Developers, Realtors
Private forest owners, Forestry consultants

### Messages

- Benefits of public lands
- Different types and density of development impact agricultural and natural lands differently
- What to expect living near farms and public lands
- Increased development impacts farms, natural areas, and wildlife.
- Voluntary tools such as conservation easements can protect natural areas and farmland
- Practice low-impact development. Plan with nature to minimize disturbance.

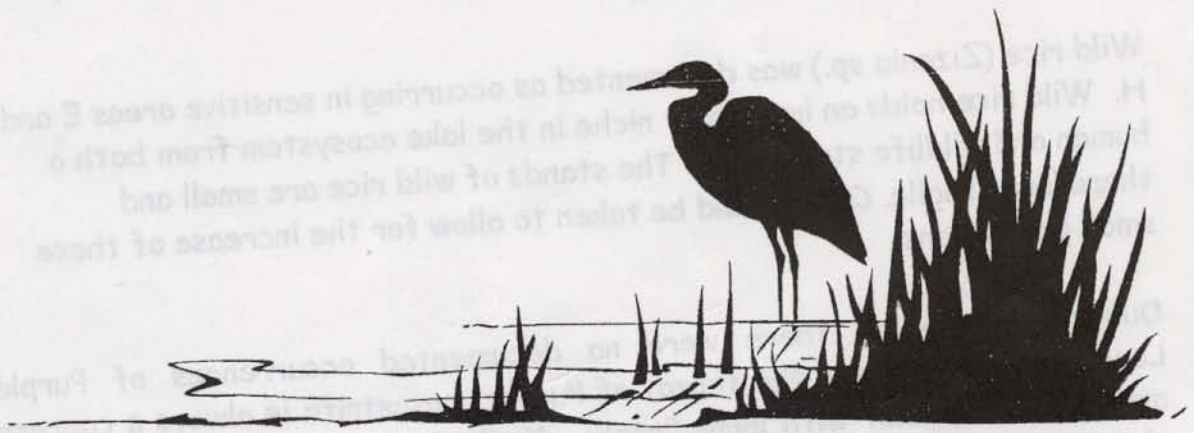
### Educational Activities[17]

1. Present information at towns association meetings, county board committees
2. Distribute written information at zoning office with permits
3. Provide articles to "the Source" a guide with county information distributed by the Spooner Advocate.
4. Provide information to columnists who cover conservation issues to local papers
5. Tours and field trips
6. Issue paper development and distribution
7. Workshop for low-impact development
8. Conservation field day for 5th graders

[17] In priority order with the first four slated for initial implementation.

# Appendix E
# Spooner Lake Sensitive Area Survey Report and Management Guidelines

# SPOONER LAKE
# SENSITIVE AREA SURVEY REPORT
# AND MANAGEMENT GUIDELINES



**This document is to be used**
**with its companion document**
**"Guidelines for protecting, maintaining,**
**and understanding lake sensitive areas"**

# Spooner Lake Integrated Sensitive Area Survey Report

Date of Survey: 29 August 2000 Number of Sensitive Areas: 9

Site Evaluators: Larry Damman, Fisheries Biologist 635-4089
Ken Jonas, Wildlife Biologist 635-4091
Mark Sundeen, Aquatic Plant Specialist 635-4074
Kurt Roblek, Water Resources Biologist 715-537-5046

**Lake Sensitive Area Survey** results identified nine areas that merit special protection of the aquatic habitat.

Wild rice (Zizania sp.) was documented as occurring in sensitive areas E and H. Wild rice holds an important niche in the lake ecosystem from both a human and wildlife standpoint. The stands of wild rice are small and therefore fragile. Care should be taken to allow for the increase of these small populations.

During this survey there were no documented occurrences of Purple Loosestrife. However, the threat of Purple Loosestrife is always a concern and should be dealt with immediately. Methods for control are to remove the entire plant before it produces seeds or by cutting the flower head and spraying with and approved herbicide. You should contact the Department before any of these methods are implemented.

The reader should consider that any buffer that does not extend back from the water edge at least 35' is not providing adequate protection for water quality and should be expanded to at least 35'. Local zoning ordinances and lakes classification systems have tried to provide better guidelines pertaining to buffer widths and set backs based on lake type. Landowners are encouraged to go beyond the minimum requirements laid out by zoning and consider extending buffer widths to beyond 35' and integrating other innovative ways to capture and reduce the runoff flowing off from their property while improving critical shoreline habitat. Berms and low head

retention areas can greatly increase the effective capture rate from developed portions in addition to that portion captured within the buffer.

Site conditions may dictate that a buffer has to be much wider than 35' to be effective at capturing the sediments and nutrients running off the developed portions of the shoreline. If the shoreline is steeply sloped (>7%slope) greater widths should definitely be used.

No mowing should take place within the buffer area (with the exception of a narrow access trail and small picnic area), and trees and shrubs should not be cut down even when they become old and die; because they provide important woody debris habitat within the buffer zone as well as aquatic habitat when they fall into the lake.

The following is a brief summary of the Spooner Lake sensitive area sites and the management guidelines. Also, the "Guidelines for Protecting, Maintaining, and Understanding Sensitive Areas" provides management guidelines and considerations for different lake sensitive areas (Attached).

I. Aquatic Plant Sensitive Areas

The following sensitive areas contain aquatic plant communities, which provide important fish and wildlife habitat as well as important shoreline stabilization functional values. Sensitive areas provide enough important habitat for the Spooner Lake ecosystem that conservation easements, deed restrictions, or zoning should be used to protect them. Management guidelines for aquatic plant sensitive areas are (unless otherwise specifically stated):

1. Limit aquatic vegetation removal to navigational channels no greater than 25 feet wide where necessary, the narrower the better. These channels should be kept as short in length as possible and it is recommended that people do not completely eliminate aquatic vegetation within the navigation channel; but instead only remove what is necessary to prevent fouling of propellers to provide access to open water areas. Chemical treatments should be discouraged and if a navigational channel

must be cleared, pulling by hand is preferable over mechanical harvesters where practical.

2. Prohibit littoral zone alterations covered by Wisconsin Statutes Chapter 30, unless there is clear evidence that such alterations would benefit the lake's ecosystem. Rock riprap permits should not be approved for areas that already have a healthy native plant community stabilizing the shoreline and property owners should not view riprap as an acceptable alternative in these situations.
3. Leave large woody debris, logs, trees, and stumps, in the littoral zone to provide habitat for fish, wildlife, and other aquatic organisms.
4. Leave an adequate shoreline buffer of un-mowed natural vegetative cover and keep access corridors as narrow as possible (preferable less than 30 feet or 30% of any developed lot which ever is less).
5. Prevent erosion, especially at construction sites. Support the development of effective county erosion control ordinances. The proper use of Best Management Practices (BMP's) will greatly reduce the potential of foreign materials entering the waterway (i.e. silt, nutrients).
6. Strictly enforce zoning ordinances and support development of new zoning regulations where needed.
7. Eliminate nutrient inputs to the lake caused by lawn fertilizers, failing septic systems, and other sources.
8. Manage for invasive/exotic species.

**Resource Value of Site A**

Sensitive area A is located at the mouth of the Yellow River above the dam. This sensitive area covers approximately 600 feet of shoreline extending out as far as 200' in shallower shoreline areas. Most of the length is dominated by a deciduous shrub/scrub wetland and an open/shallow water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average scenic beauty with minimal development.

This area provides important habitat for centrarchid (bass and panfish) and sucker species for spawning, feeding, protection and as a nursery for young.

Esocid (northern pike) will use this area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

The emergent, floating and submergent plant community structure of Sensitive area A includes: **Emergents;** arrowhead (Sagittaria sp.) and bur-reed (Sparganium sp.). **Floating leafed;** yellow pond lily (*Nuphar advena*). **Submergents;** stoneworts (Nitella sp.), white water buttercup (Ranunculus sp.), elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), water star grass (Zosterella dubia), fern leaf pondweed (Potamogeton robbinsii), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

## Resource Value of Site B

Sensitive area B is located approximately 400 feet to the East of Sensitive area A and covers 600 feet of shoreline extending out 200 feet. Most of the length is dominated by a deciduous shrub/scrub wetland and an open/shallow water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average scenic beauty with minimal development.

This area provides important habitat for large mouth bass and northern pike. These species will use the area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

The emergent and submergent plant community structure of Sensitive area B includes: **Emergents;** soft stem bulrush (Scirpus validus), pickerelweed (Pontederia cordata). **Floating;** white water lily (Nympahaea advena). **Submergents;** eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), Naiad (Najas sp.), horned pondweed (Zannichellia palustris), pipewort (Eriocaulon sp.), arrowhead (Saggitaria sp.), floating leaf pondweed (Potamogeton natans), fern leaf pondweed (P. robbinsii), large leaf pondweed (P. amplifolius), white stem pondweed (P. praelongus), fern leaf pondweed (P. richardsonii).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

## Resource Value of Site C

Sensitive area C is located on the western shore of Spooner Lake midway down the shoreline. This area covers approximately 400 feet of shoreline extending out 100 feet. Most of this length is dominated by a shrub/scrub and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has good scenic beauty with no development.

This area provides important habitat for centrarchid (panfish) and esocid (northern pike). These species will use this area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area C has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** sedges (Carex sp.), arrowhead (Saggitaria sp.), pickerelweed (Pontederia cordata), cattails (Typha sp.), bur-reed (Sparganium sp.). **Floating leafed;** yellow pond lily (Nuphar advena), duckweed (Lemna sp.). **Submergents;** white water buttercup (Ranunculus sp.), elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), naiad (Najas sp.), pipewort (Eriocaulon sp.), large leaf pondweed (Potamogeton amplifolius), clasping leaf pondweed (P. richardsonii).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

**Resource Value of Site D**

Sensitive area D is located on the southwestern shore of Spooner Lake. This area covers approximately 1,400 feet of shoreline extending out 200 feet. Most of this length is dominated by a shrub/scrub and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area rates as outstanding for natural scenic beauty.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike will use this area for spawning. Small mouth bass and panfish will use this area for feeding and protective cover. This area also provides important habitat for forage species.

