Nine Mile Creek Watershed District
12800 Gerard Drive
Eden Prairie, MN 55346
(952) 206-0980
ninemilecreek.org

# MEMO

**TO:** **Nine Mile Creek Watershed District Board of Managers**
**FROM:** **Jordan Wein, Katie Turpin-Nagel, Janna Kieffer**
**DATE:** **Date May 20, 2026**
**RE:** **Acceptance of Anderson Lakes Protection Strategies Report**

**Requested Action:** Accept the Anderson Lakes Protection Strategies Report

**Presenter(s):** Jordan Wein, Janna Kieffer

## Background

At the April 15th board meeting, the board discussed the draft of the Anderson Lake Protection Strategy Report. The board was asked to review the draft and to provide any follow up comments or concerns leading to the May 20th board meeting. No comments were received and the draft was finalized with no significant changes. The report is now ready to be accepted.

Moving forward, the next steps would be for staff to meet with agency stakeholders to determine roles and responsibilities for projects recommended in this report (e.g. cattail management, herbicide, structure redesign). Once a structure for leadership of projects is determined, Nine Mile will continue by holding public hearings for recommended projects. After comments are heard, staff could ask for the board to order projects.

As a reminder, the herbicide treatment for Eurasian watermilfoil in Southeast Anderson was publicly heard on March 4th, 2026. The next step would be to order this treatment for the fall of 2026.

## Attachments or Linked Agenda Items:

**Final Anderson Lakes Protection Strategies Report**

# Anderson Lakes Protection Strategy

*Northwest Anderson, Southwest Anderson, & Southeast Anderson Lakes*

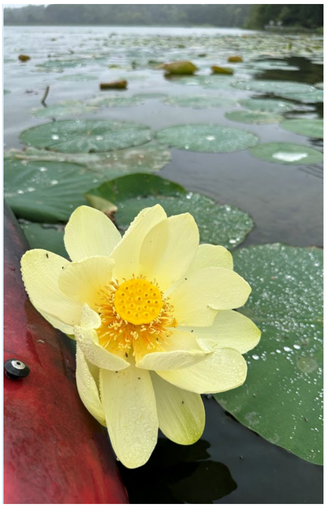
Prepared for
Nine Mile Creek Watershed District

Prepared by
Barr Engineering Co.

May 2026

4300 MarketPointe Drive, Suite 200
Minneapolis, MN 55435
952.832.2600

barr.com



# Anderson Lakes Protection Strategy

*Northwest Anderson, Southwest Anderson, and Southeast Anderson Lakes*

May 2026

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# Abbreviations and Units of Measure

| | |
|---|---|
| ac-ft | acre-feet |
| AIS | aquatic invasive species |
| BMP | best management practice |
| CLP | curly-leaf pondweed |
| CPUE | catch per unit effort |
| DO | dissolved oxygen |
| EWM | Eurasian watermilfoil |
| FQI | floristic quality index |
| IBI | Index of Biotic Integrity |
| LVMP | Lake Vegetation Management Plan |
| m | meters |
| mg/L | milligram per liter |
| mL | milliliters |
| MNDNR | Minnesota Department of Natural Resources |
| MNDOT | Minnesota Department of Transportation |
| MPCA | Minnesota Pollution Control Agency |
| NMCWD | Nine Mile Creek Watershed District |
| NGVD | National Geodetic Vertical Datum |
| NOAA | National Oceanic and Atmospheric Administration |
| NURP | Nationwide Urban Runoff Program |
| NW | northwest |
| Mobile-P | mobile phosphorus |
| OHWL | ordinary high-water level |
| Organic-P | organically bound phosphorus |
| PI | point-intercept |
| SE | southeast |
| SW | southwest |
| TP | total phosphorus |
| TRPD | Three Rivers Park District |
| UAA | Use Attainability Analyses |
| µg/L | micrograms per liter |
| WHO | World Health Organization |

# 1 Introduction

The Nine Mile Creek Watershed District (NMCWD) conducted a study of water quality conditions in the Anderson Lakes, which include Southeast Anderson Lake located in Bloomington, Southwest Anderson Lake in Eden Prairie, and Northwest Anderson Lake located in Eden Prairie and Bloomington, Minnesota. The study is a scientific assessment of the physical, chemical, and biological conditions of the lakes, and includes both a water quality and ecological assessment and provides recommendations for protective and/or remedial measures for each of the lakes and their tributary watersheds. The work presented in this report provides an update of analyses that were previously completed by the NMCWD for the Anderson Lakes in 2005 (Barr Engineering, Co., 2005).

The conclusions and recommendations presented in this report are based on historical water quality and ecological data, a review of best management practices installed since the previous water quality study, and a reassessment of District goals and priorities for water quality improvement and protection.

## 1.1 Study Approach

Beginning in the late-1990s, the NMCWD used the Use Attainability Analyses (UAA) process to assess water quality conditions relative to the desired beneficial uses that can be reasonably achieved and maintained for a given waterbody and identify management recommendations. UAAs completed by NMCWD followed a stepwise, outcome-based evaluation and planning process that diagnosed water quality problems and their causes and identified feasible alternative remedial strategies to achieve the water quality goals. The original UAA for the Anderson Lakes was completed in 2005 (Barr Engineering, Co., 2005) and several of the recommended management strategies from that study were implemented between 2008 and 2014.

The NMCWD understands that lake management is an ongoing effort and does not end with project implementation. Since it’s been over a decade since the implementation of active management practices on the Anderson Lakes, NMCWD desired to evaluate the current status of lake health and identify additional protection and management recommendations, as appropriate.

This study holistically evaluated lake health utilizing an assessment framework. The framework, shown in Figure 1-1, provides a formalized process to be utilized following project implementation to evaluate and guide future monitoring and management practices and to track progress towards identified goals. The Post-project Lake Assessment Framework includes reviewing the success of the management practices on improving water quality and ecological health, evaluating current water quality conditions, reviewing and reassessing goals for the lakes, evaluating if additional management is needed and developing management and protection strategies.

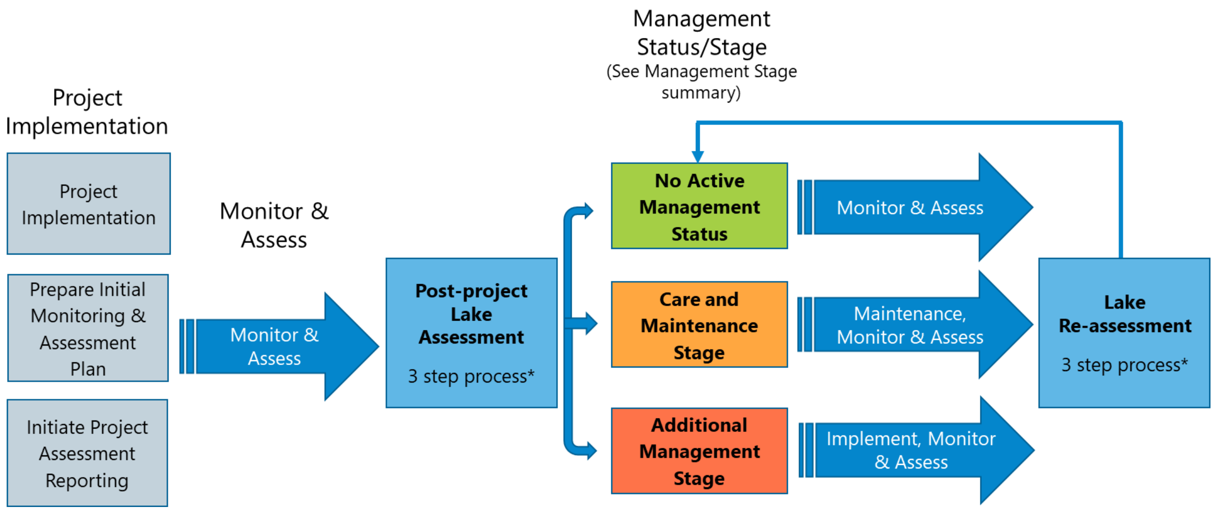



**Figure 1-1 NMCWD Post-project Lake Assessment Framework**

As part of the post-project lake assessment, the management status (or stage) of a lake is determined based on assessment of lake health conditions in relation to the established lake management goals. Three potential management stages have been identified as part of the framework: (1) No Active Management, (2) Care and Maintenance, and (3) Additional Management. A lake can be given the status of “No Active Management” if implementation is complete and lake management goals are being met or achievement of goals relies on programs or actions beyond the realm of specific lake and watershed management practices. Beyond monitoring and evaluation, there is minimal management activity anticipated for a lake with a status of *No Active Management*. For a lake in the *Care and Maintenance* stage, ongoing or periodic management activities are anticipated to maintain or improve current conditions, such as rough fish removals or herbicide treatments, until these activities are no longer needed. Once management activities are no longer needed the management status can be changed to *No Active Management*. The *Additional Management Stage* applies when lake management goals are not being met (either existing or new goals) following project implementation. In this stage, additional management practices that were not part of the original recommendations will be investigated.

Upon determination of the lake management status/stage for a lake, a high-level management plan is prepared, identifying management and protection strategies and/or management activities, depending on the assigned category. The management plan will also identify monitoring recommendations and triggers for re-assessment of management status as part of the post-project lake assessment. A summary of the anticipated components of a high-level lake management plan for each management stage is below.

**No Active Management Stage**

- Identify lake-specific protection strategies (beyond lake-specific management activities)
- Develop recommendations for monitoring (e.g., what to monitor, frequency, potential partners)
- Develop lake specific thresholds/triggers for re-assessment of management stage/status

**Care & Maintenance Stage**

- Identify lake-specific protection strategies (may include lake-specific management practices)
    - Given some threats may be beyond our control, consider changes to monitoring frequency and/or parameters, education, and public risk communication
- Identify "maintenance-based" management practices to be implemented and the recommended frequency/duration
- Develop recommendations for monitoring (e.g., what to monitor, frequency)
- Develop lake specific thresholds/triggers for re-assessment of management stage/status
- Identify potential partners to help implement practices and assist with monitoring

**Additional Management Stage**

- Conduct technical analyses to better understand current lake dynamics and/or nutrient cycling and evaluate additional management options.
    - May require targeted monitoring to inform analyses and management decisions
    - Will likely include lake modeling analyses to inform analyses and management decisions
- Develop recommendations for additional management activities
- Conduct feasibility study for additional recommended management activities, in coordination with potential project partners, and order project (including public hearing)
- Implement management activities

The final step in the post-project lake assessment framework is a periodic re-assessment of lake status. The frequency and timing of lake re-assessment will depend on results from periodic monitoring but should occur at least once every ten years.

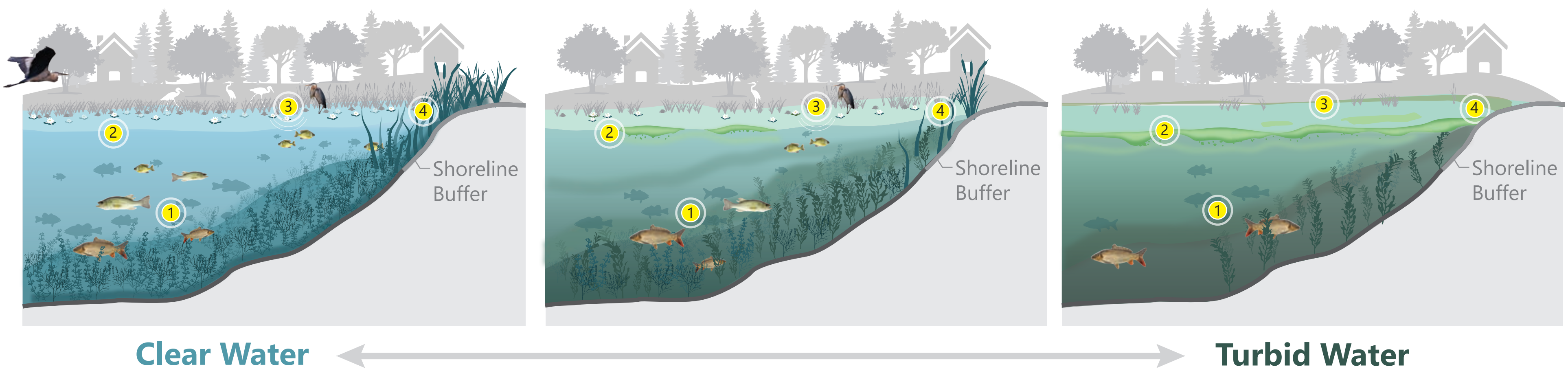
# 2 Shallow Lake Characteristics and Water Quality

Shallow lakes are unique ecosystems that differ from deeper lakes. Shallow lakes are lakes that generally have well mixed water columns throughout most of the year and have depths that potentially allow for light penetration to reach most of the lake bottom. Shallow lakes can support macrophyte growth across the entire lake surface when lake clarity is reasonably high. Shallow lakes classically exist in two states: (1) clear water with extensive coverage of submerged and emergent macrophytes and low phytoplankton (algae) abundance; and (2) turbid water where phytoplankton dominate and macrophyte coverage is limited due to phytoplankton shading. The concentration of nutrients entering the shallow water system (from stormwater or from lake bottom sediments), fishery balance and composition, the presence or absence of invasive species (such as curly-leaf pondweed, carp, and goldfish), and dissolved oxygen concentrations are primary drivers that determine the state of shallow lakes (Figure 2-1).

There are a number of concepts and terminology that are necessary to describe and evaluate a lake's water quality. This section is a brief discussion of those concepts.

## 2.1 Eutrophication

Eutrophication is the process of gradual nutrient enrichment in lakes, which can lead to increased biological production, such as amplified growth of algae and aquatic plants. This process of increased fertility is natural in an aging aquatic ecosystem and results from the normal environmental forces that influence a lake. Cultural eutrophication is an acceleration of the natural processes and is caused by human activities. Nutrient inputs from urban, agricultural, and industrial stormwater runoff can far exceed the natural inputs to a lake, often creating excessive algal blooms, low oxygen levels, and loss of aquatic species diversity.




| Clear Water | | Turbid Water |
| --- | --- | --- |
| 1. Good fishery balance | 1. Less balanced fishery, more rough fish (e.g., carp) | 1. Fishery not balanced, mostly rough fish, winter fish kills |
| 2. Algae blooms rare | 2. Algae blooms moderate | 2. Algae blooms dominant, blue-green algae possible |
| 3. Diverse prey options and healthy habitat for birds | 3. Less prey options and habitat for birds | 3. Limited prey options and habitat for birds |
| 4. Numerous and diverse native plants in the lake and within shoreline buffers; low invasive species present | 4. Less diverse native plants in the lake and within shoreline buffers; invasive species present | 4. Low diversity and quantity of native plants in the lake and within shoreline buffers; invasive species present |

**Figure 2-1 Depiction of shallow lake states**

## 2.2 Nutrients

Biological production in an aquatic ecosystem is limited by the concentrations of essential nutrients. The "limiting nutrient" concept is a widely applied principle in ecology and in the study of eutrophication. It is based on the idea that phytoplankton and plants require many nutrients to grow, but the nutrient with the lowest availability, relative to the amount needed by the phytoplankton or plant, will limit growth. It follows then, that identifying the limiting nutrient will point the way to controlling aquatic plant and algal growth. Nitrogen and phosphorus are generally the two growth-limiting macronutrients in most natural waters. Thus, efforts to improve water quality typically focus on reducing the growth-limiting nutrient concentration in the waterbody; however, it is often difficult to identify and control all the nutrient loadings to a specific waterbody.

Two primary sources, external and internal loads, are responsible for elevated nutrient concentrations in lakes. Nutrients that enter lakes through watershed runoff, groundwater inputs, or atmospheric deposition are considered external loads. As urbanization has occurred, more areas of impermeable surfaces have been developed causing increased stormwater runoff and pollutant transport during storm and spring thaw events. In urbanized areas, stormwater runoff typically flows through storm sewer systems to the downstream waterbody, which generally results in faster velocities than natural channel flow and can result in higher suspended loadings. Implementation of the NMCWD's stormwater management rules for new development and redevelopment and efforts to install retrofit best management practices (BMPs) are helping to reduce external loads to nearby waterbodies. However, for many shallow lakes, internal load reduction measures (e.g., alum treatment, aquatic plant management, fish management) are also required to meet water quality goals.

Once external nutrient loads enter a lake, over time, the nutrients accumulate in the sediment through the settling of particulates and through organism decay. Natural lake processes such as sediment resuspension, chemical dissolution, or microbial reduction can reintroduce these nutrients to the overlying water column resulting in internal loading. This is specifically common for phosphorus, which can be found bound to the sediment under oxidized conditions. The binding of phosphorus to iron in sediments allows the sediment to act as a sink or source depending on the lake's physical and chemical conditions. Therefore, understanding the chemical and physical conditions and the timing of these conditions will be important considerations when developing an internal loading management plan.

### 2.2.1 Stratification Impacts on Internal Phosphorus Loading

Lake stratification—the separation of a warm, well-mixed surface layer (epilimnion) from a cooler bottom layer (hypolimnion) (Figure 2-2)—can lead to low oxygen concentrations in bottom waters and exacerbate internal phosphorus loading. In shallow lakes, stratification is often irregular and may occur on daily, weekly, or longer timescales. During periods when the entire water column mixes, phosphorus previously released from sediments can be transported to surface waters, where it came become more accessible for algal growth.

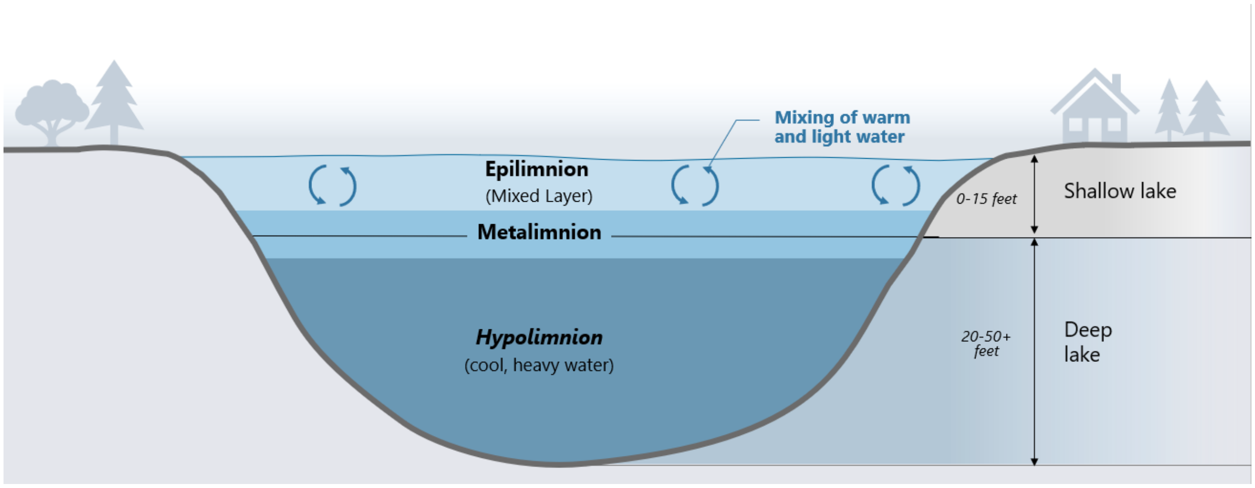



**Figure 2-2 Generalized thermal lake stratification diagram**

## 2.2.2 pH Impacts on Internal Phosphorus Loading

The pH of the water column can also play a vital role in affecting the phosphorus release rate under conditions when oxygen is present in the water column (oxic conditions). Photosynthesis by macrophytes (aquatic plants) and algae during the day tend to raise the pH in the water column, which can enhance the phosphorus release rate from the oxic sediment. Enhancement of phosphorus release at elevated pH (pH > 8.2) is thought to occur through replacement of the phosphate ion ($PO_4^{-3}$) with the excess hydroxyl ion ($OH^-$) on the oxidized iron compound (James, Barko, & Eakin, 2001). Large increases in pH are often the consequence of phytoplankton blooms (e.g., cyanobacteria harmful algal blooms).

## 2.2.3 Organism Impacts on Internal Phosphorus Loading

Benthivorous (bottom feeding), rough fish, such as carp and bullhead, can have a direct influence on the phosphorus concentration in a lake (LaMarra, 1975). These fish typically feed on decaying plant and animal matter and other organic particulates found at the sediment surface. The fish digest the organic matter, and excrete soluble nutrients, thereby transforming sediment phosphorus into soluble phosphorus available for uptake by algae at the lake surface. Benthivorous fish can also cause resuspension of sediments in shallow ponds and lakes, transporting phosphorus from sediment into the water column, causing reduced water clarity and poor aquatic plant growth, as well as high phosphorus concentrations (Cooke, Welch, Peterson, & Newroth, 1993). In some cases, the water quality impairment caused by benthivorous fish can negate the positive effects of BMPs and lake restoration.

The critical difference between biological (e.g., benthivorous fish feeding) and physical (e.g., wind and waves) sediment resuspension is the area and the frequency to which these components can induce impacts. The volume of sediment impacted by physical resuspension is largely influenced by the geometry of the lake (e.g., size, fetch, bathymetry) and wind events (e.g., direction, velocity). For example, a wind event may develop wave induced sediment resuspension along a portion of the shoreline. However, biological resuspension from feeding or mating activities of fish can occur over a much larger area and is impacted by the number of organisms in the aquatic ecosystem. Additionally, while physical resuspension occurs in a periodic, episodic-based fashion, benthivorous fish resuspension can be more continuous.

### 2.2.4 Curly-leaf Pondweed Impacts on Internal Phosphorus Loading

Another potential source of internal phosphorus loading is the growth and die-off of curly-leaf pondweed. Curly-leaf pondweed is an invasive and non-native aquatic plant that is common in many Twin Cities metropolitan area lakes. Curly-leaf pondweed grows under the ice during the winter and gets an early start in the spring, crowding out native species. It releases a small reproductive pod called a turion that resembles a small pinecone in late-June, and then begins its die-back in late-June and early-July. The biomass sinks to the bottom of the lake and begins to decay, releasing nutrients into the water column and causing oxygen depletion, exacerbating the internal sediment release of phosphorus. This cycle can result in an increase in nutrient concentrations in the lake in late-June or early-July in lakes with a higher percentage of invasive growth.

### 2.2.5 Nitrogen Inputs and Limitations

Nitrogen is a nutrient required for phytoplankton growth and hence nitrogen management also needs to be considered as an important component of lake management. Increases in nitrogen concentrations in lakes can be attributed to a combination of factors in the watershed, including increased fertilizer application rates and frequency, increased impervious surface areas, expansion of storm sewer systems, and loss of riparian wetlands. Land use changes and increased nitrogen loading can result in a decreased natural capacity for nitrogen uptake and assimilation by plants and decreased cycling back to the atmosphere as nitrogen gas ($N_2$) through natural nitrification and denitrification processes. Thus, this can result in high nitrogen concentrations in open water systems.

For the last couple of decades, phosphorus reduction has generally been the primary focus for lake management in Minnesota based on the premise that phosphorus limitation is dominant in freshwater lakes (e.g., reducing phosphorus inputs alone will limit primary productivity and algal bloom growth). While phosphorus management has been successful or partially successful in a number of lake management projects, recent research is showing that nitrogen limitation or dual nitrogen-phosphorus limitation may be more significant than initially anticipated (Paerl et. al, 2016). This is particularly true for shallow lakes. The nutrient that limits phytoplankton/algal growth can vary geographically, but limitation can also vary seasonally in a single lake. Some lakes have been shown to display phosphorus limitation in the spring but switch to nitrogen limitation in the summer and fall. Furthermore, an additional benefit of managing nitrogen in upstream ecosystems is that this reduces some of the burden in vulnerable ecosystems further downstream that are nitrogen limited (e.g., Gulf of Mexico). Given that recent research is showing higher evidence of dual nitrogen-phosphorus limitation in freshwater lakes, there is a benefit for determining whether source control programs that target both phosphorus and nitrogen will provide greater ecosystem benefits.

## 2.3 Climate Change Considerations

Considerable studies have been devoted to predicting the impacts of a warming climate on the hydrologic cycle. Of particular concern are the changes to atmospheric moisture content, evaporation, precipitation intensity, and the possibility of increased risk for drought and flooding extremes (Trenberth, 1999; Trenberth, Smith, Qian, Dai, & Fasullo, 2003; Giorgi, et al., 2011; Trenberth, 2011).

Alterations to the hydrologic cycle will consequently impact freshwater ecosystems. Observational records and climate model projections show evidence of freshwater vulnerability to a warming climate (Dokulil & Teubner, 2011). Freshwater characteristics such as lake stratification and mixing, ice coverage, and river flow could see discernable changes by the end of the 21st century (Dokulil & Teubner, 2011; Dokulil, 2013). Increases in nutrient loadings and water temperatures, changes to water levels, and amplified eutrophication could impact aquatic organisms and influence biodiversity.

### 2.3.1 Projected Changes to the Hydrologic Cycle

Larger concentrations of greenhouse gases in the atmosphere, such as carbon dioxide and methane, create an increased downwelling of longwave radiation to the earth's surface (Trenberth, 1999). This enhanced downwelling not only escalates surface temperature warming, but also induces changes to the atmospheric moisture content and evaporation. Higher atmospheric temperatures allow for an expanded water holding-capacity of the atmosphere and enhanced radiation causes elevated rates of evaporation. This results in increases to the atmospheric moisture content, which, consequently, will impact precipitation (Trenberth, 1999; Trenberth, Smith, Qian, Dai, & Fasullo, 2003; Kharin, Zwiers, Zhang, & Wehner, 2013).

While changes to precipitation amounts and intensity are expected on a global scale, the changes will be geographically disproportionate. According to the National Oceanic and Atmospheric Administration's (NOAA's) 2013 assessment of climate trends for the Midwest (NOAA, 2013), upward trends in annual and summer precipitation amounts have been observed. The frequency of higher intensity storms has also been noted. Specifically in Minnesota, climatologists have identified four significant climate trends (MNDNR, 2017):

- Increasing annual precipitation
- Increasing frequency and size of extreme rainfall events
- Increasing temperatures, with winter temperatures warming the fastest
- Decline in severity and frequency of extreme cold weather

Overall, the changes to precipitation induced by atmospheric warming pose difficult challenges. The shift to more frequent, high intensity precipitation events in Minnesota indicates a risk for extreme flood events. Higher intensity precipitation events typically produce more runoff than lower intensity events with similar amounts of precipitation because higher intensity rainfall can overwhelm the capacity of the land surface to infiltrate and attenuate runoff.

Not only do these hydrologic changes pose challenges for agriculture, infrastructure, and human safety; but also has the potential to induce changes to aquatic environments. The subsequent section describes the anticipated impacts to aquatic ecosystems if atmospheric warming trends continue.

### 2.3.2 Projected Changes to Waterbodies (Physical and Chemical)

In freshwater lakes, one of the most important atmospheric variables influencing the lake's physical and chemical parameters is temperature. Due to enhanced air temperatures and the projected increasing trends, lake water temperature and the number of ice-free days are projected to change in most inland waters globally. Increases in lake temperature will affect mixing regimes, the length and depth of summer stratification, and the oxygen concentration in the hypolimnion (Dokulil, 2013; Dokulil, 2014; Dokulil, 2016), as well as phytoplankton growth rates, and phosphorus cycling (e.g., release of phosphorus from bottom sediments). As water temperature rises, lake stability enhances, which results in longer thermal stratification and prolonged durations between mixing periods (Dokulil, 2013). Resistance to mixing, particularly in deep lakes, between the nutrient rich hypolimnion and nutrient poor epilimnion across the thermocline increases considerably at temperature gradients of only a few degrees Fahrenheit (Sahoo, et al., 2016).

Prolonged lake stability and a lower thermocline may enhance the risk of oxygen depletion in the hypolimnion and near the lake bottom sediment (Jeppesen, et al., 2009; Sahoo, et al., 2016). Anoxic conditions near the lake bottom can cause nutrient release from the sediments. Understanding the extent of nutrient release from sediments due to low oxygen conditions can be especially important in shallow lakes because shallow lakes are more prone to full lake mixing from larger wind or storm events. During these lake mixing events nutrients released from the sediment are mixed into the full water column, which can increase the potential for algal blooms. Furthermore, overall oxygen concentrations in the lake can be reduced as solubility decreases when the water temperature warms, which can impact fishery balance (Dokulil & Teubner, 2011).

In mid-latitudes where precipitation is likely to increase, with the heightened chance for extreme events, other concerns are warranted. Intense rainfalls resulting in flooding could raise the loading of suspended sediments associated with larger areas experiencing soil erosion (Dokulil & Teubner, 2011; Dokulil, 2016). The combination of longer dry periods and extreme precipitation events could create episodic and intense pulse flows affecting aquatic habitats, bank stability, and species (Dokulil, 2016). Additionally, the increase in the number of extreme, high intensity rain events is likely to increase runoff driven phosphorus transfers from the land to the water (Jeppesen, et al., 2009).

### 2.3.3 Projected Changes to Waterbodies (Biological)

The potential for increased erosion and nutrient inputs from large runoff rates combined with higher water temperatures and prolonged lake stratification in summer could lead to widespread, climate-related eutrophication based on the results of existing studies (Dokulil & Teubner, 2011; Dokulil, 2013). Nutrient enrichment, whether through external or internal loading, stimulates the development of phytoplankton biomass. This resulting surface biomass absorbs light, can shade out benthic algae or macrophytes, and can produce negative lake aesthetics (Dokulil & Teubner, 2011). Unfortunately, not only has previous research projected larger biomasses of phytoplankton in a warmer climate, but research also predicts that a higher proportion of these phytoplankton biomasses will consist of potentially toxic cyanobacteria assemblages (Jeppesen, et al., 2009; Dokulil & Teubner, 2011; Jeppesen, et al., 2014; Dokulil, 2016). Multiple regression analyses on data from 250 Danish lakes sampled during the month of August indicated higher dominance of cyanobacteria with a warming climate. Studies during heat waves in the northern hemisphere also showed that higher percentages of cyanobacteria correlated with rises in temperature (Huisman, Matthijs, & Visser, 2005).

Changes in the seasonal pattern and dynamics of freshwater productivity could also be a consequence of a changing climate. With the earlier onset of warmer air temperatures in the spring, the timing of the phytoplankton peak is likely to shift earlier in the season. If the phytoplankton blooms contain a larger percentage of cyanobacteria species or if the timing of algal production falls out of synchrony with the food demands of zooplankton and fish, then upper levels of the food chain could be negatively impacted (Dokulil, 2016). Enhanced phytoplankton biomasses can also induce thermal feedback mechanisms for lakes. A large area of phytoplankton biomass can result in greater surface temperatures and stronger stratification (Dokulil, 2013). Additionally, increased light attenuation at the surface will reduce light availability at the lake bottom influencing macrophyte growth (Jeppesen, et al., 2014).

This water quality study did not directly assess potential impacts to lake responses due to a changing climate. However, any current and/or future management efforts for waterbodies will be affected by changing climate conditions. Continued monitoring of lake conditions will be important as management efforts are implemented and as changing climate conditions progress. Long-term studies of waterbodies will be essential to create the most effective plans to overcome climate-induced impacts.

# 3 Identification of Goals and Expectations

## 3.1 Current NMCWD Holistic Goals for Lake Management

The NMCWD's approach to evaluating, improving, and protecting lake health includes numerous health assessment factors, as illustrated in Figure 3-1. The primary factors identified as affecting lake ecological health include chemical water quality (e.g., nutrient concentrations), aquatic communities (e.g., plants, fish, algae, and zooplankton), and water quantity (groundwater and surface water). The effects of recreation and wildlife habitat on overall lake health are also considered.

Table 3-1 lists the evaluation factors used by the NMCWD to holistically assess lake health. Numerical goals exist for some of the health assessment factors presented in this table (e.g., Minnesota State water quality standards), while other holistic health factors are assessed qualitatively by comparing to narrative criteria. The NMCWD collaborates with stakeholders and regulatory agencies (e.g., Minnesota Pollution Control Agency (MPCA), Minnesota Department of Natural Resources (MNDNR)) to develop lake-specific numerical goals for ecological indicators where appropriate.

The NMCWD implements an adaptive management approach to improve lake health based on water quality and assessment of the other holistic lake health factors. While striving to achieve the state standards for shallow lakes, the NMCWD recognizes that achieving the water quality goals may not be feasible for some lakes or may require a timeframe that extends several decades. For these situations, the NMCWD's objective is to make reasonable and measurable progress towards meeting the water quality goals and other holistic lake health targets.


**Figure 3-1 NMCWD holistic lake health assessment factors (NMCWD, 2017, amended 2023)**

**Table 3-1 NMCWD holistic lake health assessment evaluation factors**

| Lake Health Assessment Factors | Evaluation Factors |
|---|---|
| Water Quality | • Nutrients<br>• Sediment<br>• Clarity<br>• Chlorophyll-*a*<br>• Chloride |
| Aquatic Communities | • Aquatic Plant IBI[1]- species richness and floristic quality<br>• Invasive Species Presence<br>• Phytoplankton Populations<br>• Cyanobacteria/Blue-green Algae Presence<br>• Zooplankton Populations<br>• Fisheries Populations |
| Water Quantity | • Water Levels<br>• Water Level Bounce<br>• Groundwater Levels |
| Recreation | • Shore Access<br>• Navigation Potential<br>• Aesthetics<br>• Use Metrics |
| Wildlife Habitat | • Upland biodiversity<br>• Buffer extent/width |

[1] Lake plant eutrophication Index of Biotic Integrity (IBI) methodology developed by the MNDNR

## 3.2 Current NMCWD Numeric Water Quality Goals – State Standards and Thresholds

Table 3-2 summarizes the lake water quality standards and ecological thresholds used by the NMCWD to assess lake health. These standards and thresholds are referenced throughout the report and shown on summary plots and figures.

- **Minnesota Lake Eutrophication Standards**—The Minnesota Pollution Control Agency (MPCA) has developed deep and shallow lake eutrophication standards based on ecoregion. The NMCWD is located within the North Central Hardwood Forest Ecoregion and as such has adopted the relevant lake eutrophication standards (phosphorus, chlorophyll-a, Secchi disk transparency) for that ecoregion.

- **Minnesota Chloride Standards**—Because high concentrations of chloride can harm fish and plant life, the MPCA has established acute and chronic exposure chloride standards. A lake is considered impaired if two or more exceedances of chronic criterion (230 mg/L or less) occur within a three-year period or one exceedance of acute criterion (860 mg/L) is measured.

- **Minnesota Aquatic Plant Thresholds**—For aquatic plant monitoring, the NMCWD uses the Lake Plant Eutrophication Index of Biological Integrity (IBI) thresholds developed by the Minnesota Department of Natural Resources (MNDNR). The Lake Plant Eutrophication IBI includes two metrics to measure the response of a lake plant community to eutrophication. The first metric is species richness—the estimated number of species in a lake. The second metric is floristic quality index (FQI), which distinguishes the quality of the plant community and can be a reflection of the quantity of nutrients in the lake. Lakes that score below the thresholds contain degraded plant communities and are likely stressed from cultural eutrophication.

- **World Health Organization Cyanobacteria Thresholds**—Blue-green algae are associated with water quality problems and can be a source of health concerns due to the possible production of hepatotoxins and neurotoxins. The World Health Organization (WHO) has established thresholds for assessing the probability of adverse health effects to lake users from exposure to blue-green algae. The probability of adverse health effects ranges from low to high depending on the abundance of algae (cells/mL) and risk of whole-body contact or ingestion/aspiration.

**Table 3-2 Water quality standards and ecological thresholds used by the NMCWD to assess lake health**

| Type | Parameter[1] | Shallow Lakes[2] | Deep Lakes |
|---|---|---|---|
| Water Quality | Total Phosphorus (summer average, µg/L) | ≤ 60 | ≤ 40 |
| | Chlorophyll-*a* (summer average, µg/L) | ≤ 20 | ≤ 14 |
| | Secchi Disk transparency (summer average, meters) | > 1.0 | > 1.4 |
| | Chloride (mg/L) | ≤ 230 (chronic)<br>≤ 860 (acute) | |
| Aquatic Plants (macrophytes) | Species richness (number of species) | ≥ 11 | ≥ 12 |
| | Floristic Quality Index (FQI) | ≥ 17.8 | ≥ 18.6 |
| Blue-Green Algae (Cyanobacteria) | Low Probability of Adverse Health Effects (i.e., skin irritation, allergic effects are possible, cells/mL) | 20,000 – 100,000 | |
| | Moderate Probability of Adverse Health Effects (i.e., long term illness from algae toxins is possible, cells/mL) | > 100,000 | |
| | High Probability of Adverse Health Effects (i.e., acute poisoning from algal toxins is possible) | Areas where whole body contact or ingestion/aspiration with scums could occur (qualitative assessment only) | |

[1] µg/L = micrograms per liter; mg/L = milligrams per liter; cells/mL = cells per milliliter
[2] Shallow lakes have a maximum depth less than 15 feet or littoral area greater than 80% of the total lake surface area

## 3.3 NMCWD Goals Identified in the 2005 Use Attainability Analysis Study

During the completion of the Southeast, Southwest, and Northwest Anderson Lake Use Attainability Analysis (UAA) Study the following goals were identified by the NMCWD (Barr Engineering, Co., 2005):

- The **Water Quantity Goal** for the three Anderson Lakes was to provide sufficient water storage of surface runoff during a regional flood, the critical 100-year frequency storm event.
    - This goal was identified as attainable with no action.

- The **Water Quality Goal** for Southeast and Southwest Anderson Lakes was based on the goals outlined in the 1996 *NMCWD Water Management Plan* (Barr Engineering, Co., Nine Mile Creek Watershed District Water Management Plan, 1996). The plan specified achieving Category II classification goals for Southeast and Southwest Anderson Lakes (i.e., achieve and maintain a $TSI_{SD}$ (Secchi Disk Transparency derived Trophic Status Index) between 50 and 60). For Northwest Anderson, the plan specified achieving Category III classification goals (i.e., a $TSI_{SD}$ between 60 and 70).
    - These goals were identified as attainable, but only with the implementation of the management practices described in the UAA study.

- The **Aquatic Communities Goal** for Southeast Anderson Lake was to achieve in-lake water quality that fully supported the lake's fisheries-use classification determined by the MDNR (Schupp, 1992) and achieve a balanced ecosystem (e.g., $TSI_{SD}$ approximately 61). This included diverse growth of native aquatic macrophytes. Since the MDNR did not specify the ecologic class for Northwest and Southwest Anderson Lakes there was no specific fisheries related goal identified in the study. However, like Southeast Anderson Lake, the NMCWD desired to achieve in-lake water quality that would result in a diverse native ecosystem.
    - The report did not identify how attainable these aquatic community goals were.

- The **Wildlife Goal** for each of the three Anderson Lakes was to protect existing beneficial wildlife uses.
    - The wildlife goal was identified as attainable with no action, especially if the wetlands and natural land surrounding the lake remained intact.

The 2005 UAA study also summarized the lake goals outlined by the cities of Eden Prairie and Bloomington as well as Three Rivers Park District (TRPD), which can be viewed in the study report (Barr Engineering, Co., 2005).

## 3.4 Reassessment of Lake Water Quality and Ecological Goals

As part of this study, the NMCWD sought to reevaluate the lake management goals after implementing multiple water quality and ecological management practices since the 2005 Anderson Lakes UAA study and completing subsequent monitoring efforts. Table 3-3 summarizes the specific lake-management goals developed for the Anderson Lakes, based on goals identified in the NMCWD's Water Management Plan, discussions with agency stakeholders (including Bloomington, Eden Prairie, and Three Rivers Park District), feedback from public meeting(s) held with interested residents, and discussions with NMCWD staff and board of managers.