Wildlife are also reliant upon this area for habitat. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area D has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** pickerelweed (Pontederia cordata), cattails (Typha sp.). **Floating leafed;** yellow pond lily (Nuphar advena), white water lily (Nymphaea odorata). **Submergents;**

elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), naiad (Najas sp.), large leaf pondweed (Potamogeton amplifolius), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

## Resource Value of Site E

Sensitive area E is located on the southern shore of Spooner Lake. This area covers approximately 800 feet of shoreline extending out 200 feet. Most of this length is dominated by a bog and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area rates as outstanding for natural scenic beauty.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and panfish will use this area for spawning, feeding, protection and as a nursery for young. Large mouth bass will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area E has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), sedges (Cares sp.), arrowhead (Sagittaria sp.), pickerelweed (Pontederia cordata), cattails (Typha sp.), blue flag iris (Iris versicolor), wild rice (Zizania sp.). **Floating leafed**; yellow pond lily (Nuphar advena). **Submergents;** elodea, coontail (Ceratophyllum demersum), eel grass (Vallisneria americana), narrow leaf pondweed (Potamogeton zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

## Resource Value of Site F

Sensitive area F is located on the southeastern shore of Spooner Lake. This area covers approximately 2,400 feet of shoreline extending out 150 feet. Most of this length is dominated by a bog and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has good natural scenic beauty with no development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area F has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), sedges (Carex sp.), arrowhead (Sagittaria sp.), cattails (Typha sp.). **Floating leafed;** duck weed (Lemna sp.), watermeal (Wolffia sp.), yellow pond lily (Nuphar advena), white water lily (Nymphaea odorata). **Submergents;** filamentous alga, coontail (Ceratophyllum demersum), common bladderwort (Utricularia vulgaris), eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), naiad (Najas sp.), floating leaf pondweed (Potamogeton natans), sago pondweed (P. pectinatus), large leaf pondweed (P. amplifolius), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis), curly leaf pondweed (P. crispus).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

## Resource Value of Site G

Sensitive area G is located on the eastern shore of Spooner Lake midway down the shoreline. This area covers approximately 500 feet of shoreline extending out 100 feet. Most of this length is dominated by a forested deciduous and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average natural scenic beauty with minimal development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area G has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), pickerelweed (Pontederia cordata), bur-reed (Sparganium sp.) **Floating leafed**; duck weed (Lemna sp.), yellow pond lily (Nuphar advena). **Submergents;** filamentous alga, northern milfoil (Myriophyllum sibiricum), large leaf pondweed (Potamogeton amplifolius), narrow leaf pondweed (P. zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

## Resource Value of Site H

Sensitive area H is located on the eastern shore of Spooner Lake north of sensitive area F. This area covers approximately 1,100 feet of shoreline extending out 100 feet. Most of this length is dominated by a bog and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average natural scenic beauty with minimal development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides extremely valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

Sensitive area H has a diverse community structure of emergent, floating and submergent aquatic plants including: **Emergents;** soft stem bulrush (Scirpus validus), arrowhead (Sagittaria sp.), pickerelweed (Pontederia cordata), cattails (Typha sp.), common bur-reed (Sparganium sp.), giant reed grass (Phragmites australis), wild rice (Zizania sp.) **Floating leafed;** yellow pond lily (*Nuphar advena).* **Submergents;** elodea, northern milfoil (Myriophyllum sibiricum), large leaf pondweed (Potamogeton amplifolius), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

## Resource Value of Site I

Sensitive area I is located on the northern shore of Spooner Lake. This area covers approximately 1,200 feet of shoreline extending out 100 feet. Most of this length is dominated by a shrub/scrub wetland and shallow or open water wetland, which have helped protect it from the negative impacts that can be associated with improperly developed shorelines. This sensitive area has average natural scenic beauty with minimal development.

This area provides important habitat for centrarchid (panfish and bass) and esocid (northern pike). Northern pike and large mouth bass will use this area for spawning, feeding, protection and as a nursery for young. Panfish will use this area for feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

This area also provides valuable habitat for wildlife. Eagles, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

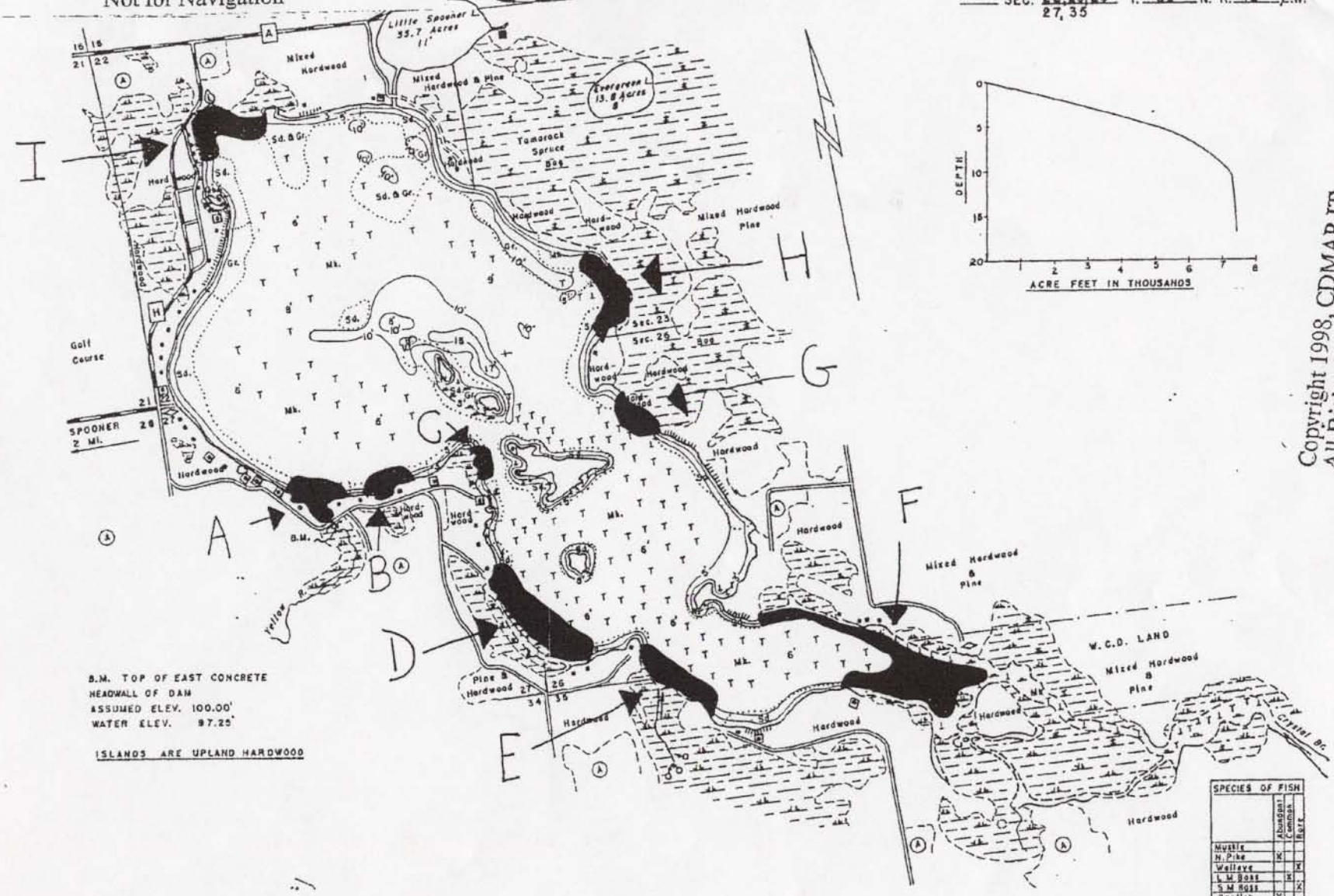
Sensitive area I has a diverse community structure of emergent and submergent aquatic plants including: **Emergents;** pickerelweed (Pontederia cordata), cattails (Typha sp.), common bur-reed (Sparganium sp.), giant reed grass (Phragmites australis). **Submergents;** elodea, eel grass (Vallisneria americana), northern milfoil (Myriophyllum sibiricum), water stargrass (Zosterella dubia), naiad (Najas sp.), large leaf pondweed (Potamogeton amplifolius), clasping leaf pondweed (P. richardsonii), narrow leaf pondweed (P. zosteriformis).

Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only. All other interests in chemical treatments and mechanical harvesting should be scrutinized.

# LAKE SURVEY MAP

SPOONER LAKE — WASHBURN COUNTY

SEC. 22,23,26 27, 35 T. 39 N. R. 12 W.




B.M. TOP OF EAST CONCRETE HEADWALL OF DAM
ASSUMED ELEV. 100.00'
WATER ELEV. 97.25'

ISLANDS ARE UPLAND HARDWOOD




| SPECIES OF FISH | Abundant | Common | Rare |
|---|---|---|---|
| Muskie | | | |
| N. Pike | X | | |
| Walleye | | | X |
| L.M. Bass | | X | |
| S.M. Bass | | | X |
| Panfish | X | | |
| Trout | | | |

EQUIPMENT RECORDING SONAR MAPPED JUNE (MO.) 1964 (YR.)

WATER ELEV. 97.25

TOPOGRAPHIC SYMBOLS
- (B) Brush
- (PW) Partially wooded
- (W) Wooded
- (C) Cleared
- (P) Pastured
- (A) Agricultural
- B.M. Bench Mark
- Dwelling
- Resort
- Steep slope
- Indefinite shoreline
- Marsh
- Spring
- Intermittent stream
- Permanent inlet
- Permanent outlet
- Dam

LAKE BOTTOM SYMBOLS
- P. Peat
- Mk. Muck
- C. Clay
- M. Marl
- Sd. Sand
- St. Silt
- Gr. Gravel
- R. Rubble
- Br. Bedrock
- T Submergent vegetation
- ⊥ Emergent vegetation
- Floating vegetation

1,000' 0' 1,000' 2,000' 3,000' 4,000' 5,000'
SCALE

◇ Access ◆ Access with Parking ◆ Boat Livery

Field work by: B. Hoehn, M. Perkins, J. Sather Drawn by: E. Eaton

1,110.5 WITH ISLANDS
AREA 1,092.2 ACRES
UNDER 3FT. 11 %
OVER 20FT. 0 %
VOLUME 7,390.4 ACRE FT.
TOTAL ALK. 77 P.P.M.
SHORELINE 11.2 MILES
MAX. DEPTH 17 FEET

# Appendix F
# Water Quality and Lake-Stage Data for Spooner Lake, 2004 (USGS Study)

# Water Quality and Lake-Stage Data for Spooner Lake near Spooner, Wisconsin for 2004

## Data Summary

This summary contains all data that were collected by US Geological Survey for Spooner Lake District as part of the program that was partially funded by Wisconsin Department of Natural Resources Lake Planning Grant LPL-914. The monitoring in 2004 was a follow-up to monitoring that was done in 2002 and 2003, which was partially funded by Lake Planning Grant LPL-814. In 2002 considerable macrophyte control spraying was done. No macrophyte spraying was done in 2004. A primary purpose of the 2004 monitoring was to obtain data to compare conditions in the lake during a year with no spraying with conditions in 2002.

All data collected in 2004 are included in this summary. Some of the data collected in 2002 and 2003 are included in selected graphs and tables to facilitate comparison of conditions between years.

United States Geological Survey
Madison, Wisconsin

Prepared by
W.J. Rose

April 14, 2005

**Lake description and sampling locations:**

Spooner Lake is classified as a drainage lake, having one main inlet (Crystal Brook) and an outlet (Yellow River). The average depth of the lake is 7 feet and maximum depth is 17 feet, and surface area is 1092 acres ("Wisconsin Lakes" Wisconsin Department of Natural Resources, PUB-FH-800, 2001). The Lake's watershed area, including the lake, is 31.1 square miles, (Drainage Area Data for Wisconsin Streams", Henrich and Daniel, 1983, USGS Open-File Report 83-933).

Two sites in the lake were sampled for water quality. Lake stage was measured at the dam at the lake's outlet. Locations of these sites are shown in Figure 1.

**Lake water quality:**

Lake-depth profiles:

Vertical profiles of water temperature, dissolved oxygen, pH, and specific conductance are typical of those for a shallow lake. Profile data in Tables 1 indicate alternate periods of thermal stratification and mixing at the deep-hole sampling site. As shown in the graphs in figure 2 there was strong oxygen stratification and oxygen depletion in the lower 10 feet at the deep-hole sampling site by late summer of 2002 and little depletion in 2004. There was little oxygen depletion at the southeast sampling site in 2002 and in 2004 (table 2).

2004 chemical constituents:
Chemical constituent values for sampling dates in 2004 for both the Deep-Hole and Southeast sites are listed in tables 3 and 4. Differences in values for near-surface and near-bottom samples generally were small, as would be expected given the relatively mixed conditions in 2004.

Trophic-state indices:

Three common measures of water quality, which are used as indices, are concentrations of near-surface total phosphorus and chlorophyll a, and Secchi depth. These data are given in tables 5 and 6 and graphed in figures 3-6. The data for all three indices indicate significant decline in quality from June through August 2002 at the deep-hole site. However, a similar decline in quality did not occur at the deep-hole site in 2004. Water quality at southeastern sampling site in 2004, as indicated by these indices, was similar to that of 2002.

Trophic status:
Another means of assessing the nutrient, or trophic, status of a lake is to compute trophic state indices (TSIs). The TSIs were developed to place phosphorus and chlorophyll a concentration and Secchi depth data on a common scale. TSI equations for Wisconsin Lakes developed by Lillie and others in "Trophic State Index

Equations and regional predictive equations for Wisconsin Lakes," WDNR Management Findings, no. 35, 1993. These data are summarized in tables 5 and 6 and graphed in figure 7 show water quality conditions in Spooner Lake to be solidly in the eutrophic range in 2002. However, by late summer 2004, conditions at the deep-hole site were borderline mesotrophic-to-eutrophic.

**Lake Stage:**

Lake stage was measured by USGS personnel at sampling visits to the lake and more frequently by a local observer (Joe Banick). Observed lake stages ranged from 6.75 ft to 7.30 ft (table 7and fig. 8)

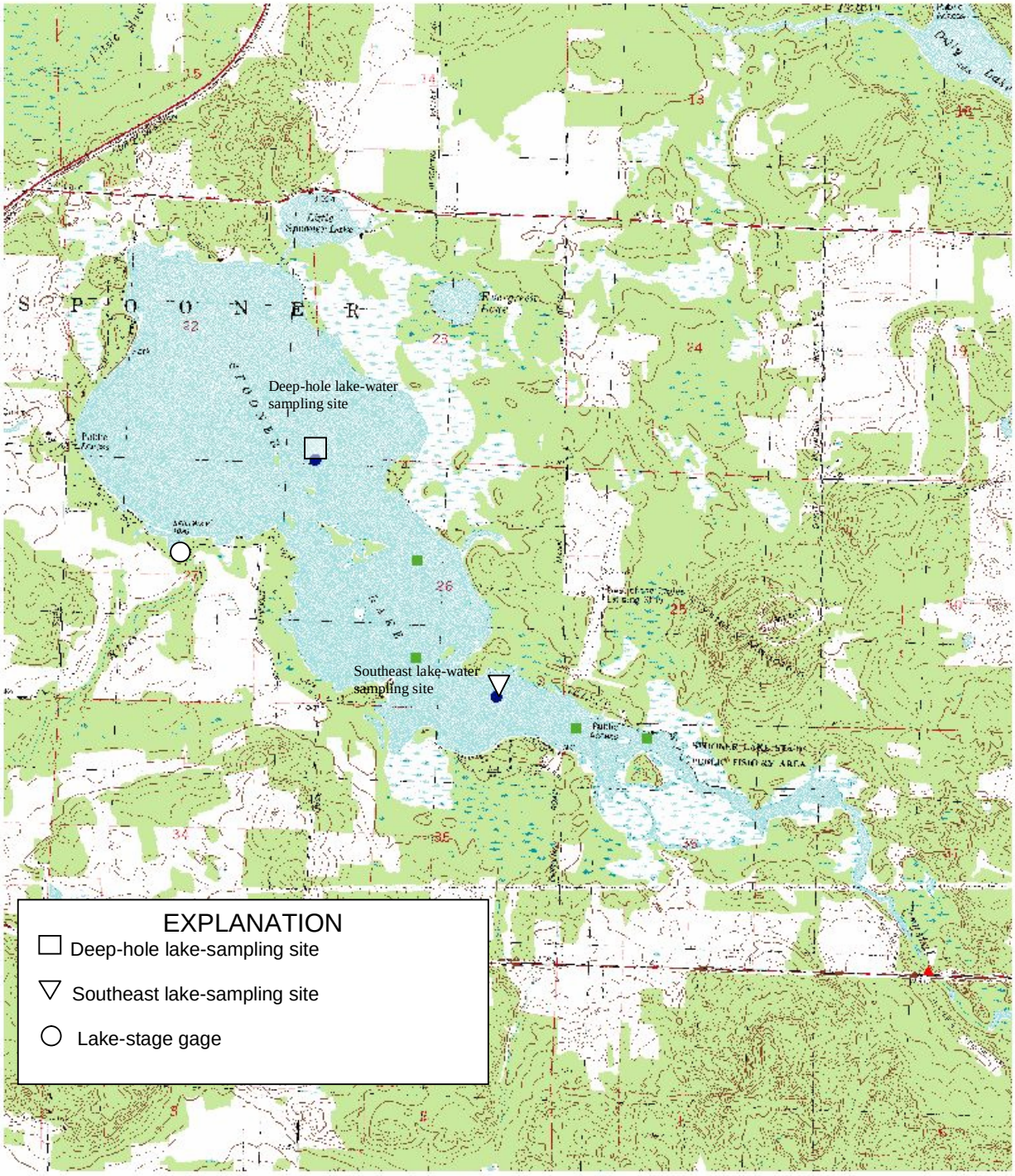



**Figure 1.** Locations of lake water-quality sampling sites and lake-stage gage in Spooner Lake near Spooner, Wisconsin.

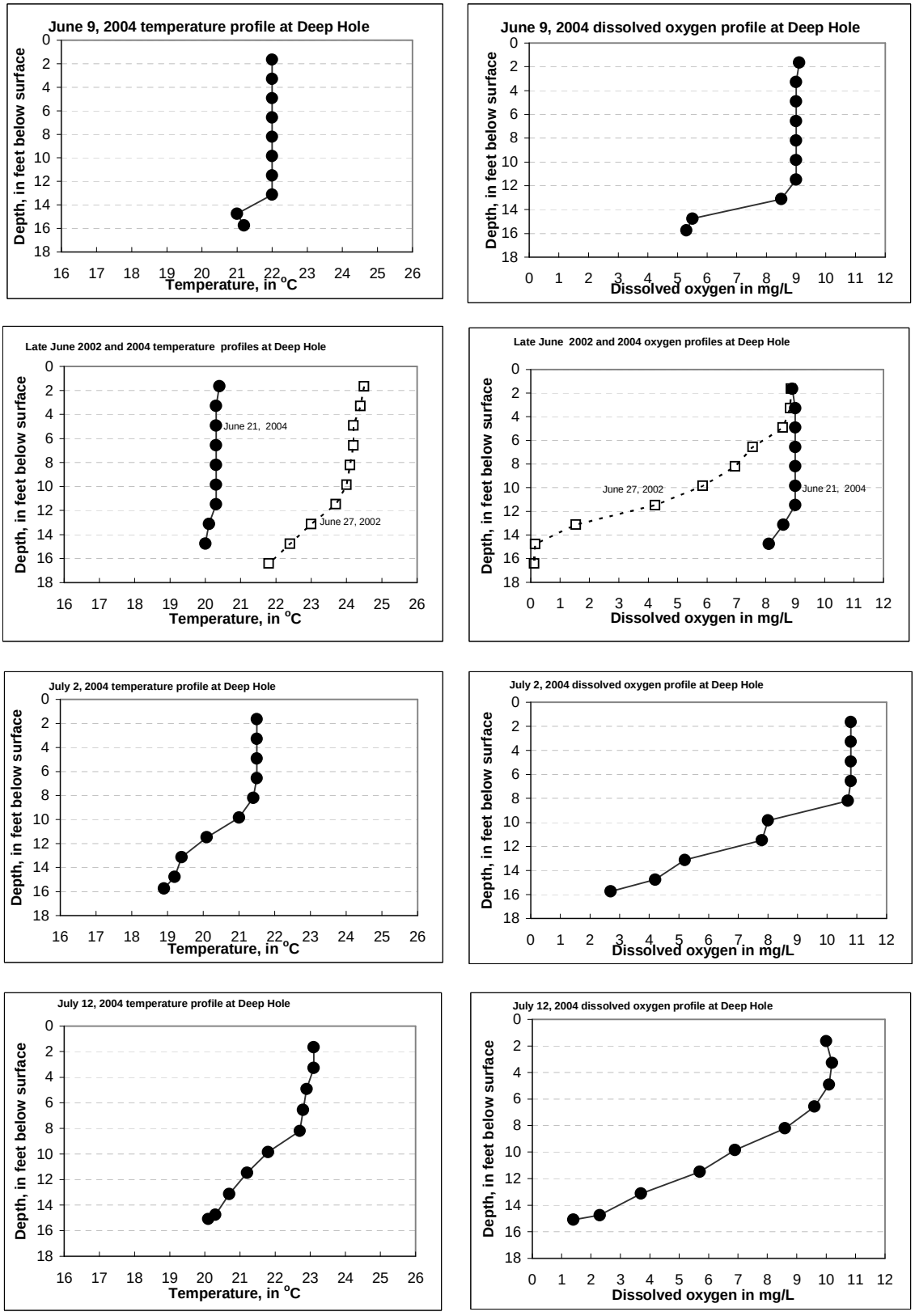
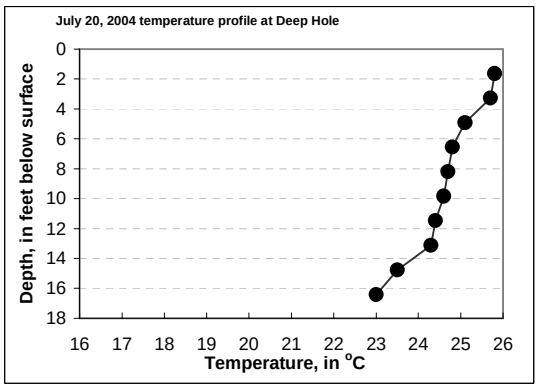
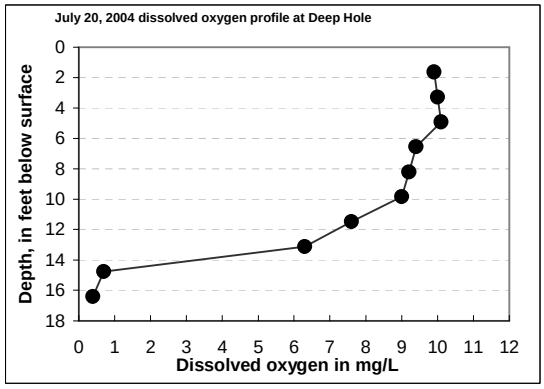
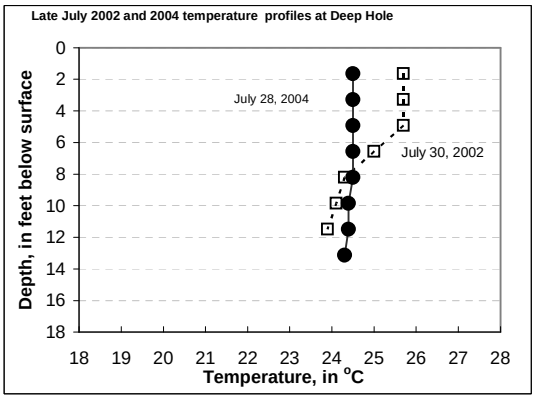
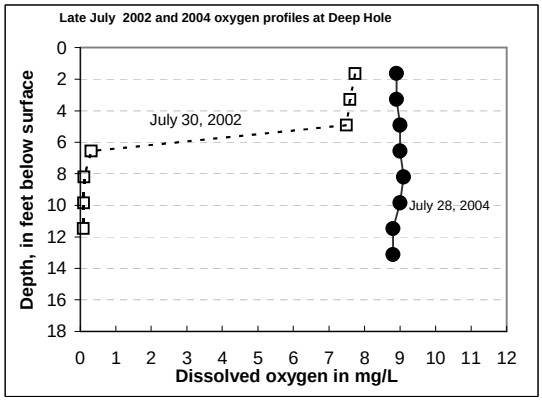