The reassessed goals informed the management and protection strategies that are outlined in Section 8 of this study and are intended to guide lake management decisions.

**Table 3-3 Reassessed Anderson Lake Goals**

<table>
<tr><th colspan="2">Lake Health Assessment Factor</th><th>Anderson Lake Goal</th></tr>
<tr><td colspan="2">Water Quality</td><td>• Protect water quality to continue meeting MPCA’s shallow lake water quality standards</td></tr>
<tr><td rowspan="3">Aquatic Communities</td><td>Aquatic Plants (Macrophytes)</td><td>• Support and protect a healthy, diverse native plant population</td></tr>
<tr><td>Algae (Phytoplankton)</td><td>• Minimize frequency of harmful algal blooms through the protection/improvement of water quality<br>• Increase public awareness and understanding of potential health risks of harmful algal blooms</td></tr>
<tr><td>Fisheries</td><td>• Minimize the impact of fisheries on water quality</td></tr>
<tr><td colspan="2">Water Quantity</td><td>• Support water level equalization between all three basins, while balancing aquatic invasive species (AIS) considerations</td></tr>
<tr><td colspan="2">Wildlife Habitat</td><td>• No specific goal. Promote enhancement of habitat conditions and habitat connectivity to support ecological movement across the lake ecosystem.</td></tr>
<tr><td colspan="2">Recreation</td><td>• No specific goal. The promotion of habitat connectivity could offer a secondary benefit of supporting improved recreational activities.</td></tr>
</table>

# 4 Lake Basin and Watershed Characteristics

The following sections describe the unique characteristics of the Anderson Lakes and their tributary watersheds. The Anderson Lakes are located just south of the intersection of Interstate 494 and U.S. Highway 169. Northwest Anderson is located in both the City of Eden Prairie and the City of Bloomington. Southwest Anderson is located in the City of Eden Prairie and Southeast Anderson is located in the City of Bloomington.

## 4.1 Northwest Anderson Lake Basin Characteristics

Northwest Anderson Lake has a water surface area of approximately 185 acres, a maximum depth of approximately 12 feet, and a mean depth of 4 feet at a water surface elevation of 839.0 (NGVD29), which is the elevation of the control outlet. At this elevation the lake volume is approximately 743 acre-feet (Figure 4-1). The MNDNR-defined ordinary high-water level (OHWL) is 839.0 ft (NGVD 29). The water level in the lake is controlled by weather conditions (snowmelt, rainfall, and evaporation), inflow from Southwest Anderson Lake, groundwater flow, inflow from the direct subwatershed, and outflow from the lake outlet. Flow through the Northwest Anderson outlet is conveyed north via storm sewer and is ultimately discharged to the South Fork of Nine Mile Creek.

Since Northwest Anderson is shallow, the lake is prone to frequent mixing events. Because of this, Northwest Anderson is considered *polymictic* (mixing many times per year) as opposed to lakes with deep, steep-sided basins that are usually *dimictic* (mixing only twice per year).

## 4.2 Southwest Anderson Lake Basin Characteristics

Southwest Anderson Lake has a water surface area of approximately 106 acres, a maximum depth of 8 feet, and a mean depth of 4 feet at a water surface elevation of 839.0 (NGVD29), which is the elevation of the control outlet on Northwest Anderson. The control outlet on Northwest Anderson sets the normal water level on Southwest Anderson. At this elevation the lake volume is approximately 405 acre-feet (Figure 4-1). The MNDNR-defined OHWL is also 839.0 ft (NGVD29). Water levels on Southwest Anderson are influenced by flows to or from Southeast Anderson Lake, weather events, groundwater flow, inflow from its direct subwatershed and outflow to Northwest Anderson. Southwest Anderson Lake discharges north by gravity through a natural channel to Northwest Anderson Lake, which discharges to the South Fork of Nine Mile Creek.

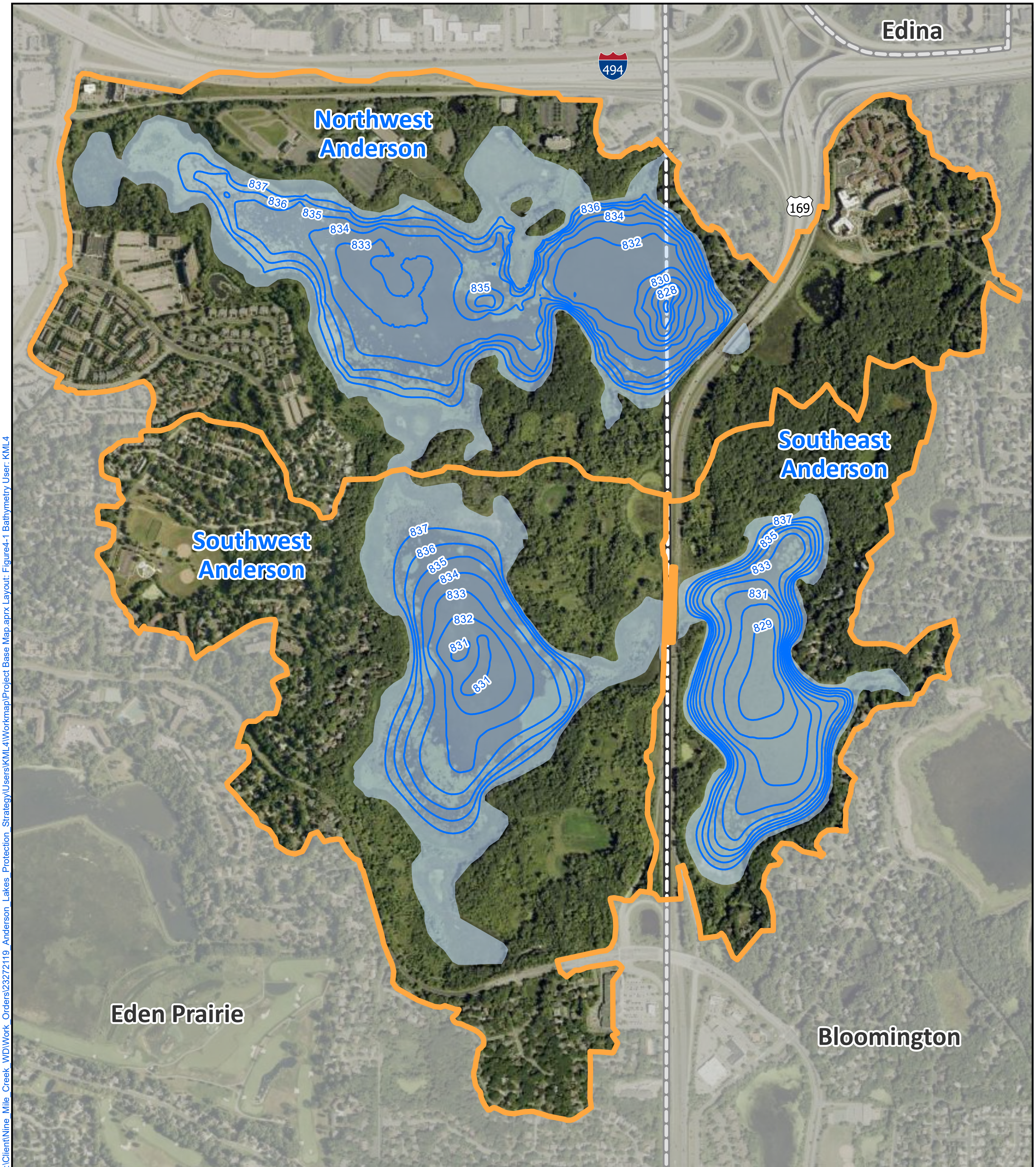
Similar to Northwest Anderson Lake, Southwest Anderson Lake is considered polymictic because of its shallow characteristics and frequent mixing events throughout the year.

## 4.3 Southeast Anderson Lake Basin Characteristics

Southeast Anderson Lake is the smallest in this chain of lakes, with a water surface area of approximately 82 acres, a maximum depth of 10 feet, and a mean depth of 6 feet at a water surface elevation of 839.0 (NGVD29), which is the elevation of Southeast Anderson's control outlet located near U.S. Highway 169. At this elevation the lake volume is approximately 483 acre-feet (Figure 4-1). The MNDNR-defined OHWL is 839.0 ft (NGVD 29). Water from Bush Lake, located southeast of Southeast Anderson Lake, is pumped into Southeast Anderson Lake during times of high water levels in Bush Lake. Other inflows to Southeast Anderson Lake include precipitation, groundwater flow, inflow from its direct subwatershed, and occasional flows from Southwest Anderson.

The control structure between Southwest and Southeast Anderson Lakes is a culvert with a weir at elevation 839.0 and a screen above the weir for aquatic invasive species (AIS) management. Under regular operating conditions (e.g., when the screen is maintained), water can move between Southeast and Southwest Anderson Lakes if the water level is above 839.0.

Because of the lake's shallow characteristics, Southeast Anderson Lake is considered polymictic.




Major Watersheds

Municipal Boundary

Bathymetry Contours (ft)

NWL (ft) = 839.0 NGVD29

0 600 1,200

Feet

9 MILE CREEK WATERSHED DISTRICT

**Anderson Lakes Bathymetry**

Nine Mile Creek Watershed District

FIGURE 4-1

BARR

## 4.4 Watershed Characteristics

Under typical climatic conditions the total watershed area tributary to Northwest, Southwest, and Southeast Anderson Lakes is approximately 1,236 acres, located within the cities of Eden Prairie and Bloomington. During markedly wet climatic conditions, water is pumped from Bush Lake into Southeast Anderson Lake when the lake's water surface elevation exceeds 834.0 (NGVD29). When pumping occurs, the watershed area tributary to the Anderson Lakes increases by approximately 1,192 acres to a total tributary area of 2,427 acres. Bush Lake has not been pumped into Southeast Anderson Lake since mid-summer 2020.

Northwest Anderson Lake's direct watershed is approximately 577 acres, including the surface area of the lake (185 acres). Runoff from the direct watershed enters Northwest Anderson through overland flow and from several storm sewer outfalls along the lakeshore. However, the overall watershed to Northwest Anderson Lake includes the tributary areas that drain to upstream Bush (when pumped), Southeast Anderson, and Southwest Anderson lakes before entering Northwest Anderson Lake.

Southwest Anderson Lake's immediate watershed is approximately 453 acres, including the surface area of the lake (106 acres). Runoff from the direct watershed enters Southwest Anderson through overland flow and from several storm sewer outfalls along the lakeshore. The overall watershed to Southwest Anderson Lake also includes the tributary areas that drain to upstream Bush (when pumped) and Southeast Anderson lakes.

The direct watershed of Southeast Anderson Lake is approximately 206 acres, including approximately 82 acres of open water from the lake's surface area. Southeast Anderson receives runoff from its immediate watershed through overland flow and from a few storm sewer outfalls at various points along the lakeshore. When Bush Lake is pumped during notably wet conditions, the tributary area to Southeast Anderson also includes those land areas tributary to Bush Lake.

Major watersheds and the locations of the major stormwater conveyance features are shown in Figure 4-2.

### 4.4.1 Land Use

Land use practices within a lake's watershed impact the lake and its water quality by altering the volume of stormwater runoff, sediment load, and pollutant load (namely nutrients such as phosphorus and nitrogen) that reaches the lake from the watershed. Each land use contributes a different amount of runoff and pollutants to the lake, thereby impacting the lake's water quality differently. As land use changes over time, changes can be expected in downstream water bodies as a result, unless mitigated.

Historically, the Anderson Lakes watersheds were primarily comprised of basswood, sugar maple, and oak forests. There were also numerous wetlands located throughout the watershed. The terrain varies from gently to steeply rolling.

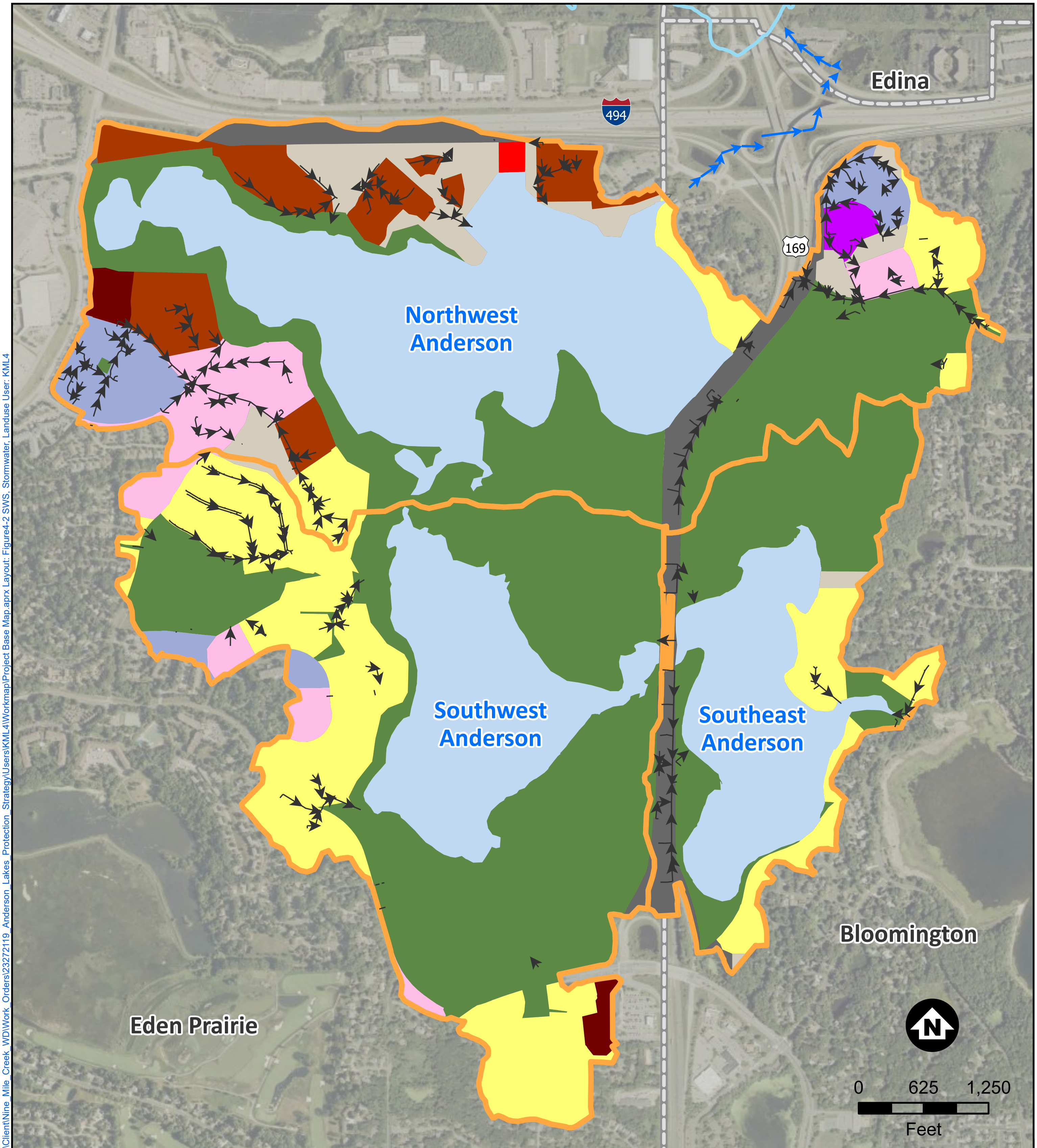
According to the 2020 Met Council's generalized land use dataset, the Anderson Lakes watersheds are largely undeveloped, with 36% of the surrounding watershed comprised of park, recreational, or preserve area and 30% comprised of open water area. Table 4-1 provides a summary of the land use classifications within the watersheds. Figure 4-2 shows a map of the land use classifications within the Anderson Lakes watersheds.

The small watershed-to-lake area ratios and high percentage of park, recreation, and preserve land uses contribute to favorable water quality conditions in the Anderson Lakes by reducing pollutant loading from stormwater runoff.

**Table 4-1 Land use classifications in Anderson Lakes watersheds**

| Land Use Classification | Percent of Watershed[1] | | | |
|---|---|---|---|---|
| | NW | SE | SW | Total |
| Park, Recreational, or Preserve | 26% | 48% | 38% | 36% |
| Open Water | 34% | 21% | 39% | 30% |
| Single Family Detached | 6% | 25% | 14% | 14% |
| Office | 9% | 0% | 0% | 4% |
| Major Highway | 5% | 1% | 8% | 4% |
| Single Family Attached | 5% | 3% | 0% | 4% |
| Undeveloped | 7% | 0% | 1% | 3% |
| Multifamily | 5% | 1% | 0% | 3% |
| Retail and Other Commercial | 1% | 1% | 0% | 1% |
| Institutional | 1% | 0% | 0% | 0% |
| Industrial or Utility | 0% | 0% | 0% | 0% |
| Total Watershed Area (acres) | 577 | 453 | 206 | 1,236 |

[1]Land use summary based on data collected by MetCouncil Environmental Services in 2020.




Nine Mile Creek
Major Watersheds
Storm sewer lines
Storm Mainline to Nine Mile Creek
Municipal Boundary

**Land Use (MetCouncil 2020)**

Industrial or Utility
Institutional
Major Highway
Multifamily
Office
Open Water
Park, Recreational, or Preserve
Retail and Other Commercial
Single Family Attached
Single Family Detached
Undeveloped

**Anderson Lakes Stormwater Conveyance and Land Use**
Nine Mile Creek Watershed District
FIGURE 4-2

# 5 Existing Water Quality and Ecological Health

## 5.1 Water Quality

### 5.1.1 Eutrophication Parameters—Phosphorus, Chlorophyll-*a*, and Clarity

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-a, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in the Anderson Lakes by the NMCWD periodically between 1988 - 2024 and the values were compared to the state eutrophication standards for shallow lakes in the North Central Hardwood Forest Ecoregion (Table 3-2). The June - September data are presented using box plots. The box plots show summer averages (black 'x'), median values (straight horizontal line), minimum and maximum values (whiskers), outliers (circles), as well as the region where 50 percent of the data lie (the area within the boxes). Box plots shown in Figure 5-1 through Figure 5-3 display the total phosphorus and chlorophyll-*a* concentrations and the Secchi disk transparency depths observed between June through September, 1988 through 2024 for the Anderson Lakes.

The eutrophication monitoring data indicates:

- Northwest Anderson Lake: the summer average total phosphorus concentration, chlorophyll-*a* concentration, and Secchi depth failed to meet the state standards prior to 2007, but met the standards during 2007 through 2024, except for the 2010 summer average chlorophyll-*a* concentration (Figure 5-1).
- Southwest Anderson Lake: Prior to 2013, water quality in Southwest Anderson Lake only occasionally met state eutrophication standards. Since 2013, the summer average total phosphorus and chlorophyll-a concentrations and Secchi depth have been better than the state eutrophication standards (Figure 5-2).
- Southeast Anderson Lake: Throughout the historical record, Southeast Anderson Lake has occasionally met the state eutrophication standards. Monitored years between 2018–2024 indicated that total phosphorus concentrations and Secchi depth were better than the state eutrophication standards. Chlorophyll-a concentrations were better than the state standard in both 2021 and 2024. (Figure 5-3).

Monitoring data for all three Anderson Lakes indicate that the management activities completed as part of the Eden Prairie Lakes Water Quality Improvement Project and Southeast Anderson Lake Improvement Project between 2008 and 2014 have improved the lakes' water quality. These projects are discussed in Section 6. After completion of the water quality improvement projects, all water quality measurements in Northwest and Southwest Anderson Lakes have met the state eutrophication standards. For Southeast Anderson, all water quality measurements collected in 2021 and 2024 met the state eutrophication standards. In 2018, total phosphorus and Secchi disk transparency met the state standards, but chlorophyll-*a* was slightly above the state standard.

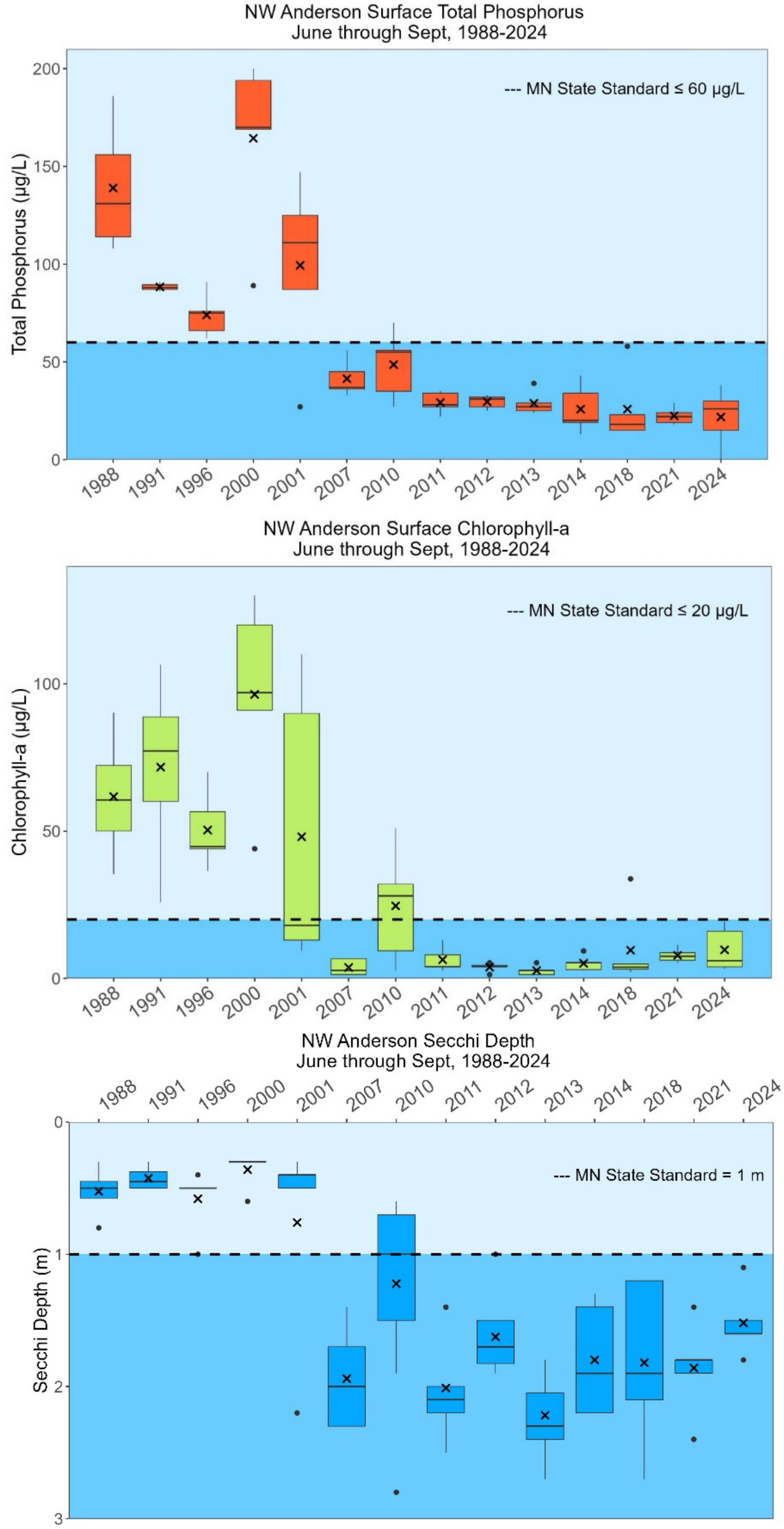



**Figure 5-1 Total phosphorus, chlorophyll-*a*, and Secchi depth from 1988 – 2024 for Northwest Anderson Lake**

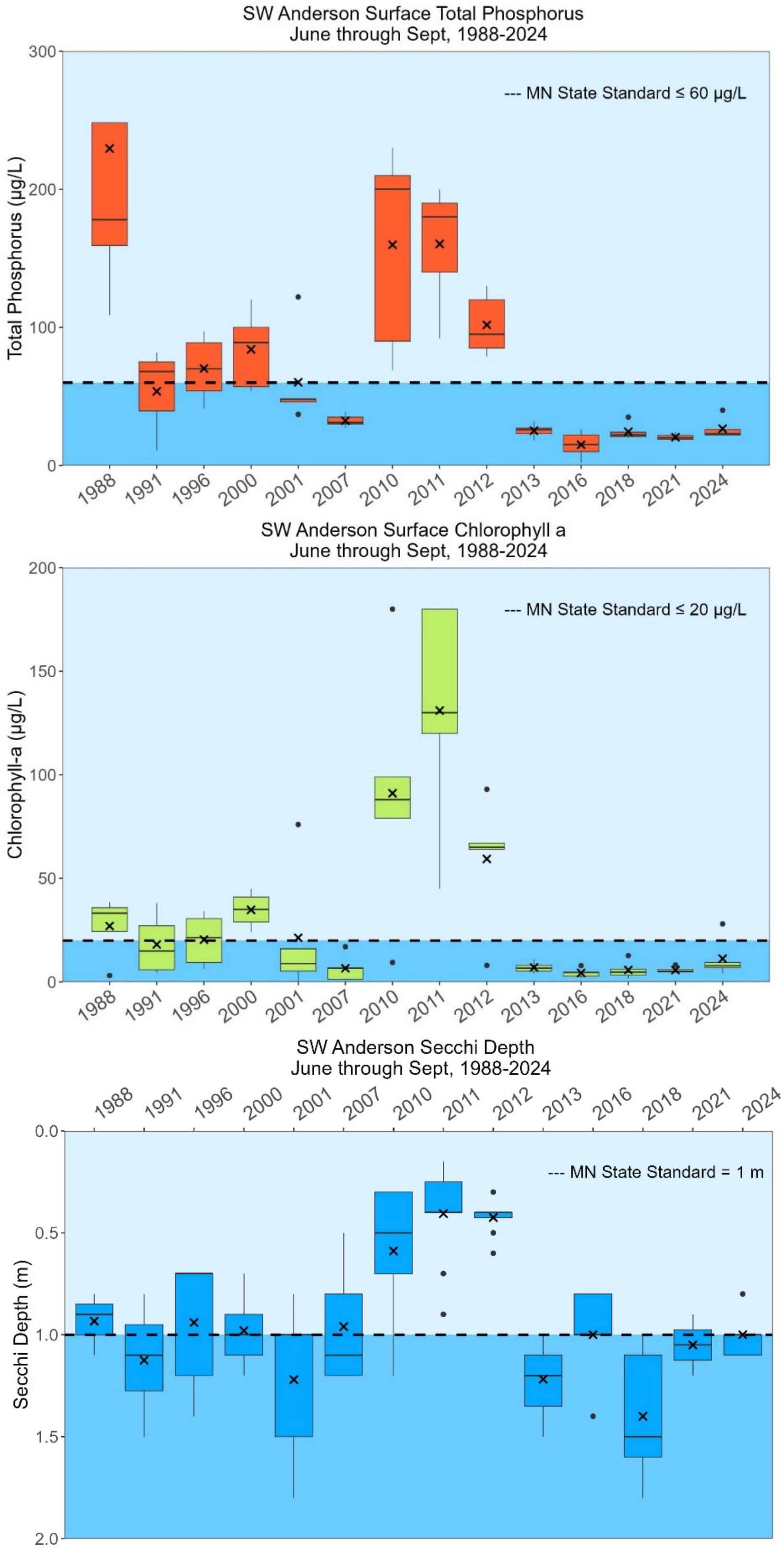



**Figure 5-2** **Total phosphorus, chlorophyll-*a*, and Secchi depth from 1988 – 2024 for Southwest Anderson Lake**

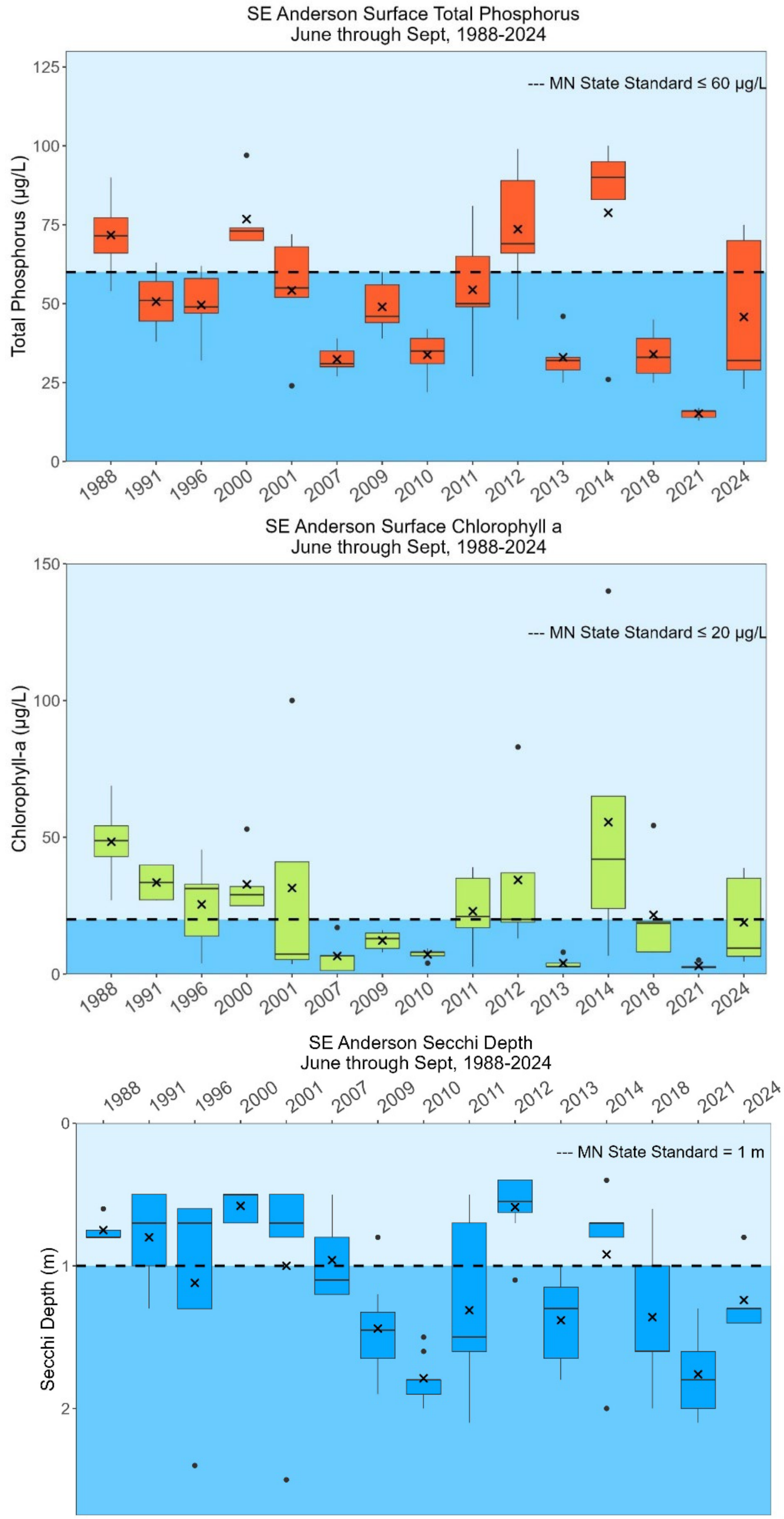



**Figure 5-3** **Total phosphorus, chlorophyll-*a*, and Secchi depth from 1988 – 2024 for Southeast Anderson Lake**

### 5.1.2 Chloride

Chloride can accumulate in lakes from road de-icing salts, synthetic fertilizers, groundwater, or other sources. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In the Anderson Lakes, observed chloride concentrations have never exceeded the state chronic criterion standard of 230 mg/L. However, monitored chloride concentrations in 2024 were the highest observed on record in Northwest (Figure 5-4) and Southeast Anderson Lakes (Figure 5-6), with chloride concentrations in April 2024 of 135 and 132 mg/L, respectively. Southwest Anderson Lake had higher observed chloride concentrations in monitoring year 2021 (Figure 5-5). The highest observed chloride concentration in Southwest Anderson Lake occurred in August 2021 at a concentration of 77 mg/L. The NMCWD will continue to periodically monitor changes in chloride concentrations.

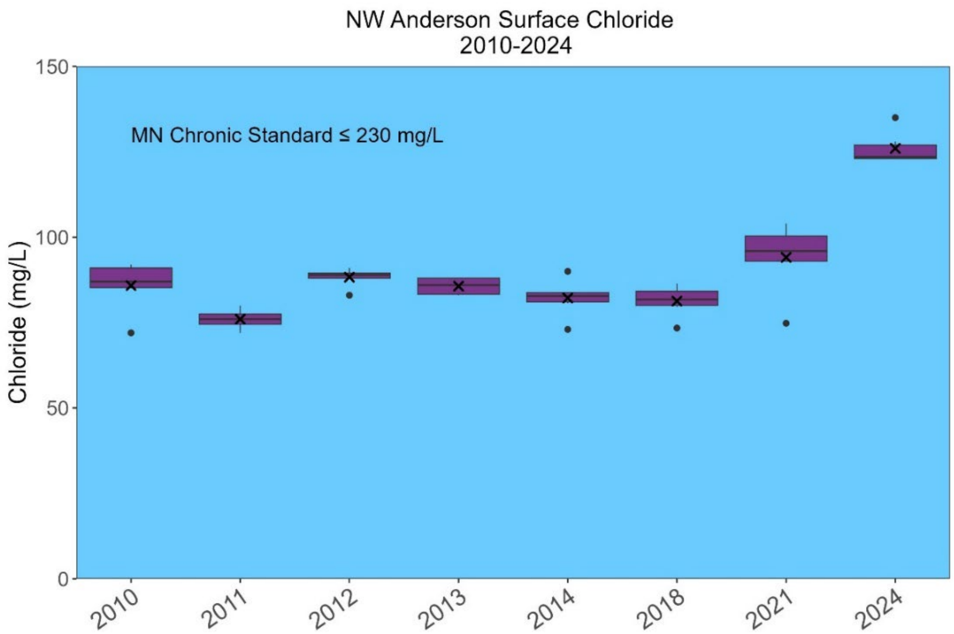



**Figure 5-4 Surface chloride concentrations in Northwest Anderson Lake**

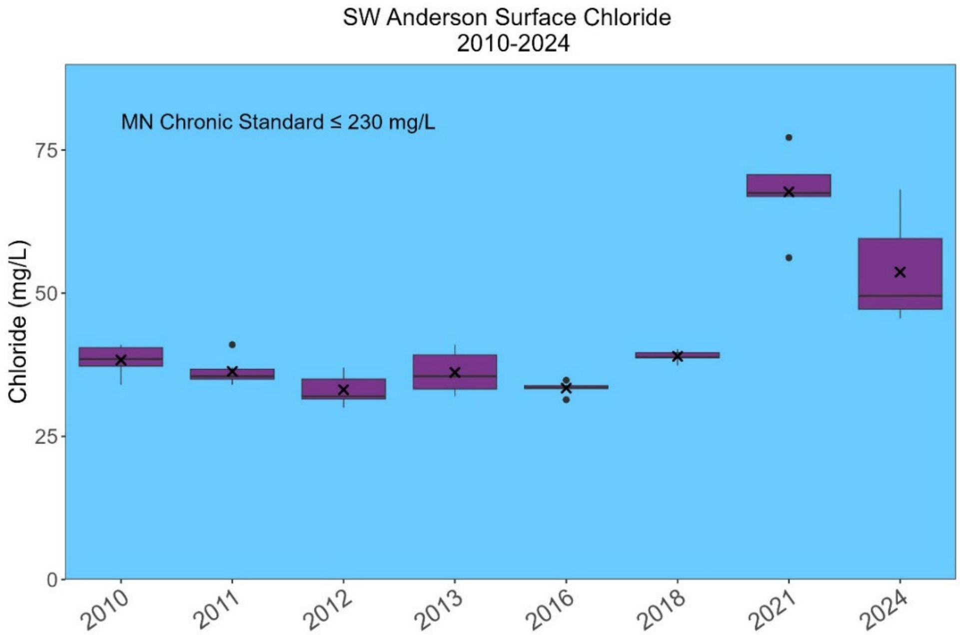



**Figure 5-5 Surface chloride concentrations in Southwest Anderson Lake**

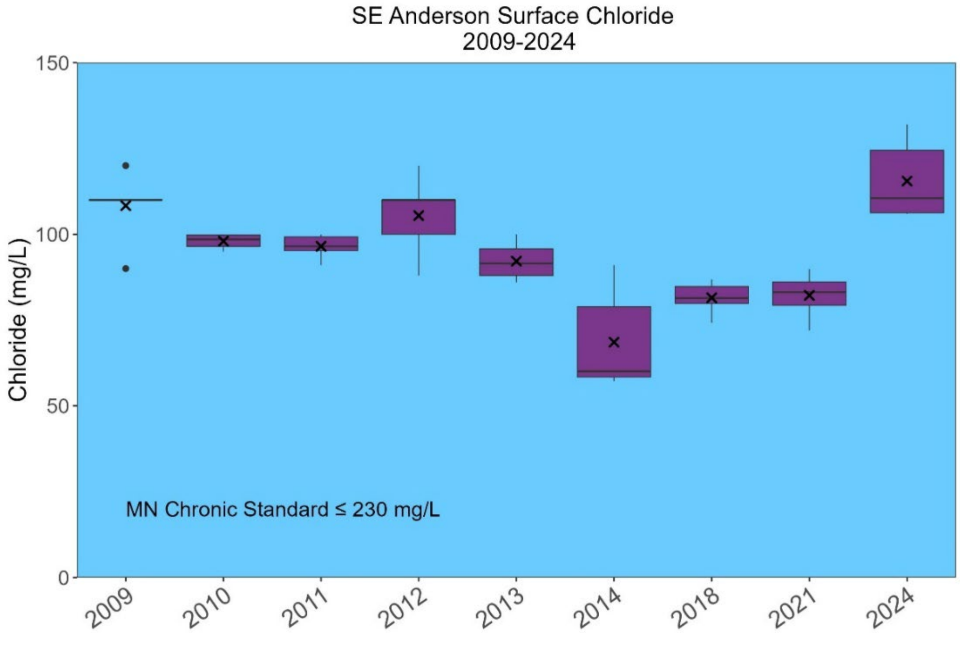



**Figure 5-6 Surface chloride concentrations in Southeast Anderson Lake**

### 5.1.3 Profile Monitoring Data – Stratification and Anoxia

The NMCWD monitors temperature and dissolved oxygen (DO) throughout a lake profile (i.e., measurements collected at multiple depths from the lake surface to the bottom) to evaluate stratification and lake mixing. Lakes that are more strongly stratified and resistant to mixing can develop low oxygen conditions at the bottom of the lake, which can influence bacterial activity and phosphorus loading from lake bottom sediment (see Section 5.2 for a more complete discussion of phosphorus release from lake bottom sediments).

The monitored Anderson Lakes temperature and DO profiles were plotted for the monitoring years where full profiles were collected (2014, 2018, 2021, and 2024). Temperature profiles for the Anderson Lakes, as shown in Figure 5-7, Figure 5-8, and Figure 5-9, indicate these shallow lakes rarely stratify throughout the growing season. DO profiles, however, do indicate that anoxic (low oxygen) conditions occur, often in the later summer months.