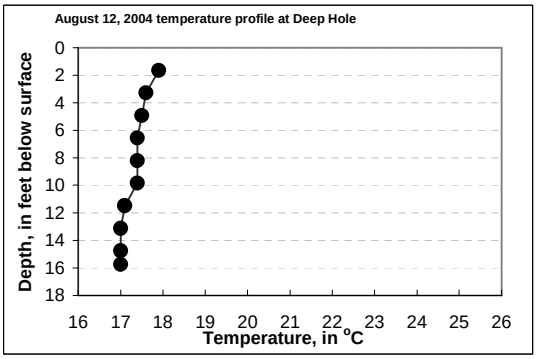

**Figure 2.** Temperature and dissolved oxygen profiles for Spooner Lake, Deep-Hole Site, 2002 and 2004.

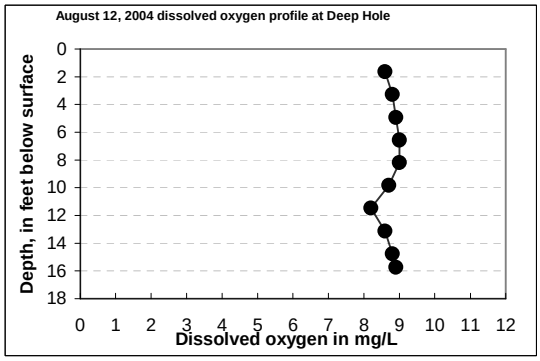


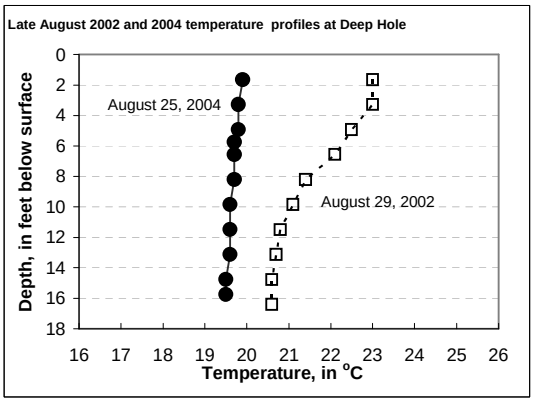



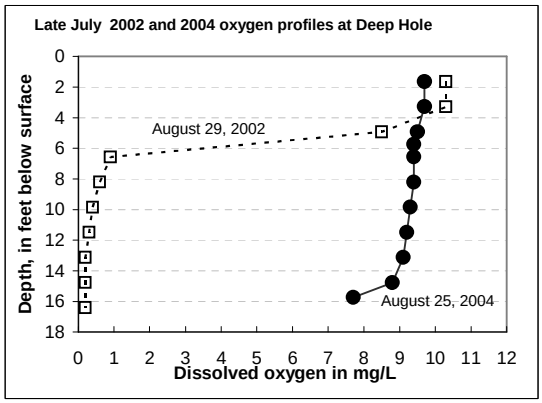




**Figure 2.** Temperature and dissolved oxygen profiles for Spooner Lake, Deep-Hole Site, 2002 and 2004--cont.

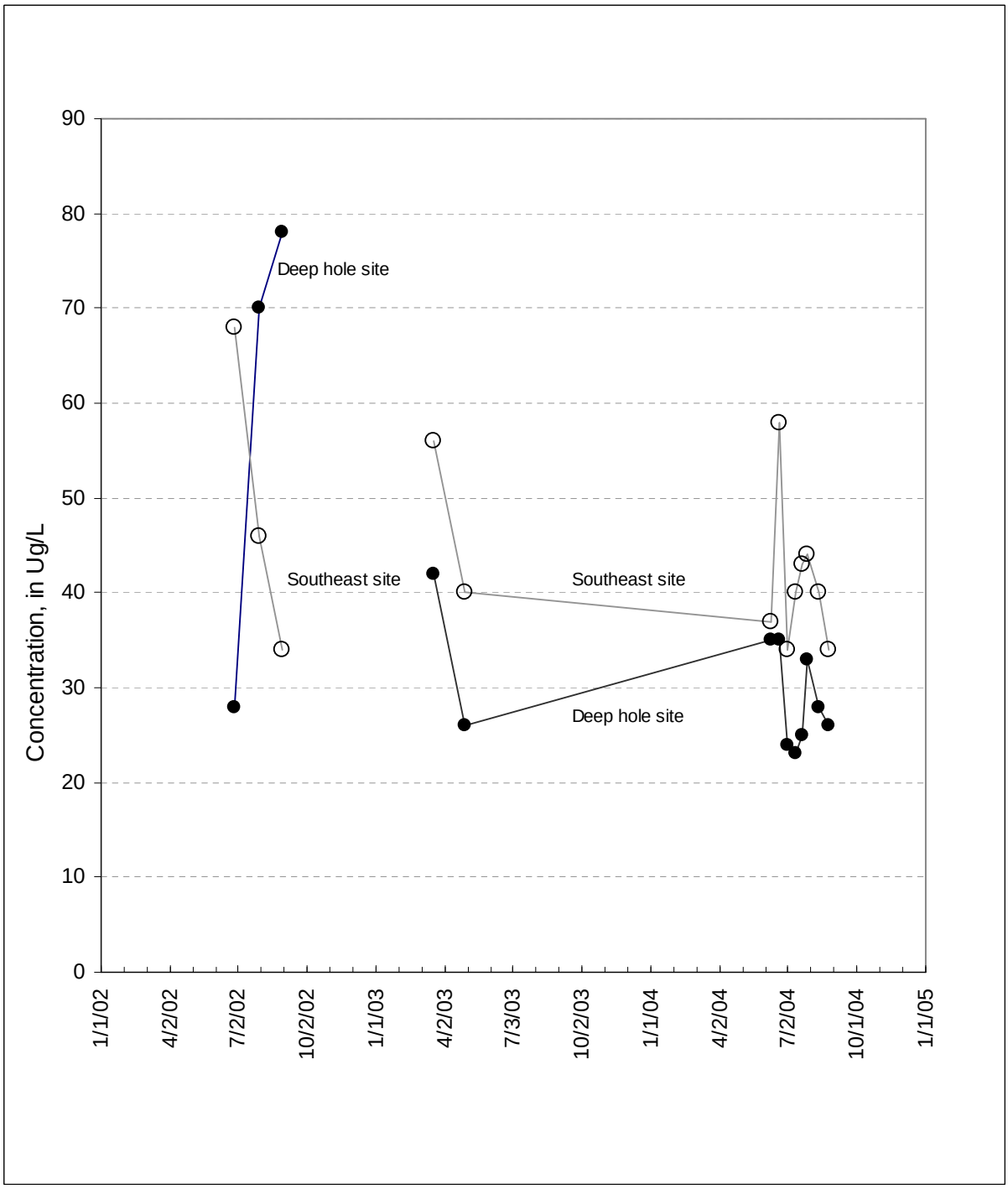



**Figure 3.** Total phosphorus concentrations for Spooner Lake, June 2002 – August 2004.

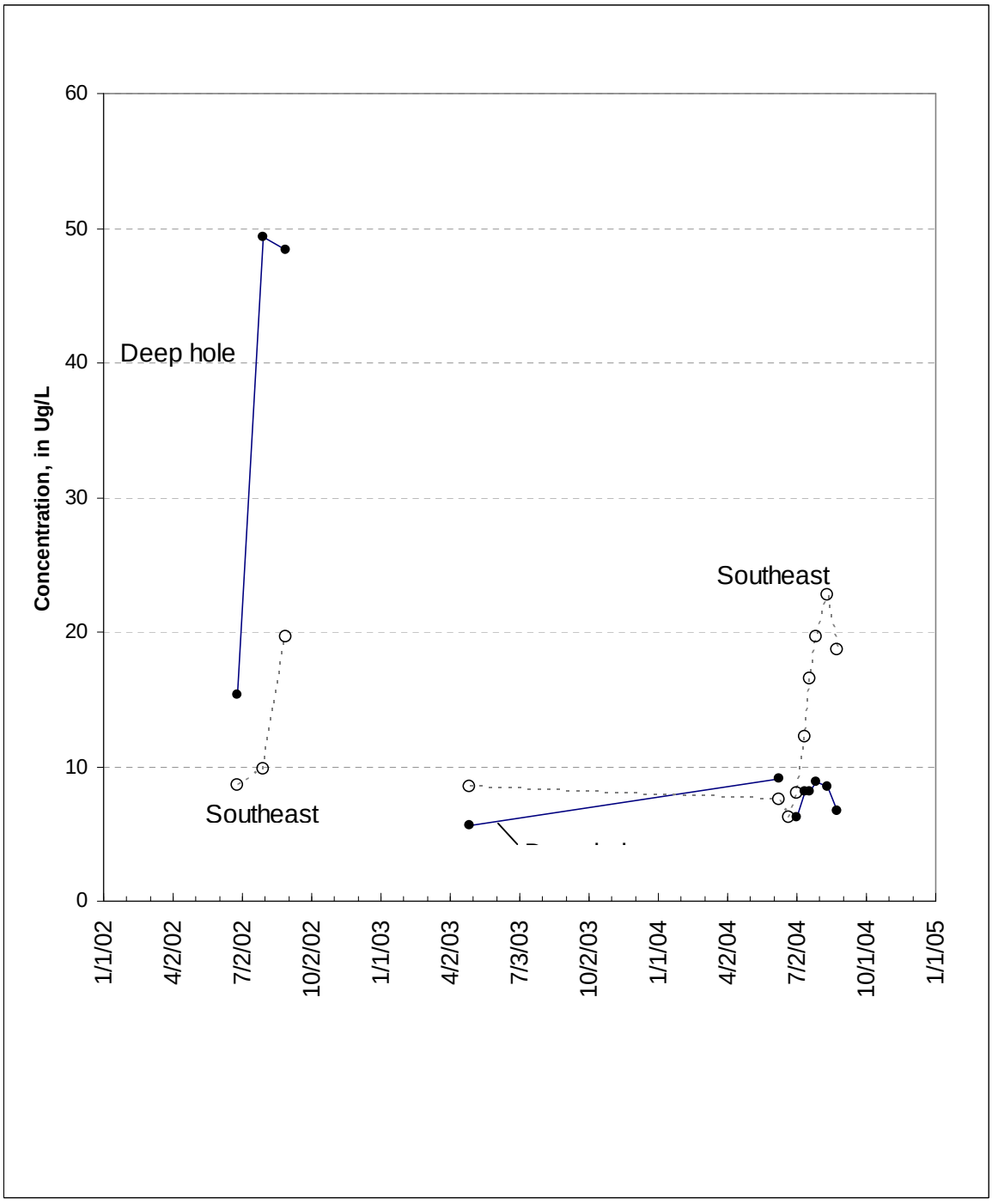



**Figure 4.** Chlorophyll a concentrations for Spooner Lake, June 2002 – August 2004.

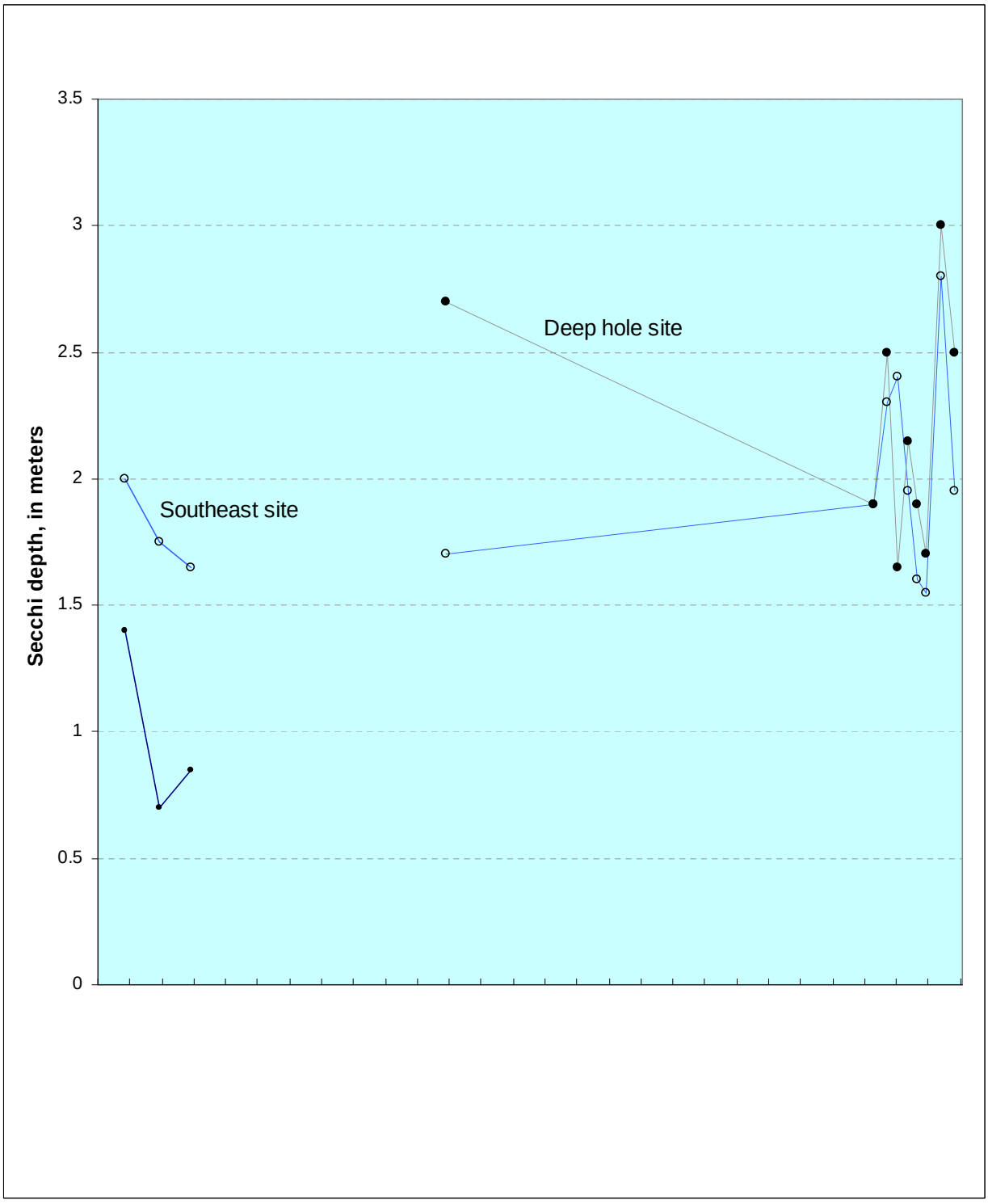



**Figure 5.** Secchi depths for Depths for Spooner Lake, June 2002 – August 2004.

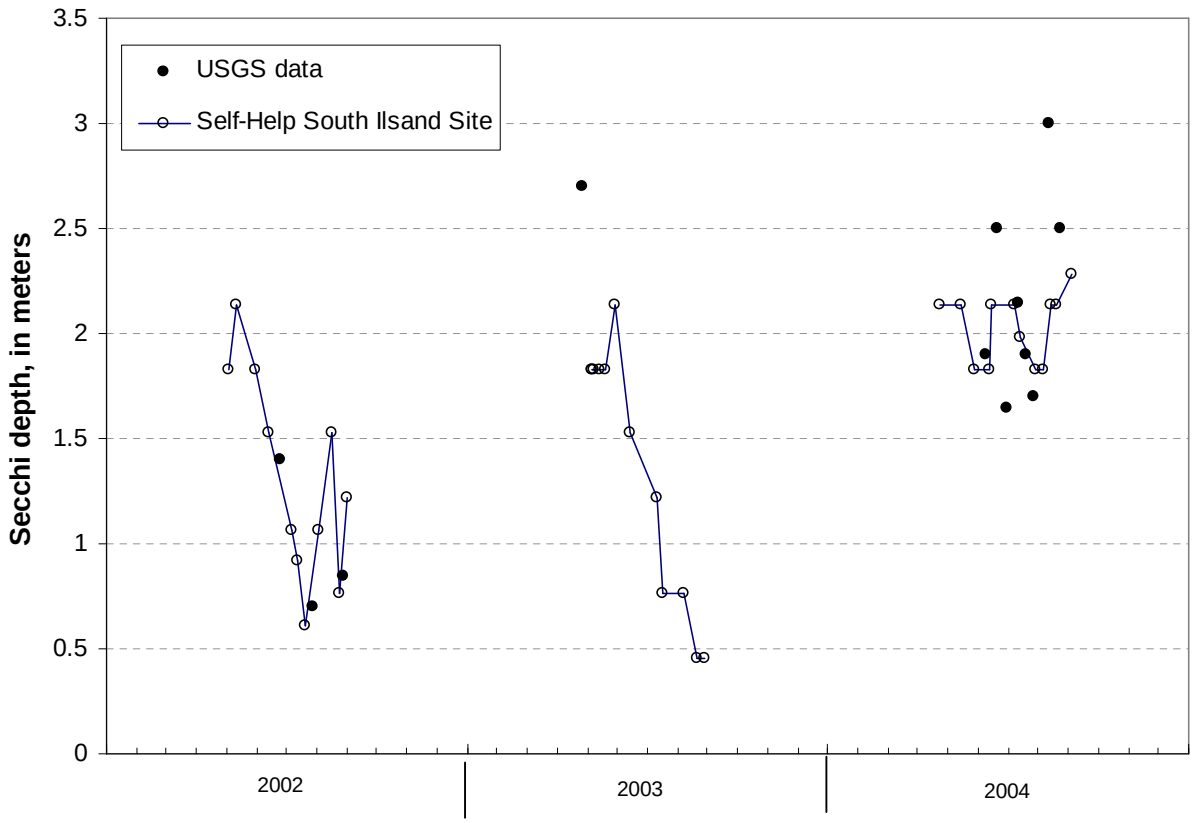



**Figure 6.** Water clarity (secchi depth) for USGS Southeast Site Self-Help South Island Site, Spooner Lake, 2002 - 2004.

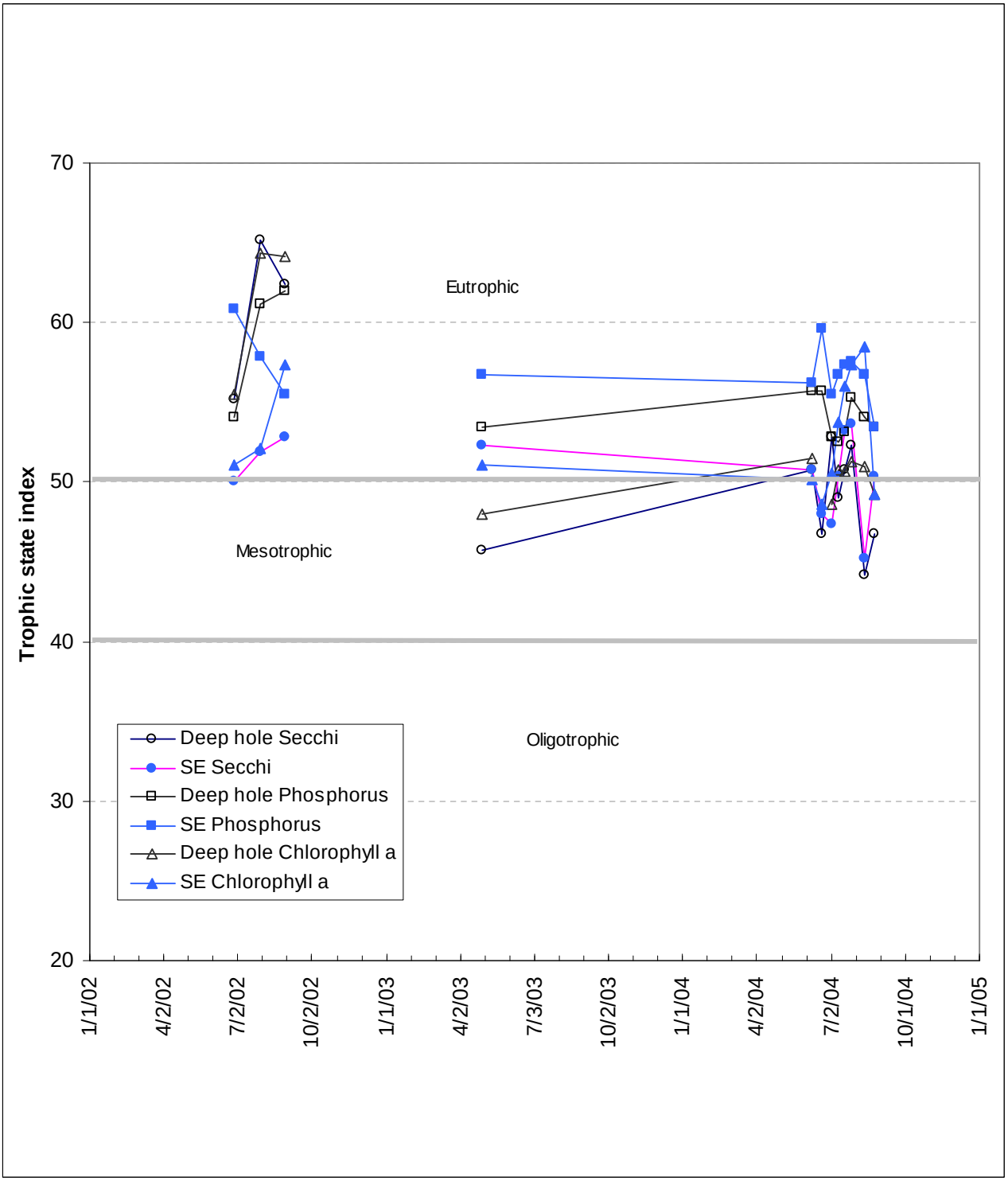
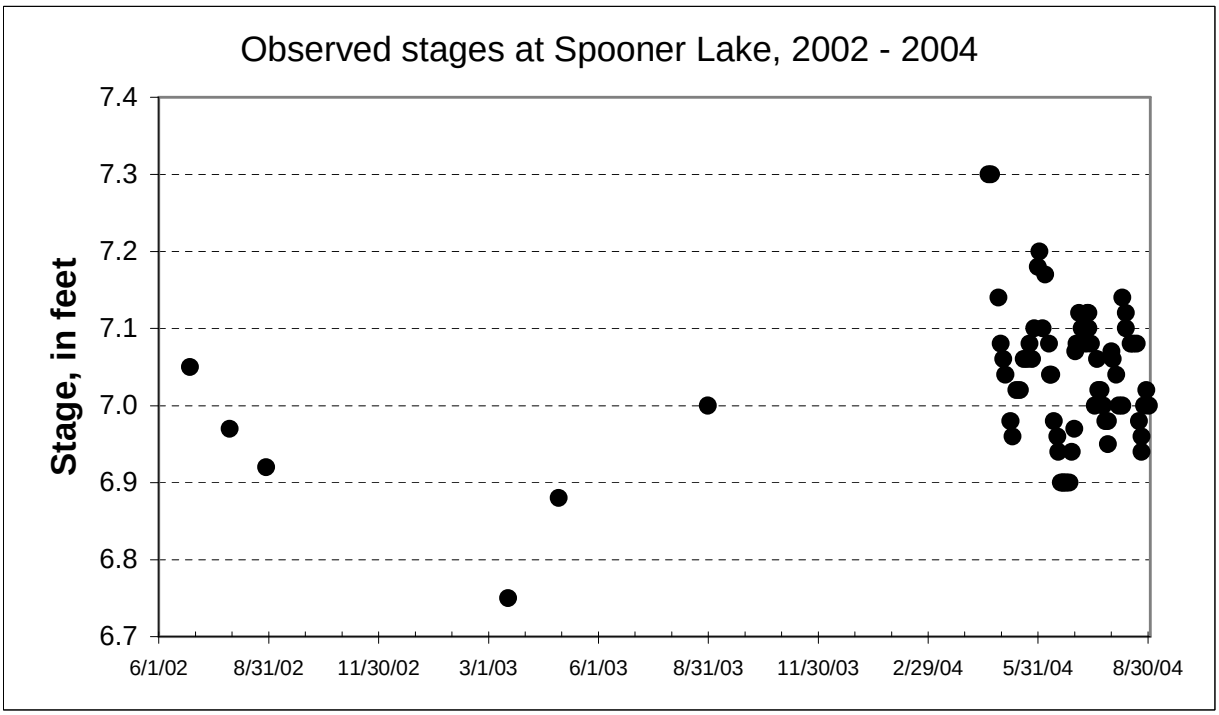