DO concentrations measured in Northwest Anderson Lake between 2014 - 2024 ranged from 7.5 to 11.6 mg/L in the surface waters and 0.0 to 13.3 mg/L near the lake bottom. The profiles from 2014 and 2018 show periods of anoxia at depths of 2 meters and greater; however, more recent years indicate few recordings of anoxic conditions (2021), and no readings below 2 mg/L in 2024 (Figure 5-7).

Southwest Anderson DO concentrations ranged from 4.2 to 13 mg/L in the surface waters to 0.2 to 13.2 in the bottom waters in monitored years between 2016 – 2024. Similar to Northwest Anderson, Southwest Anderson DO profiles show a few occurrences of anoxic conditions in 2016, however, observed DO concentrations between 2018 – 2024 were consistently above 2 mg/L (Figure 5-8).

The Southeast Anderson DO profiles show concentrations ranging from 2.6 to 12.6 mg/L in surface waters and 0 to 11.6 mg/L in bottom water samples (Figure 5-9). The majority of the DO readings in 2014 were below 2 mg/L, indicating strong anoxic conditions occurring throughout the summer months. Observations from 2018 – 2024, show infrequent anoxic conditions, with only one observation below 2 mg/L in 2018 and 2021, and no anoxic measurements in 2024. It’s likely that low water levels observed in Southeast Anderson Lake in the last decade allowed for greater lake mixing and reaeration.

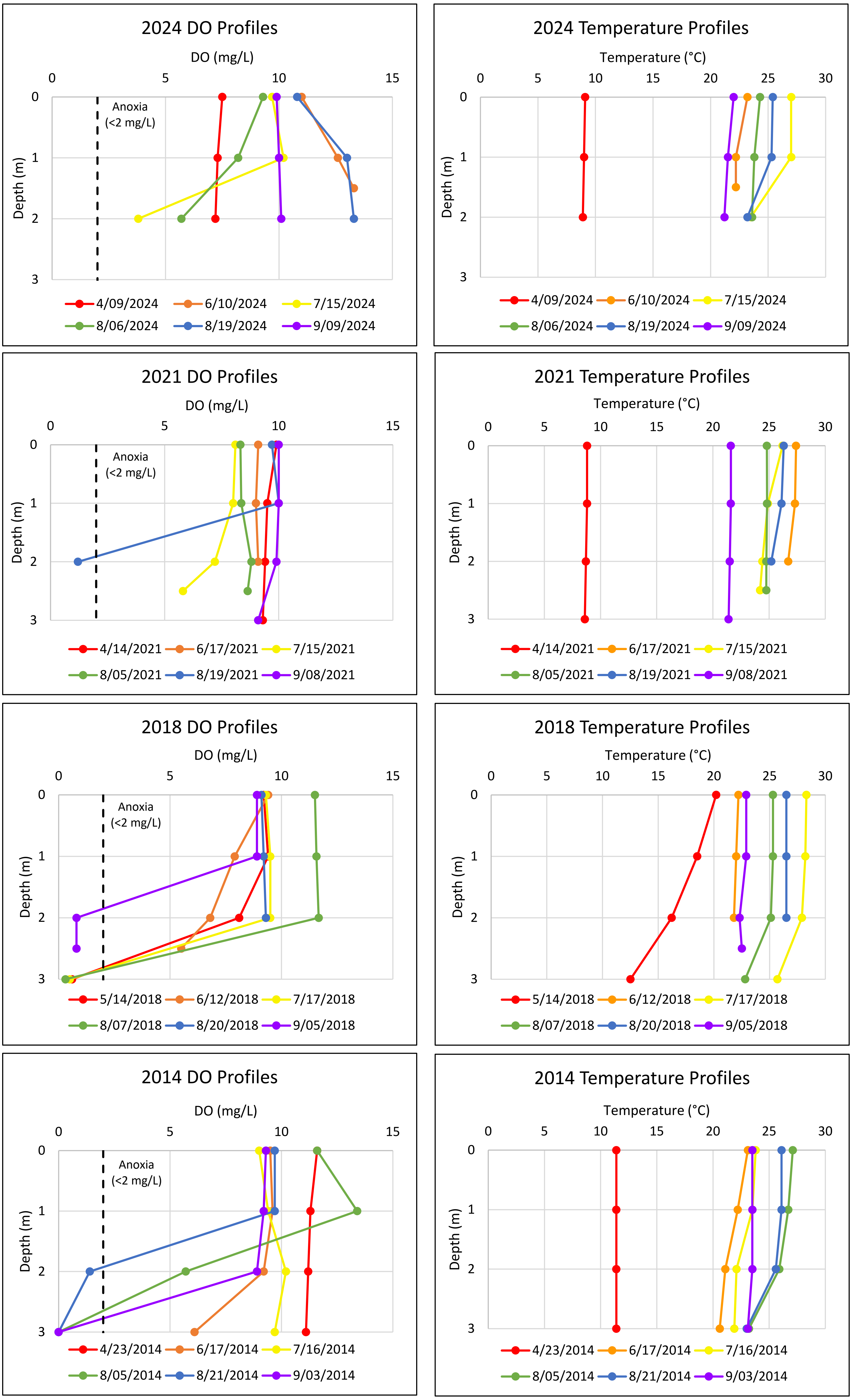



**Figure 5-7** **Temperature and dissolved oxygen (DO) depth profiles for Northwest Anderson Lake.**

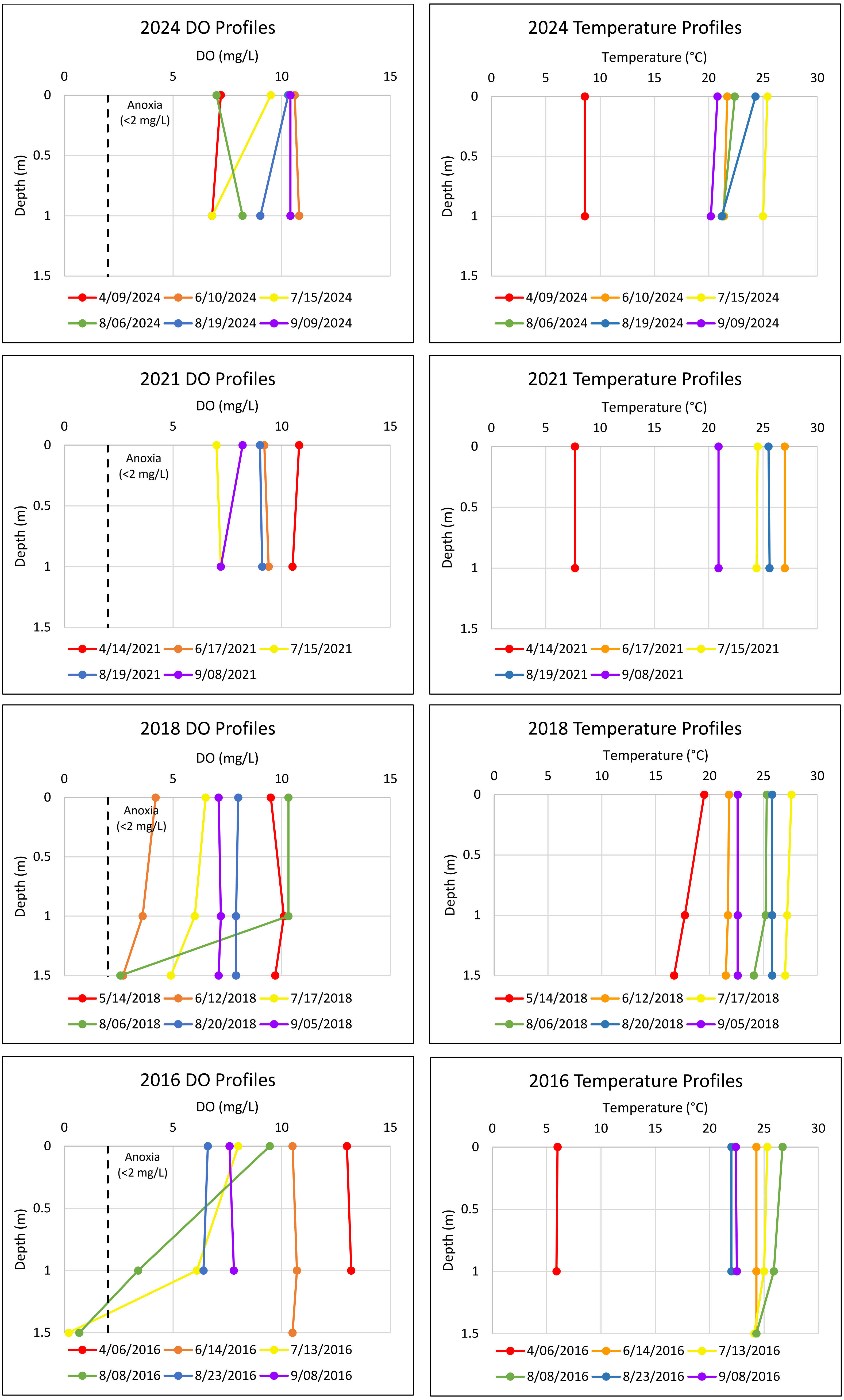



**Figure 5-8** **Temperature and dissolved oxygen (DO) depth profiles for Southwest Anderson**

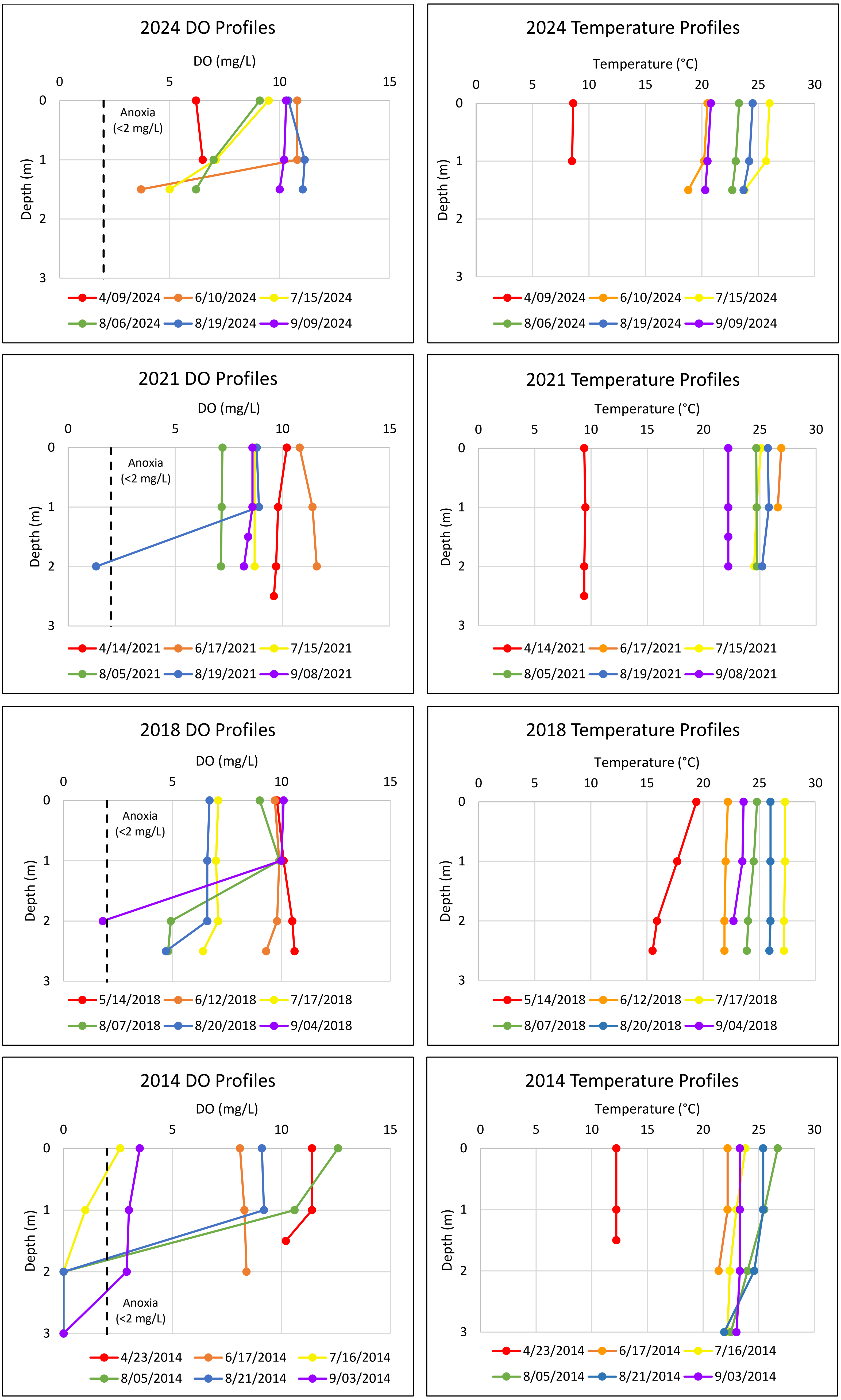



**Figure 5-9 Temperature and dissolved oxygen (DO) depth profiles for Southeast Anderson**

### 5.1.4 Water Quality Surface and Bottom Monitoring

As discussed in Section 5.1.1, the NMCWD collects surface total phosphorus and chlorophyll-*a* concentrations as a part of the district's standard eutrophication monitoring program. For the most recent monitored year (2024), the NMCWD completed a more detailed water quality sampling protocol and collected samples from near the lake surface and bottom for select parameters. Water quality samples can be collected near the bottom of lakes to inform the severity of internal phosphorus loading from lake bottom sediment. If phosphorus concentrations near the lake bottom are noticeably higher than concentrations observed near the surface, this can indicate that internal loading from lake bottom sediments may be causing water quality concerns.

Monitoring results from 2024 for all three Anderson Lakes showed a similar story:

- As discussed in Section 5.1.3, observed temperature and dissolved oxygen profiles indicated that the lakes were fairly well mixed between April and September 2024. In all three lakes, the lowest observed dissolved oxygen concentrations near the lake bottoms were seen in either June or July. No anoxic measurements (i.e., no dissolved oxygen concentrations less than 2 mg/L) were observed. The monitored profiles do not provide enough information to discern diurnal impacts on dissolved oxygen. Dissolved oxygen concentrations may have decreased below the observed concentrations during the nighttime, when photosynthesis is inactive.
- Total phosphorus concentrations observed in 2024 were higher in June and July than August and September. High phosphorus concentrations observed in the early portions of the growing season correlated with periods of wetter climatic conditions. Lakes within the Twin Cities Metro area that have strong internal loading signatures typically see higher phosphorus concentrations later in the growing season (August, September).
- Higher bottom total phosphorus concentrations correlated with higher bottom chlorophyll-*a* concentrations indicating that higher total phosphorus concentrations were likely due to increased algal growth near the lake bottom.
- Observed dissolved phosphorus and orthophosphate levels near the lake surface and at the lake bottom were very similar. This suggests that phosphorus coming from the lake's bottom sediments was not clearly evident in the monitoring data. Observed orthophosphate concentrations were below or just above detection limit for all monitoring events ranging from < 3 µg/L to 6 µg/L.

Based on the monitoring data from 2024, internal loading from lake bottom sediment does not appear to be noticeably influencing in-lake water quality. Higher total phosphorus concentrations observed near the lake bottom are likely due to increased abundance of benthic algae species and/or buoyancy regulating species migrating to lower depths for preferred light or nutrient conditions or to escape unfavorable conditions at the surface. The observed surface and bottom total phosphorus, dissolved phosphorus, and chlorophyll-*a* concentrations are shown for Southeast Anderson Lake in Figure 5-10 as an example.

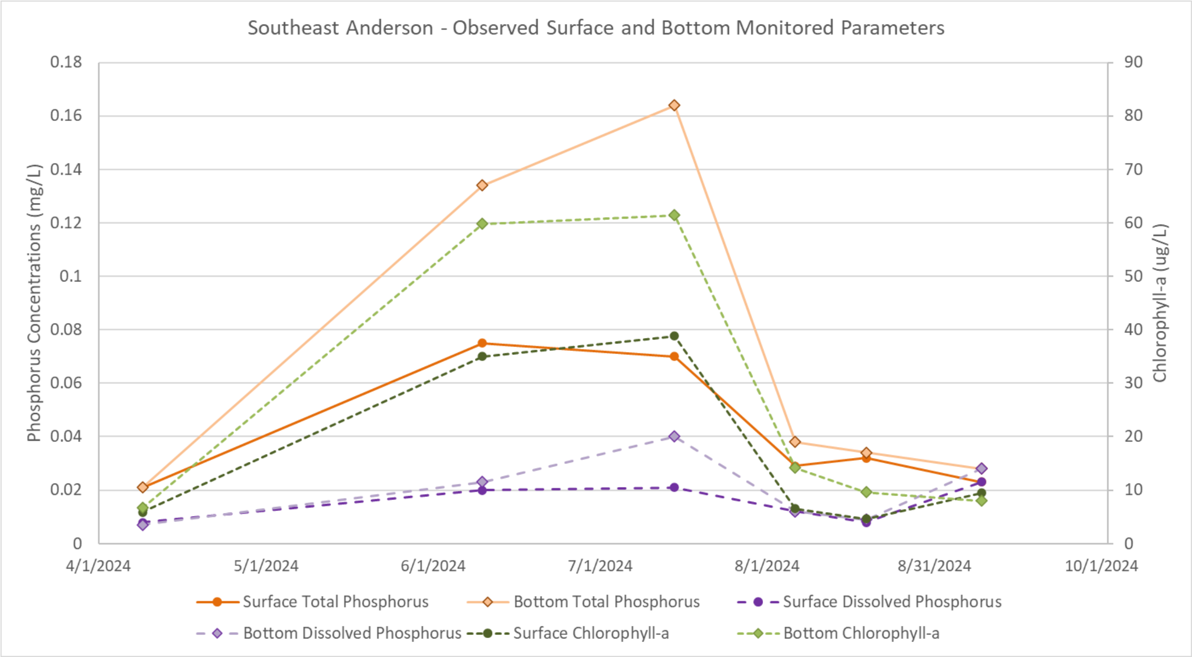



**Figure 5-10 Observed 2024 Southeast Anderson surface and bottom phosphorus and chlorophyll-*a* concentrations**

## 5.2 Sediment Quality

Phosphorus in lake bottom sediments is often bound to a range of different elements such as iron and manganese (often referred to as mobile phosphorus), aluminum, or calcium. The mobile phosphorus fraction can be released from sediment during low oxygen conditions. Phosphorus can also be found incorporated into organic matter in the sediment (organically bound phosphorus). A portion of the organically bound phosphorus is released into the water column from lake sediments through mineralization, but typically at a slower rate than mobile phosphorus. The mineralization release rate is controlled by lake water temperature and can occur under aerobic or anaerobic conditions. Phosphorus release from sediment is typically termed as “internal phosphorus loading”.

Sediment cores were collected from Northwest and Southwest Anderson Lakes in 2012 and used to evaluate the internal phosphorus loading potential of the mobile and organically bound phosphorus fractions. Three sediment cores were collected from each lake. The average concentrations of organically bound phosphorus and mobile phosphorus in the top 4 centimeters of the three cores taken from Northwest Anderson Lake were 32.0 and 5.0 µg P/cm$^3$ wet sediment, respectively. These observed concentrations indicate that there is moderate potential for internal phosphorus loading of organically bound phosphorus (organic-P) and low potential from mobile phosphorus (mobile-P). The average concentrations of organically bound phosphorus and mobile phosphorus in the top 4 centimeters of the three cores taken from Southwest Anderson Lake were 37.0 and 5.0 µg P/cm$^3$ wet sediment, respectively. These observed concentrations indicated that there is moderate to high potential for internal phosphorus loading of organically bound phosphorus (organic-P) and low potential from mobile phosphorus (mobile-P).

Based on the 2012 sediment coring results and accompanying water quality monitoring data, an alum treatment was recommended for Southwest Anderson Lake (Barr Engineering Co., 2012). In fall 2012, an alum treatment was conducted on Southwest Anderson Lake to reduce internal phosphorus loading from lake bottom sediment. This is discussed in more detail in Section 6.3. An alum treatment of Northwest Anderson Lake was not recommended at that time.

The sediment core data collected from Northwest and Southwest Anderson Lakes indicated that internal phosphorus loading from organic-P could be a notable source of phosphorus. Previously, research has focused heavily on mobile-P being the main mechanism of internal phosphorus loading. However, recent research and monitoring data indicate that organic-P, especially organic-P fractions that are susceptible to biological or chemical decomposition (e.g., phosphate esters, phospholipids), can be a noteworthy source of phosphorus and can maintain high productivity in lakes (Wei, et al., 2022).

Four sediment cores were collected from Southeast Anderson Lake in 2019 and used to evaluate the internal phosphorus loading potential of the mobile and organically bound phosphorus fractions. The average concentrations of organically bound phosphorus and mobile phosphorus in the top 4 centimeters of the four cores taken from Southeast Anderson Lake were 16.0 and 1.0 µg P/$cm^3$ wet sediment, respectively. These observed concentrations indicate that there is low potential for internal phosphorus loading of organically bound phosphorus (organic-P) and minimal potential from mobile phosphorus (mobile-P). As such, the 2019 sediment coring data from Southeast Anderson suggests that the internal phosphorus loading rate from lake bottom sediment is very low.

The mobile-P and organic-P concentrations per sediment core depth are shown in Figure 5-11 and Figure 5-12, respectively, for each lake. The phosphorus fractionation data in the top 4 – 6 cm is often analyzed for internal loading potential since these layers often represent the biogeochemically active zones that have a higher likelihood of phosphorus release to the water column. Deeper sediment layers generally contain more stable phosphorus that is less likely to affect water quality without significant sediment disturbance.

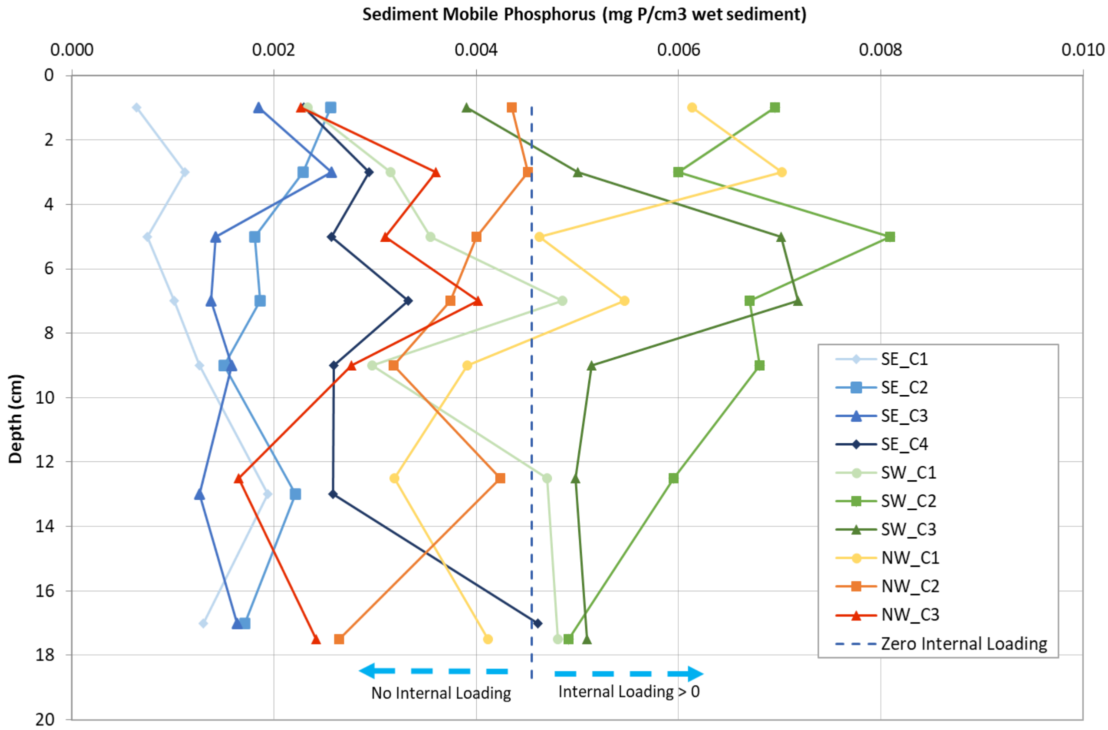



**Figure 5-11** **Mobile bound phosphorus in NW (2012), SW (2012), and SE (2019) Anderson Lake bottom sediments.**

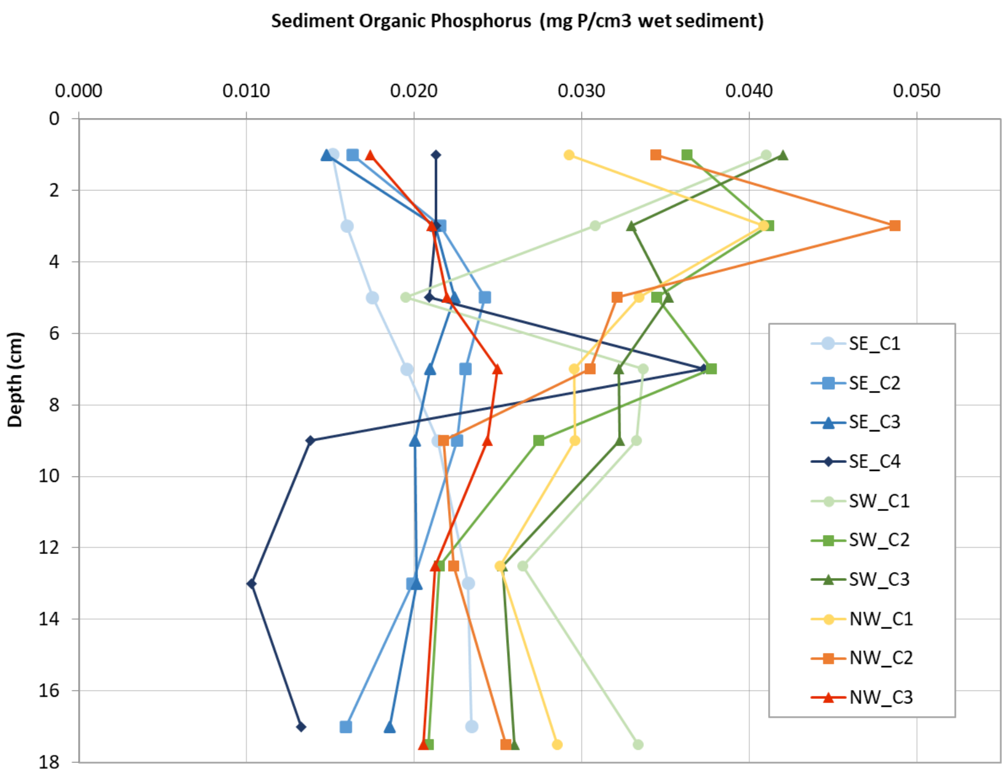



**Figure 5-12** **Organic phosphorus in NW (2012), SW (2012), and SE (2019) Anderson Lake bottom sediments.**

## 5.3 Aquatic Communities

The aquatic plants, phytoplankton (algae), zooplankton, and fish residing in lakes are all linked, and the composition and abundance of biota observed in the lakes provide an indication of lake health and if biological management should be considered to improve water quality.

### 5.3.1 Aquatic Plants – Macrophytes

A healthy, shallow urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

The NMCWD conducted qualitative macrophyte monitoring as part of its routine monitoring of the Anderson Lakes in 1996, 2000 - 2001, 2007 (NW, SW only), 2016 (SW only) and 2018. Plant surveys were conducted in June and August in each of the monitored years, with qualitative notation of plants observed and their density throughout the lake. The qualitative aquatic plant maps are provided in Appendix A. The NMCWD also conducted point-intercept (PI) plant surveys between 2010 – 2013 for Northwest Anderson Lake, 2010 – 2011 for Southwest Anderson Lake, and 2009 – 2014 for Southeast Anderson Lake during a period of extensive aquatic plant management to reduce the prevalence of curly-leaf pondweed. These management efforts are discussed in more detail in Section 6.2. The NMCWD also completed a PI plant survey on Southeast Anderson Lake in 2019 and on all three lakes in 2021 and 2024. TRPD completed PI plant surveys on the Anderson Lakes between 2006 – 2008 and 2012 – 2014. While these TRPD surveys were referenced during this study, they are not described in detail in this report.

The plant species and their percent occurrence during the most recent PI surveys (June and August 2024) are summarized in Table 5-1. Figure 5-13 through Figure 5-15 show the number of native species found at each survey point during the August 2024 survey. Below are noteworthy observations on the native plant species for each lake:

- In Northwest Anderson Lake, the highest diversity of native species was found in the northwest portion of lake in the shallower, nearshore regions. A maximum of 8 - 10 different native species were found in this region. Approximately 57% of the sample locations observed only 1 - 2 native plant species. Most of the points with reduced native species diversity (<2 species) had high abundances of bearded stonewort.
- In Southwest Anderson Lake, the highest diversity of native species was found in various locations along the northern, eastern, and western shallower, nearshore regions. A maximum of 7 different native species were found in these locations. Approximately 39% of the sample locations observed only 1 - 2 native plant species. Most of the points with reduced native species diversity (<2 species) had high abundances of bearded stonewort.
- In Southeast Anderson Lake, the highest diversity of native species was found in various locations along the nearshore regions. A maximum of 7 - 8 different native species were found in these locations. Out of the three lakes, Southeast Anderson Lake had the least number of points with higher native species diversity. Approximately 60% of the sample locations observed only 1 - 2 native plant species. Only 18% of the sample points had greater than 3 native species present.

Most of the points with low native species diversity (<2 species) had high abundances of bearded stonewort or Eurasian watermilfoil.

**Table 5-1 Frequency of Occurrence (%) of aquatic plant species in NW, SW, and SE Anderson surveyed in 2024.**

| Plant Taxa | Common name | NW | | SW | | SE | |
|---|---|---|---|---|---|---|---|
| | | June 2024 | Aug 2024 | June 2024 | Aug 2024 | June 2024 | Aug 2024 |
| Submerged Taxa | | | | | | | |
| *Ceratophyllum demersum* | Coontail | 24 | 31 | 62 | 60 | 42 | 52 |
| *Chara spp.* | Muskgrass | 2 | P | | | 12 | 8 |
| *Elodea canadensis* | Common waterweed | 14 | 9 | 23 | 18 | 11 | 17 |
| *Heteranthera dubia* | Water stargrass | 3 | 4 | 9 | 4 | 3 | 8 |
| *Lychnothamnus barbatus* | Bearded stonewort | 66 | 69 | 38 | 37 | 11 | 18 |
| ***Myriophyllum spicatum*** | **Eurasian watermilfoil** | | | | | **73** | **72** |
| *Najas flexilis* | Slender waternymph | | P | | 1 | | P |
| *Najas guadalupensis* | Southern naiad | | | P | | | |
| *Nitella spp.* | Nitella | | 1 | 2 | | 2 | |
| *Potamogeton amplifolius* | Largeleaf pondweed | 1 | 2 | | | 13 | 9 |
| ***Potamogeton cripus*** | **Curlyleaf pondweed** | **2** | | **3** | | **64** | **1** |
| *Potamogeton folius* | Leafy pondweed | | 2 | | 1 | 1 | 1 |
| *Potamogeton friesii* | Flat-stalked pondweed | 4 | | 6 | | 1 | |
| *Potamogeton nodosus* | Long-leaf pondweed | | P | | | 2 | 1 |
| *Potamogeton pectinatus* | Sago pondweed | P | P | 2 | 1 | 2 | 1 |
| *Potamogeton pusillus* | Small pondweed | 10 | 2 | 3 | | 5 | 1 |
| *Potamogeton zosteriformis* | Flatstem pondweed | 45 | 21 | 40 | 26 | 33 | 29 |
| *Utricularia vulgaris* | Common bladderwort | 2 | 4 | | P | | |
| *Vallisneria americana* | Wild celery | | P | | | 3 | 5 |
| *Zanichella palustris* | Horned pondweed | | | | | 1 | |
| Floating / Emergent Taxa | | | | | | | |
| *Alisma triviale* | Northern water-plantain | | | P | P | | |
| *Brasenia schreberi* | Watershield | | | | | | 1 |
| *Carex comosa* | Bottle bursh sedge | P | P | | | | |
| *Eleocharis erythropoda* | Bald spikerush | 2 | 2 | P | | | |
| *Hydrocotyle ranunculoides* | Floating pennywort | | | | P | | |
| *Iris virginica* | Southern blue flag | P | | | | | |

| Plant Taxa | Common name | NW | | SW | | SE | |
|---|---|---|---|---|---|---|---|
| | | June 2024 | Aug 2024 | June 2024 | Aug 2024 | June 2024 | Aug 2024 |
| *Leersia oryzoides* | Rice cut-grass | | P | | | | 7 |
| *Lemna minor* | Small duckweed | 5 | 8 | 24 | 17 | 9 | 6 |
| *Lemna trisulca* | Star duckweed | 35 | 35 | 50 | 49 | 3 | 3 |
| ***Lythrum salicaria*** | **Purple loosestrife** | | **P** | | | | **1** |
| *Nelumbo lutea* | American lotus | 2 | P | 10 | 10 | | |
| *Nuphar variegata* | Spatterdock | | | P | P | | |
| *Nymphaea odorata* | White water lily | 33 | 36 | 43 | 38 | 29 | 33 |
| ***Phalaris arundinacea*** | **Reed canary grass** | **P** | **1** | | | **7** | **2** |
| *Polygonum amphibium* | Water smartweed | P | P | | | | P |
| *Riccia fluitans* | Crystalwort moss | P | 2 | 2 | 1 | | |
| *Ricciocarpus natans* | Purple-fringed riccia | | 1 | P | 1 | | |
| *Sagittaria cristata* | Crested arrowhead | | 1 | | | | |
| *Sagittaria latifolia* | Broadleaf arrowhead | P | 2 | | 2 | 5 | 4 |
| *Sagittaria rigida* | Sessile-fruited arrowhead | 1 | | | | 4 | 2 |
| *Sagittaria sp.* | Hooded arrowhead | | | | | 1 | 1 |
| *Schoenoplectus tabernaemontani* | Softstem bulrush | 3 | 3 | 1 | | 11 | 9 |
| *Schoenplectus acutus* | Hardstem bulrush | 1 | 1 | | | 2 | 2 |
| *Schoenplectus fluviatilis* | Rilver bulrush | P | P | | | 2 | 2 |
| *Scirpus cyperinus* | Woolgrass | | | | | 1 | |
| *Sparganium eurycarpum* | Common bur-reed | 1 | 2 | | | | |
| *Spirodela polyrhiza* | Great duckweed | 14 | 17 | 25 | 17 | 6 | 5 |
| ***Typha angustifolia*** | **Narrow-leaved cattail** | **19** | **20** | **29** | **29** | **8** | **13** |
| *Typha latifolia* | Broad-leaved cattail | 1 | 1 | P | | 6 | 2 |
| *Wolffia columbiana* | Common watermeal | 8 | 11 | 22 | 17 | 5 | 3 |

P = present, **bold** = invasive species, which include Eurasian watermilfoil, curly-leaf pondweed, purple loosestrife, reed canary grass, and narrow-leave cattail