**Figure 7.** Trophic State Indices for Spooner Lake, June 2002 – August 2004.



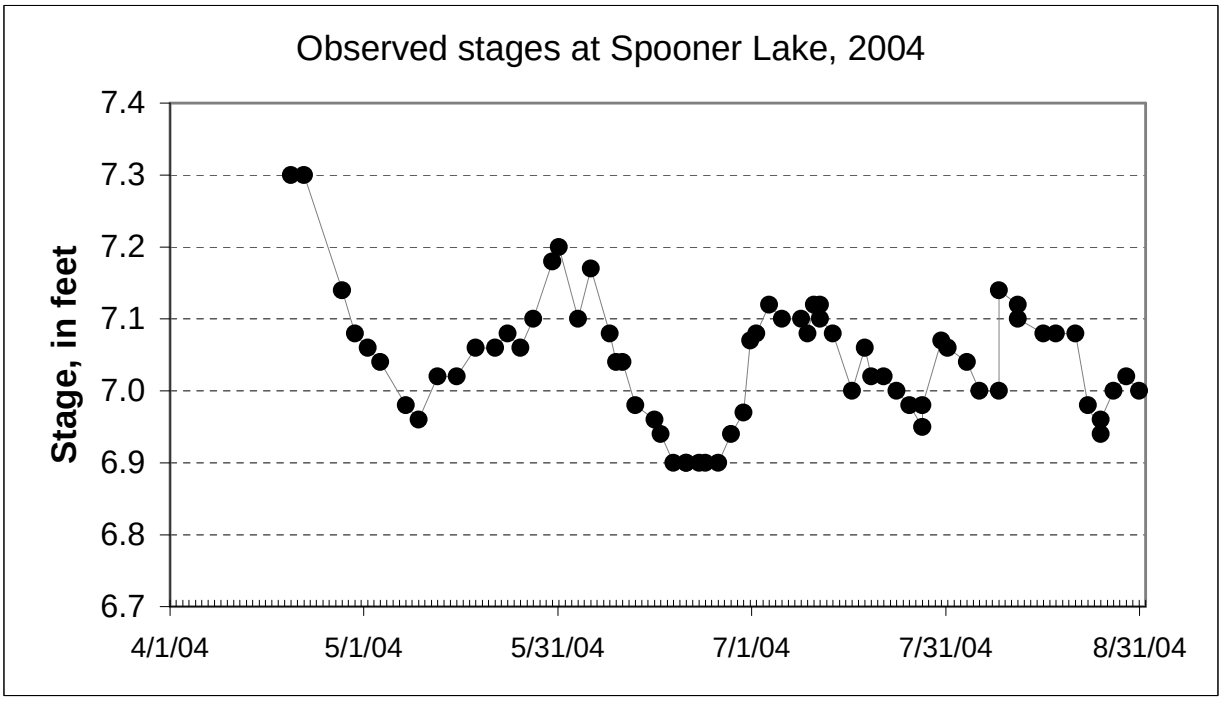




**Figure 8.** Observed stages at Spooner Lake near Spooner, 2002 -2004.

**Table 1.** Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Deep-Hole Site, 2004

| Date | Depth (meters) | Dissolved oxygen (mg/L) | pH | Specific conductance ( S/cm) | Temperature ($^{o}$C) |
|---|---|---|---|---|---|
| 6/9/2004 | 0.5 | 9.1 | 8.0 | 179 | 22.0 |
| | 1 | 9.0 | 8.0 | 179 | 22.0 |
| | 1.5 | 9.0 | 8.1 | 179 | 22.0 |
| | 2 | 9.0 | 8.1 | 179 | 22.0 |
| | 2.5 | 9.0 | 8.1 | 179 | 22.0 |
| | 3 | 9.0 | 8.1 | 179 | 22.0 |
| | 3.5 | 9.0 | 8.1 | 179 | 22.0 |
| | 4 | 9.5 | 8.1 | 179 | 22.0 |
| | 4.5 | 5.5 | 7.6 | 185 | 21.0 |
| | 4.8 | 5.3 | 7.6 | 185 | 21.2 |
| 6/21/2004 | 0.5 | 8.9 | 8.6 | 184 | 20.4 |
| | 1 | 9.0 | 8.6 | 183 | 20.3 |
| | 1.5 | 9.0 | 8.6 | 183 | 20.3 |
| | 2 | 9.0 | 8.6 | 184 | 20.3 |
| | 2.5 | 9.0 | 8.6 | 183 | 20.3 |
| | 3 | 9.0 | 8.6 | 183 | 20.3 |
| | 3.5 | 9.0 | 8.6 | 183 | 20.3 |
| | 4 | 8.6 | 8.5 | 184 | 20.1 |
| | 4.5 | 8.1 | 8.4 | 185 | 20.0 |
| 7/2/2004 | 0.5 | 10.8 | 8.4 | 184 | 21.5 |
| | 1 | 10.8 | 8.7 | 183 | 21.5 |
| | 1.5 | 10.8 | 8.7 | 184 | 21.5 |
| | 2 | 10.8 | 8.7 | 184 | 21.5 |
| | 2.5 | 10.7 | 8.7 | 184 | 21.4 |
| | 3 | 8.0 | 8.4 | 190 | 21.0 |
| | 3.5 | 7.8 | 8.2 | 189 | 20.1 |
| | 4 | 5.2 | 8.0 | 193 | 19.4 |
| | 4.5 | 4.2 | 7.8 | 193 | 19.2 |
| | 4.8 | 2.7 | 7.6 | 198 | 18.9 |
| 7/12/2004 | 0.5 | 10.0 | 8.8 | 176 | 23.1 |
| | 1 | 10.2 | 8.8 | 176 | 23.1 |
| | 1.5 | 10.1 | 8.8 | 175 | 22.9 |
| | 2 | 9.6 | 8.8 | 176 | 22.8 |
| | 2.5 | 8.6 | 8.6 | 176 | 22.7 |
| | 3 | 6.9 | 8.3 | 180 | 21.8 |
| | 3.5 | 5.7 | 8.1 | 182 | 21.2 |
| | 4 | 3.7 | 7.8 | 184 | 20.7 |
| | 4.5 | 2.3 | 7.6 | 185 | 20.3 |
| | 4.6 | 1.4 | 7.6 | 188 | 20.1 |

**Table 1.** Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Deep-Hole Site, 2004--continued.

| Date | Depth (meters) | Dissolved oxygen (mg/L) | pH | Specific conductance (µS/cm) | Temperature (°C) |
|---|---|---|---|---|---|
| 7/20/2004 | 0.5 | 9.9 | 8.8 | 169 | 25.8 |
| | 1 | 10.0 | 8.8 | 171 | 25.7 |
| | 1.5 | 10.1 | 8.8 | 171 | 25.1 |
| | 2 | 9.4 | 8.8 | 171 | 24.8 |
| | 2.5 | 9.2 | 8.7 | 171 | 24.7 |
| | 3 | 9.0 | 8.7 | 172 | 24.6 |
| | 3.5 | 7.6 | 8.6 | 172 | 24.4 |
| | 4 | 6.3 | 8.5 | 175 | 24.3 |
| | 4.5 | 0.7 | 8.0 | 187 | 23.5 |
| | 5 | 0.4 | 7.7 | 192 | 23.0 |
| 7/28/2004 | 0.5 | 8.9 | 8.7 | 169 | 24.5 |
| | 1 | 8.9 | 8.7 | 170 | 24.5 |
| | 1.5 | 9.0 | 8.8 | 170 | 24.5 |
| | 2 | 9.0 | 8.8 | 170 | 24.5 |
| | 2.5 | 9.1 | 8.8 | 170 | 24.5 |
| | 3 | 9.0 | 8.8 | 170 | 24.4 |
| | 3.5 | 8.8 | 8.8 | 169 | 24.4 |
| | 4 | 8.8 | 8.8 | 169 | 24.3 |
| 8/12/2004 | 0.5 | 8.6 | 7.7 | 153 | 17.9 |
| | 1 | 8.8 | 8.3 | 153 | 17.6 |
| | 1.5 | 8.9 | 8.5 | 152 | 17.5 |
| | 2 | 9.0 | 8.8 | 152 | 17.4 |
| | 2.5 | 9.0 | 8.8 | 152 | 17.4 |
| | 3 | 8.7 | 8.8 | 152 | 17.4 |
| | 3.5 | 8.2 | 8.7 | 153 | 17.1 |
| | 4 | 8.6 | 8.7 | 152 | 17.0 |
| | 4.5 | 8.8 | 8.8 | 151 | 17.0 |
| | 4.8 | 8.9 | 8.8 | 151 | 17.0 |
| 8/25/2004 | 0.5 | 9.7 | 9.0 | 152 | 19.9 |
| | 1 | 9.7 | 9.1 | 152 | 19.8 |
| | 1.5 | 9.5 | 9.1 | 152 | 19.8 |
| | 1.75 | 9.4 | 9.1 | 152 | 19.7 |
| | 2 | 9.4 | 9.1 | 152 | 19.7 |
| | 2.5 | 9.4 | 9.1 | 152 | 19.7 |
| | 3 | 9.3 | 9.0 | 153 | 19.6 |
| | 3.5 | 9.2 | 9.0 | 152 | 19.6 |
| | 4 | 9.1 | 9.1 | 153 | 19.6 |
| | 4.5 | 8.8 | 9.0 | 153 | 19.5 |
| | 4.8 | 7.7 | 9.0 | 154 | 19.5 |