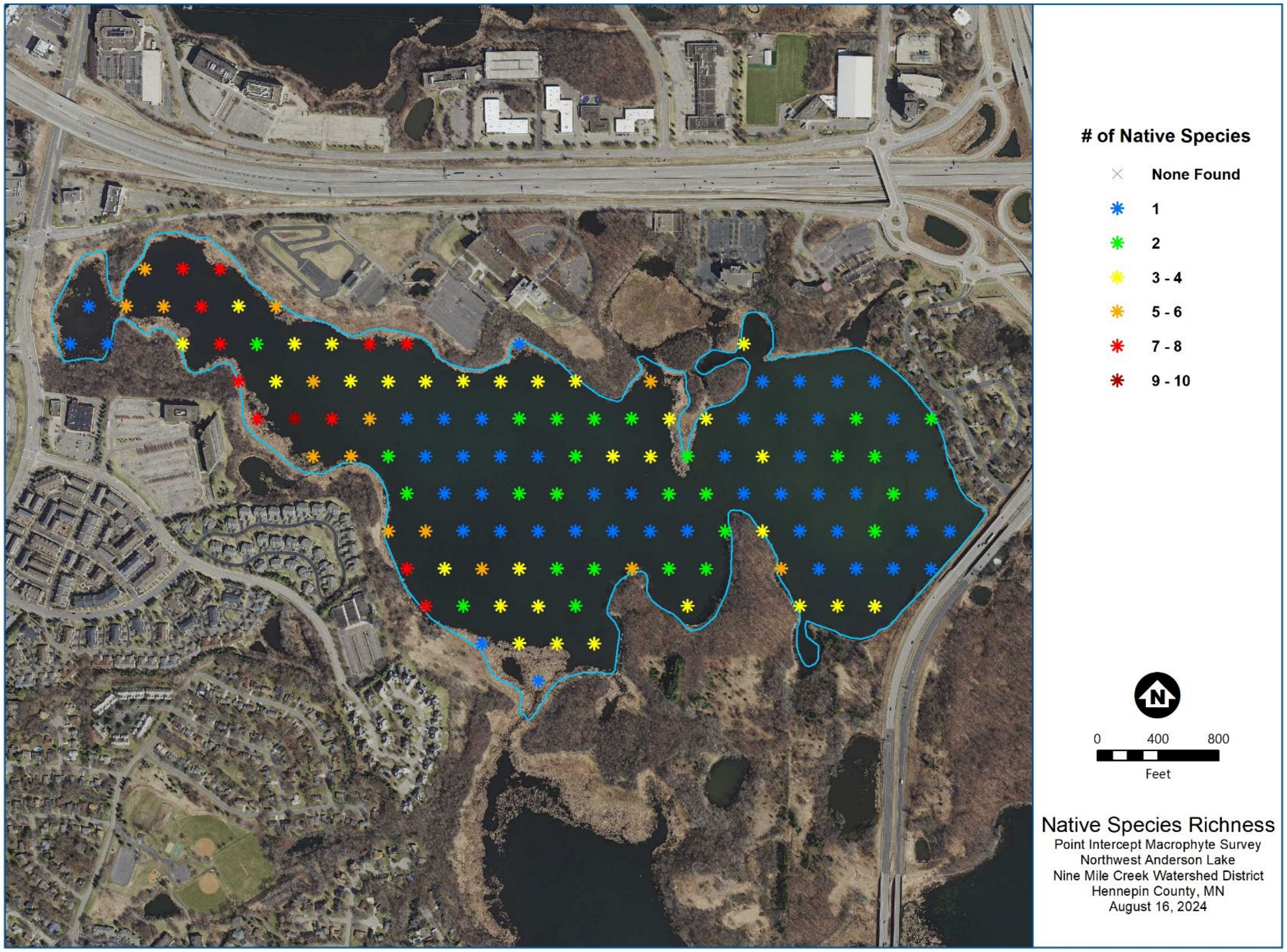



**Figure 5-13 Native species richness on Northwest Anderson Lake in August 2024**

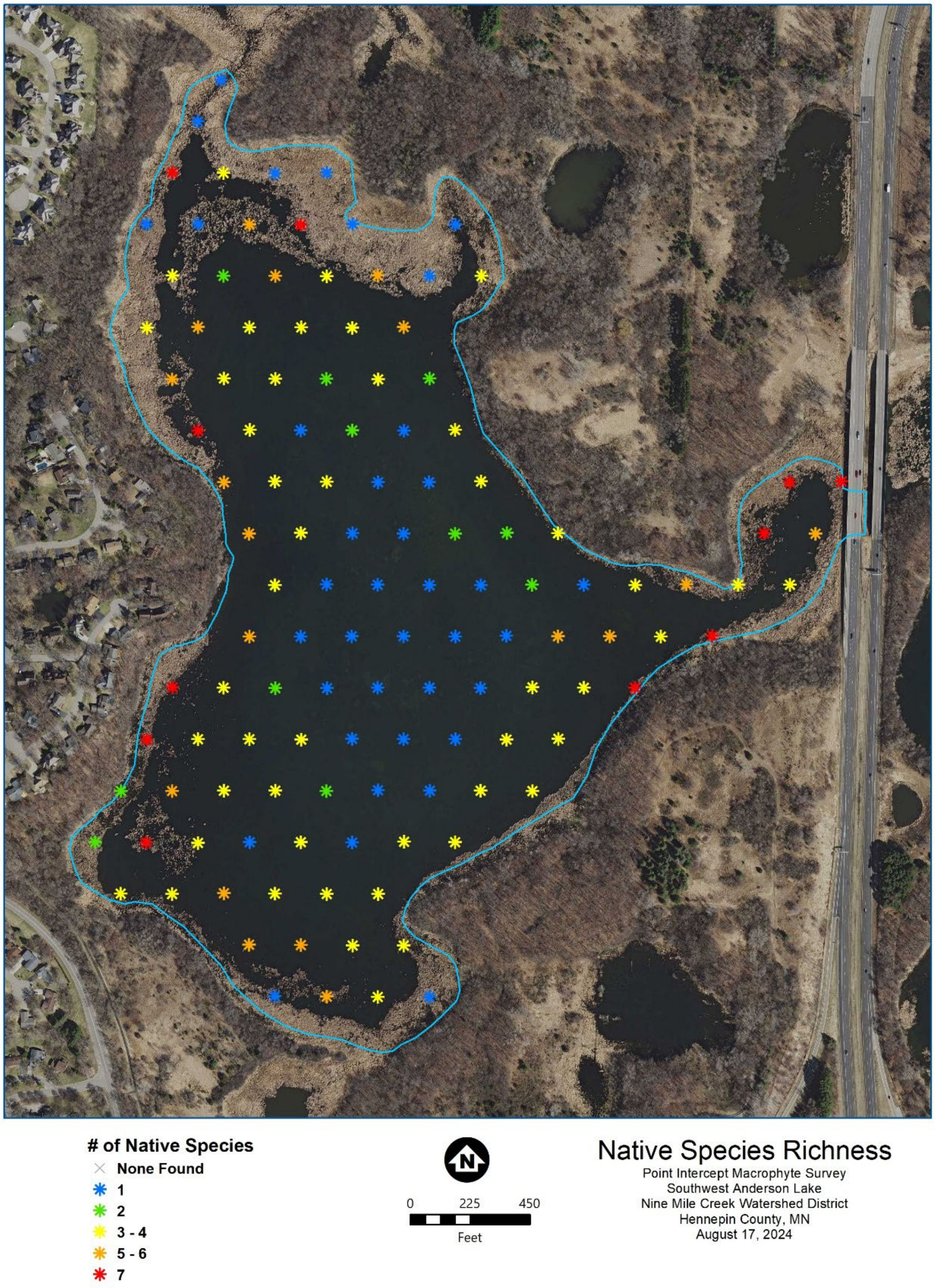



**Figure 5-14 Native species richness on Southwest Anderson Lake in August 2024**

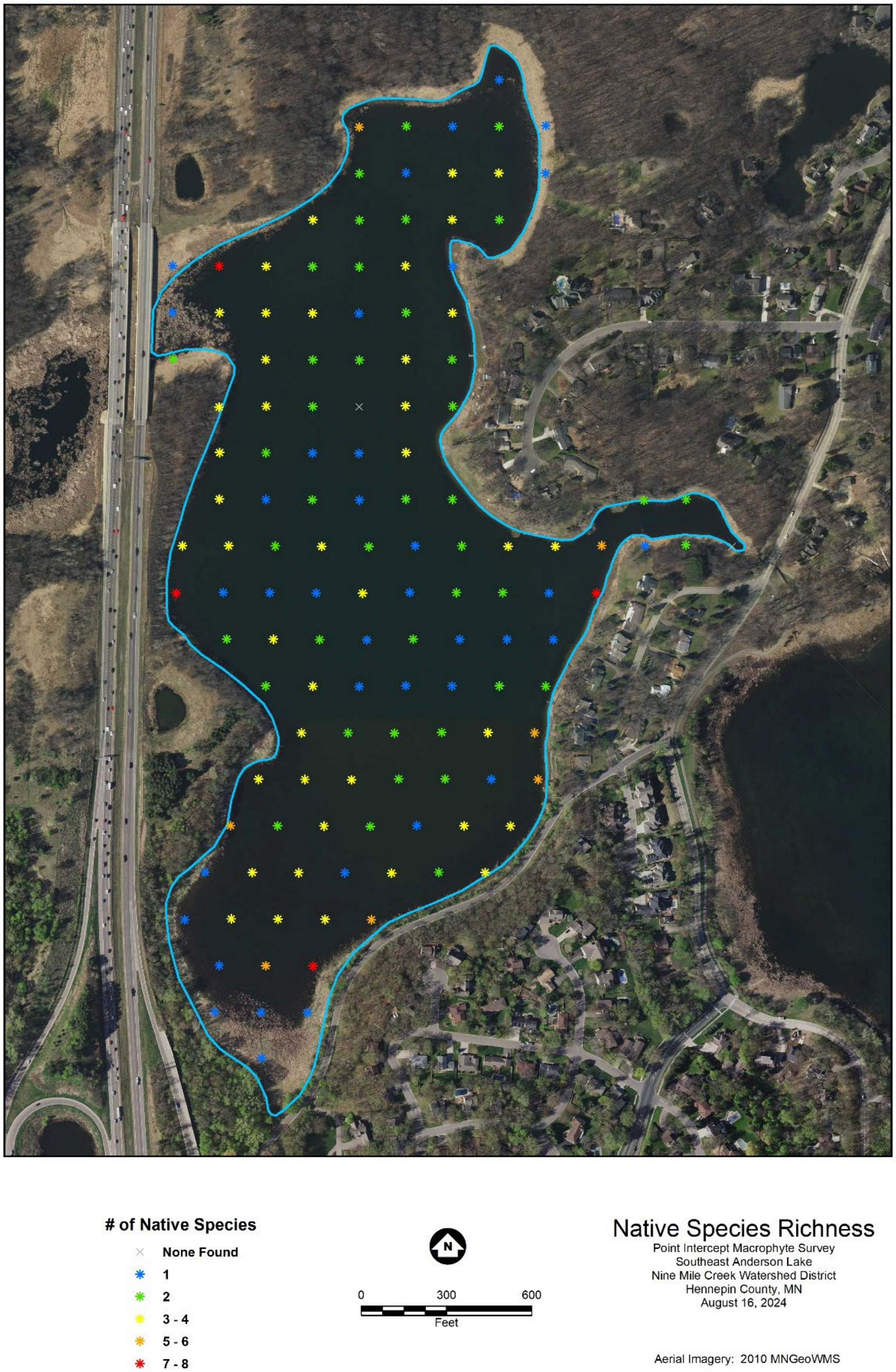



**Figure 5-15 Native species richness on Southeast Anderson Lake in August 2024**

Below is a summary of noteworthy non-native aquatic invasive species (AIS) that were observed in the Anderson Lakes 2024 PI surveys:

## Northwest Anderson Lake

- Curly-leaf pondweed (*Potamogeton crispus*): While curly-leaf pondweed was found in Northwest Anderson in 2024, it was found at only a few locations and low densities. Curly-leaf pondweed was collected on the rake at 3 locations (2.3% occurrence) and visually observed at 2 locations in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.0 during the June survey. During the August survey, curly-leaf pondweed was not collected on a rake, which is typical for the plant's growth cycle.

- Purple loosestrife (*Lythrum salicaria*): Observed at one location along the western shoreline in August among the cattails. Most purple loosestrife plants are managed naturally by Galerucella, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

- Reed canary grass (Phalaris arundinaceae): Observed at one location along the southern shore in June and August.

- Narrow-leaved cattail (Typha angustifolia): Dominant along the northern, western, and southern shorelines in June and August.

## Southwest Anderson Lake

- Curly-leaf pondweed (*Potamogeton crispus*): While curly-leaf pondweed was found in Southwest Anderson in 2024, it was found at only a few locations and low densities. Curly-leaf pondweed was collected on the rake at 4 locations (3.2% occurrence) and visually observed at 1 location in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.0 during the June survey. During the August survey, curly-leaf pondweed was not collected on a rake, which is typical for the plant's growth cycle.

- Narrow-leaved cattail (Typha angustifolia): Dominant along the northern, eastern, and southern shorelines in June and August.

## Southeast Anderson Lake

- Eurasian watermilfoil (*Myriophyllum spicatum*): Eurasian Watermilfoil was widespread throughout the lake in 2024. Eurasian Watermilfoil was collected on the rake at 97 locations (74% occurrence) and visually observed at additional 8 locations in June (Figure 5-17). On a scale of 1 (low) to 3 (high), the average rake density was 2.0 during the June survey. Eurasian Watermilfoil was collected on the rake at 95 locations (72% occurrence) and visually observed at 7 locations in August with an average rake density of 2.2.

- Curly-leaf pondweed (*Potamogeton crispus*): Curly-leaf pondweed was widespread throughout the lake in 2024. Curly-leaf pondweed was collected on the rake at 84 locations (64% occurrence) and visually observed at 6 locations in June (Figure 5-18). On a scale of 1 (low) to 3 (high), the average rake density was 1.6 during the June survey. During the August survey, curly-leaf pondweed was collected on the rake at 1 location. Low occurrence in August is typical for the plant's growth cycle.

- Purple loosestrife (*Lythrum salicaria*): Observed at one location along the western shoreline.
- Reed canary grass (Phalaris arundinaceae): Observed at multiple locations along the eastern and western shorelines in June and August.
- Narrow-leaved cattail (Typha angustifolia): Dominant along the northern, western, and southern shorelines in June and August.
- Common reed (*Phragmites australis*): Observed at one location along the southern shoreline in August.

**Figure 5-16 While curly-leaf pondweed was found in Northwest Anderson (left photo) and Southwest Anderson Lakes in 2024, it was found at only a few locations and low densities. Curly-leaf pondweed was widespread throughout Southeast Anderson Lake in 2024. The right photo shows a dense curly-leaf pondweed rake that was observed at one of the sample locations.**

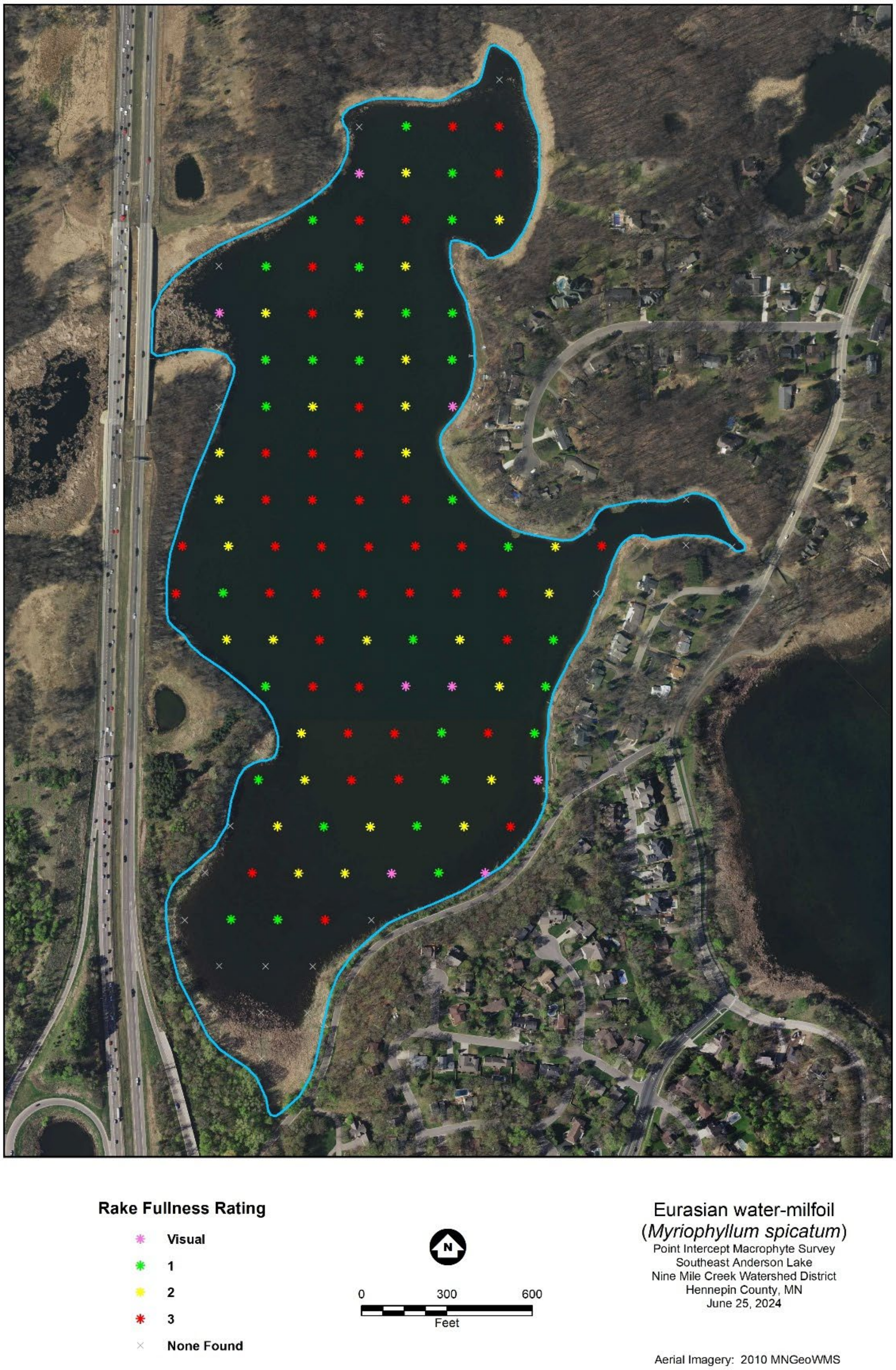



**Figure 5-17 Abundance of Eurasian watermilfoil observed during the June 2024 point-intercept survey in Southeast Anderson**

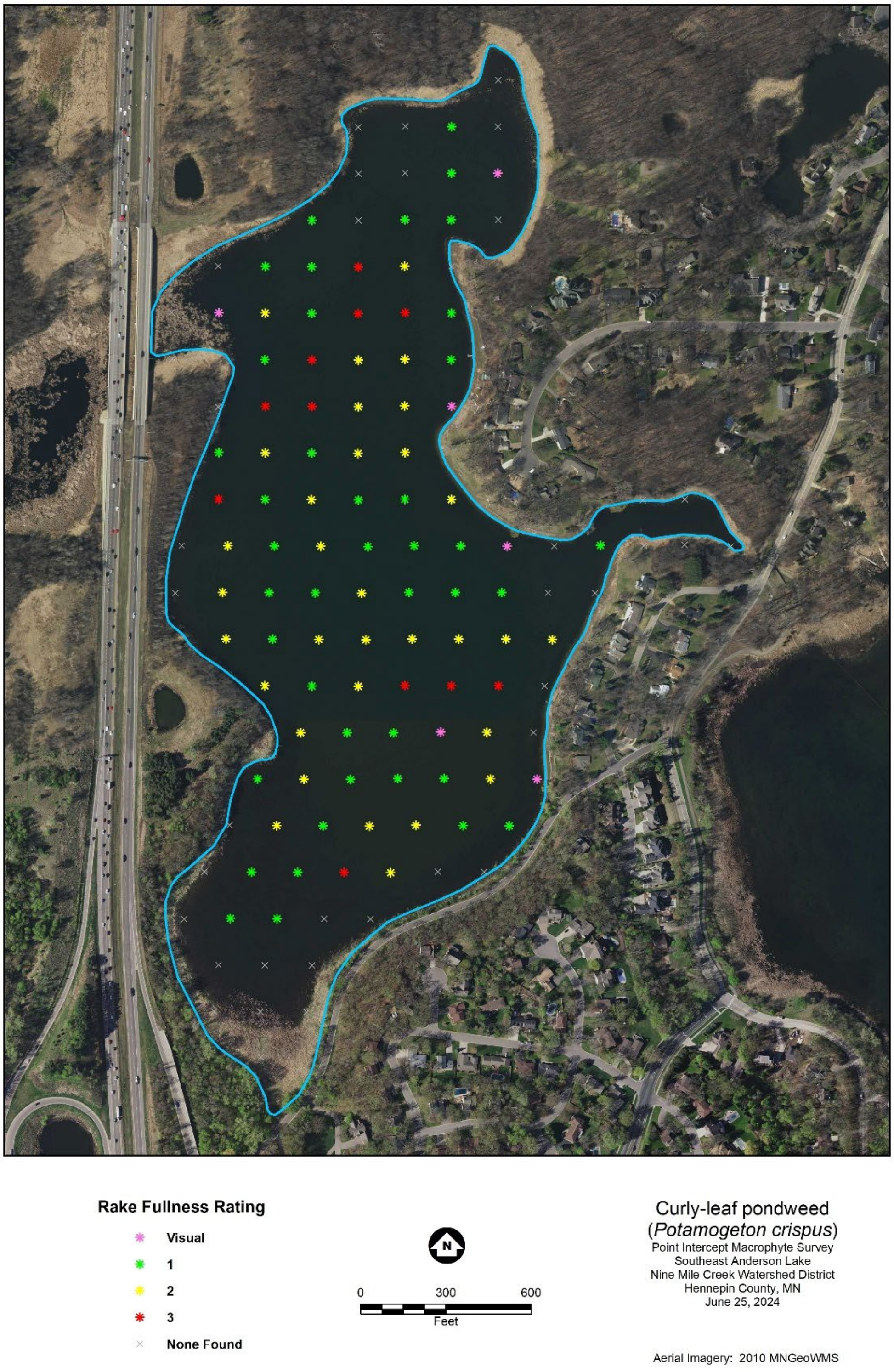



**Figure 5-18 Abundance of curly-leaf pondweed observed during the June 2024 point-intercept survey in Southeast Anderson**

The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication. The MNDNR Lake Plant Eutrophication IBI plots for each of the Anderson Lakes is presented on the following pages. The purple bars indicate the period following the implementation of extensive plant management projects. See Section 6.2 for more information on these projects.

Since 2013, Northwest Anderson Lake has been experiencing an increasing trend in the number of plant species observed (Figure 5-19) and the calculated FQI values have been well above the IBI threshold (Figure 5-20). Since 2010 the number of plant species observed in Southwest Anderson Lake (Figure 5-21) as well as the calculated FQI values (Figure 5-22) have been well above the MNDNR Plant IBI thresholds. Observing more diverse species with increased floristic quality in Northwest and Southwest Anderson Lake is likely due in part to the water quality and ecological improvement projects implemented since 2007.

Since 2013, Southeast Anderson Lake has also been experiencing an increasing trend in the number of plant species observed (Figure 5-23) and the calculated FQI values have been well above the IBI threshold (Figure 5-24). However, despite having a high number of native plant species present, many are only found at only a few locations and low abundances. Southeast Anderson Lake has a very high presence of the aquatic invasive species (AIS) curly-leaf pondweed and Eurasian watermilfoil which are limiting available growth areas for native plant species. Management recommendations for these AIS are discussed in Section 8.1.1.

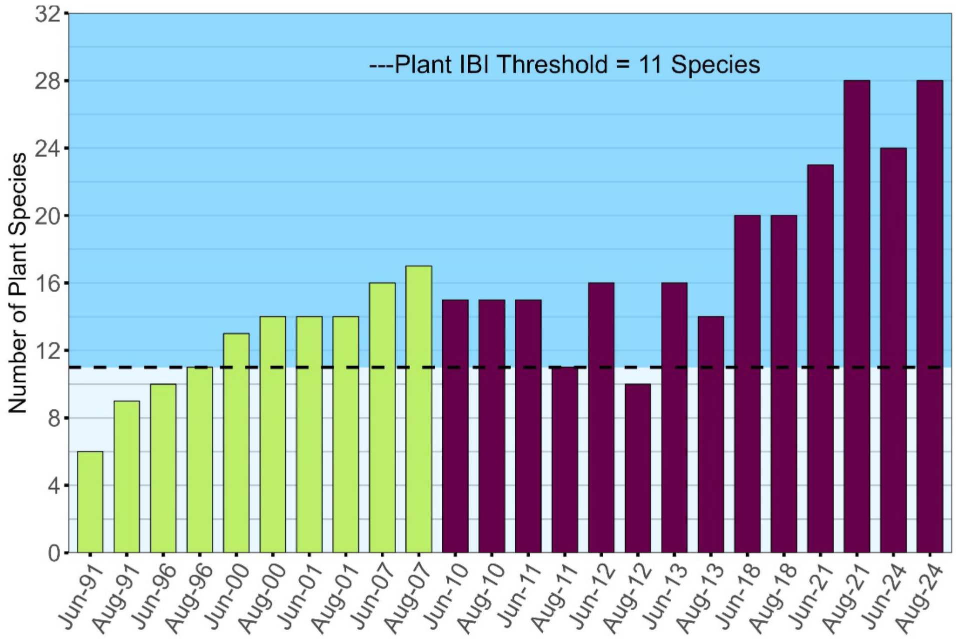



**Figure 5-19** **Northwest Anderson Lake aquatic plant species richness compared with plant IBI threshold**

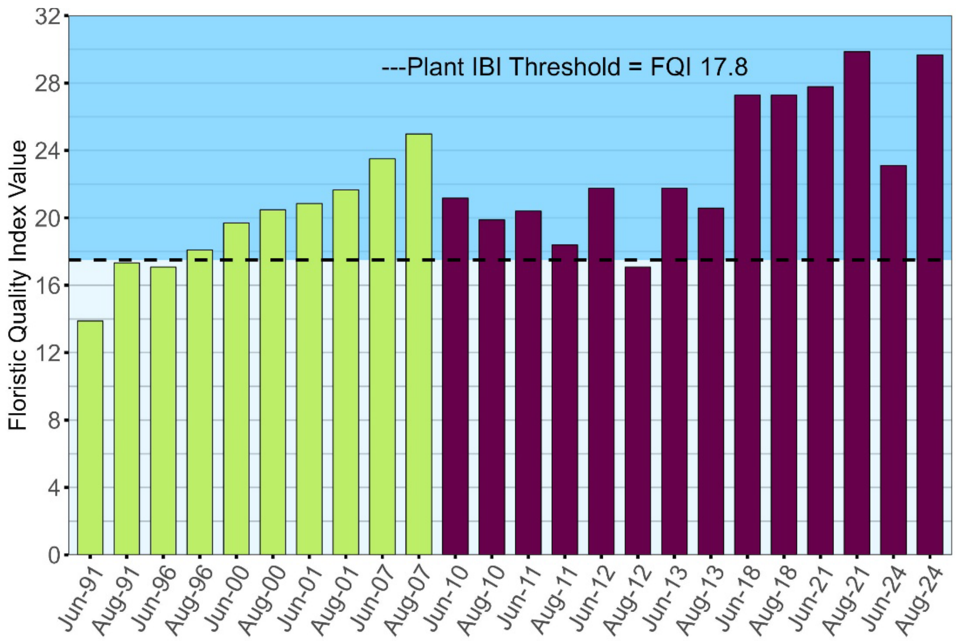



**Figure 5-20** **Northwest Anderson Lake aquatic plant floristic quality index compared with plant IBI threshold**

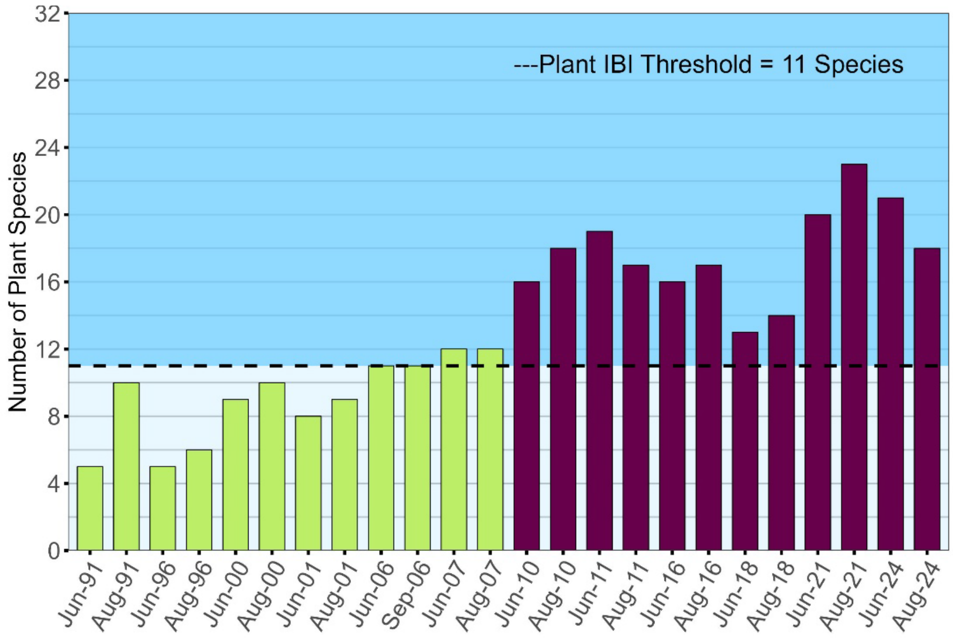



**Figure 5-21 Southwest Anderson Lake aquatic plant species richness compared with plant IBI threshold**

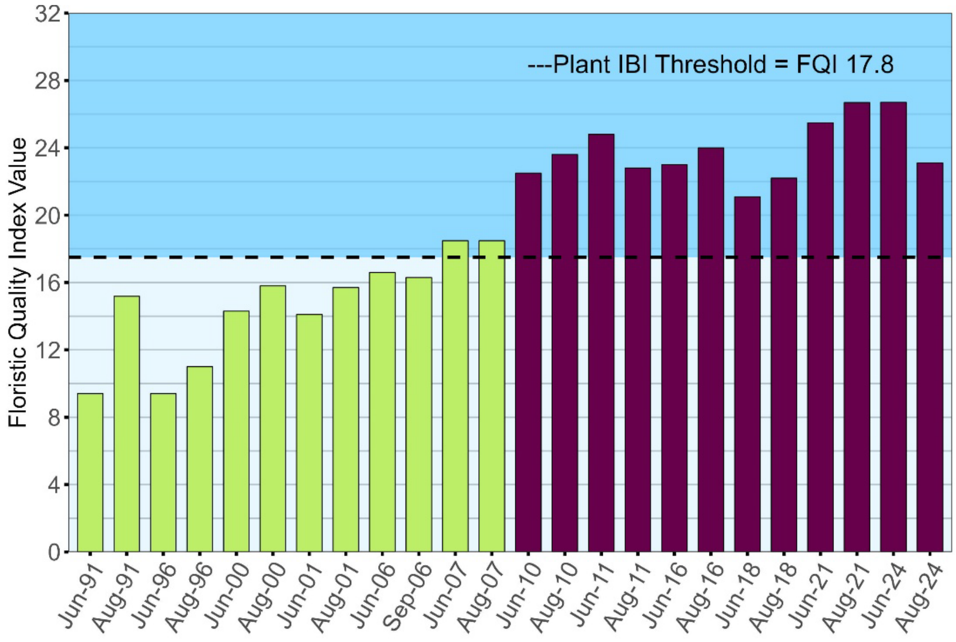



**Figure 5-22 Southwest Anderson Lake aquatic plant floristic quality index compared with plant IBI threshold**

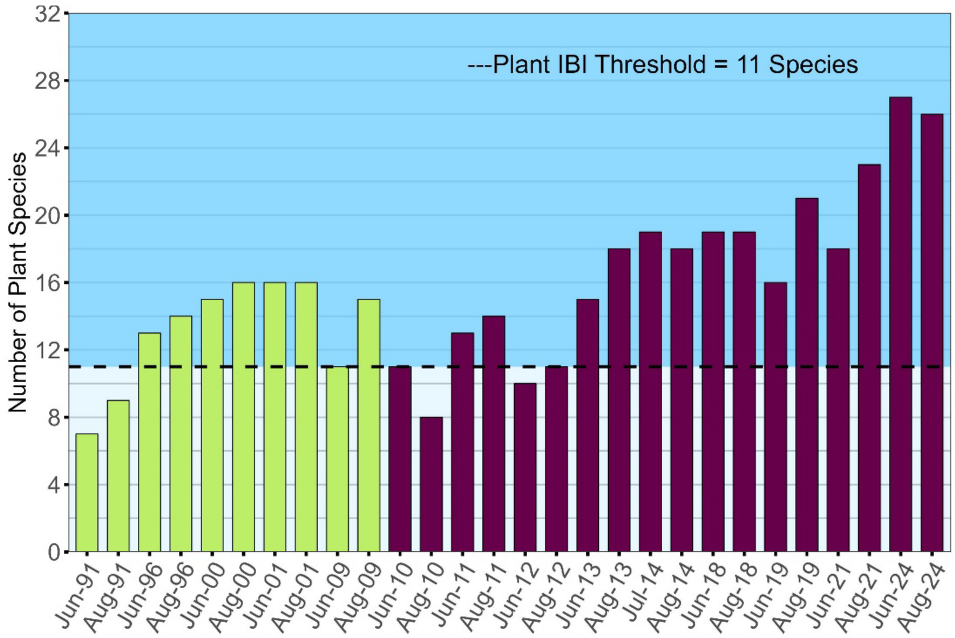



**Figure 5-23 Southeast Anderson Lake aquatic plant species richness compared with plant IBI threshold**

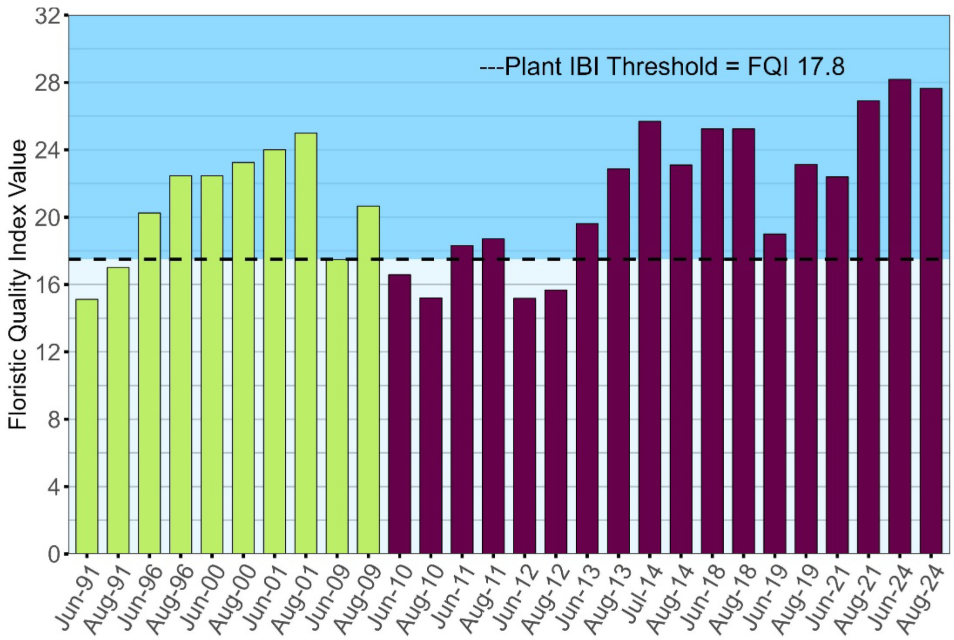



**Figure 5-24 Southeast Anderson Lake aquatic plant floristic quality index compared with plant IBI threshold**

### 5.3.2 Algae – Phytoplankton

Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from a high amount of nutrients can reduce water clarity, hinder aquatic plant growth, and possibly cause human health concerns. The phytoplankton community in the Anderson Lakes were monitored in 1988, 1991, 1996, 2000, 2001, 2010 – 2014, 2018, and 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton.

Historically, Northwest Anderson has experienced fluctuating summer average phytoplankton levels, with blue-green algae being the dominant algal group observed from 1988 – 2010 (Figure 5-25). Total algal abundances, as well as blue-green abundances notably decreased and have remained relatively stable from 2011 – 2024. Observing lower phytoplankton abundance in Northwest Anderson Lake in the last decade is likely due in part to the water quality and ecological improvement projects implemented since 2007.

In the most recent monitored year, 2024, a slightly higher abundance of blue-green algae was observed in Northwest Anderson Lake than other monitored years since 2011. This is especially evident from the monitoring data collected between mid-June and early August. However, only a small percentage of the blue-green algae species were potential toxin producing species. For example, in June less than one percent of the observed blue-green algae were species that have the potential to produce toxins. In June over 92% of the blue-green algae were a non-toxin producing, picoplankton species called *Cyanocatena imperfecta*. Picoplankton are very small photosynthetic phytoplankton of cell sizes between 0.2 and 2 µm. As such, even if there is a high abundance of picoplankton, the water column may still be noticeably clear. High blue-green algae abundance in 2024 occurred in the early portions of the summer, which was during noteworthy wet climatic conditions. It's possible that increased nutrients from stormwater runoff may have created favorable conditions for enhanced picoplankton growth.

Southwest Anderson Lake has also had fluctuating summer average phytoplankton levels throughout the monitoring period of 1988 – 2024 (Figure 5-26). There was a notable increase in algal abundance between 2010 and 2012, where blue-green algae were the dominant taxon. Following an alum treatment in 2012, algal concentrations, especially blue-green algal numbers noticeably declined during monitored years between 2013 – 2024. The alum treatment is discussed in more detail in Section 6.3.

In the most recent monitored year, 2024, a higher abundance of blue-green algae was observed between July and early August. However, only a portion of the blue-green algae species were potential toxin producing species. For example, in July less than five percent of the observed blue-green algae were species that have the potential to produce toxins. In July over 53% of the blue-green algae were a different non-toxin producing picoplankton species called *Cyanogranis irregularis*. Similar to Northwest Anderson, having a high abundance of picoplankton can still result in a noticeably clear water column given that this algal species consists of very small photosynthetic phytoplankton of cell sizes between 0.2 and 2 µm.

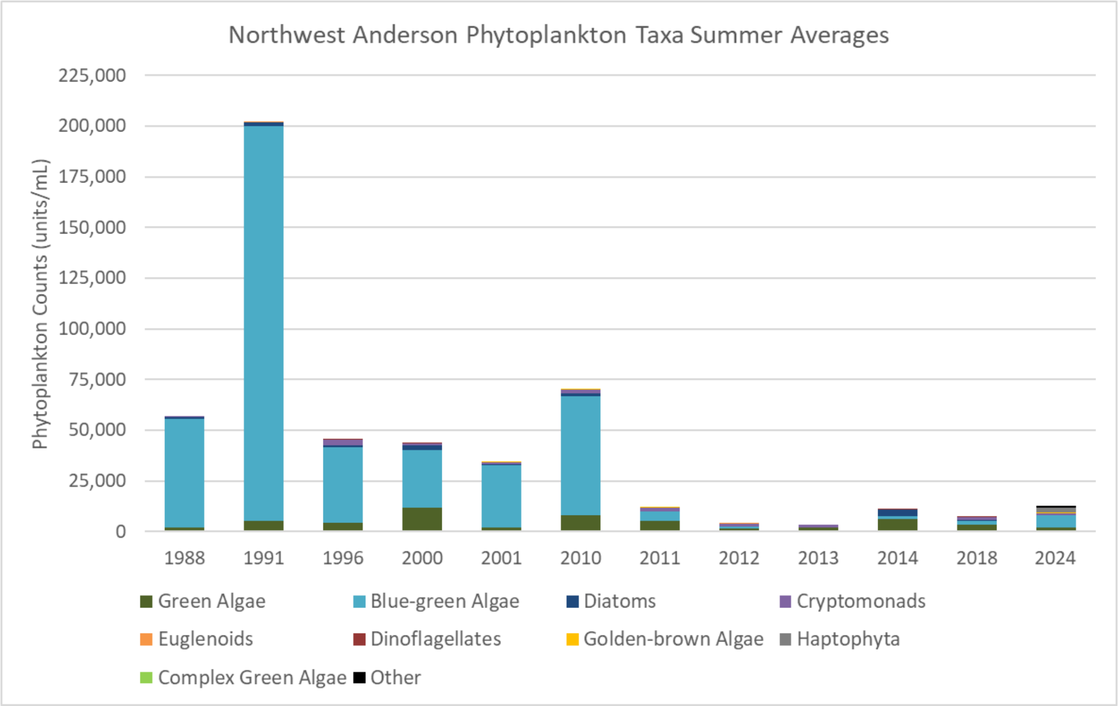



**Figure 5-25 1988-2024 phytoplankton summer averages in Northwest Anderson**

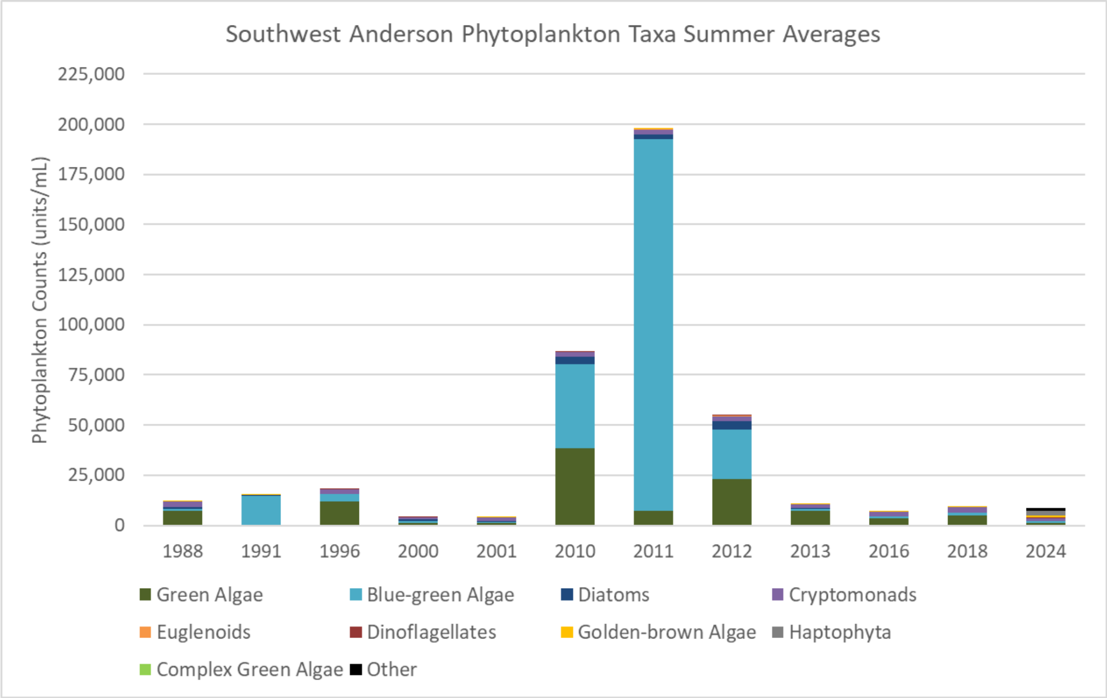



**Figure 5-26 1988-2024 phytoplankton summer averages in Southwest Anderson**

Unlike Northwest and Southwest Anderson Lakes, Southeast Anderson has not shown a consistent pattern in summer average phytoplankton abundance between 1988 – 2024 (Figure 5-27). Blue-green algae have been the dominant taxa for most years; however, some years, like 2010 and 2013, had very low abundances of both total algae and blue-green algae. Other years, such as 1991 and 2014, were dominated by green algae.