**Table 2.** Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Southeast Site, 2004

| Date | Depth (meters) | Dissolved oxygen (mg/L) | pH | Specific conductance (µS/cm) | Temperature (°C) |
|---|---|---|---|---|---|
| 6/9/2004 | 0.5 | 9.9 | 8.5 | 177 | 22.2 |
| | 0.75 | 9.9 | 8.5 | 177 | 22.2 |
| | 1.0 | 9.9 | 8.5 | 177 | 22.2 |
| | 1.25 | 10.2 | 8.5 | 177 | 22.2 |
| | 1.5 | 10.0 | 8.5 | 177 | 22.2 |
| | 1.75 | 10.1 | 8.5 | 177 | 22.2 |
| | 2.0 | 10.1 | 8.5 | 177 | 22.2 |
| | 2.25 | 10.1 | 8.5 | 177 | 22.2 |
| | 2.5 | 9.5 | 8.4 | 178 | 22.1 |
| 6/21/2004 | 0.5 | 8.3 | 8.3 | 190 | 20.6 |
| | 0.75 | 8.3 | 8.3 | 190 | 20.6 |
| | 1.0 | 8.3 | 8.3 | 190 | 20.6 |
| | 1.25 | 8.4 | 8.3 | 190 | 20.6 |
| | 1.5 | 8.4 | 8.3 | 190 | 20.6 |
| | 1.75 | 8.4 | 8.3 | 190 | 20.6 |
| | 2.0 | 8.4 | 8.3 | 190 | 20.5 |
| | 2.25 | 8.4 | 8.4 | 190 | 20.5 |
| | 2.4 | 8.4 | 8.4 | 190 | 20.5 |
| 7/2/2004 | 0.5 | 11.7 | 8.8 | 191 | 22.3 |
| | 0.75 | 11.7 | 8.8 | 191 | 22.3 |
| | 1.0 | 11.8 | 8.8 | 191 | 22.3 |
| | 1.25 | 11.8 | 8.8 | 191 | 22.2 |
| | 1.5 | 11.8 | 8.8 | 191 | 22.2 |
| | 1.75 | 11.8 | 8.8 | 191 | 22.2 |
| | 2.0 | 9.9 | 8.6 | 195 | 22.0 |
| | 2.25 | 9.5 | 8.6 | 196 | 21.9 |
| | 2.3 | 8.1 | 8.4 | 200 | 21.7 |
| 7/12/2004 | 0.5 | 9.6 | 8.4 | 194 | 23.5 |
| | 0.75 | 9.7 | 8.3 | 195 | 23.3 |
| | 1.0 | 9.3 | 8.3 | 196 | 23.1 |
| | 1.25 | 10.0 | 8.2 | 199 | 22.4 |
| | 1.5 | 9.9 | 8.2 | 199 | 22.2 |
| | 1.75 | 9.2 | 8.0 | 203 | 21.5 |
| | 2.0 | 6.8 | 7.7 | 206 | 21.1 |
| | 2.2 | 1.7 | 7.6 | 207 | 21.1 |

**Table 2.** Depth profiles of dissolved oxygen, pH, specific conductance, and temperature at Spooner Lake, Southeast Site, 2004--continued

| Date | Depth (meters) | Dissolved oxygen (mg/L) | pH | Specific conductance (µS/cm) | Temperature (°C) |
|---|---|---|---|---|---|
| 7/20/2004 | 0.5 | 10.0 | 8.5 | 197 | 26.0 |
| | 0.75 | 10.2 | 8.6 | 196 | 25.8 |
| | 1.0 | 9.9 | 8.6 | 195 | 24.9 |
| | 1.25 | 9.2 | 8.5 | 196 | 24.7 |
| | 1.5 | 8.6 | 8.4 | 201 | 24.6 |
| | 1.75 | 8.7 | 8.1 | 204 | 24.0 |
| | 2.0 | 8.3 | 8.0 | 206 | 23.7 |
| | 2.25 | 6.6 | 7.8 | 209 | 23.5 |
| | 2.5 | 5.6 | 7.8 | 209 | 23.5 |
| 7/28/2004 | 0.5 | 9.1 | 8.4 | 201 | 23.6 |
| | 0.75 | 9.0 | 8.4 | 201 | 23.6 |
| | 1.0 | 9.1 | 8.4 | 201 | 23.6 |
| | 1.25 | 9.2 | 8.4 | 201 | 23.6 |
| | 1.5 | 9.3 | 8.4 | 201 | 23.6 |
| | 1.75 | 9.3 | 8.4 | 201 | 23.6 |
| | 2.0 | 9.2 | 8.4 | 201 | 23.6 |
| | 2.20 | 8.7 | 8.3 | 202 | 23.6 |
| 8/12/2004 | 0.5 | 8.2 | 7.9 | 197 | 17.5 |
| | 0.75 | 8.4 | 7.9 | 197 | 17.3 |
| | 1.0 | 9.0 | 8.0 | 195 | 17.0 |
| | 1.25 | 9.1 | 8.0 | 195 | 16.8 |
| | 1.5 | 9.0 | 8.1 | 195 | 16.7 |
| | 1.75 | 8.3 | 8.0 | 196 | 16.5 |
| | 2.0 | 8.0 | 7.9 | 196 | 16.5 |
| | 2.25 | 7.7 | 7.9 | 196 | 16.5 |
| | 2.4 | 7.5 | 7.8 | 196 | 16.5 |
| 8/25/2004 | 0.5 | 9.6 | 8.3 | 200 | 20.2 |
| | 0.75 | 9.6 | 8.4 | 200 | 20.1 |
| | 1.0 | 9.6 | 8.4 | 200 | 20.1 |
| | 1.25 | 9.6 | 8.4 | 200 | 20.0 |
| | 1.5 | 9.2 | 8.4 | 200 | 19.9 |
| | 1.75 | 8.7 | 8.3 | 201 | 19.9 |
| | 2.0 | 7.0 | 8.2 | 204 | 19.8 |
| | 2.2 | 7.0 | 8.0 | 204 | 19.8 |

**Table 3.** Water-quality data for Deep-Hole Site at Spooner Lake near Spooner, Wisconsin, 2004

| Date | 6/9/2004 | | 6/21/2004 | | 7/2/2004 | | 7/12/2004 | |
|---|---|---|---|---|---|---|---|---|
| Lake stage (ft) | 7.08 | | 6.90 | | 7.08 | | -- | |
| Secchi-depth (m) | 1.9 | | 2.5 | | 1.7 | | 2.2 | |
| Depth of sample (m) | 0.5 | 4.5 | 0.5 | 4 | 0.5 | 4.5 | 0.5 | 4 |
| Chlorophyll a, phytoplankton (µg/L) | 9.1 | -- | -- | -- | 6.2 | -- | 8.2 | -- |
| Water temperature (°C) | 22.0 | 21.0 | 20.4 | 20.1 | 21.5 | 19.2 | 23.1 | 20.7 |
| Specific conductance (µS/cm) | 179 | 185 | 184 | 184 | 184 | 193 | 176 | 184 |
| pH | 8.0 | 7.6 | 8.6 | 8.5 | 8.4 | 7.8 | 8.8 | 7.8 |
| Dissolved oxygen (mg/L) | 9.1 | 5.5 | 8.9 | 8.6 | 10.8 | 4.2 | 10.0 | 3.7 |
| Phosphorus, total (as P, mg/L) | 0.035 | 0.031 | 0.035 | 0.043 | 0.024 | 0.033 | 0.023 | 0.027 |

| Date | 7/20/2004 | | 7/28/2004 | | 8/12/2004 | | | 8/25/2004 | |
|---|---|---|---|---|---|---|---|---|---|
| Lake stage (ft) | 7.02 | | 6.95 | | 7.12 | | | 6.40 | |
| Secchi-depth (m) | 1.9 | | 1.7 | | 3.0 | | | 2.5 | |
| Depth of sample (m) | 0.5 | 4.5 | 0.5 | 4 | 0.5 | 3.5 | 4.5 | 0.5 | 4.5 |
| Chlorophyll a, phytoplankton (µg/L) | 8.1 | -- | 8.8 | -- | 8.5 | -- | -- | 6.7 | -- |
| Water temperature (°C) | 25.8 | 23.5 | 24.5 | 24.3 | 17.9 | 17.1 | 17.0 | 19.9 | 19.5 |
| Specific conductance (µS/cm) | 169 | 187 | 169 | 169 | 153 | 153 | 151 | 152 | 153 |
| pH | 8.8 | 8.0 | 8.7 | 8.8 | 7.7 | 8.7 | 8.8 | 9.0 | 9.0 |
| Dissolved oxygen (mg/L) | 9.9 | 0.7 | 8.9 | 8.8 | 8.6 | 8.2 | 8.8 | 9.7 | 8.8 |
| Phosphorus, total (as P, mg/L) | 0.025 | 0.031 | 0.033 | 0.033 | 0.028 | 0.028 | 0.026 | 0.026 | 0.026 |
| Phosphorus, ortho, dissolved (as P) | -- | -- | 0.003 | -- | -- | -- | -- | -- | -- |
| Nitrogen, $NO_2$ + $NO_3$, diss. (as N) | -- | -- | <0.019 | -- | -- | -- | -- | -- | -- |
| Nitrogen, ammonia, dissolved (as N | -- | -- | <0.015 | -- | -- | -- | -- | -- | -- |
| Nitrogen, amm. + diss., total (as N) | -- | -- | 0.52 | -- | -- | -- | -- | -- | -- |

**Table 4.** Water-quality data for Southeast Sampling Site at Spooner Lake near Spooner, Wisconsin, 2004

| Date | 6/9/2004 | | 6/21/2004 | | 7/2/2004 | | 7/12/2004 | |
|---|---|---|---|---|---|---|---|---|
| Lake stage (ft) | 7.08 | | 6.90 | | 7.08 | | 7.10 | |
| Secchi-depth (m) | 1.9 | | 2.3 | | 2.4 | | 2.0 | |
| Depth of sample (m) | 0.5 | 2 | 0.5 | 2.2 | 0.5 | 2 | 0.5 | 2 |
| Chlorophyll a, phytoplankton (µg/L) | 7.6 | -- | 6.2 | -- | 8.1 | -- | 12.2 | -- |
| Water temperature (°C) | 22.2 | 22.2 | 20.6 | 20.5 | 22.3 | 22.0 | 23.5 | 21.1 |
| Specific conductance (µS/cm) | 177 | 177 | 190 | 190 | 191 | 195 | 194 | 206 |
| pH | 8.5 | 8.5 | 8.3 | 8.4 | 8.8 | 8.6 | 8.4 | 7.7 |
| Dissolved oxygen (mg/L) | 9.9 | 10.1 | 8.3 | 8.4 | 11.7 | 9.9 | 9.6 | 6.8 |
| Phosphorus, total (as P, mg/L) | 0.037 | 0.036 | 0.058 | 0.050 | 0.034 | 0.033 | 0.040 | 0.037 |

| Date | 7/20/2004 | | 7/28/2004 | | 8/12/2004 | | 8/25/2004 | |
|---|---|---|---|---|---|---|---|---|
| Lake stage (ft) | 7.02 | | 6.95 | | 7.12 | | 6.94 | |
| Secchi-depth (m) | 1.6 | | 1.6 | | 2.8 | | 1.9 | |
| Depth of sample (m) | 0.5 | 2 | 0.5 | 2 | 0.5 | 2.2 | 0.5 | 1.8 |
| Chlorophyll a, phytoplankton (µg/L) | 16.5 | -- | 19.6 | -- | 22.7 | -- | 18.7 | -- |
| Water temperature (°C) | 26.0 | 23.7 | 23.6 | 23.6 | 17.5 | 16.5 | 20.2 | 19.9 |
| Specific conductance (µS/cm) | 197 | 206 | 201 | 201 | 197 | 196 | 200 | 201 |
| pH | 8.5 | 8.0 | 8.4 | 8.4 | 7.9 | 7.9 | 8.3 | 8.3 |
| Dissolved oxygen (mg/L) | 10.0 | 8.3 | 9.1 | 9.2 | 8.2 | 7.7 | 9.6 | 8.7 |
| Phosphorus, total (as P, mg/L) | 0.043 | 0.044 | 0.044 | 0.041 | 0.040 | 0.046 | 0.034 | 0.032 |