In the most recent monitored year, 2024, a high abundance of blue-green algae was observed in Southeast Anderson Lake during the June sampling event (505,430 cells/mL). The observed June 2024 blue-green algae abundance was above the WHO threshold of 100,000 cells per milliliter for a moderate probability of adverse health effects to recreational users. Of the blue-green algae species observed in June, 56% of the species were potential toxin producing species. While blue-green algae abundance decreased in July (68,650 cells/mL), observed cell counts were still above the WHO low probability of adverse health effects threshold (>20,000 cells per milliliter). Sixteen percent (16%) of the observed blue-green algae species in July were potential toxin producing species. The abundance of blue-green algae observed in June and July 2024 was notably higher than what has been observed in other monitored years within the last decade. High blue-green algae abundance in 2024 occurred in the early portions of the summer, which was during noteworthy wet climatic conditions. It's possible that increased nutrients in runoff created favorable conditions for enhanced blue-green algae growth. Early die-off and degradation of curly-leaf pondweed may have also contributed to high nutrient availability for enhanced blue-green algae growth.

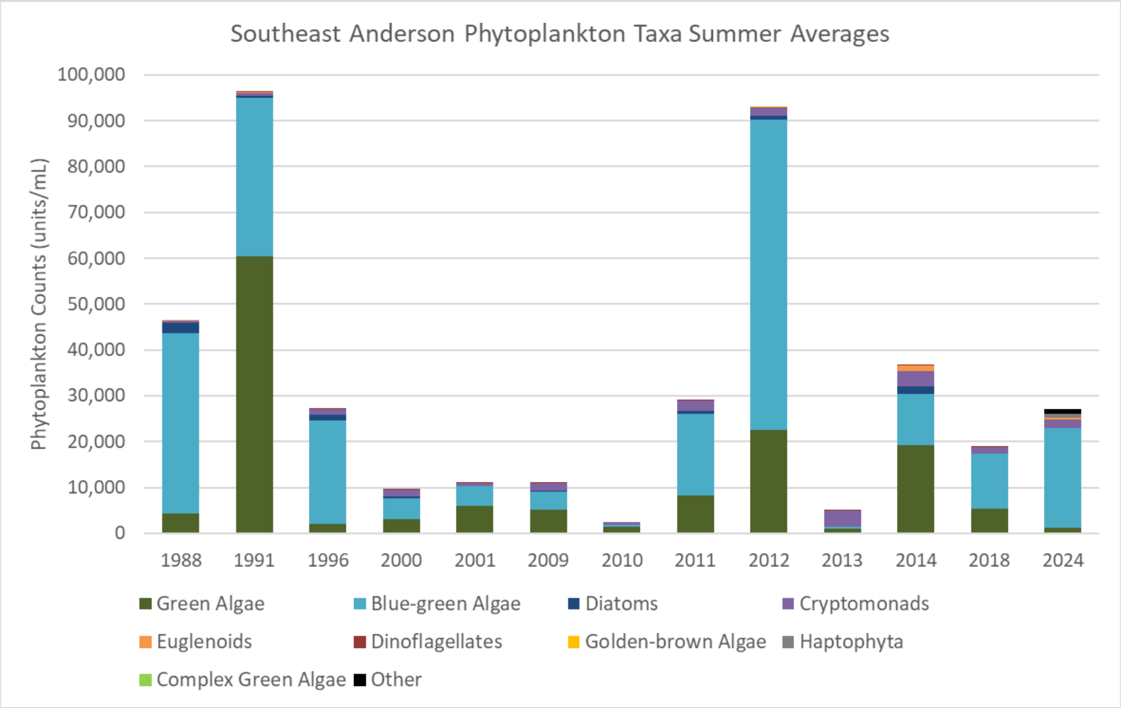



**Figure 5-27 1988-2024 phytoplankton summer averages in Southeast Anderson**

## 5.3.3 Zooplankton

Zooplankton are microscopic aquatic animals that drift and move throughout the lake water column. They play major roles in the aquatic food web by consuming algae and are primary food sources for larger organisms such as fish. The zooplankton community in the Anderson Lakes were monitored periodically between 1988 and 2024 to help evaluate water quality and the quality of food available to fish. Fish preference for certain groups of zooplankton can vary depending on the fish species, fish age, and the lake habitat. Copepods can have high protein content making them a nutritious option for certain fish species. Cladocerans tend to be larger in size (i.e., a more substantial food source) and can be relatively easy to capture due to their slower movements. Rotifers are generally smaller in size and provide less nutritional value compared to cladocerans and copepods. While adult fish often prefer larger prey that offer more energy and nutrients per capture, rotifers are still consumed by many fish species, particularly when other food sources are scarce. Additionally, the smaller size of rotifers may be attractive to young, larval fish species.

Figure 5-28 summarizes the historical summer averages of the major groups of zooplankton observed in Northwest Anderson Lake. Since 1988, the observed quantity of zooplankton and the percentages of observed rotifers, copepods, and cladocerans have been variable. Rotifers have typically been the most abundant. The summer average quantity of rotifers ranges from 32%–86% of the observed species. Copepods have typically been the second most abundant and represent approximately 10%–37% of the observed species based on summer average concentrations. Cladocerans are typically the least abundant group observed in the historical record. Besides 2000 and 2001, the summer average quantity of cladocerans were less than 25% of the observed species, ranging from 0%–23%. Higher abundances of cladocerans were observed in 2000 and 2001, where the summer average abundance of cladocerans represented 46% and 51% of the observed species, respectively.

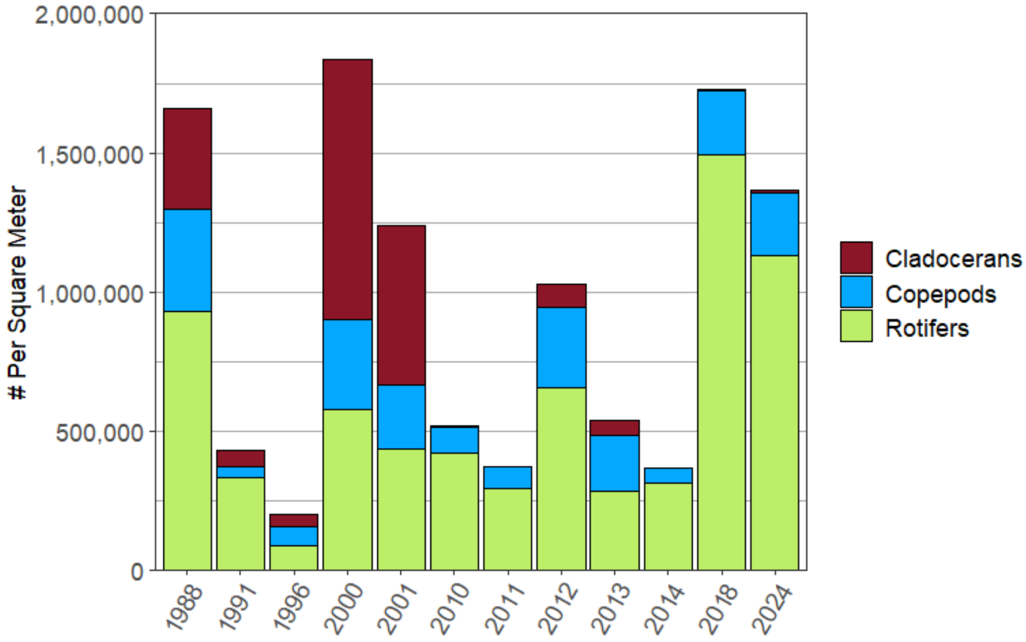



**Figure 5-28 Summer average zooplankton abundance in Northwest Anderson Lake**

Figure 5-29 summarizes the historical summer averages of the major groups of zooplankton observed in Southwest Anderson Lake. Since 1988, the observed quantity of zooplankton and the percentages of observed rotifers, copepods, and cladocerans have been variable. Rotifers have typically been the most abundant, especially in the last 20 years. Between 2010–2024 the summer average quantity of rotifers ranged from 38%–91% of the observed species. Copepods have typically been the second most abundant and between 2010–2024 represented approximately 9%–60% of the observed species based on summer average concentrations. Since 2000 cladocerans are typically the least abundant group observed in the historical record. Between 2010–2024, the summer average quantity of cladocerans ranged from 0%–8%. Higher abundances of cladocerans were observed between 1988–2000, where the summer average abundance of cladocerans ranged between 19%–58% of the observed species.

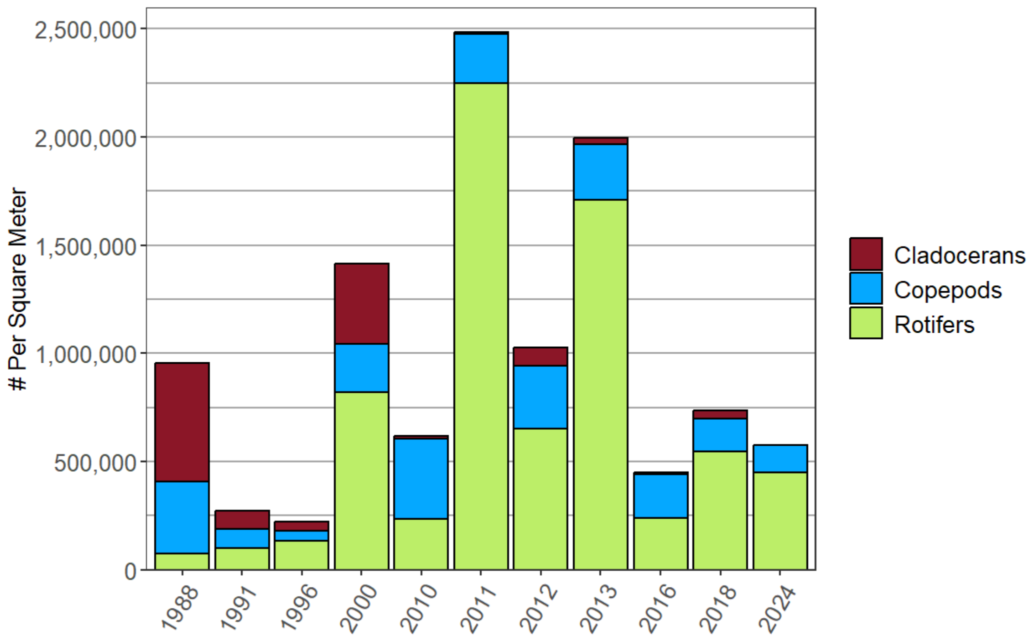



**Figure 5-29 Summer average zooplankton abundance in Southwest Anderson Lake**

Figure 5-30 summarizes the historical summer averages of the major groups of zooplankton observed in Southeast Anderson Lake. Since 1988, the observed quantity of zooplankton and the percentages of observed rotifers, copepods, and cladocerans have been variable. Rotifers have typically been the most abundant. The summer average quantity of rotifers ranges from 22%–90% of the observed species. Copepods have typically been the second most abundant and represent approximately 10%–43% of the observed species based on summer average concentrations. Cladocerans are typically the least abundant group observed in the historical record with the summer average quantity of cladocerans ranging from <1%–45% of the observed species.

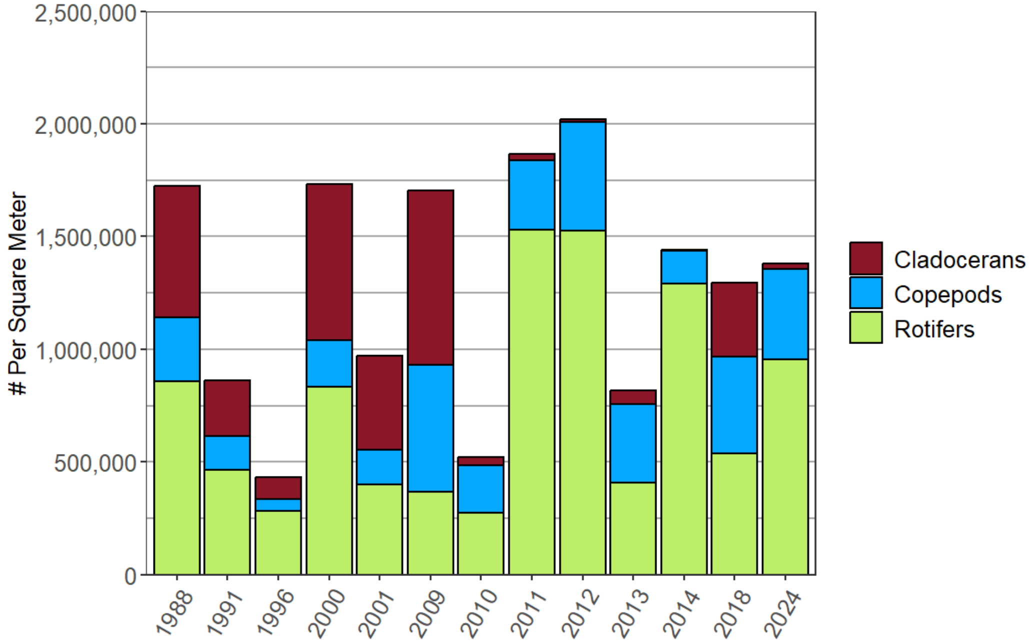



**Figure 5-30 Summer average zooplankton abundance in Southeast Anderson Lake**

## 5.3.4 Fisheries

NMCWD conducted a fisheries assessment of Northwest and Southeast Anderson Lakes in September 2024. Southwest Anderson Lake was not included in the survey because of access challenges. The survey was completed using trap nets, both standard and mini, and electrofishing (WSB, 2025).

The electrofishing survey was completed for Northwest Anderson on September 10, 2024. Only four species were observed during the electrofishing survey including black bullheads, central mudminnows, fathead minnows, and sticklebacks (Table 5-2). Trap nets were set on September 10$^{th}$ and sampled and removed on September 11$^{th}$. The same four species were observed in the trap nets as were found during the electrofishing survey. The abundance of black bullheads observed in the mini trap net notably exceeded the "MNDR Normal Range" for similar lake types. Historical records show fish stocking efforts occurred in 2016 from private citizens and sporting groups. Black crappie, bluegill sunfish, largemouth bass, and yellow perch were all stocked in 2016; however, none of these species were sampled in the 2024 survey.

**Table 5-2 Northwest Anderson fish assemblage from 2024 sampling**

| Date | Method | Species and # Sampled[1] | | | |
|---|---|---|---|---|---|
| | | Black Bullhead | Central Mudminnow | Fathead Minnow | Stickleback |
| 9/10/2024 | Electrofishing | 13 | 4 | 526 | 2 |
| 9/11/2024 | Trap Net – Standard | 0 | 0 | 0 | 0 |
| 9/11/2024 | Trap Net - Mini | 31 | 8 | 38 | 1 |

[1] Values from trap netting method are showing catch per unit effort (CPUE) for one net night, not total sampled.

The electrofishing survey on Southeast Anderson occurred on September 10, 2024. Black bullheads and fathead minnows were the only two species sampled using this method. Trap nets, both standard and mini, were set on September 9th. They were sampled and reset on September 10th and sampled and removed on September 11th, 2024. Along with black bullheads and fathead minnows, central mudminnows and green sunfish were also sampled using this method (Table 5-3). Similar to Northwest Anderson, the abundance of black bullheads observed in the mini trap net notably exceeded the "MNDNR Normal Range" for similar lake types. Stocking occurred in Southeast Anderson in 2016 by private citizens and sporting groups. Many species including walleye, black crappie, bluegill sunfish, largemouth bass, and yellow perch were stocked in 2016; however, none of these species were sampled in the 2024 survey.

**Table 5-3 Southeast Anderson fish assemblage from 2024 sampling**

| Date | Method | Species and # Sampled[1] | | | |
|---|---|---|---|---|---|
| | | Black Bullhead | Central Mudminnow | Fathead Minnow | Green Sunfish |
| 9/10/2024 | Electrofishing | 44 | 0 | 450 | 0 |
| 9/10/2024 & 9/11/2024 | Trap Net – Standard | 13 | 0.5 | 0.5 | 0 |
| 9/10/2024 & 9/11/2024 | Trap Net - Mini | 43.3 | 0.5 | 3.7 | 0.3 |

[1] Values from trap netting method are showing catch per unit effort (CPUE), not total sampled.

Fisheries assessments of Northwest and Southeast Anderson Lakes demonstrate low species diversity, with a high density of fish that are tolerant of low-oxygen conditions. Past stocking efforts in both lakes have been unsuccessful, suggesting poor survival or limited reproductive success of these species within these lakes. No carp or goldfish were sampled in the 2024 survey in either lake, which are two invasive species that have caused ecological challenges in other NMCWD waterbodies. The full 2024 fisheries assessment report can be found in Appendix B.

## 5.4 Water Levels

The lake level monitoring program was initiated by the NMCWD in 1960. Since inception of the program, the number of lakes being monitored has fluctuated over time in response to specific data needs. For monitored lakes, lake level readings are taken monthly and are generally measured using an engineering level from permanent structures along the shore. The observed monthly lake levels for the Anderson Lakes between January 2000–December 2025 are shown in Figure 5-31.

In general, lake levels are influenced by local precipitation, size of the drainage area, local land uses, outlet elevation and configuration, groundwater conditions, and evaporation rates. The Anderson Lakes are unique, though, where their historical water surface elevations have also been influenced by management projects. In fall 2008 through spring 2009, whole lake drawdowns were performed in Northwest and Southwest Anderson lakes to control the aquatic invasive species curly-leaf pondweed (see Section 6.2). Following completion of the drawdown in spring 2009, below average precipitation over the subsequent few years resulted in slow refilling of the lakes and prolonged low water levels.

Although Southeast Anderson Lake was not included in the 2008/2009 drawdown project, it has experienced relatively low water levels since project completion, in comparison with Northwest and Southwest Anderson Lakes. As shown in Figure 5-31, all three lakes followed similar monthly water level patterns prior to the drawdown project.

In preparation for the drawdown project on Northwest and Southwest Anderson, a weir control structure was installed in an existing culvert between Southwest and Southeast Anderson Lakes to maintain Southeast Anderson's water level during the drawdown. Since completion of the drawdown and refilling of the lakes (i.e., all lakes above the control elevation of 839.0), Northwest and Southwest Anderson water levels have tracked closely through 2025, while Southeast Anderson followed its own pattern. Review of the data indicates that the weir and macrophyte screen installed in the control structure between Southwest and Southeast Anderson prior to the drawdown have hindered the movement of water from Southwest Anderson to Southeast Anderson. This is especially evident during times when water levels are below the control elevation of 839.0, unintentionally resulting in lower-than-expected water levels in Southeast Anderson Lake. The control structure is discussed in further detail in Section 8.1.2.

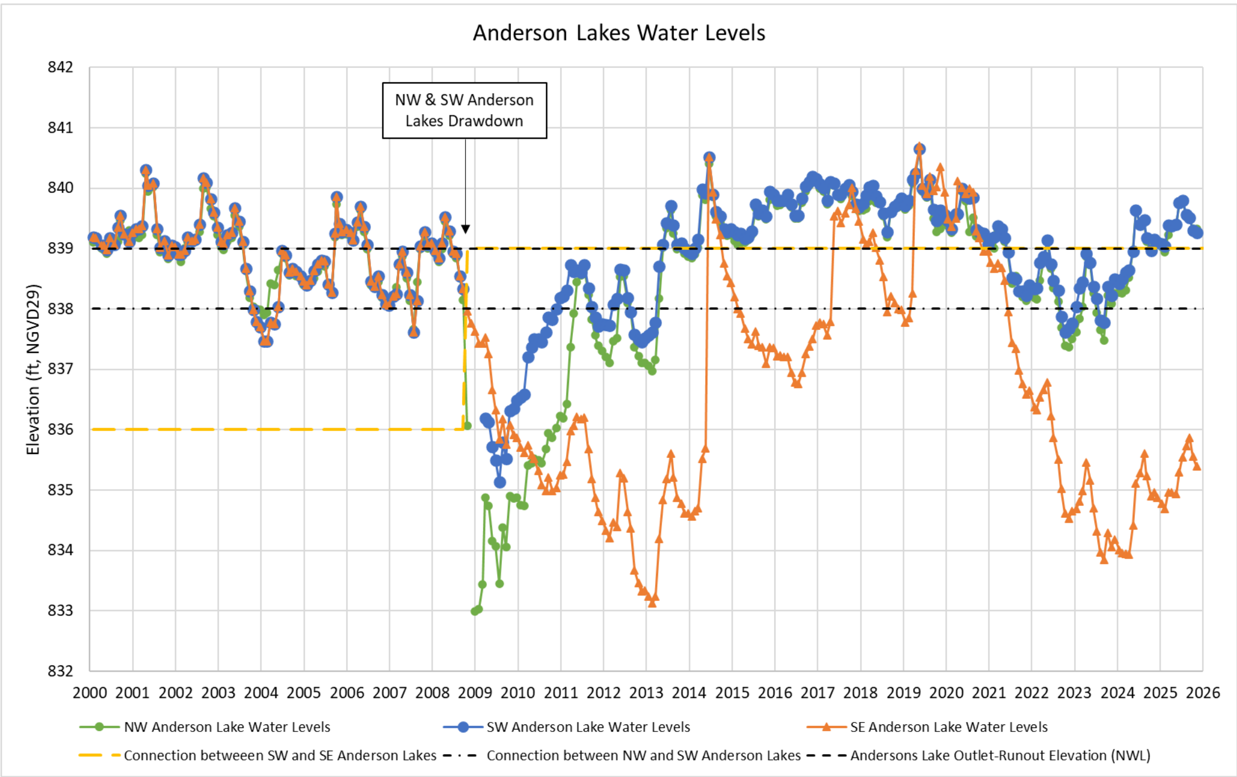



**Figure 5-31 Observed Monthly Water Levels in the Anderson Lakes between 2000 - 2025**

# 6 Management Practices Implementation & Success

The District completed a water quality study for the Anderson Lakes in 2005 to identify water quality and ecological improvement measures (Barr Engineering, Co., 2005). The study concluded that water quality concerns in the Anderson Lakes were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed, and its early senescence during the early summer months, was identified as a significant source of phosphorus to the lakes. Watershed runoff was also identified as a noteworthy source of phosphorus. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering the Anderson Lakes to improve water quality and enhance ecological health. Table 6-1 provides a description of the management practices implemented since the 2005 water quality study in all three Anderson Lakes. The following subsections provide additional information on the management practices implemented, and short-term and long-term successes, where appropriate.

**Table 6-1 Management Practices Implemented in the Anderson Lakes since 2005**

| Management Practice | Basis | Year Implemented | Lead Agency |
|---|---|---|---|
| Upgrade Existing Stormwater Pond<br>*Northwest Anderson* | Reduce pollutant loads entering Northwest Anderson from watershed runoff | 2007 | NMCWD |
| Lake Drawdown<br>*Northwest and Southwest Anderson Lakes* | Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions | Fall 2008 – Spring 2009 | NMCWD |
| Herbicide Treatments<br>*All Anderson Lakes* | Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions. Whole lake herbicide treatments were performed on Southeast Anderson. Spot treatments were completed on Northwest and Southwest Anderson (targeting areas not exposed during drawdown) | 2009 – 2014 | NMCWD |
| Alum Sediment Treatment<br>*Southwest Anderson Lake* | Reduce internal sediment phosphorus load to Southwest Anderson Lake, which also reduces phosphorus inflows to Northwest Anderson Lake | 2012 | NMCWD |
| Cost Share Grants | In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries | Ongoing | NMCWD |

## 6.1 Upgrade Existing Stormwater Pond

Some of the detention basins in Eden Prairie were constructed prior to the establishment of current MPCA (i.e., (MPCA, 2000)) and NURP (Nationwide Urban Runoff Program) design criteria. Current design standards require a minimum permanent pool or dead storage volume for each constructed stormwater pond based upon the tributary watershed size and land use type. If a stormwater pond is too small for its watershed size and land use type, the treatment effectiveness may not be adequate to protect downstream waterbodies from stormwater pollutants.

Stormwater ponds that were constructed before current MPCA and NURP design standards can often be retrofitted to improve water quality treatment. Increasing a stormwater pond's permanent pool volume can result in improved solids capture and reduce phosphorus loading to downstream waterbodies. Ideally, retrofits should aim for a permanent pool volume equivalent to 2.5 inches of runoff from the tributary watershed, provided existing site topography and infrastructure allow for these changes. However, there may be site constraints that limit the ability to significantly expand a pond's footprint or depth.

In the 2005 Anderson Lakes UAA study, stormwater pond NW-AL-12 was identified as undersized for the pond's tributary watershed (Barr Engineering, Co., 2005). This stormwater pond is located west of Northwest Anderson Lake, with a 67.8-acre tributary watershed that's primarily composed of retail, office, multi-family, and single-family land use types. In 2007, the stormwater pond was retrofitted to increase the pond's permanent pool volume and modify the outlet structure to improve treatment effectiveness. While site limitations did not allow for a retrofitted permanent pool volume equivalent to 2.5 inches of runoff from its tributary watershed, the stormwater pond volume was increased by approximately 0.85 acre-feet. Additional details on the existing and retrofitted stormwater pond features are provided in Table 6-2. No pre- or post-water quality monitoring is available to quantify water quality improvement.

**Table 6-2 Upgrade existing stormwater pond NW-AL-12**

| Watershed Area (acres) | Impervious Area (acres) | NURP Permanent Pool Volume (ac-ft[1]) | Existing Permanent Pool Volume (ac-ft[1]) | Retrofitted Permanent Pool Volume (ac-ft[1]) | Downstream Waterbody |
|---|---|---|---|---|---|
| 67.8 | 43.4 | 11.7 | 3.09 | 3.94 | Northwest Anderson |

[1] ac-ft = acre-feet


**Figure 6-1 Stormwater pond NW-AL-12 west of Northwest Anderson Lake**

## 6.2 Aquatic Invasive Species (AIS) Plant Management Practices

Management of the AIS plant species curly-leaf pondweed was recommended for all three Anderson Lakes in the 2005 Anderson Lakes UAA study due to the plant's negative ecological and water quality impacts. This AIS can outcompete native plants by growing under ice and establishing early in spring. Additionally, curly-leaf pondweed typically dies back in mid-summer, and as it decays, it can cause low oxygen conditions and phosphorus release, which often fuels algal blooms.

Whole-lake drawdowns were performed on Northwest and Southwest Anderson Lakes between fall 2008 and spring 2009 to allow the lakebeds to freeze over the winter. Since curly-leaf pondweed primarily propagates through the production of dormant vegetative propagules called turions, a winter freeze can kill the turions, thus disrupting curly-leaf pondweed's reproductive cycle and reducing the efficacy of establishment the following spring. Following the lake drawdown, the NMCWD performed plant surveys and applied spot herbicide treatments as necessary to areas with continued curly-leaf pondweed growth. These tended to be lakebed areas that were not exposed to winter freeze conditions during the drawdown. Spot herbicide treatments were completed on Northwest Anderson Lake between 2010–2013 and on Southwest Anderson Lake between 2010–2011.

A whole-lake drawdown was not performed on Southeast Anderson Lake due to limited resident support during the project planning process. Instead, the NMCWD conducted herbicide treatments on Southeast Anderson Lake between 2009–2014. Whole-lake herbicide applications using endothall were completed between 2009–2013 and a partial lake treatment was completed in 2014 using Imazamox (Clearcast).

Figure 6-2 through Figure 6-4 provide an overview of notable plant observations in Northwest, Southwest, and Southeast Anderson Lakes starting with the last year of active curly-leaf pondweed management through the most recent monitored year (2024). Notable observations are as follows:

<u>Northwest Anderson (Figure 6-2):</u>

- The final year of curly-leaf pondweed herbicide spot treatments occurred in 2013. Both the pre- and post-treatment surveys showed a low abundance of curly-leaf pondweed (≤4% occurrence) indicating that the drawdown and follow-up herbicide applications had effectively reduced the abundance of this AIS. The observed curly-leaf pondweed abundance remained low in the June 2021 and 2024 surveys (≤2% occurrence) indicating continued long-term success of the management project.
- Muskgrass, coontail, and common bladderwort were the most abundant native plant species observed in Northwest Anderson Lake in 2013. In 2021 and 2024, coontail continued to be observed at high abundances, but muskgrass and common bladderwort were found at noticeably lower abundances. Instead, bearded stonewort, flatstem pondweed, white water lily and various duckweed species (not plotted) were found in more locations.
- Native submerged species richness generally increased between 2013 and 2024 with 8–10 native submerged species observed in June and August 2013 and 11–15 observed in June and August 2024.

<u>Southwest Anderson (Figure 6-3):</u>

- The final year of curly-leaf pondweed herbicide spot treatments occurred in 2011. Both the pre- and post-treatment surveys showed a low abundance of curly-leaf pondweed (≤1% occurrence) indicating that the drawdown and follow-up herbicide applications had effectively reduced the abundance of this AIS. The observed curly-leaf pondweed abundance remained low in the June

2021 and 2024 surveys (≤3% occurrence) indicating continued long-term success of the AIS management project.

- Common waterweed, coontail, and sago pondweed were the most abundant native plant species observed in Southwest Anderson Lake in 2011. In 2021 and 2024, common waterweed and coontail continued to be observed at high abundances, but sago pondweed was found at noticeably lower abundances. Instead, bearded stonewort, flatstem pondweed, white water lily and various duckweed species (not plotted) were found in more locations.
- Native submerged species richness generally increased between 2011 and 2024 with 7–9 native submerged species observed in June and August 2011 and 9–10 observed in June and August 2024.

Southeast Anderson (Figure 6-4):

- The final year of curly-leaf pondweed herbicide treatments occurred in 2014. Both the pre- and post-treatment surveys showed a low abundance of curly-leaf pondweed (≤1% occurrence) indicating that the whole-lake and partial-lake herbicide applications had effectively reduced the abundance of this AIS. However, the observed curly-leaf pondweed abundance was noticeably higher in the June 2019 (70% occurrence) and 2024 (64% occurrence) surveys indicating that long-term success of the AIS management project was not achieved.
- A second submerged AIS species, Eurasian watermilfoil (EWM), was first observed in Southeast Anderson Lake in June of 2007 during a point intercept survey completed by TRPD. Although initially noted in 2007, the species was not observed again in any qualitative or quantitative surveys until 2018 where it was documented in a qualitative plant survey completed by the NMCWD. High frequencies of EWM were documented in Southeast Anderson in the 2019, 2021, and 2024 point-intercept surveys (31%–73% occurrence).
- Common waterweed and muskgrass were the most abundant native plant species observed in Southeast Anderson Lake in 2014. Between 2019 – 2024, both common waterweed and muskgrass were found at noticeably lower abundances. Instead, coontail, curly-leaf pondweed, Eurasian watermilfoil, flatstem pondweed, and white water lily were found in more locations.
- Despite having a high occurrence of submerged AIS, the native submerged species richness generally increased between 2014 and 2024 with 9–10 native submerged species observed in June and August 2014 and 13–15 observed in June and August 2024.

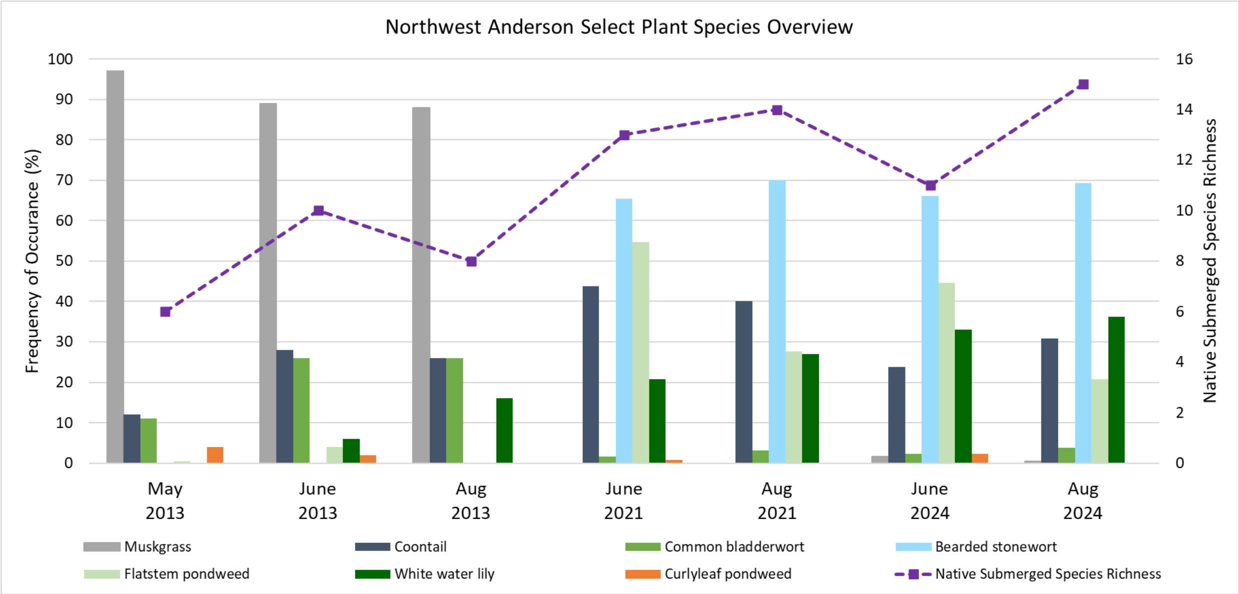



**Figure 6-2 Northwest Anderson notable plant species overview 2013 – 2024**

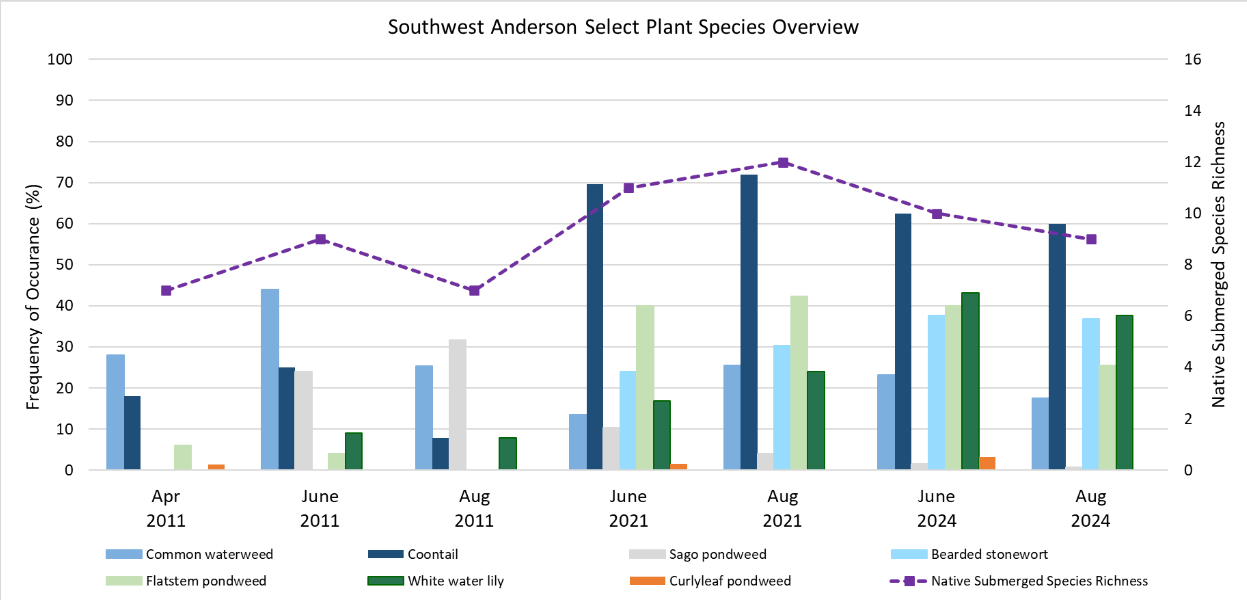



**Figure 6-3 Southwest Anderson notable plant species overview 2011 – 2024**

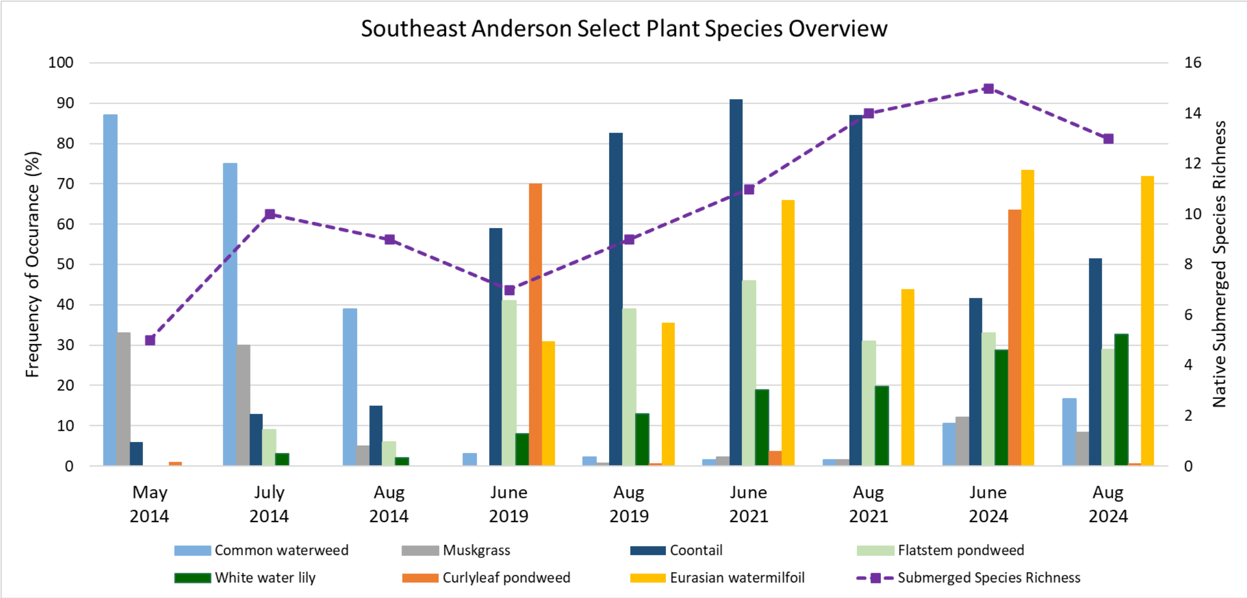



**Figure 6-4 Southeast Anderson notable plant species overview 2014 – 2024**

## 6.3 Alum Sediment Treatment

In January 2012, sediment cores were collected from Northwest and Southwest Anderson Lakes to determine internal phosphorus loading potential and to inform alum dosing, as appropriate. The sediment core data can be viewed in more detail in Section 5.2. Based on the sediment core data collected, an alum sediment treatment was only recommended for Southwest Anderson Lake at a dose of 51 grams aluminum per square meter. In fall 2012, a buffered alum treatment was applied to Southwest Anderson Lake (i.e., aluminum sulfate + sodium aluminate) to reduce internal phosphorus loading from lake bottom sediment.

As discussed in Section 5.1, since 2013, Southwest Anderson Lake has consistently met the eutrophication water quality state standards (total phosphorus, chlorophyll-*a*, Secchi disk depth) and has seen an increase in native plant abundance and diversity. Profile monitoring data collected in 2024 did not show a strong internal loading signature, indicating that another sediment inactivation project is not yet warranted. Monitoring data should continue to be collected periodically to determine if a second sediment inactivation project might be necessary in the future.

**Figure 6-5 Alum sediment treatment on Southwest Anderson in fall 2012**

## 6.4 Cost Share Grants

The NMCWD offers cost share grants to residents, associations, nonprofits, schools, businesses, and cities for eligible projects located within the boundaries of the district. Cost share grants are awarded to projects that prevent stormwater pollution or restore native plant and wildlife habitats. Additional information on the NMCWD cost share grant program can be viewed here: Grants - Nine Mile Creek Watershed District

Between 2005 and 2025, four cost share grants were awarded to two homeowners associations and two private residents within the Southwest and Southeast Anderson Lakes watersheds. These cost share grants helped to fund a habitat restoration project, native plantings, shoreline buffer creation, and the construction of a bioswale. The locations of these cost share projects can be seen in Figure 6-6.

## 6.5 Stormwater Regulatory Program

The NMCWD has stormwater management rules in place for land development activities that are derived from Minnesota Statutes Chapters 103B and 103D. The purposes of the rules include, but are not limited to, the conservation of water for public uses, controlling erosion and siltation of lakes, streams, and wetlands, and protecting the water quality of the District's waterbodies. Since the 2005 Anderson Lakes UAA study, eight land development activities within the Anderson Lake's tributary watershed triggered the NMCWD Stormwater Management Rule. When this rule is triggered, stormwater management practices must be installed or existing features must be retrofitted to provide required stormwater retention volumes, limit peak runoff flow rates, and provide water quality treatment. Additional information on the NMCWD stormwater regulatory program can be viewed here: Permits - Nine Mile Creek Watershed District

The locations of the eight permitted projects can be seen in Figure 6-6. The stormwater management practices installed or retrofitted included infiltration and filtration basins, underground stormwater facilities, stormwater pond improvements, rainwater gardens, and the installation of pervious pavement.


Permit Sites
Cost Share Sites
Major Watersheds
Municipal Boundary

N

0 600 1,200
Feet

**Cost Share Grant and Regulatory Program Project Locations**
NMCWD

FIGURE 6-6

BARR

# 7 Public Engagement Meetings

The NMCWD considers public engagement to be an important part of completing lake water quality studies. Because the recommendations that stem from this study may impact residents adjacent to the Anderson Lakes, input from residents was sought at two public engagement meetings.  The meetings allowed NMCWD to gain further insight on resident lake use, goals, and concerns. The meetings also presented an opportunity to get feedback from the public on proposed lake management activities and willingness to participate in various activities to improve lake water quality.

## 7.1 Public Meeting #1 – August 2025

The first public engagement meeting was held in a private resident's garage on Southeast Anderson Lake in the evening on August 19, 2025 (Birchwood Lane). The garage was fitted with a projection screen and chairs, which allowed for a similar presentation set-up as other District or City facilities. This location was ultimately selected to encourage higher attendance, given the close vicinity to Anderson Lakes residents. In July, a postcard was mailed to Anderson Lake residents informing them of a planned community meeting. At this meeting, NMCWD staff and engineers, as well as City of Eden Prairie, Bloomington, and Three Rivers Park District (TRPD) staff provided an overview of the upcoming study and provided a summary of the current water quality and ecological status of each lake. Following the background presentation, the remainder of the meeting involved an open discussion with residents regarding their observations and concerns regarding lake health. Comments provided during the community meeting were considered during the development of lake goals and management recommendations. A summary of comments, concerns, and observations provided by residents during the August meeting can be found in Appendix C.

## 7.2 Public Meeting #2 – February 2026

In January 2026, a postcard was mailed to Anderson Lake residents informing them of a planned in-person community meeting held at the Eden Prairie City Center on February 11, 2026. At this meeting, NMCWD staff and engineers provided an overview of the study goals and discussed the evaluated lake management practices. City of Eden Prairie, Bloomington, and TRPD staff were also in attendance to help answer questions. Following the presentation, the remainder of the meeting involved open discussion with residents to answer questions and address concerns. Comments provided during the community meeting were considered during development of the final water quality report.

# 8 Management Status/Stage

Based on the 2024 water quality and ecological monitoring data (Section 5) and the reassessed lake goals (Section 3.4), the post-project lake management statuses were identified for each primary health assessment category with an identified goal (i.e., water quality, aquatic communities, water quantity). The management status/stages identified for the health assessment factors include: (1) No Active Management, (2) Care and Maintenance, and (3) Additional Management. For additional information on these management stages, see Section 1.1. Table 8-1 through Table 8-3 provide an overview of the identified management statuses for all three Anderson Lakes.

**Table 8-1 Identified management status for Northwest Anderson Lake Health Assessment Factors**

| Lake | Health Assessment Factors Identified Management Status[1] | | |
|---|---|---|---|
| | No Active Management | Care and Maintenance | Additional Management |
| **Northwest Anderson Lake** | • Water Quality<br>• Macrophytes (Aquatic Plants) - Submerged<br>• Phytoplankton (Algae)<br>• Fisheries<br>• Water Quantity | | |

[1]District goals were not identified for the wildlife habitat and recreation assessment factors; however, the improvement of habitat conditions and promotion of habitat connectivity may be considered alongside other management activities.

**Table 8-2 Identified management statuses for Southwest Anderson Lake Health Assessment Factors**

| Lake | Health Assessment Factors Identified Management Status[1] | | |
|---|---|---|---|
| | No Active Management | Care and Maintenance | Additional Management |
| **Southwest Anderson Lake** | • Water Quality<br>• Macrophytes (Aquatic Plants) - Submerged<br>• Phytoplankton (Algae)<br>• Fisheries<br>• Water Quantity | | |

[1]District goals were not identified for the wildlife habitat and recreation assessment factors; however, the improvement of habitat conditions and promotion of habitat connectivity may be considered alongside other management activities.

**Table 8-3 Identified management statuses for Southeast Anderson Lake Health Assessment Factors**

| Lake | Health Assessment Factors Identified Management Status[1] | | |
|---|---|---|---|
| | No Active Management | Care and Maintenance | Additional Management |
| **Southeast Anderson Lake** | • Water Quality<br>• Fisheries | • Phytoplankton (Algae) | • Macrophytes (Aquatic Plants) - Submerged<br>• Water Quantity |

[1]District goals were not identified for the wildlife habitat and recreation assessment factors; however, the improvement of habitat conditions and promotion of habitat connectivity may be considered alongside other management activities.

## 8.1 Additional Management Overview

Management practices were evaluated for lakes and health categories marked as "Additional Management" in Table 8-1 through Table 8-3, or for topics where the NMCWD Board of Managers requested more information to support informed decision making during the study. The following sections summarize the evaluated management strategies for the Anderson Lakes.

### 8.1.1 Southeast Anderson Submerged Aquatic Invasive Species Management

During plant surveys completed in 2024, Southeast Anderson Lake was observed to have high abundances of the submerged aquatic invasive species, curly-leaf pondweed and Eurasian watermilfoil. Conversely, no Eurasian watermilfoil and only low abundances of curly-leaf pondweed were observed in Northwest and Southwest Anderson. For more information on historical aquatic plant surveys and previous AIS management efforts on the Anderson Lakes please refer to Sections 5.3.1 and 6.2.

Curly-leaf pondweed, CLP, (*Potamogeton crispus*) and Eurasian watermilfoil, EWM, (*Myriophyllum spicatum*) are invasive aquatic plants that can considerably impact lake ecosystems and water quality. EWM grows rapidly, forming dense mats that shade out native vegetation, reduce biodiversity, impair fish and wildlife habitat, and hinder recreation. CLP establishes early, even under winter ice, allowing this AIS to outcompete native species. Its life cycle further disrupts lake health: by late June or early July, the plant senesces, leaving large areas of shallow lakes unvegetated. This lack of submerged vegetation can increase turbidity through sediment resuspension and promote phytoplankton growth due to reduced nutrient competition. Open sediment areas also create opportunities for other fast growing invasive species, such as EWM, to expand. Additionally, CLP's decaying biomass can release pulses of phosphorus and can lower dissolved oxygen, exacerbating internal nutrient loading. Together, these invasive species can degrade ecological integrity, diminish habitat quality, and present significant water quality/ecological management challenges.

Based on the management success stories from similar waterbodies in the Twin Cities Metro area, controlling EWM is generally more achievable in the short term than managing CLP. Whole-lake herbicide treatments over one to two years often yield high success in reducing EWM abundance and coverage. In contrast, effective CLP control typically requires a longer timeline and a comprehensive, long-term management plan. The most protective long-term goal for Southeast Anderson Lake and downstream ecosystems would be to eliminate CLP and its turions entirely. However, achieving this would require intensive, ongoing treatment that may not be sustainable. Therefore, the immediate management objective for Southeast Anderson is to reduce CLP extent and density to a level that does not significantly impact native plant communities or pose notable water quality concerns. This objective guided the development of the CLP treatment plan for this study.

Two AIS management alternatives were assessed – (1) annual herbicide management and (2) a whole-lake drawdown coupled with follow-up herbicide control. These management alternatives are discussed in detail in the sections below.

#### 8.1.1.1 AIS Management – Annual Herbicide Treatments

Herbicide treatments are an effective method to control the extent and density of AIS. In general, herbicides selected for AIS control are applied early in the growing season and/or at low concentrations to minimize negative impacts to native plant species. There are multiple herbicides available that target EWM and CLP, and selection depends on several factors including the surveyed extent and density, lake bathymetry, lake size, and native plant species present.

The following herbicide strategy is recommended for Southeast Anderson Lake (Figure 8-1):

- Years 1 – 2: Whole-lake fluridone herbicide treatment from ice-off through early summer maintaining concentrations between 2 – 4 µg/L to target both CLP and EWM. To maintain a contact time between 60 – 90 days, “bump” treatments would need to be applied approximately every 30 days to increase the fluridone concentration back to control levels. It’s anticipated that EWM can be sufficiently managed in about two years with fluridone applications based on correspondence with MNDNR staff.
- Years 3 – 6: Whole-lake Galleon herbicide treatment in early spring at an applied concentration of 6 µg/L to target CLP. Galleon has also shown to be effective in limiting the growth of EWM offering a secondary benefit.
- Adaptive Management:
    - Post-treatment aquatic plant monitoring can be used to confirm management success and adapt the management approach as needed.
    - EWM: Spot treatments using the herbicide ProcellaCOR may be needed following the whole-lake fluridone applications if post-treatment monitoring identifies smaller areas of EWM regrowth or reintroduction.
    - CLP: Spot treatments using the herbicide Diquat may be needed to continue to suppress the growth of CLP following the whole-lake applications dependent on the long-term viability of turions in the lake sediment.

Fluridone and Galleon are both systemic herbicides that are typically used for larger-scale aquatic plant management applications (whole waterbody treatments). Systemic herbicides are absorbed into the plant when the plant is actively growing and in general, affect a specific internal growth mechanism or mechanisms (e.g., inhibiting enzyme, amino acid, or protein production). The low concentration needed for both these herbicides to be effective for invasive species control, as well as their toxic specificity (i.e., reduced impacts on native plant species), make these herbicides good options for AIS management. Based on correspondence with the MNDNR, the submersed native plant species in Southeast Anderson that may have temporary impacts (suppressed growth) due to fluridone toxicity include coontail, common waterweed, northern watermilfoil, and slender waternymph. Native plant species that may have temporary impacts due to Galleon toxicity include water stargrass, wild celery, and sago pondweed.

Historically, the contact herbicide Endothall has been used for larger-scale CLP management efforts. Within the last few years the cost of Endothall significantly increased, making the herbicide a less cost-effective option for whole-lake treatments, especially since a higher concentration is needed for effective management. The MNDNR notes a typical target concentration for Endothall between 0.75–5.0 mg/L (depending on lake conditions) (MnDNR, 2020). Other NMCWD lakes have also noted CLP plants re-growing from root masses following Endothall treatments given that the herbicide is a contact herbicide rather than systemic.

#### 8.1.1.1.1 Permitting

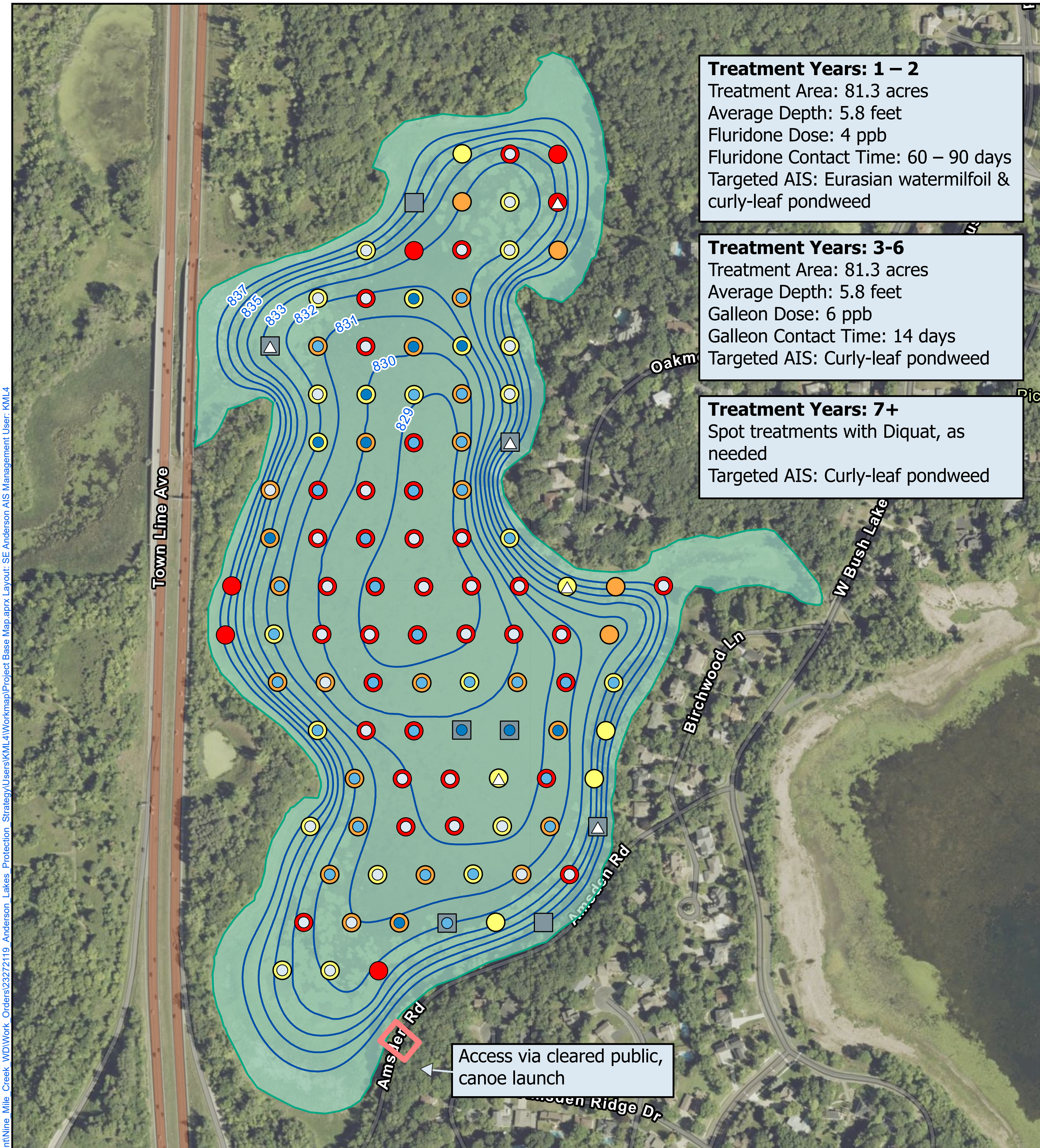
Implementing the whole-lake herbicide management strategy described above will require a variance from the MNDNR. To obtain a variance, the NMCWD will need to develop and submit a Lake Vegetation Management Plan (LVMP) to the MNDNR for review and approval.

The multi-year whole-lake herbicide management strategy described above would also require an annual Invasive Aquatic Plant Management Permit from the MNDNR. The permit requires completion of a pretreatment vegetation survey. Annual plant monitoring in June and August is also anticipated to fulfil the requirements of the LVMP.

In early 2026, the MNDNR communicated potential changes to its aquatic plant management permitting process that may result in longer review timelines to identify and minimize impacts to threatened and endangered species. At the time this study report was prepared, specific details regarding the anticipated permitting changes were not available. However, discussions with MNDNR staff indicated that the presence of the threatened species hooded arrowhead (*Sagittaria calycina*) in Southeast Anderson Lake will likely require additional evaluation by MNDNR staff prior to approval of a management approach. Depending on the anticipated impacts of an herbicide treatment to hooded arrowhead, the MNDNR may require the NMCWD to conduct additional habitat surveys, collect supplemental monitoring data during and/or after treatment, and/or obtain a permit for the taking of a threatened or endangered species. Accordingly, it will be important for the NMCWD to coordinate with the MNDNR as the agency continues to develop changes to its aquatic plant management permitting program to better understand permitting limitations and requirements.

#### 8.1.1.1.2 Cost Estimate

The planning-level opinion of probable cost for two years of fluridone treatments and four years of Galleon treatments in Southeast Anderson Lake is approximately $204,000 - $288,000 (-15% to +20%). This estimate includes the preparation of contract documents, permitting, and herbicide applications. The cost estimate also includes potential costs related to monitoring that may be required by the MNDNR as a permit condition, including aquatic plant monitoring. A detailed opinion of probable cost for six years of herbicide treatments is included in Appendix D.




CLP Survey Results (June 2024)

- 1
- 2
- 3
- Visual

EWM Survey Results (June 2024)

- 1
- 2
- 3
- Visual

Proposed Treatment Area

Access Area

Bathymetry Contours (ft, NGVD29)
NWL = 839.0 ft, NGVD29

0 225 450
Feet

**Southeast Anderson Lake AIS Management Plan**
Nine Mile Creek Watershed District

FIGURE 8-1

Barr Footer: ArcGISPro 3.4.3, 2026-01-02 11:57 File: I:\Client\Nine_Mile_Creek_WD\Work_Orders\23272119_Anderson_Lakes_Protection_Strategy\Users\KML4\Workmap\Project Base Map.aprx Layout: SE Anderson AIS Management User: KML4

### 8.1.1.2 AIS Management – Lake Drawdown

Another potential method to control CLP is to draw down Southeast Anderson Lake to allow the lakebed to freeze over the winter. Curly-leaf pondweed primarily propagates through the production of dormant vegetative propagules called turions. Turions are produced in late spring, remain dormant in sediment through the summer, and germinate under cooler water conditions in the fall. A winter freeze can reduce the viability of turions, thus disrupting curly-leaf pondweed's reproductive cycle.

A high-level evaluation of conducting a drawdown to control curly-leaf pondweed in Southeast Anderson was included as part of this study due to the success of this approach in other lakes, including several in the NMCWD, and the desire to minimize the need for future recurring herbicide treatments. The sections below discuss drawdown background and methods, and a high-level assessment of a drawdown in Southeast Anderson, including permitting, opinion of probable cost, and other considerations.

#### 8.1.1.2.1 Drawdown Background

Several other waterbodies in the region have used partial or whole-lake drawdowns as a means to achieve water quality objectives. A successful shallow lake restoration was conducted in Big Muskego Lake in southeast Wisconsin using a combination of several in-lake treatments, including an 18-month drawdown period. This drawdown resulted in the consolidation of sediments in addition to allowing for the removal of rough fish populations and reestablishment of native aquatic plant species. Sediment consolidation was desired for the reduction of future sediment resuspension, although the extent of consolidation was limited by rain and flood events during the drawdown period.

The NMCWD completed a drawdown on Northwest and Southwest Anderson Lakes in Eden Prairie in fall 2008. The drawdown was conducted using electrical pumps to dewater a significant portion of each lake in an effort to significantly reduce and potentially eliminate curly-leaf pondweed from the two lakes. The goal of the project was to expose as much of the lake sediment as possible to freezing conditions during the 2008-2009 winter season and chemically treat any remaining open water areas a few years post drawdown. Freezing the lake sediment was expected to effectively kill the young curly-leaf pondweed plants and the curly-leaf pondweed turions. As discussed in Section 6.2, plant surveys completed in June 2024 found CLP growing at only a handful of locations in Northwest and Southwest Anderson Lakes and at very low densities. Overall, the drawdown effort and follow-up spot herbicide treatments resulted in long-term success in controlling curly-leaf pondweed in these two waterbodies.

Three Rivers Park District performed a successful lake level drawdown on Cleary Lake in Scott County, Minnesota to control curly-leaf pondweed (Barr Engineering Co., 2020). The initial Cleary Lake drawdown was not a complete drawdown because of a restriction in the outlet channel which limited the volume of water that would flow out of the lake by gravity. As a result, the initial drawdown was only effective at controlling curly-leaf pondweed over the portions of the lakebed exposed to freezing conditions. Therefore, TRPD did a complete drawdown the following year by modifying the outlet channel and installing temporary pumps to completely dewater the lake. TRPD has indicated the drawdown was extremely effective at controlling curly-leaf pondweed.

The NMCWD also conducted a drawdown of Normandale Lake in Bloomington in fall 2018. The initial drawdown was conducted using diesel pumps to dewater a significant portion of the lake in order to install a new bypass pipe which would drain the lake by gravity. The pipe was installed in November 2018 and was successful in keeping the majority of the lake drawn down over the 2018–2019 winter season. Freezing the lake bottom sediments killed many of the curly-leaf pondweed turions; sediment samples taken in the fall of 2019 found that the number of turions had decreased dramatically. Aquatic plant surveys conducted between 2019 and 2025 indicate reduced frequency and density of curly-leaf pondweed throughout Normandale Lake since the drawdown. However, annual herbicide spot treatments are still occurring, as of this study, to continue to manage CLP expansion.

### 8.1.1.2.2 Drawdown Method

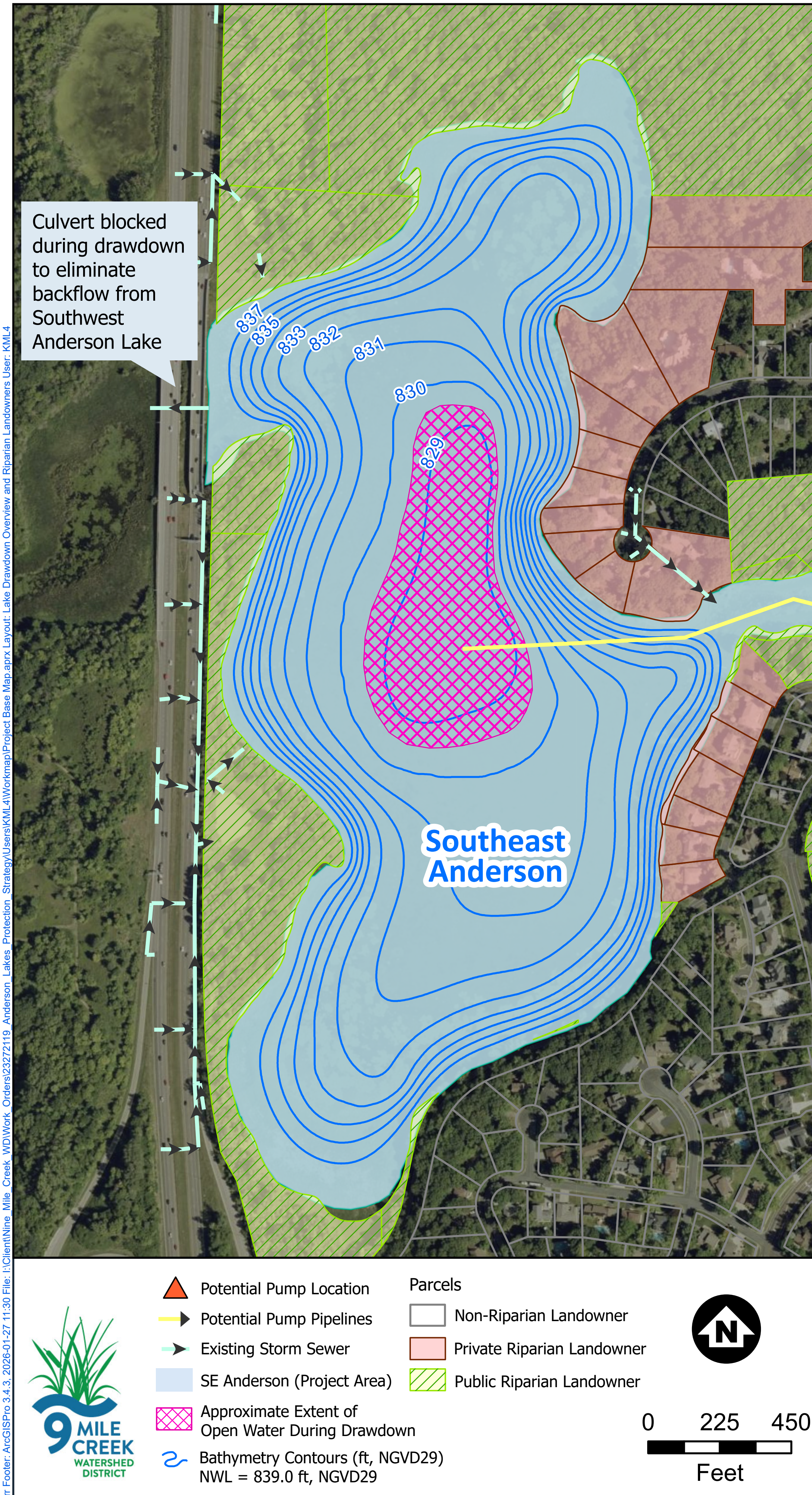
Outlet modification, siphoning and temporary pumping are drawdown methods that have been used for dewatering in similar projects. Modifying the outlet to draw down Southeast Anderson by gravity is not feasible since a large portion of the lake is below the elevation of the outlet weir and downstream storm sewer. Siphoning could be used to draw the lake down below the outlet elevations but difficulties in maintaining and re-priming the siphon once the lake is drawn down and then receives inflow in response to precipitation events, especially during winter months, make this option impractical. Installing temporary pumping is the only feasible option for dewatering Southeast Anderson. Temporary pumps have the potential to quickly draw down waterbodies in the late summer and can be easily turned on and off as needed to keep the lake drawn down over the fall and winter months.

This study investigated pumping water from Southeast Anderson Lake to Bush Lake given the closer proximity and noticeably lower than average water levels in Bush Lake in the past 5 years (e.g., five-year average WSE of 830.4 NGVD29 as compared to the pump-on elevation of 834.0 NGVD29). Bush Lake also has the same submerged AIS species, avoiding the requirement for AIS screening of pumped water. Figure 8-2 shows the proposed location of a temporary pumping station located on the eastern side of Southeast Anderson Lake on city-owned property. Based on similar projects, it is assumed that a diesel pump equipped with a muffler would be used to reduce noise in this residential area. It is possible that an electric pump could be an option if temporary connections to the 3-phase power system at the Bush Lake pump station can be installed; however, this design was not evaluated in detail as a part of this study. Overall, this study provides a high-level assessment of drawdown feasibility and does not include a detailed evaluation of alternative design options. Assessing drawdown feasibility using a diesel pump configuration is expected to provide a conservative estimate of project costs.

### 8.1.1.2.3 Drawdown Analysis

A predictive spreadsheet water balance model was created to evaluate several drawdown options in terms of how quickly Southeast Anderson could be drawn down in the fall, how likely the lake would remain drawn down over winter, and how quickly lake levels can rebound post winter. A lake level drawdown goal of approximately 829.5 feet was used for this high-level drawdown analysis (~0.5 feet above the lowest bathymetric contour). Figure 8-2 shows the extent of open water within the lake at a drawdown elevation of 829.5 feet (~9 acres).

Daily inflows to the lake were estimated using a P8 watershed model. Outflows from Southeast Anderson were only via evaporation or groundwater discharge as it was assumed that the existing outlet structure was blocked (i.e., no discharges towards Southwest Anderson Lake). Seventy-five years of precipitation data (1949–2024) were input into the model to predict the water surface elevations in the lake over a wide range of actual climatic conditions. The model was also set up to predict lake responses to various drawdown options including varying starting elevations of the lake, pump capacity, and the dates that the pumps are turned on.




**Lake Drawdown Overview and Riparian Landowners**
Nine Mile Creek Watershed District

FIGURE 8-2

BARR

### *Drawdown Timing*

The amount of time for Southeast Anderson Lake to draw down to its target elevation of 829.5 feet is dependent on the starting elevation of the lake, pumping capacity, groundwater discharge rates, evaporation rates, and amount precipitation received during the drawdown period. For the Normandale Lake drawdown project, MnDNR indicated a preference for the lake to be drawn down by September 15 to minimize impacts to the area's turtle community as the species prepares for winter hibernation. The predictive spreadsheet water balance model was used to evaluate various pumping capacities and the likelihood of meeting an anticipated September 15 drawdown goal if drawdown were to begin on August 15 and the lake's water elevation is 836.0 (near its observed elevation in the fall of 2025). Figure 8-3 shows the likelihood (% of 75 years modeled) of drawing the lake down to an elevation of 829.5 feet on a given date for each of the pump capacities, based on the predictive water balance model. The modeling shows that a pump with a capacity greater than or equal to 2,500 gpm should have a high likelihood of success in drawing down the lake to the elevation of 829.5 feet by September 15 under varying climatic conditions. If the lake is at a higher elevation than 836.0 on August 15th this analysis should be updated to determine if the 2,500 gpm pump is still adequate.

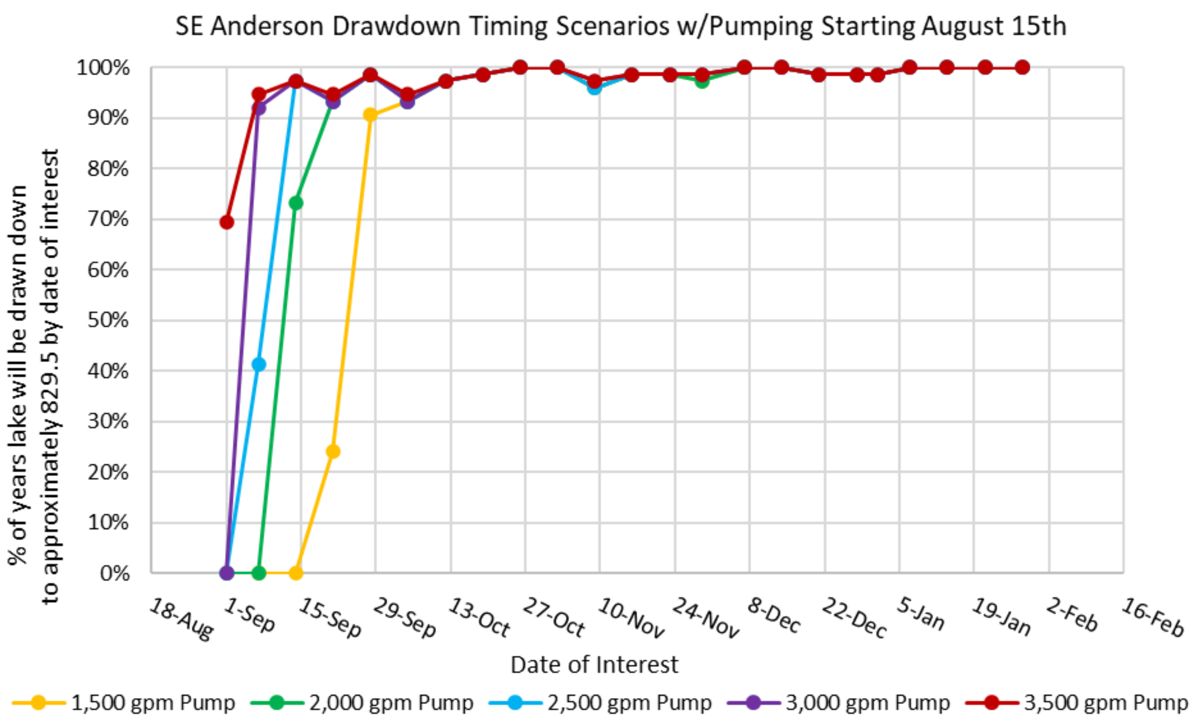



**Figure 8-3 Drawdown Effectiveness of Various Pump Capacities based on August 15 Start Date**

### *Maintaining Winter Drawdown Conditions*

A lake drawdown could allow much of the lakebed to freeze over the winter (~89% of the Southeast Anderson Lake surface area). Maintaining the drawdown over the winter months is important to maximize the extent and amount of time the sediments are frozen. Rainfall or snowmelt events do occasionally happen during the winter months and the resulting increased inflows from the watershed can cause the lake level to bounce up. The predictive water balance model was used to evaluate the likelihood of maintaining low lake levels during the months of December through February for each of the evaluated drawdown options, based on a 75-year time period representing a wide range of climate conditions.

Figure 8-4 shows the percentage of years that the drawdown target elevation of 829.5 feet was exceeded at least once during a given month due to a rainfall or snowmelt event. Model results indicate that all five pump sizes would perform fairly well at keeping the lake levels below the target elevation of 829.5, particularly during January, and there is no significant difference between the pump sizes in maintaining the drawdown.

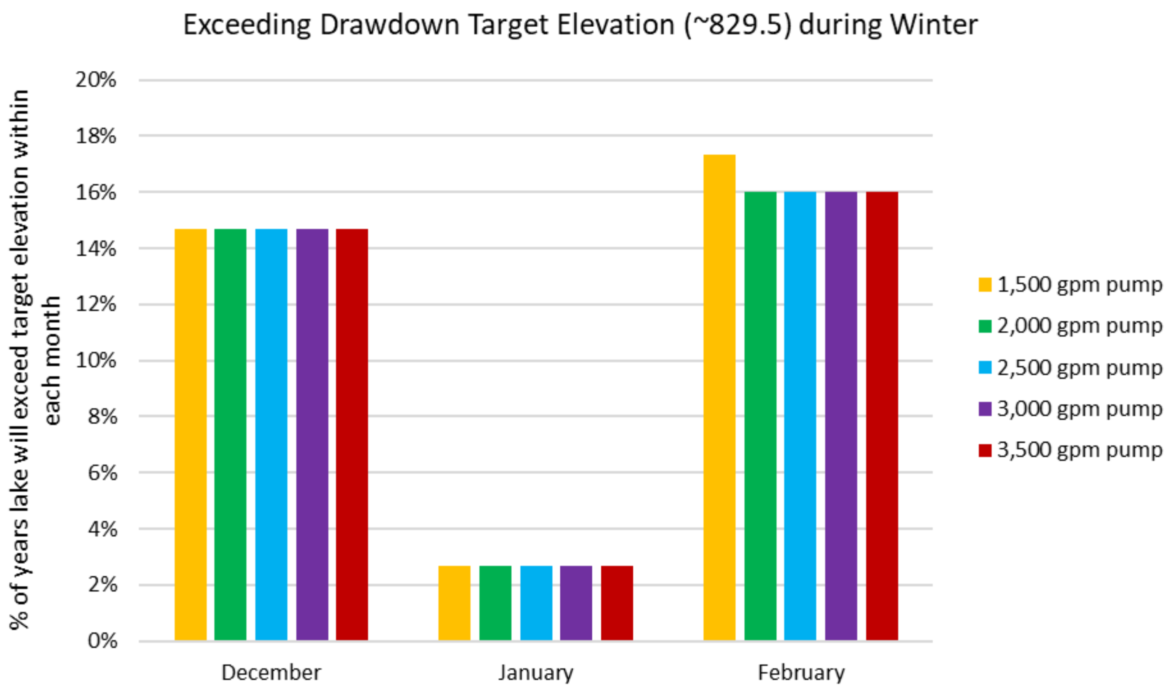



**Figure 8-4 Effectiveness of Maintaining Drawdown Conditions**

## *Lake Refilling Timeline*

The amount of time for Southeast Anderson Lake to refill back to its control elevation following a winter drawdown would be dependent on the amount of precipitation received, groundwater discharge rates, and evaporation rates. A spreadsheet water balance model was used to evaluate the lake's annual inflows and outflows under varying climatic conditions (75-years of historical data). The model assumed that the Northwest Anderson outlet would be blocked during the refill time period. This means that any runoff to Northwest and Southwest Anderson lakes would discharge towards Southeast Anderson when the lakes were above 839.0 (outlet elevation), instead of discharging towards the Nine Mile Creek. Blocking the Northwest Anderson outlet would allow for a larger tributary watershed to Southeast Anderson during the refilling period to expedite filling. Based on the water balance model, the estimated durations of time to refill Southeast Anderson Lake post drawdown under a range of climatic conditions are summarized below:

- Very wet climatic conditions (<15% of years modeled): approximately 1 year to refill
- Average climatic conditions: approximately 3 years (assuming average conditions 3 years in a row)
- Dry climatic conditions: indefinite

### *Bush Lake Water Surface Elevations*

Under typical operating conditions, Bush Lake discharges to Southeast Anderson Lake when water levels reach 834.0 feet, NGVD29. At this elevation, water is pumped from Bush Lake to Southeast Anderson Lake. Over the past 5 years, observed water levels in Bush Lake have been well below average (Figure 8-5). Given the low water levels, this study evaluated the benefits and risks of dewatering Southeast Anderson to Bush Lake. Benefits include an increase in water surface elevations in Bush Lake of 1 to 4 feet from existing water levels, a more cost-effective pump station set-up and operation (as opposed to pumping towards the Nine Mile Creek), and no AIS screening required during dewatering as the same AIS are currently present in Bush Lake. The predictive water balance model was also used to evaluate the likelihood of increased flood risk on Bush Lake based on a 75-year time period representing a wide range of climate conditions. The model indicates negligible increased flood risk for Bush Lake infrastructure if the existing water surface elevations are below 830.0 feet, NGVD29 at the start of the Southeast Anderson drawdown (e.g., water surface elevations are unlikely to exceed the 834.0 ft, NGVD29 pump-on elevation during the drawdown period).

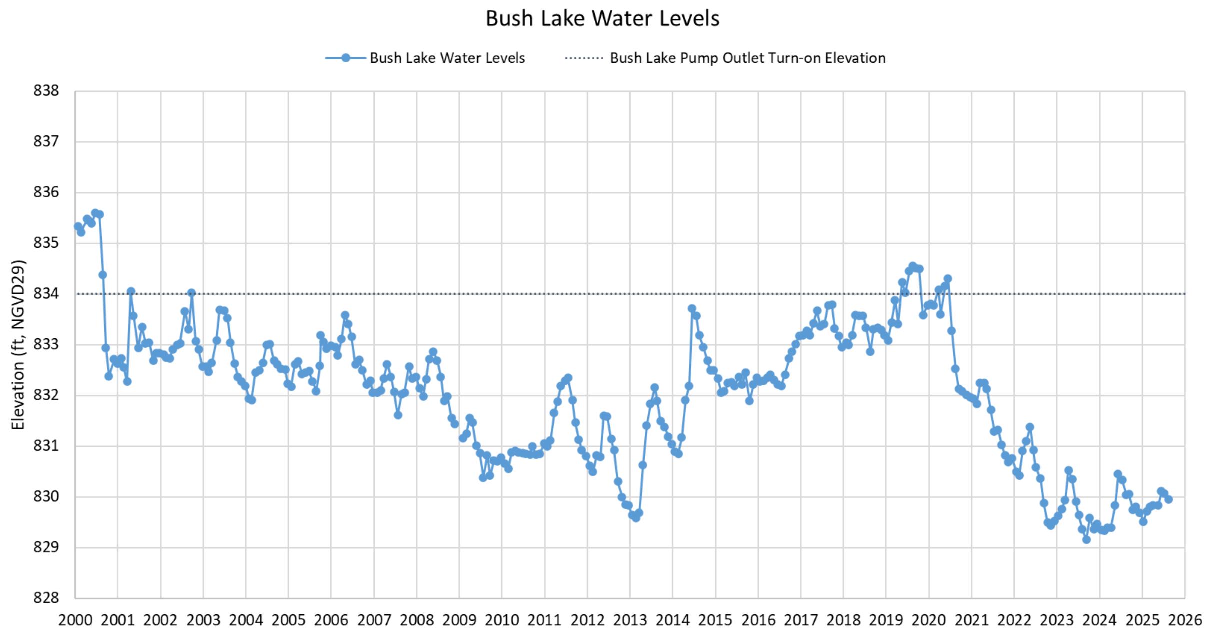



**Figure 8-5 Observed water levels in Bush Lake between 2000 - 2025**

## 8.1.1.2.4 Permitting

Conducting a lake drawdown would require approval from the MNDNR through a Work in Public Waters Permit. Under Minnesota Statute Section 103G.408, 75 percent of the riparian landowners must authorize a drawdown. The City of Bloomington and TRPD own the properties along the northern, southern, and western portions of the lake. The eastern portion of the lake consists of 19 private, riparian landowners; more than 14 private landowners would need to authorize a drawdown for it to proceed (>75% landowner approval). Figure 8-2 identifies the riparian property owners around Southeast Anderson Lake.