**Table 5.** Water clarity and water-quality analyses and their associated Trophic State Indices (TSI) for Spooner Lake, Deep Hole Site

| Date | Secchi Disk | | | Sampling | Total Phosphorus | | | Chlorophyll a | | Dissolved Ortho-phosphate Phosphorus |
|---|---|---|---|---|---|---|---|---|---|---|
| | Depth (meters) | Depth (feet) | TSI | Depth (meters) | Conc. (mg/L) | Conc. (ug/L) | TSI | Conc. (ug/L) | TSI | Conc. (mg/L) |
| 6/27/02 | 1.4 | 4.6 | 55 | 0.5 | 0.028 | 28 | 54 | 15.3 | 55 | -- |
| 7/30/02 | 0.7 | 2.3 | 65 | 0.5 | 0.070 | 70 | 61 | 49.3 | 64 | 0.004 |
| 8/29/02 | 0.85 | 2.8 | 62 | 0.5 | 0.078 | 78 | 62 | 48.4 | 64 | -- |
| 3/18/03 | -- | -- | -- | 0.5 | 0.042 | 42 | 57 | | -- | -- |
| 4/29/03 | 2.7 | 8.9 | 46 | 0.5 | 0.026 | 26 | 53 | 5.68 | 48 | -- |
| 6/9/04 | 1.9 | 6.2 | 51 | 0.5 | 0.035 | 35 | 56 | 9.11 | 52 | -- |
| 6/21/04 | 2.5 | 8.2 | 47 | 0.5 | 0.035 | 35 | 56 | | -- | -- |
| 7/2/04 | 1.65 | 5.4 | 53 | 0.5 | 0.024 | 24 | 53 | 6.19 | 49 | -- |
| 7/12/04 | 2.15 | 7.1 | 49 | 0.5 | 0.023 | 23 | 52 | 8.18 | 51 | -- |
| 7/20/04 | 1.9 | 6.2 | 51 | 0.5 | 0.025 | 25 | 53 | 8.12 | 51 | -- |
| 7/28/04 | 1.7 | 5.6 | 52 | 0.5 | 0.033 | 33 | 55 | 8.83 | 51 | 0.003 |
| 8/12/04 | 3.0 | 9.8 | 44 | 0.5 | 0.028 | 28 | 54 | 8.49 | 51 | -- |
| 8/25/04 | 2.5 | 8.2 | 47 | 0.5 | 0.026 | 26 | 53 | 6.67 | 49 | -- |

**Table 6.** Water clarity and water-quality analyses and their associated Trophic State Indices (TSI) for Spooner Lake, Southeast Site

| Date | Secchi Disk | | | Sampling | Total Phosphorus | | | Chlorophyll a | | Dissolved Ortho-phosphate Phosphorus |
|---|---|---|---|---|---|---|---|---|---|---|
| | Depth (meters) | Depth (feet) | TSI | Depth (meters) | Conc. (mg/L) | Conc. (ug/L) | TSI | Conc. (ug/L) | TSI | Conc. (mg/L) |
| 6/27/2002 | 2 | 6.6 | 50 | 0.5 | 0.068 | 68 | 61 | 8.57 | 51 | -- |
| 7/30/2002 | 1.75 | 5.7 | 52 | 0.5 | 0.046 | 46 | 58 | 9.84 | 52 | -- |
| 8/29/2002 | 1.65 | 5.4 | 53 | 0.5 | 0.034 | 34 | 56 | 19.6 | 57 | -- |
| 3/18/2003 | -- | -- | -- | 0.5 | 0.056 | 56 | 59 | -- | -- | -- |
| 4/29/2003 | 1.7 | 5.6 | 52 | 0.5 | 0.04 | 40 | 57 | 8.52 | 51 | -- |
| 6/9/2004 | 1.9 | 6.2 | 51 | 0.5 | 0.037 | 37 | 56 | 7.55 | 50 | -- |
| 6/21/2004 | 2.3 | 7.5 | 48 | 0.5 | 0.058 | 58 | 60 | 6.18 | 49 | -- |
| 7/2/2004 | 2.4 | 7.9 | 47 | 0.5 | 0.034 | 34 | 56 | 8.06 | 51 | -- |
| 7/12/2004 | 1.95 | 6.4 | 50 | 0.5 | 0.04 | 40 | 57 | 12.2 | 54 | -- |
| 7/20/2004 | 1.6 | 5.2 | 53 | 0.5 | 0.043 | 43 | 57 | 16.5 | 56 | -- |
| 7/28/2004 | 1.55 | 5.1 | 54 | 0.5 | 0.044 | 44 | 58 | 19.6 | 57 | -- |
| 8/12/2004 | 2.8 | 9.2 | 45 | 0.5 | 0.04 | 40 | 57 | 22.7 | 58 | -- |
| 8/25/2004 | 1.95 | 6.4 | 50 | 0.5 | 0.034 | 34 | 56 | 18.7 | 57 | -- |

**Table 7.** Observed stages at Spooner Lake near Spooner, Wisconsin, 2002 - 2004

[**Bold** entries made by USGS personnel, other entries by Joe Banick of Lake District]

| Date | Time | Stage [Staff gage on dam] (feet) | Remarks |
|---|---|---|---|
| | | | |
| **6/27/2002** | | **7.05** | |
| **7/30/2002** | | **6.97** | |
| **8/29/2002** | | **6.92** | |
| **3/18/2003** | | **6.75** | |
| **4/29/2003** | | **6.88** | |
| **8/31/2003** | **1600** | **7.00** | |
| 4/10/2004 | | | Ice out today |
| 4/20/2004 | 1530 | 7.30 | Heavy rain on 4/18/04 |
| 4/22/2004 | 1230 | 7.30 | |
| 4/28/2004 | 7.14 | 7.14 | |
| 4/30/2004 | 1800 | 7.08 | |
| 5/2/2004 | 1730 | 7.06 | Water is crystal clear |
| 5/4/2004 | 1000 | 7.04 | |
| 5/8/2004 | 1330 | 6.98 | |
| 5/10/2004 | 1900 | 6.96 | Rained on 5/9/04 |
| 5/13/2004 | 1405 | 7.02 | Heavy rain today & 5/12/04 |
| 5/16/2004 | 1430 | 7.02 | Rained on 5/15/04 |
| 5/19/2004 | 1000 | 7.06 | |
| 5/22/2004 | 1000 | 7.06 | Water is crystal clear today |
| 5/24/2004 | 1930 | 7.08 | Rained all day on 5/23/04 |
| 5/26/2004 | 1000 | 7.06 | |
| 5/28/2004 | 2030 | 7.10 | Rained all night 5/2/04--water high |
| 5/31/2004 | 1830 | 7.18 | Rained all day 5/30/04 |
| 6/1/2004 | 1500 | 7.20 | |
| 6/4/2004 | 1630 | 7.10 | No rain since last recording. |
| 6/6/2004 | 1300 | 7.17 | Rained all day on May 5, 2004 (probably 6/5/04)--lake has been high all spring. |
| **6/9/2004** | **1040** | **7.08** | **2.36 ft from top of dam bracked to where chain attaches on left sid of dam to top of I-beam** |
| 6/10/2004 | 1100 | 7.04 | No rain prior to this |
| 6/11/2004 | 1000 | 7.04 | No rain prior to this |
| 6/13/2004 | 1100 | 6.98 | Light rain on 6/12/04. |
| 6/16/2004 | 1030 | 6.96 | Light rain today |
| 6/17/2004 | 1100 | 6.94 | No rain--lake is lower than normal |
| 6/19/2004 | 1830 | 6.90 | No rain--lake is lower than normal |
| 6/21/2004 | 1000 | 6.90 | No rain--called County about dam being low. |
| **6/21/2004** | **1145** | **6.90** | **(tape-down to top of board = 2.36 ft.)** |
| 6/23/2004 | 1330 | 6.90 | No rain (called county again--Hyw Dept wants dam's at official marks set by railroad 100 years ago--96.8, this is too low for our lake for 2004) |
| 6/24/2004 | 1300 | 6.90 | |
| 6/26/2004 | 1200 | 6.90 | |
| 6/28/2004 | 1100 | 6.94 | No rain (count placed board in dam to slightly raise level) |
| 6/30/2004 | 1400 | 6.97 | No rain (water up slightly) |

**Table 7.** Observed stages at Spooner Lake near Spooner, Wisconsin, 2002 - 2004--continued

[**Bold** entries made by USGS personnel, other entries by Joe Banick of Lake District]

| Date | Time | Stage [Staff gage on dam] (feet) | Remarks |
|---|---|---|---|
| 7/1/2004 | 1100 | 7.07 | Rained quite hard on 6/30/04 |
| **7/2/2004** | **0810** | **7.08** | **New board has been installed. 2.38 ft form top of I-beam to top of chained bracket)** |
| 7/4/2004 | 1000 | 7.12 | Rained over night on 7/3/04. Lake looks good so far as algae--lake growth of curley leaf pond weed at mouth of Crystal Brook. |
| 7/6/2004 | 1100 | 7.10 | |
| 7/9/2004 | 0930 | 7.10 | Water above normal--rained on and off for two days |
| 7/10/2004 | 1030 | 7.08 | Water above normal--lake looks good |
| 7/11/2004 | 1530 | 7.12 | Rained very heavy during night |
| 7/12/2004 | 1100 | 7.12 | |
| **7/12/2004** | **1110** | **7.10** | **2.35 from bracket to board** |
| 7/14/2004 | 1800 | 7.08 | |
| 7/17/2004 | 1130 | 7.00 | No rain last few days |
| 7/19/2004 | 1200 | 7.06 | Very heavy rain this morning |
| **7/20/2004** | **1040** | **7.02** | **3 boards, 2.35 ft TD to bracket** |
| 7/22/2004 | 1130 | 7.02 | No rain (Lake is staying in good shape so far this year. One algae bloom--very sight sor far. Water turning a little green on east side. |
| 7/24/2004 | 1230 | 7.00 | No rain |
| 7/26/2004 | 1730 | 6.98 | |
| **7/28/2004** | **0850** | **6.95** | **5 boards, TD to bracket = 2.35 from top of I-beam.** |
| 7/28/2004 | 1530 | 6.98 | |
| 7/31/2004 | 1330 | 7.07 | Rained on the 29th & 30th. To bring up the height on the dam. Lake water is still very clear with little algae. |
| 8/1/2004 | 1530 | 7.06 | Lake has held up well this year. |
| 8/4/2004 | 1330 | 7.04 | No rain since the lastt reading, lake is clear and cloudy in other parts of the lake. |
| 8/6/2004 | 1400 | 7.00 | On my side, the north shore, is showing a lot of filamentous algae growth for the first time this year. |
| 8/9/2004 | 1300 | 7.00 | |
| **8/9/2004** | **1750** | **7.14** | |
| **8/12/2004** | **1205** | **7.12** | **TD from top of I-beam to chain bracket = 2.35 ft.** |
| 8/12/2004 | 1400 | 7.10 | Rained Tues & Weds., 10th & 11th. |
| 8/16/2004 | 1430 | 7.08 | Rained this morning. Lake water is as clear as I've ever seen it this time of the year, 6 ft deep. |
| 8/18/2004 | 1300 | 7.08 | |
| 8/21/2004 | 1100 | 7.08 | |
| 8/23/2004 | 1300 | 6.98 | No rain--lake water clear |
| **8/25/2004** | **0840** | **6.94** | **TD from top of I-beam to chain bracket = 2.35 ft. ~ 0.7 ft of water over boards** |
| 8/25/2004 | 1400 | 6.96 | No rain. |
| 8/27/2004 | 1300 | 7.00 | One inch of rain on the 26th. |
| 8/29/2004 | 1500 | 7.02 | Rain night before. |
| 8/31/2004 | 1300 | 7.00 | Dam has been between 6.96 and 7.00 for most of the summer, which is a good setting for our lake. Water is still very clear. |