The pumping station set up to pump water from Southeast Anderson towards Bush Lake can be located on City of Bloomington property. NMCWD would need to obtain the necessary rights to use property owned by the City of Bloomington in a cooperative agreement between the two entities for the project.

Permits/approvals for the drawdown may also be required from the City of Bloomington, U.S. Army Corps of Engineers, the MPCA and NMCWD, depending on the ultimate dewatering method.

#### 8.1.1.2.5 Cost Estimate

A planning-level opinion of probable cost has been developed for the 2,500-gpm pump capacity option assuming the pump would need to run continuously from mid-August to mid-September and then run approximately 50 percent of the time from mid-September through February. The planning-level opinion of probable cost for conducting a winter drawdown in Southeast Anderson Lake is approximately $969,000, with a range of $679,000 to $1,454,000 (30% to +50%). The opinion of probable cost is based on engineering judgement, experience with similar projects, and review of actual bid values from recent, similar projects. An expected accuracy range of -30% to 50% is based on the current extent of project definition, wide-scale use of parametric models to calculate estimated costs (i.e., making extensive use of order-of-magnitude costs from similar projects or proposals), and project uncertainty. Engineering, design, construction administration, and permitting costs are also included in the total cost estimate. A detailed opinion of probable cost for a drawdown of Southeast Anderson Lake is included in Appendix D.

#### 8.1.1.2.6 Other Drawdown Considerations

Temporary pumping would likely require construction of temporary enclosures to store the pump, minimizing the potential for vandalism or accidents. Pumping during winter months introduces the potential for complications related to flash freezing, frazil ice, etc. The pump would need to be checked daily in times of extreme cold to ensure it is functioning properly. The pump would likely operate on diesel fuel and would need to be refueled daily when running. The pump would also need noise baffling for noise reduction due to the proximity to residential areas.

The long-term effectiveness of using a winter drawdown to manage the growth of EWM is unclear. Research shows that EWM root crowns exposed to the air and freezing conditions can result in the desiccation and death of the plants. However, in areas where full air exposure is not possible (e.g., areas of standing water), EWM may persist and require additional management following a drawdown. High amounts of snow accumulation on top of exposed sediment may also minimize EWM root damage and may allow the root systems to survive and regrow shoots post drawdown completion (Lonergan, Marsicano, & Wagener, 2014). Additionally, slow refilling of the lake following a drawdown may allow EWM to expand to greater proportions of the lakebed before an herbicide contractor can safely access the lake to perform follow-up treatments.

### 8.1.1.3 Potential Risks to Project Success

While winter drawdowns have generally been effective in controlling curly-leaf pondweed growth in other NMCWD lakes (e.g., Normandale Lake, Northwest and Southwest Anderson Lakes), there are potential risks to project success that should be considered for Southeast Anderson Lake:

- Possibility of insufficient riparian landowner support (>14 private residents).
- Possibility of slow refilling timeline (3 years of consecutive average climatic conditions).
- Potential prolonged impacts to wildlife during drawdown and refilling (e.g., turtles, muskrats, invertebrates).

- Increase in non-native cattail extents (unless management is pursued, see Section 8.1.3).
- Incomplete sediment freezing conditions
    - Potential for a large area of lake bottom with standing water (9+ acres) and unfrozen sediment. This may require increased volume and length of post-drawdown herbicide applications for both EWM and CLP.
    - Shorter ice-on season and increased winter temperatures documented in recent years.
    - Decaying organic matter may maintain increased sediment temperatures in winter.
    - Thick winter snowpack may insulate sediments from freezing.
- Although a low probability is anticipated given the current water levels, there is the potential for record precipitation that would require that Bush Lake be pumped back to Southeast Anderson Lake during the initial drawdown period.

## 8.1.2 Water Level Equalization

As discussed in Section 5.4, Southeast Anderson Lake has experienced relatively low water levels since completion of the Northwest and Southwest Anderson Lakes drawdown project, in part due to installation of a weir control structure and macrophyte screen on an existing culvert between Southeast and Southwest Anderson Lakes prior to the drawdown. Review of the monthly lake level data indicates that the weir and macrophyte screen have hindered the movement of water from Southwest Anderson to Southeast Anderson, especially during times when water levels are below the control elevation of 839.0, unintentionally resulting in lower-than-expected water levels in Southeast Anderson Lake.

The control structure installed at the outlet of Southeast Anderson Lake consists of a stoplog weir with a macrophyte screen. The top of weir elevation (839.0 ft, NGVD29) matches the ultimate control elevation of the outlet at Northwest Anderson Lake (Figure 8-6). This elevation was originally selected to maintain a consistent control elevation of 839.0 feet on Southeast Anderson Lake during the drawdown project. The macrophyte screen has a top elevation of 842.0 ft, NGVD29 and slotted 1.0 mm openings. The small openings were originally selected to limit the migration of curly-leaf pondweed downstream (Figure 8-6). This control structure has remained in place since its installation in fall 2008. While typical storm event flows from Southeast Anderson are directed through the macrophyte screen, during an extreme storm event, water would overtop a berm adjacent to the control structure and surface flow towards Southwest Anderson.

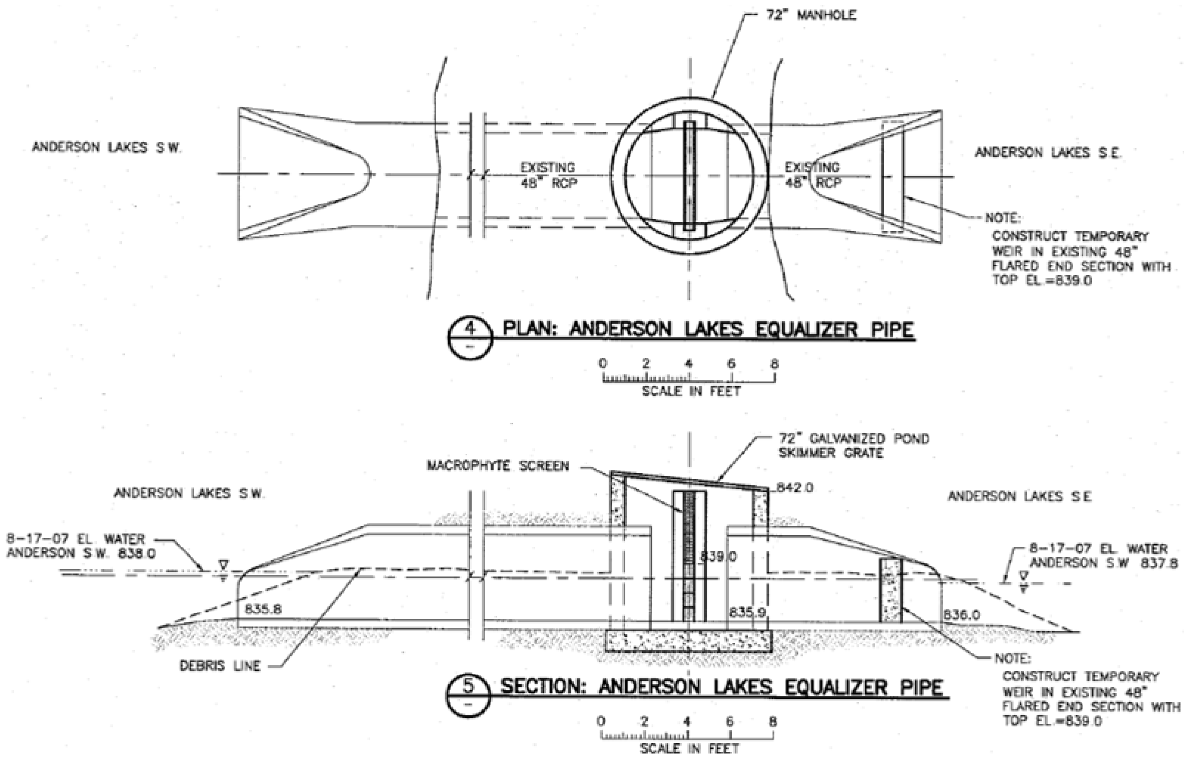



**Figure 8-6 Southeast Anderson control structure – plan and section view**

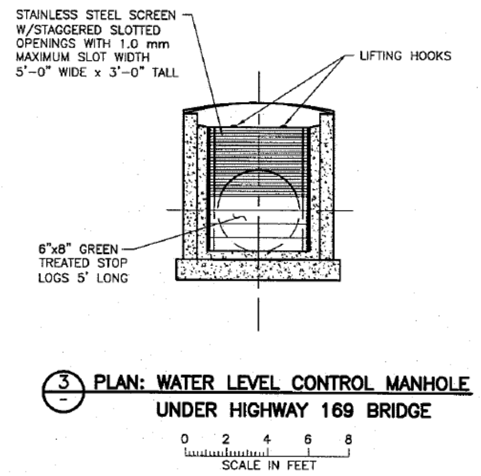



**Figure 8-7 Southeast Anderson control structure macrophyte screen – plan view**

Given the small, slotted openings of the macrophyte screen, the screen plugs rapidly and regularly, significantly restricting flow from Southwest Anderson to Southeast Anderson under typical storm events (Figure 8-8). Additionally, since the control structure was installed, U.S. Highway 169 has been re-constructed, creating more difficult access conditions for maintenance of the structure. As such, regular macrophyte screen cleaning and maintenance has been a challenge for the City of Bloomington, resulting in prolonged screen-plugging conditions.

**Figure 8-8 Photo of plugged Southeast Anderson macrophyte screen on top of stop logs (May 2025)**

It should also be noted that site visits in 2025 found notable degradation (Figure 8-9) and settling/erosion (Figure 8-10) on the downstream end of the culvert between Southeast and Southwest Anderson Lakes. As such, any proposed temporary or permanent construction changes should consider the integrity of the existing infrastructure and subsurface conditions.

**Figure 8-9 Degrading Southeast Anderson storm sewer infrastructure (September 2025)**

**Figure 8-10 Settling and/or soil erosion around Southeast Anderson culvert (September 2025)**

Since two submerged AIS are currently present in Southeast Anderson Lake and are not present at concerning levels in Northwest and Southwest Anderson Lake, solutions to address water level equalization on Southeast Anderson Lake must consider and minimize potential AIS migration downstream. Three alternatives were evaluated to address water level equalization concerns on Southeast Anderson Lake with considerations for minimizing AIS migration.

**Alternative 1- Increase in screen cleaning frequency**

- Implementation during AIS management on Southeast Anderson (5 – 10 years):
  - Clean the macrophyte screen 1 – 2 times per week from April through October
  - No constructed changes to the existing control structure.
- Implementation after AIS management project(s) reach expected goals on Southeast Anderson
  - Remove control structure and pipes.
  - Construct an open channel connecting Southeast and Southwest Anderson Lakes.
- Benefits:
  - No large, upfront capital costs.
  - The ultimate construction of an open channel reduces long-term stormwater infrastructure maintenance needs at a location that is difficult to access and offers better opportunities for biological migration.
- Drawbacks:
  - Does not allow for water level equalization between lakes under dry climatic conditions (e.g., when water levels are below the weir elevation of 839.0 feet, NGVD29).
  - The required frequency of macrophyte screen cleaning is impractical. If the macrophyte screen is not frequently cleaned, flow between Southeast and Southwest Anderson can be significantly restricted, preventing water level equalization and potentially causing water levels to be above the control elevation during times of high water (reduced flood protection).
  - The installation of a temporary or permanent maintenance access should be considered to facilitate more frequent screen maintenance
  - The construction timeline of the open channel is dependent on the success of the AIS management projects.
  - Does not address degrading storm infrastructure in the short-term.

**Alternative 2- Screen lifts and intermittent cleaning**

- Implementation during AIS management on Southeast Anderson (5 – 10 years):
  - Permanently remove 1 – 2 stop logs to approximately 838.0 ft, NGVD29
  - Hire a subcontractor to temporarily remove (i.e., lift) macrophyte screen to allow water from Northwest and Southwest Anderson to flow into Southeast Anderson, in accordance with an MNDNR-approved water management plan. Clean and replace screen.
    - Ideally completed in spring to take advantage of spring snow melt.
    - Repeat annually, as needed, to balance water levels.
  - Clean the macrophyte screen twice per month from April through October
- Implementation after AIS management projects reach expected goals on Southeast Anderson
  - Remove control structure and pipes
  - Construct an open channel connecting Southeast and Southwest Anderson Lakes.

- Benefits:
  - Spring screen lifts can allow Southeast Anderson to fill with available volume from Northwest and Southwest Anderson lakes.
  - Relatively low upfront capital construction costs for temporary improvements.
  - Avoids reconstructing stormwater infrastructure that requires maintenance in a difficult-to-access location. The ultimate construction of an open channel allows for reduced long-term stormwater infrastructure maintenance needs at a location that is difficult to access and offers better opportunities for biological migration.
- Drawbacks:
  - Requires an MNDNR-approved water management plan
  - The increase in water levels in Southeast Anderson Lake post screen lift will be dependent on the starting water levels in Northwest and Southwest Anderson lakes and the amount of seasonal runoff. If water levels are not high enough, Southeast Anderson will only partially fill.
  - The macrophyte screen will still need cleaning regularly during the growing season.
  - The installation of a temporary or permanent maintenance access must be considered to facilitate screen lifts and improved screen maintenance needs
  - The construction timeline of the open channel is dependent on the success of the AIS management projects.
  - If the macrophyte screen is not replaced as soon as water level equalization occurs, there is risk for AIS migration downstream from Southeast Anderson Lake.
  - Does not address degrading storm infrastructure in the short-term.

**<u>Alternative 3- Outlet Reconstruction</u>**

- Implementation during AIS management on Southeast Anderson (5 – 10 years):
  - Remove all existing storm infrastructure and replace it with a new control structure and storm sewer pipes.
    - Weir constructed to elevation 838.0 ft, NGVD29 (1 foot below NWL)
    - Install orifice in the weir with a backflow preventor. This will allow for water to flow from Southwest Anderson to Southeast Anderson Lake during low water levels, but not from Southeast to Southwest.
    - Install a new macrophyte screen on top of the weir with 1.0 mm slotted openings to limit AIS migration downstream during high water levels.
  - Check and clean backflow preventor and macrophyte screen periodically (e.g., assumed three times per year).
- Implementation after AIS management projects reach expected goals on Southeast Anderson
  - Remove macrophyte screen
  - Alternatively, consider installation of open channel based on available funding and stakeholder interest
- Benefits:
  - Allows water levels in Southeast Anderson to equalize with Northwest and Southwest Anderson via gravity.
  - Addresses degraded storm infrastructure in the short-term.
  - Construction timeline is not dependent on the success of the AIS management projects.
- Drawbacks:
  - Highest upfront capital costs.

- Long-term storm sewer infrastructure maintenance required.
- Macrophyte screen and backflow preventor will still need cleaning periodically.
- The installation of a temporary or permanent maintenance access must be considered to facilitate screen maintenance needs
- Limits biological migration from Southeast to Southwest Anderson, especially when macrophyte screen is in place, unless open channel is constructed after AIS management projects reach expected goals on Southeast Anderson.

#### 8.1.2.1 Permitting

During this study, a planning meeting was held with MNDNR representatives to discuss potential permitting requirements for modifying the Southeast Anderson outlet. When the control structure was installed in 2008, NMCWD obtained a Work in Public Waters permit from MNDNR. For a reconstruction project, it is anticipated that NMCWD could apply for a permit amendment rather than a new permit. Once a reconstruction alternative is selected, the MNDNR should be contacted to confirm.

A Minnesota Department of Transportation (MNDOT) application for drainage permit would likely be necessary for any reconstruction of the Southeast Anderson outlet given that the infrastructure is located within the right-of-way of U.S. Highway 169.

Permits/approvals for the reconstruction of the Southeast Anderson outlet may also be required from the City of Bloomington, TRPD, U.S. Army Corps of Engineers (Section 404 Permit and Section 401 Certification), the MPCA, and NMCWD, depending on the ultimate construction alternative selected.

#### 8.1.2.2 Cost Estimate

The planning-level opinion of probable costs for the three alternatives presented above for Southeast Anderson lake level equalization are shown in Table 8-4. The opinions of probable costs are based on engineering judgement, experience with similar projects, and review of actual bid values from recent, similar projects. An expected accuracy range of -15% to 25% is based on the current extent of project definition, wide-scale use of parametric models to calculate estimated costs (i.e., making extensive use of order-of-magnitude costs from similar projects or proposals), and project uncertainty. Engineering, design, construction administration, and permitting costs are also included in the total cost estimate. Detailed opinions of probable costs for the Southeast Anderson lake level equalization projects are included in Appendix D.

Given the importance of establishing reliable long-term access to the outlet for ongoing maintenance, a planning-level cost estimate for a maintenance access was developed based on experience with similar projects and a review of recent bid values. It was assumed that the existing paved trail located west of Southeast Anderson, on City of Bloomington property, would be extended approximately 0.3 miles to provide access to the outlet. Trail extension would require clearing and grubbing, selective removal of larger trees, subcutting, placement of granular and aggregate base, and installation of bituminous pavement. Based on these assumptions, the estimated design, permitting, and construction cost for the trail extension ranges from $184,000 to $270,000, depending on the extent of tree removal and the amount of fill required to ensure trail stability.

The Hyland–Bush–Anderson Lakes Regional Park Reserve Joint Master Plan identifies a proposed paved trail west of Southeast Anderson that would ultimately provide access to the outlet location (TRPD & Bloomington, 2010). At the time of this study, however, TRPD indicated that there is no confirmed timeline for trail installation. Because this trail is already included in the adopted master plan, continued coordination with TRPD may present a meaningful partnership opportunity. Such collaboration could help advance construction of the trail in a manner that supports long-term outlet maintenance while aligning with broader regional park system objectives.

**Table 8-4 Southeast Anderson Lake Level Equalization Cost Estimates[1]**

| Outlet Alternatives | Costs During AIS Management (assumed 7 years) (Const. + Engineering) | Costs Post AIS Management (Const. + Engineering) | Estimated Total Cost (Const. + Engineering) | Estimated Range (-15% to +25%) |
|---|---|---|---|---|
| **1. Increased screen cleaning & open channel construction** | $29,000[2] | $116,000 | **$145,000** | **$123,000 - $181,000** |
| **2. Screen lifts & open channel construction** | $105,000[2] | $116,000 | **$221,000** | **$188,000 - $276,000** |
| **3. Outlet reconstruction** | $252,000 | - | **$252,000** | **$214,000 - $315,000** |
| **Maintenance Access** | | | | **$184,000 - $270,000** |

[1] Time value-of-money escalation (i.e., inflation) costs are not included.

[2] Estimated costs assume screen cleaning is performed by a NMCWD intern. Alternative estimated subcontractor costs are provided in Appendix D.

### 8.1.3 Non-Native Cattail Management

During plant surveys completed in 2024, extensive stands of non-native and hybrid cattails were observed along the majority of the emergent fringe zones of all three Anderson Lakes. Hybrid cattails are an invasive species that has been observed in the state of Minnesota since the 1950's. Hybrid cattails are formed when the native cattail species, the broadleaf cattail (*Typha latifolia*), is found with the non-native narrowleaf cattail (*Typha angustifolia*). These two parent species will hybridize to form hybrid cattail (*Typha x glauca*), which grows more aggressively than either of its parent species and can form dense stands. Additionally, hybrid cattails can grow taller, produce more plant litter (dead plant material), thrive in higher nutrient conditions, and are more tolerant of variable water levels and saline conditions than their parent species. These competitive advantages allow hybrid cattail to outcompete native emergent plant species, creating monocultures at shoreline fringe zones. Studies have shown that waterbodies with heavy cattail emergent zones can have reduced dissolved oxygen levels, low plant diversity, and lower fish abundance and diversity as compared to shorelines with more diverse emergent and floating species (Schrank, 2024).

Before this study, the NMCWD has not previously evaluated or implemented large-scale cattail management projects. However, because concerns about cattail abundance were a common theme during resident engagement, this study explored broader management options for the NMCWD to consider. Figure 8-11 shows the cattail management zones for each of the Anderson Lakes. Immediately adjacent shoreline fringe zones are shown in yellow. Areas within the shoreline fringe zones where flow is obstructed are shown with yellow and black hatching. Adjacent emergent areas that may warrant management—if the yellow areas are addressed—due to potential cattail encroachment are shown in orange. A summary of the estimated cattail management areas is provided in Table 8-5. For the yellow areas identified (shoreline fringe zones), 96% (NW), 100% (SW), and 89% (SE) of the management areas are adjacent to parcels owned by TRPD or the cities of Eden Prairie and Bloomington. Only 4% and 11% of the cattail management areas are adjacent to privately-owned parcels on Northwest and Southeast Anderson, respectively.

**Table 8-5 Potential Cattail Management Areas on the Anderson Lakes**

| Cattail Management Zones | Northwest Anderson | Southwest Anderson | Southeast Anderson | Total |
|---|---|---|---|---|
| Shoreline Fringe | 39 acres | 40 acres | 18 acres | 97 acres |
| Flow Obstructed Areas (within shoreline fringe) | 7 acres | 11 acres | 4 acres | 22 acres |
| Adjacent Emergent Areas | 14 acres | 8 acres | - | 22 acres |

Two larger-scale cattail management methods were considered for the Anderson Lakes based on discussions with the MNDNR and City of Bloomington on their experiences with similar large-scale removal efforts on Little Rock Lake in Rice and Bush Lake in Bloomington. Selection of a method or methods for the Anderson Lakes would be based on lake levels at the start of cattail management, among other factors:

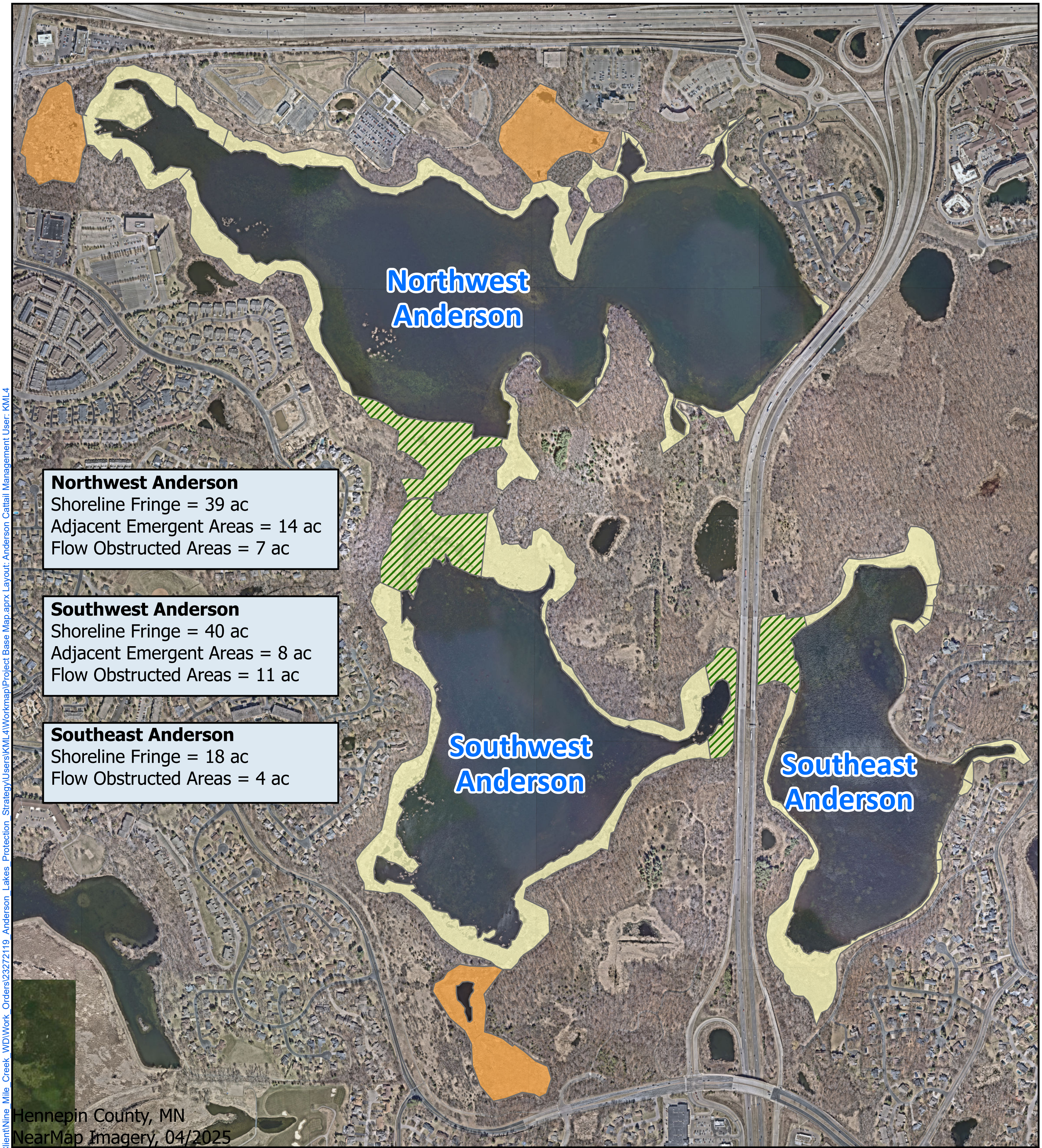
Method 1 (water levels near or at normal)

1. Herbicide applications in late summer
2. Cut cattails down to ice level in the winter
3. Burn cut cattails on the ice when greater than three inches of snow or adequate ice depth is present or remove/dispose of cut cattails
4. Post-cutting herbicide treatments, as needed, the following summer
5. Review native species re-establishment in managed areas the following summer and consider if native species introductions are needed in year 2.

Method 2 (water levels well below normal)

1. Burn cattails in place (controlled burn) when greater than three inches of snow is present
2. Post-burn herbicide treatments, as needed, the following summer
3. Review native species re-establishment in managed areas the following summer and consider if native species introductions are needed in year 2.

It is likely that cattail management method 2 would only be feasible for Southeast Anderson Lake. Currently, Southeast Anderson Lake's water surface elevations are well below the control elevation (see Section 5.4), so a large portion of the shoreline fringe zone could likely be managed through in-place controlled burns. Furthermore, if a whole-lake drawdown was pursued (see Section 8.1.1.2.3), the entire shoreline fringe area would be accessible for a controlled burn.




Cattail Management Zones

- Shoreline Fringe
- Adjacent Emergent Areas
- Flow Obstructed Areas

N

0 500 1,000 2,000

Feet

9 MILE CREEK WATERSHED DISTRICT

**Potential Anderson Lake Cattail Management**

Nine Mile Creek Watershed District

FIGURE 8-11

BARR

#### 8.1.3.1 Permitting

Completing a large-scale cattail management project would require a variance from the MNDNR. Currently, the MNDNR requires a permit for the destruction of any emergent vegetation and typically allows removal of a channel from the shoreline to open water. To manage invasive cattails to a larger extent, the NMCWD would need to develop and submit a Lake Vegetation Management Plan (LVMP) to the MNDNR for review and approval.

A large-scale cattail management approach would also require an Aquatic Plant Management Permit from the MNDNR. The permit would likely require the completion of a pretreatment vegetation survey. Follow-up plant monitoring is also anticipated to fulfil the requirements of the LVMP.

Applying for and receiving approval for city burn permits is also an expected requirement of a large-scale cattail management project.

#### 8.1.3.2 Cost Estimate

The planning-level opinion of probable costs for three cattail management projects of varying scale and method are shown in Table 8-6. The cattail management project options summarized include:

1. Whole-lake cattail management of the shoreline fringe regions on all three Anderson Lakes using management method 1 –cut and burn biomass on ice (yellow zones in Figure 8-11).
2. Whole-lake cattail management of the shoreline fringe region of Southeast Anderson Lake using management method 2 –burn in-place (yellow zones in Figure 8-11).
3. Cattail management of the hydraulic maintenance zones (e.g., potential flow obstructed areas) on all three Anderson Lakes using management method 1–cut and burn biomass on ice (yellow and black hatched zones in Figure 8-11).

**Table 8-6 Cattail Management Opinion of Probable Cost Estimates**

| Cattail Management Project | Cattail Management Type | Estimated Total Cost (Const + Engineering) | Estimated Range (-30% to +50%)[2] |
|---|---|---|---|
| Whole-lake shoreline fringe – all three Anderson Lakes | Method 1 – cut and burn biomass on ice[1] | $1,041,000 | $729,000 - $1,562,000 |
| Whole-lake shoreline fringe – Southeast Anderson | Method 2 – burn in-place | $137,000 | $96,000 - $206,000 |
| Hydraulic maintenance zones – all three Anderson Lakes | Method 1 – cut and burn biomass on ice[1] | $289,000 | $202,000 - $434,000 |

[1] The construction cost estimates presented in this table for cattail management method 1 assume that any cattail biomass cut and removed from the lake shorelines are burned on the ice rather than hauled offsite. The detailed opinions of cost in Appendix D provide alternative cost estimates for biomass removal offsite. However, hauling cattails offsite is expected to be very difficult due to limited access options at the Anderson Lakes.

[2] The cattail management project cost estimates do not include costs for long-term maintenance

The opinions of probable costs are based on engineering judgement, experience with similar projects, and review of actual bid values from recent, similar projects. An expected accuracy range of -30% to 50% is based on the current extent of project definition, wide-scale use of parametric models to calculate estimated costs (i.e., making extensive use of order-of-magnitude costs from similar projects or proposals), and project uncertainty. Engineering, design, construction administration, and permitting costs are also included in the total cost estimate. Detailed opinions of probable costs for the cattail management projects are included in Appendix D.

### 8.1.3.3 Small-scale projects

If the NMCWD decides not to pursue large-scale cattail management projects, private shoreline residents have the option to submit and apply for a permit to manage emergent vegetation adjacent to their privately-owned shorelines. Per current MNDNR rules, the destruction of any emergent vegetation, whether native or non-native, requires an aquatic plant management permit (Aquatic plant management permits | Minnesota DNR). For small-scale resident projects, the MNDNR will typically permit the removal of cattails only in a small area to provide boat access to deeper lake water (e.g., 15-foot wide channel). The MNDNR should be contacted for site-specific questions, variances, and removal allowances.

# 9 Conclusion and Recommendations

## 9.1 Water Quality and Ecological Health Conclusions

Recent monitoring data indicate that all three Anderson Lakes are currently meeting the state eutrophication standards for shallow lakes. The observed summer average total phosphorus and chlorophyll-*a* concentrations and the Secchi disk depths have been better than the MPCA shallow lake water quality standards in recent monitored years. Northwest and Southwest Anderson Lakes have consistently met the state standards for all three parameters since 2011 and 2013, respectively (Figure 9-1 & Figure 9-2). Notable improvements in water quality in Northwest and Southwest Anderson lakes are largely due, in part, to the management activities completed as part of the Eden Prairie Lakes Water Quality Improvement Project between 2008 and 2014. These projects included a stormwater pond retrofit upstream of Northwest Anderson Lake, an alum treatment in Southwest Anderson Lake, and aquatic invasive plant species management in both lakes. For more information on these projects see Section 6. The observed water quality in Southeast Anderson Lakes has been more variable; yet in the most recent monitored years of 2021 and 2024, all three eutrophication parameters were better than the state standards (Figure 9-3).

Plant surveys were completed periodically in the Anderson Lakes by the NMCWD between 1991 and 2024. Since 2013, Northwest Anderson Lake has been experiencing an increasing trend in the number of plant species observed. The plant species observed also show high diversity with elevated floristic quality indicating a healthy aquatic plant community. The plant species observed in Southwest Anderson Lake since 2010 have also shown high diversity and elevated floristic quality. Observing more diverse species with increased floristic quality in Northwest and Southwest Anderson Lake is likely due in part to the water quality and ecological improvement projects implemented since 2007 (see Section 6). Since 2013, Southeast Anderson Lake has also been experiencing an increasing trend in the number of plant species observed. However, despite having a high number of native plant species present, many are only found at a few locations and low abundances. Southeast Anderson Lake has a very high presence of the aquatic invasive species (AIS) curly-leaf pondweed and Eurasian watermilfoil which are limiting available growth areas for native plant species.

Phytoplankton samples were collected periodically in the Anderson Lakes by the NMCWD between 1988 and 2024. Historically, Northwest and Southwest Anderson Lakes have experienced fluctuating summer average phytoplankton levels. However, distinct decreases in total algae, as well as blue-green algae, abundances were observed following the water quality and ecological improvement projects implemented between 2007 and 2013 (Section 6). Unlike Northwest and Southwest Anderson Lakes, Southeast Anderson has not shown a consistent pattern in summer average phytoplankton abundance between 1988 – 2024. In 2024, the most recent monitored year, a high abundance of blue-green algae was observed in Southeast Anderson Lake during the June (505,430 cells/mL) and July (68,650 cells/mL) sampling events. The observed June and July 2024 blue-green algae abundances were above the WHO moderate and low probability of adverse health effects thresholds, respectively. High blue-green algae abundance in 2024 occurred in the early portions of the summer, which was during noteworthy wet climatic conditions. It’s possible that increased nutrients in runoff created favorable conditions for enhanced blue-green algae growth. Early die-off and degradation of curly-leaf pondweed may have also contributed to high nutrient availability for enhanced blue-green algae growth.

A fish survey was completed by the NMCWD in September 2024 in Northwest and Southeast Anderson Lakes. Southwest Anderson Lake was not surveyed due to access limitations from a high abundance of cattails in the channel between Northwest and Southwest Anderson Lakes. Fisheries assessments of Northwest and Southeast Anderson Lakes demonstrate low species diversity, with a high density of fish that are tolerant of low-oxygen conditions. Past stocking efforts in both lakes have been unsuccessful, suggesting poor survival or limited reproductive success of these species within these lakes. No carp or goldfish were sampled in the 2024 survey in either lake, which are two invasive species that have caused ecological challenges in other NMCWD waterbodies.

The NMCWD has collected monthly lake levels of the Anderson Lakes since the early 1980's. In general, lake levels are influenced by local precipitation, size of the drainage area, local land uses, outlet elevation and configuration, groundwater conditions, and evaporation rates. Beyond these factors, historical water surface elevations in the Anderson Lakes have also been influenced by management projects. In fall 2008 through spring 2009, whole lake drawdowns were performed in Northwest and Southwest Anderson lakes for aquatic invasive species management (see Section 6.2). Following completion of the drawdown in spring 2009, below average precipitation over the subsequent few years resulted in slow refilling of the lakes and prolonged low water levels on Northwest and Southwest Anderson lakes.

Although Southeast Anderson Lake was not included in the 2008/2009 drawdown project, it has experienced relatively low water levels since project completion, in comparison with Northwest and Southwest Anderson Lakes. This is partly due to a control structure installed between Southwest and Southeast Anderson Lakes prior to the drawdown to maintain water levels in Southeast Anderson during the project. Review of the data indicates that the weir and macrophyte screen installed in the control structure between Southwest and Southeast Anderson have hindered the movement of water from Southwest Anderson to Southeast Anderson, especially during times when water levels are below the control elevation of 839.0, unintentionally resulting in lower-than-expected water levels in Southeast Anderson Lake. The control structure is discussed in further detail in Section 8.1.2.

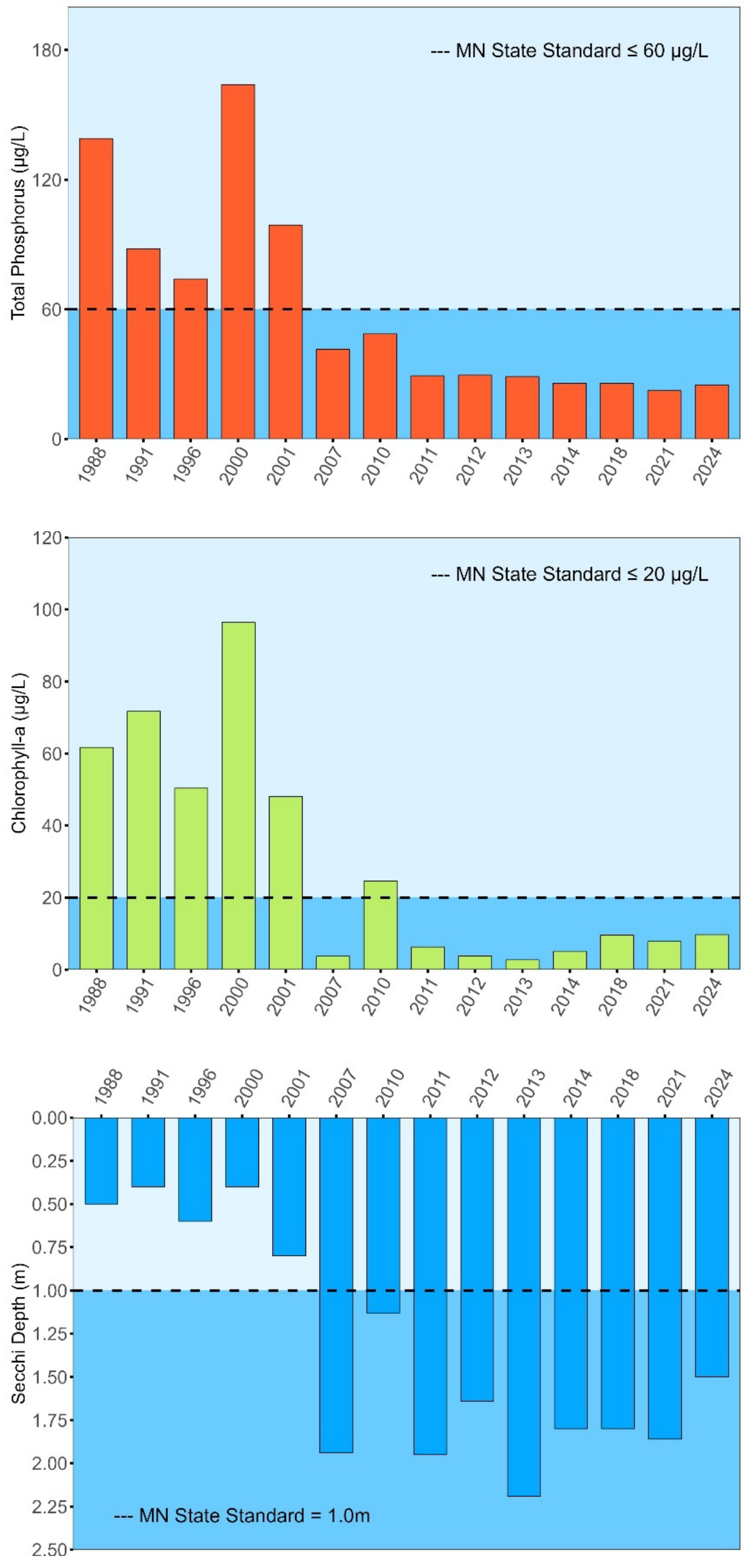



**Figure 9-1** **Summer average total phosphorus and chlorophyll-a concentrations and Secchi disk depth measured in Northwest Anderson Lake between 1988 and 2024**

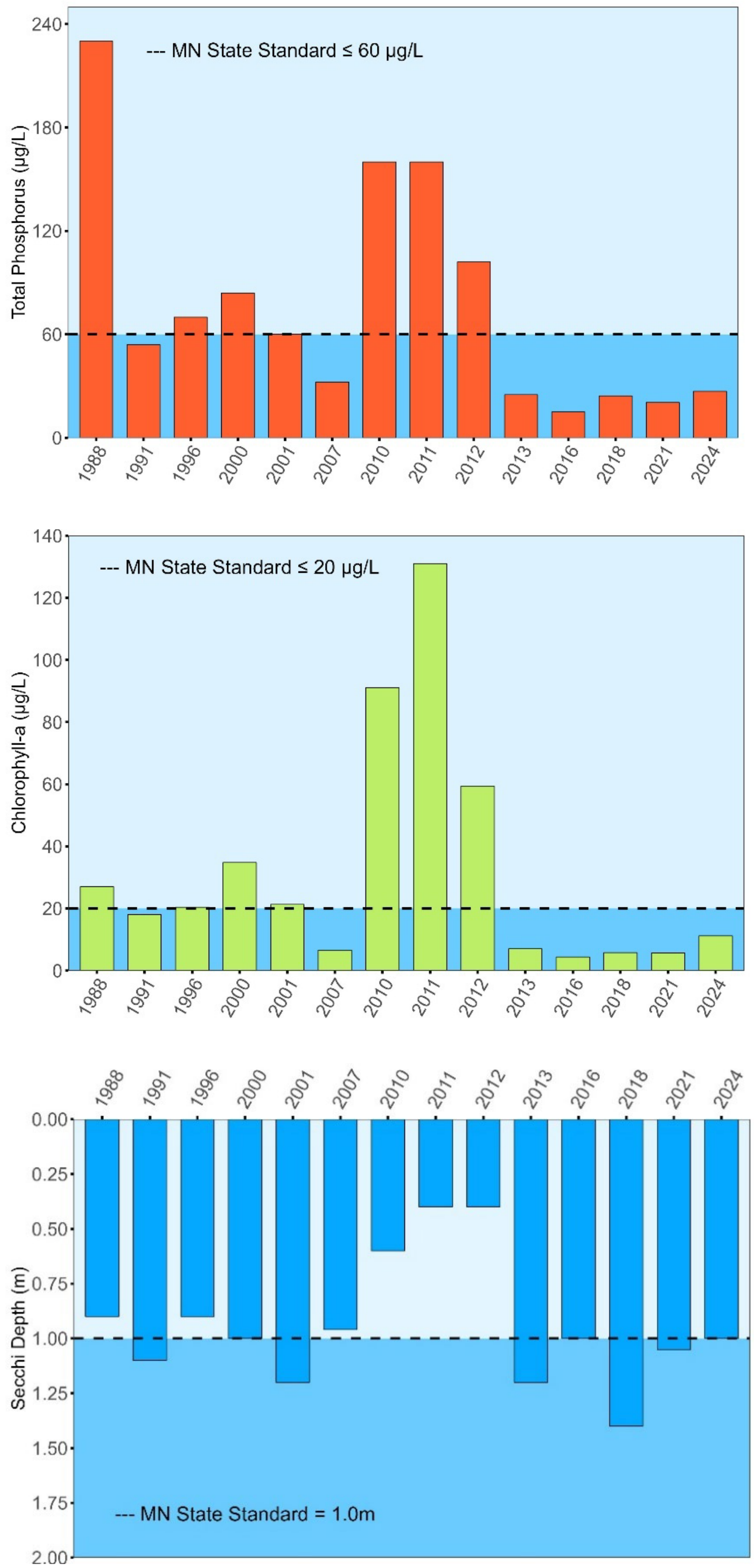



**Figure 9-2 Summer average total phosphorus and chlorophyll-a concentrations and Secchi disk depth measured in Southwest Anderson Lake between 1988 and 2024**

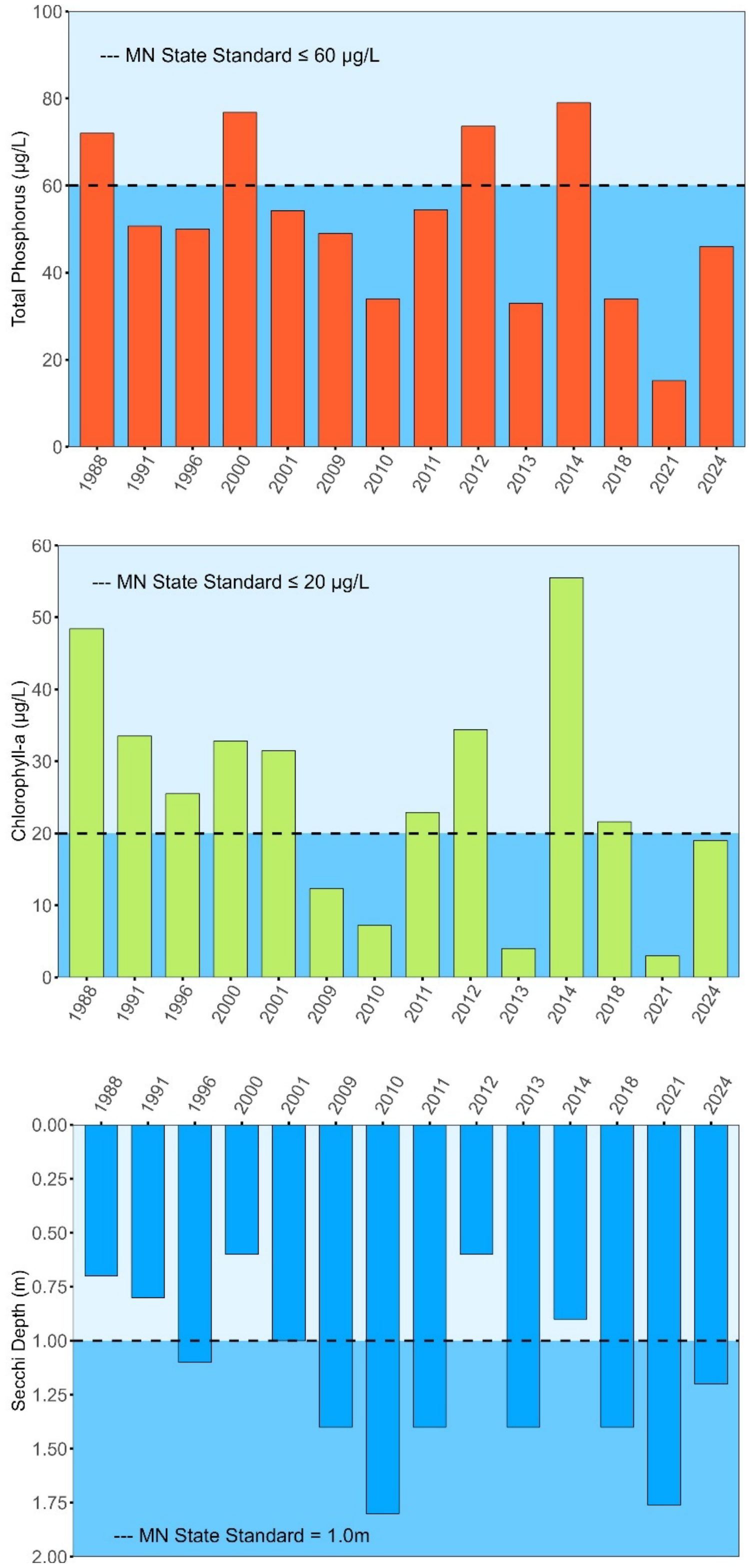



**Figure 9-3** **Summer average total phosphorus and chlorophyll-a concentrations and Secchi disk depth measured in Southeast Anderson Lake between 1988 and 2024**

## 9.2 Post-Project Lake Management Statuses/Stages

Based on the 2024 water quality and ecological monitoring data (Section 5) and the reassessed lake goals (Section 3.4), post-project lake management statuses were identified for each of the primary health assessment categories (i.e., water quality, aquatic communities, water quantity). The Management Status/Stages identified for each health assessment factor follow the lake assessment framework, as shown in Figure 9-4, and include: (1) No Active Management, (2) Care and Maintenance, and (3) Additional Management.

Table 9-1 through Table 9-6 provide a comprehensive overview for each lake and associated health assessment factors. They summarize monitoring observations, updated District goals, identified management statuses, recommended management or protection actions, and triggers for changes in management status. These tables are intended to serve as reference resources as ongoing monitoring and additional management practices are implemented, supporting informed and adaptive decision-making over time.

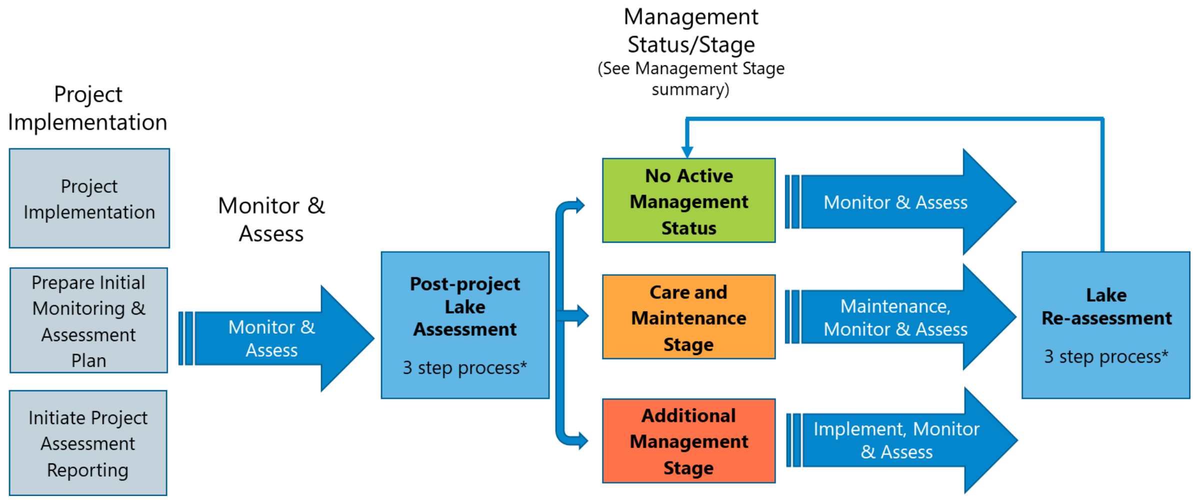



**Figure 9-4 NMCWD Post-project Lake Assessment Framework**

**Table 9-1 Water Quality Overview and Management Status**

| Lake Health Category | Parameter | Standard, Threshold, Guideline | 2024 Monitoring Observations | | |
|---|---|---|---|---|---|
| | | | Northwest Anderson | Southwest Anderson | Southeast Anderson |
| Water Quality | Minnesota State Standards Lake Classification | Ecoregion, Deep/Shallow Lake | NCHF Ecoregion, Shallow Lake | NCHF Ecoregion, Shallow Lake | NCHF Ecoregion, Shallow Lake |
| | Total Phosphorus Summer Average (µg/L) | ≤ 60 | 25 | 27 | 46 |
| | Chlorophyll-a Summer Average (µg/L) | ≤ 20 | 10 | 11 | 19 |
| | Secchi Disk Summer Average (m) | ≥ 1.0 | 1.5 | 1.0 | 1.2 |
| | Chloride (mg/L) (highest observed) | < 230 (chronic) | 135 | 68 | 132 |
| | District Goal | | Protect water quality to continue meeting the Minnesota State shallow lake water quality standards | | |
| | Management Status | | No Active Management | No Active Management | No Active Management |
| | Management/Protection Practices | | Continue periodic routine water quality monitoring to assess changes. | | |
| | | | Seek opportunities to work with Hennepin County, MNDOT, property owners and/or property management companies to reduce winter salt usage. | | |
| | | | Continue to implement NMCWD regulatory program to minimize impacts from redevelopment in the watershed. | | |
| | | | As development or re-development occurs in the watershed, consider partnering with landowners to install additional and/or enhanced BMPs, where feasible and cost effective. | | |
| | | | Continue to promote the NMCWD cost share grant programs to educate landowners on the benefits of smaller-scale stormwater protection and habitat restoration projects. | | |
| | Management Status Change Trigger(s) | | If total phosphorus and either chlorophyll-*a* or Secchi disk depth summer average values approach state standards, this will result in a management status adjustment to either the care and maintenance stage or active management depending on the identified cause. | | |

**Table 9-2 Aquatic Plants Overview and Management Status**

| Lake Health Category | Parameter | Standard, Threshold, Guideline | 2024 Monitoring Observations | | |
|---|---|---|---|---|---|
| | | | Northwest Anderson | Southwest Anderson | Southeast Anderson |
| Aquatic Communities-Macrophytes (Aquatic Plants) | MNDNR IBI Thresholds Lake Classification | Deep/Shallow Lake | Shallow Lake | Shallow Lake | Shallow Lake |
| | IBI Species Richness (number of species) | ≥ 11 | 24 (June); 28 (August) | 21 (June); 18 (August) | 27 (June); 26 (August) |
| | IBI Floristic Quality Index | ≥ 17.8 | 23.1 (June); 29.7 (August) | 26.7 (June); 23.1 (August) | 28.2 (June); 27.7 (August) |
| | Submerged AIS | - | Curly-leaf pondweed (CLP) | Curly-leaf pondweed (CLP) | Curly-leaf pondweed (CLP), Eurasian watermilfoil (EWM) |
| | CLP Frequency of Occurrence (FOO) | | 2% (June) | 3% (June) | 64% (June) |
| | EWM FOO | | - | - | 73% (June); 72% (August) |
| | Emergent AIS | - | Narrow-leaved cattail, purple loosestrife reed canary grass | Narrow-leaved cattail | Narrow-leaved cattail, purple loosestrife, common reed, reed canary grass |
| | | District Goal | Support and protect a healthy, diverse native plant population | | |
| | | Management Status | No Active Management | No Active Management | Additional Management |
| | | Management/Protection Practices | • Continue periodic routine aquatic plant monitoring (point-intercept surveys) to assess changes.<br>• Consider non-native cattail management in areas with restricted hydraulic capacity and ecological movement and reduced habitat connectivity. See Section 8.1.3. | | |
| | | | Maintain protective measures downstream of Southeast Anderson Lake to minimize AIS introduction to NW and SW Anderson. | | Implement a submerged AIS management plan. See Section 8.1.1. |
| | | Management Status Change Trigger(s) | CLP FOO >10% may result in status change. Consider spot herbicide treatments, as needed. | | CLP FOO <10% may result in status change. |
| | | | Consider rapid response if EWM is observed. Consider spot herbicide treatments or mechanical removal, as needed. | | EWM FOO <1% may result in a status change to no active management |

**Table 9-3 Phytoplankton (Algae) Overview and Management Status**

| Lake Health Category | Parameter | Standard, Threshold, Guideline | 2024 Monitoring Observations | | |
|---|---|---|---|---|---|
| | | | Northwest Anderson | Southwest Anderson | Southeast Anderson |
| Aquatic Communities - Phytoplankton (Algae) | WHO Low Probability of Adverse Health Effects (cells/mL) | 20,000 – 100,000 | 2024 phytoplankton observations below risk thresholds | 2024 phytoplankton observations below risk thresholds | WHO Moderate Probability of Adverse Health Effects Exceeded |
| | WHO Moderate Probability of Adverse Health Effects (cells/mL) | > 100,000 | | | |
| | WHO High Probability of Adverse Health Effects (qualitative) | Areas where whole-body contact or risk of ingestion could occur | | | |
| | District Goals | | • Minimize frequency of harmful algal blooms (HABs) through protection/improvement of in-lake water quality<br>• Increase public awareness and understanding of potential health risks of HABs | | |
| | Management Status | | No Active Management | No Active Management | Care and Maintenance |
| | Management/Protection Practices | | Protect water quality to continue meeting the Minnesota State water quality standards | | |
| | | | Continuation of periodic routine phytoplankton enumeration to assess changes. | | |
| | | | Implementation of the NMCWD Harmful Algal Bloom (HAB) Response Plan as necessary based on field observations. | | |
| | | | | | Develop/distribute HAB educational materials to increase awareness of potential health risks. |
| | Management Status Change Trigger(s) | | Dependent on the type and severity of HABs observed, management status may change to care and maintenance stage, public health risk communication methods may be modified, and frequency/type of monitoring may be adjusted. | | |

**Table 9-4 Fisheries Overview and Management Status**

| Lake Health Category | Parameter | Standard, Threshold, Guideline | 2024 Monitoring Observations | | |
|---|---|---|---|---|---|
| | | | Northwest Anderson | Southwest Anderson | Southeast Anderson |
| Aquatic Communities - Fisheries | MDNR IBI Lake Classification | Deep, Moderately Deep, Moderately Shallow, Shallow | MNDNR Fish IBI not evaluated | MNDNR Fish IBI not evaluated | MNDNR Fish IBI not evaluated |
| | Fish species diversity | - | fathead minnow, central mudminnow, black bullhead, brook stickleback | *not available* | fathead minnow, black bullhead, green sunfish, central mudminnow |
| | Invasive Rough Fish | - | None observed | *not available* | None observed |
| | District Goal | | Minimize the impact of fisheries on water quality | | |
| | Management Status | | No Active Management | No Active Management | No Active Management |
| | Management/Protection Practices | | Conduct periodic fisheries surveys to assess changes. | | |
| | Management Status Change Trigger(s) | | Significant changes in the invasive rough fish population may result in a management status adjustment to assess rough fish removal options. | | |

**Table 9-5 Water Quantity Overview and Management Status**

| Lake Health Category | Parameter | Standard, Threshold, Guideline | 2024 Monitoring Observations | | |
|---|---|---|---|---|---|
| | | | Northwest Anderson | Southwest Anderson | Southeast Anderson |
| Water Quantity | Water Level Fluctuations | - | Normal lake level fluctuations that align with variations in climatic conditions | Normal lake level fluctuations that align with variations in climatic conditions | Prolonged low water levels |
| | District Goal | | Support water level equalization between all three basins while balancing AIS considerations | | |
| | Management Status | | No active management | No active management | Additional Management |
| | Management/Protection Practices | | Consider modifications to the Southeast Anderson outlet structure operation and/or maintenance to support water level equalization with Northwest and Southwest Anderson Lakes while continuing to minimize AIS migration. See Section 8.1.2. | | |
| | Management Status Change Trigger(s) | | | | Southeast Anderson management status may be adjusted to no active management once permanent structure modifications are complete and water level equalization achieved. |

**Table 9-6 Wildlife Habitat Overview and Management Status**

| Lake Health Category | Parameter | Standard, Threshold, Guideline | 2024 Monitoring Observations | | |
|---|---|---|---|---|---|
| | | | Northwest Anderson | Southwest Anderson | Southeast Anderson |
| Wildlife Habitat | Upland Biodiversity, Buffer extent/width | - | • TRPD manages the lake as a wildlife sanctuary, with recreation limited to trail uses<br>• Anderson Lakes Park Reserve has an 80/20 policy: 80% of upland maintained in natural state and up to 20% may be developed for recreation uses<br>• Majority of emergent shoreline fringe is dominated by non-native cattail species<br>• The channel between NW and SW Anderson Lakes has a high abundance of non-native cattails (this may limit ecological movement)<br>• High buckthorn abundance in upland areas | • TRPD manages the lake as a wildlife sanctuary, with recreation limited to trail uses<br>• Anderson Lakes Park Reserve has an 80/20 policy: 80% of upland maintained in natural state and up to 20% may be developed for recreation uses<br>• Majority of emergent shoreline fringe is dominated by non-native cattail species<br>• The channel between NW and SW Anderson Lakes has a high abundance of non-native cattails (this may limit ecological movement)<br>• High buckthorn abundance in upland areas | • Anderson Lakes Park Reserve has an 80/20 policy: 80% of upland maintained in natural state and up to 20% may be developed for recreation uses<br>• Majority of emergent shoreline fringe is dominated by non-native cattails<br>• High buckthorn abundance in upland areas |
| | | District Goal | No specific goal. Promote enhancement of habitat conditions and habitat connectivity to support ecological movement across the lake ecosystem. | | |
| | | Management Status | No management status assigned | No management status assigned | No management status assigned |
| | | Management/Protection Practices | • Consider non-native cattail management in areas with restricted hydraulic capacity and ecological movement and reduced habitat connectivity. See Section 8.1.3.<br>• Continue periodic plant surveys to assess changes. | | |
| | | Management Status Change Trigger(s) | Not applicable. | | |

**Table 9-7 Recreation Overview and Management Status**

| Lake Health Category | Parameter | Standard, Threshold, Guideline | 2024 Monitoring Observations | | |
|---|---|---|---|---|---|
| | | | | | |
| Recreation | Shore Access, Navigation Potential | - | • No public access<br>• TRPD manages the lake as a wildlife sanctuary, with recreation limited to trail uses<br>• Majority of emergent shoreline fringe is dominated by non-native cattail species<br>• The channel between NW and SW Anderson Lakes has a high abundance of non-native cattails, limiting navigability and potentially limiting hydraulic capacity | • No public access<br>• TRPD manages the lake as a wildlife sanctuary, with recreation limited to trail uses<br>• Majority of emergent shoreline fringe is dominated by non-native cattail species<br>• The channel between NW and SW Anderson Lakes has a high abundance of non-native cattails limiting navigability and potentially limiting hydraulic capacity | • Public non-paved canoe launch<br>• Majority of emergent shoreline fringe is dominated by non-native cattail species<br>• Non-native cattail species surround the upstream and downstream end sections of the pipe between SW and SE Anderson, potentially restricting hydraulic capacity |
| | District Goal | | No specific goal. The promotion of habitat connectivity could offer a secondary benefit of supporting improved recreational activities. | | |
| | Management Status | | No management status assigned | No management status assigned | No management status assigned |
| | Management/Protection Practices | | • Consider non-native cattail management in areas with restricted hydraulic capacity and ecological movement and reduced habitat connectivity. This may also offer improved recreational access. See Section 8.1.3.<br>• Continuation of periodic plant surveys to assess changes. | | |
| | Management Status Change Trigger(s) | | Not applicable. | | |

## 9.3 Additional Management Recommendations

The following management projects are recommended for the Anderson Lakes based on consideration of engineering feasibility, project cost, permitting, landowner approvals, NMCWD staff resources, agency partner support, and other feedback from stakeholders. Table 9-8 presents a potential management timeline to support effective implementation and improve overall project success. Although the management projects address separate health assessment goals, the projects are interrelated and should be considered and implemented collectively, as appropriate.

### Southeast Anderson Submerged Aquatic Invasive Species (AIS) Management:

- Management of AIS with herbicide treatments is the recommended approach at this time to manage curly-leaf pondweed and Eurasian watermilfoil (see Section 8.1.1.1).
- Construction + engineering cost estimate: $204,000 - $288,000 (-15% to +20%)
- While lake drawdown has been shown to be an effective approach for managing curly-leaf pondweed in nearby lakes, it is not recommended for Southeast Anderson Lake at this time due to project cost, uncertainty in project effectiveness, potential for extended lake refill timeline, and extensive project permitting and landowner approvals needed.

### Water Level Equalization

- Reconstructing the existing outlet control structure at Southeast Anderson Lake to include a backflow preventer (Alternative 3) is the recommended approach (see Section 8.1.2)
- Construction + engineering cost estimate: $214,000 - $315,000 (-15% to +25%)
- Installation of a maintenance access to the control structure should also be considered. The estimated cost, including construction + engineering: $184,000 - $270,000 (-15% to +25%)
    - TRPD has identified a proposed trail in their adopted master plan that would allow access to the outlet. Continued communication with TRPD is recommended.
- Benefits:
    - Allows water levels in Southeast Anderson to equalize with Northwest and Southwest Anderson via gravity.
    - Addresses degraded storm infrastructure.
    - Construction timeline is not dependent on the effectiveness of the AIS management projects.
    - The proposed culvert and control structure do not preclude future open-channel construction, which can be considered in the future after AIS goals are met based on funding availability and stakeholder interest.

### Non-native Cattail Management

- Management of whole-lake shoreline fringe on Southeast Anderson and hydraulic maintenance zones on Northwest and Southwest Anderson Lakes is the recommended approach at this time (see Section 8.1.3)
- Construction + engineering cost estimate: $262,000 - $561,000 (-30% to +50%)
- Benefits:
    - Agency stakeholders are interested in project partnerships (TRPD, Bloomington)
    - Low water levels currently in Southeast Anderson Lake present an opportunity for more cost-effective non-native cattail management, especially when coupled with a project that restores water levels and drowns the cattail stems after initial removal. Southeast

Anderson provides a unique low-water level condition that could allow the District and agency partners to pilot a large-scale management project.

- Non-native cattail management within hydraulic maintenance zones can help to maintain and improve flow conditions between the lakes.
- Non-native cattail management can offer secondary benefits of promoting the enhancement of habitat conditions and connectivity to support ecological movement and improved recreational access.

**Table 9-8 Potential Anderson Lakes Management Project Implementation Timeline**

| Proposed Management Projects | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 |
|---|---|---|---|---|---|---|---|---|
| Southeast Anderson submerged AIS management | Herbicide | Herbicide | Herbicide | Herbicide | Herbicide | Herbicide | Herbicide (contingent) | Herbicide (contingent) |
| Water Level Equalization | | Outlet Reconstruction | | | | | | |
| Non-Native Cattail Management | Cattail Removals – SE Anderson | Cattail Maintenance-SE Anderson | Cattail Removals – Hydraulic Zones (NW & SW Anderson) | Cattail Maintenance-Hydraulic Zones (NW & SW Anderson) | | | | |

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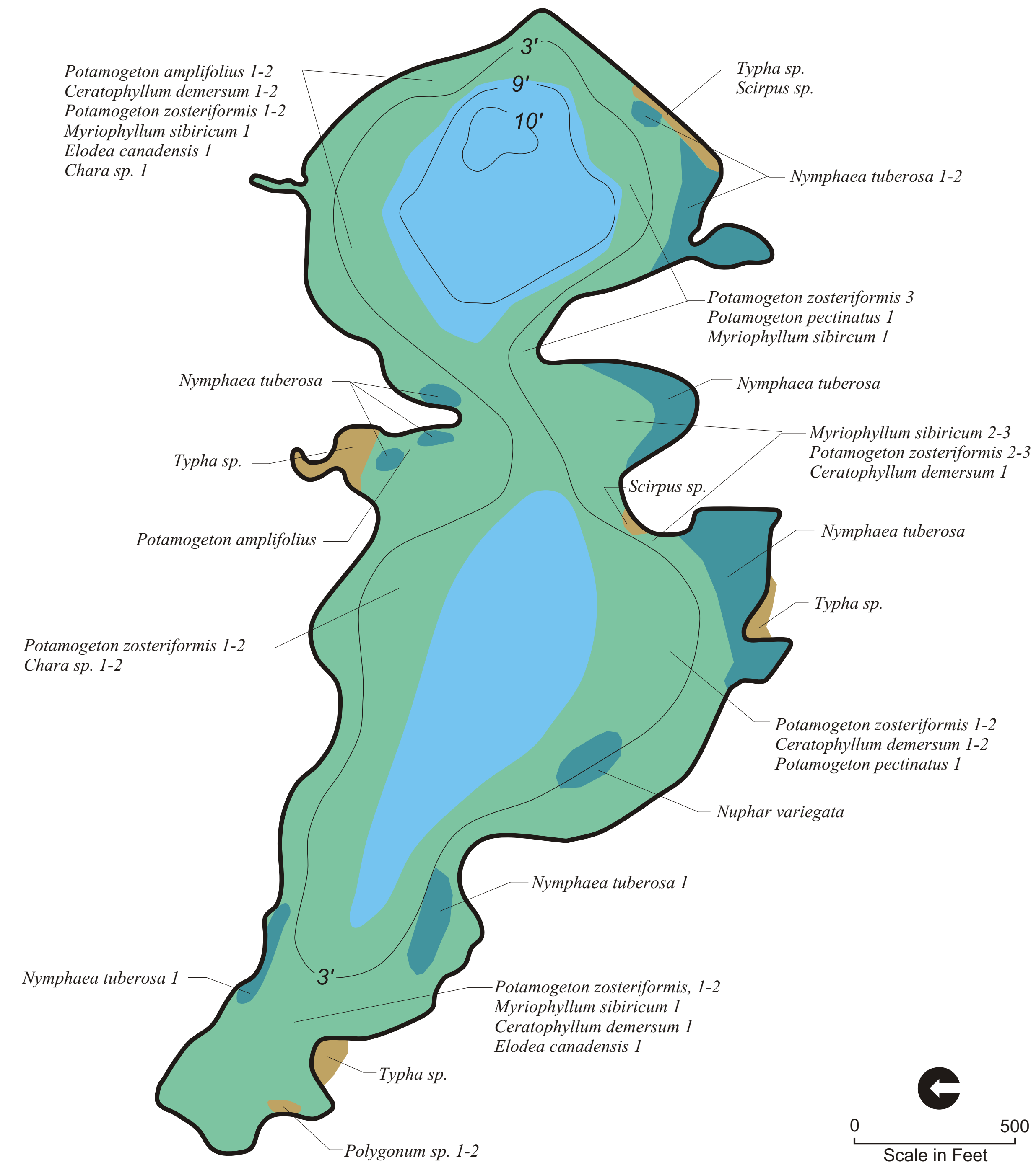
# Appendix A

## Qualitative Plant Survey Maps

• No Macrophytes Found in Water > 7.0'
• Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Sago pondweed | *Potamogeton pectinatus* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Yellow waterlily | *Nuphar variegata* |
| Emergent: | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Water smartweed | *Polygonum sp.* |
| No Aquatic Vegetation Found: | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 20, 1996

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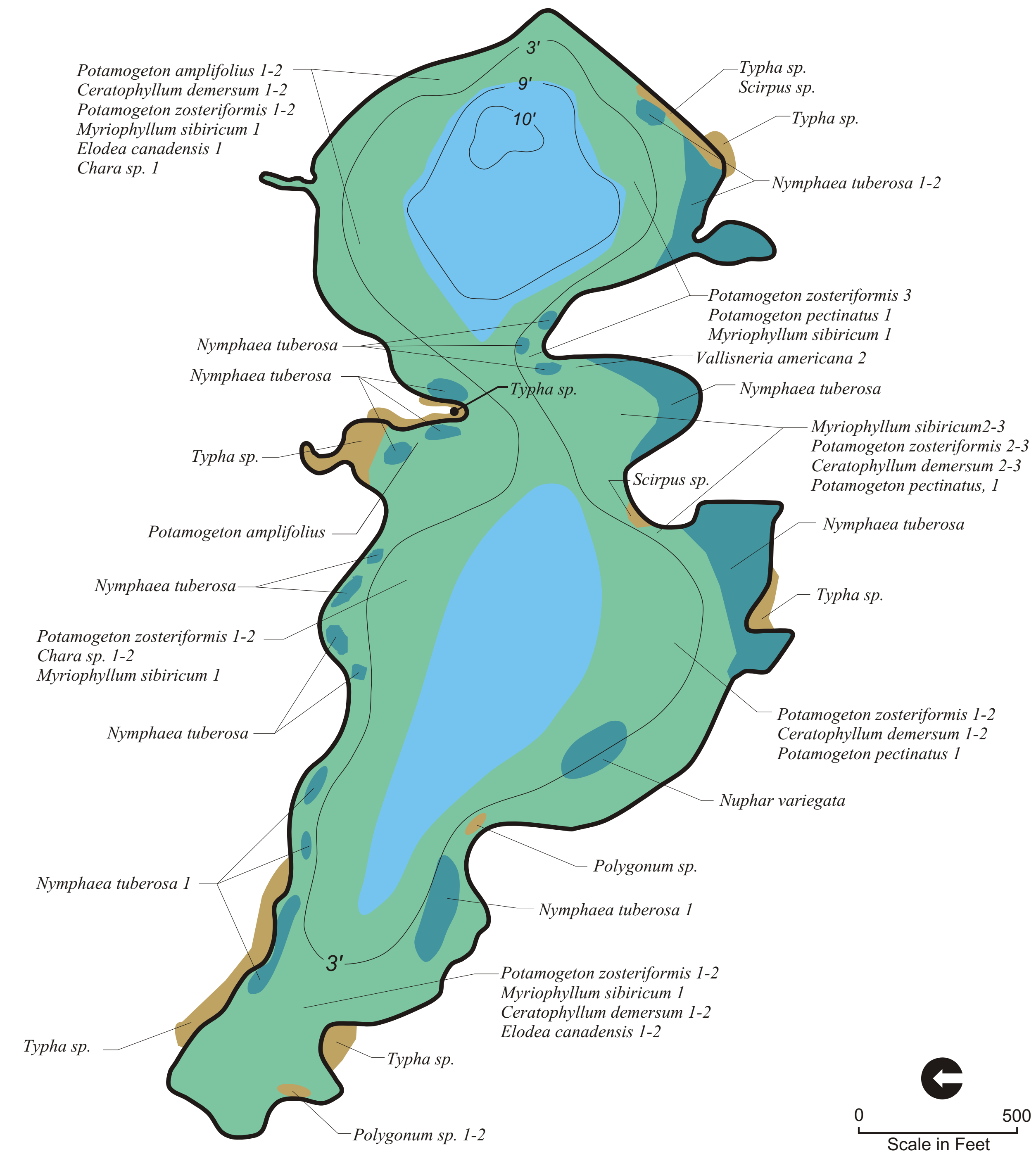
• No Macrophytes Found in Water > 7.0'
• Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

| | | Common Name | Scientific Name |
|---|---|---|---|
| Submerged Aquatic Plants: | | Flatstem pondweed | *Potamogeton zosteriformis* |
| | | Large-leaf pondweed | *Potamogeton amplifolius* |
| | | Sago pondweed | *Potamogeton pectinatus* |
| | | Northern watermilfoil | *Myriophyllum sibiricum* |
| | | Coontail | *Ceratophyllum demersum* |
| | | Elodea | *Elodea canadensis* |
| | | Muskgrass | *Chara sp.* |
| | | Wild celery | *Vallisneria americana* |
| Floating Leaf: | | White waterlily | *Nymphaea tuberosa* |
| | | Yellow waterlily | *Nuphar variegata* |
| Emergent: | | Bulrush | *Scirpus sp.* |
| | | Cattail | *Typha sp.* |
| | | Water smartweed | *Polygonum sp.* |
| No Aquatic Vegetation Found: | | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 21, 1996

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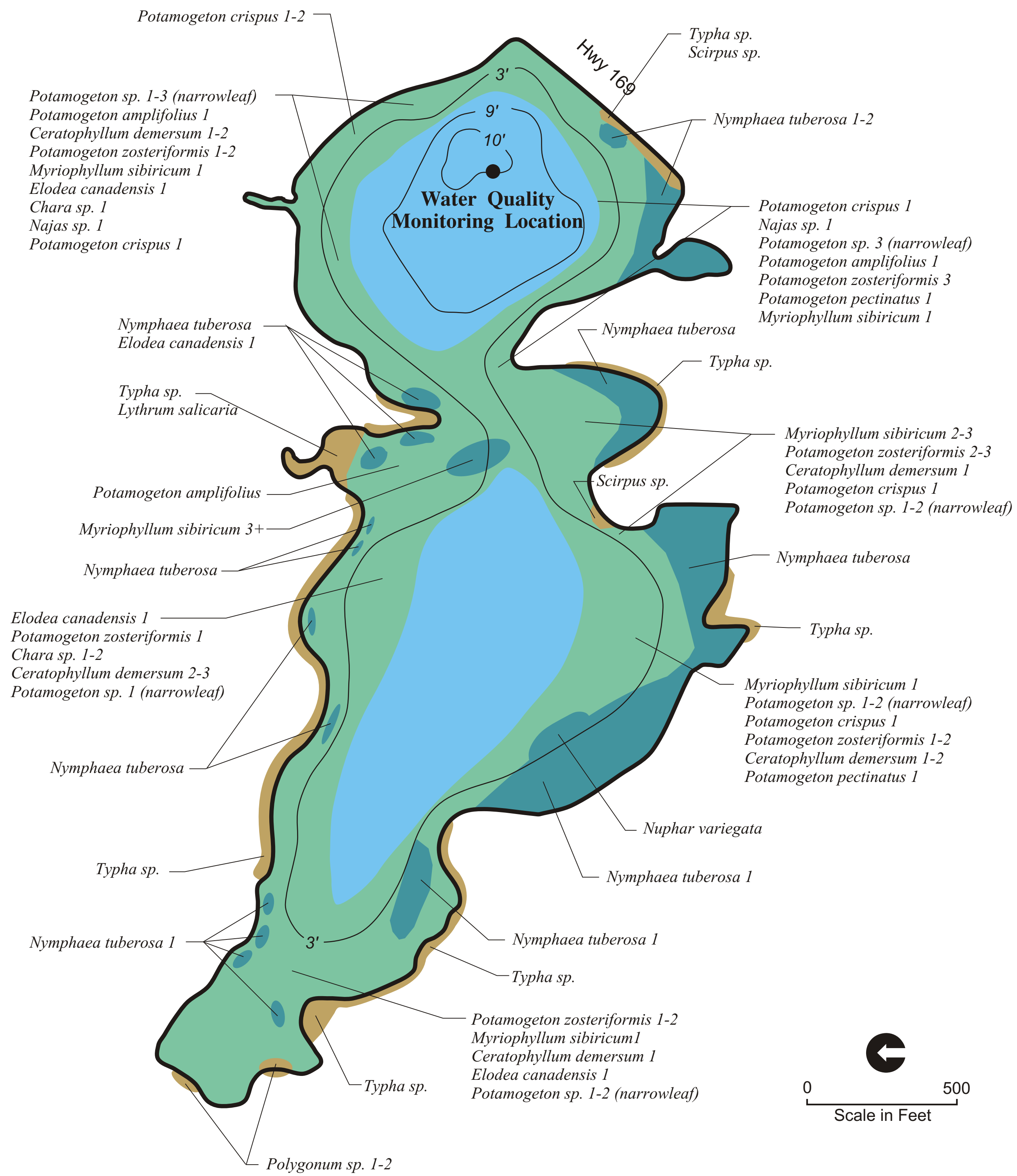
- No Macrophytes Found in Water > 5.0'-6.0'
- Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Curlyleaf pondweed | *Potamogeton crispus* |
| | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Bushy pondweed and naiad | *Najas sp.* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Yellow waterlily | *Nuphar variegata* |
| Emergent: | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Water smartweed | *Polygonum sp.* |
| | Purple loosestrife | *Lythrum salicaria* |
| No Aquatic Vegetation Found: | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 12, 2000

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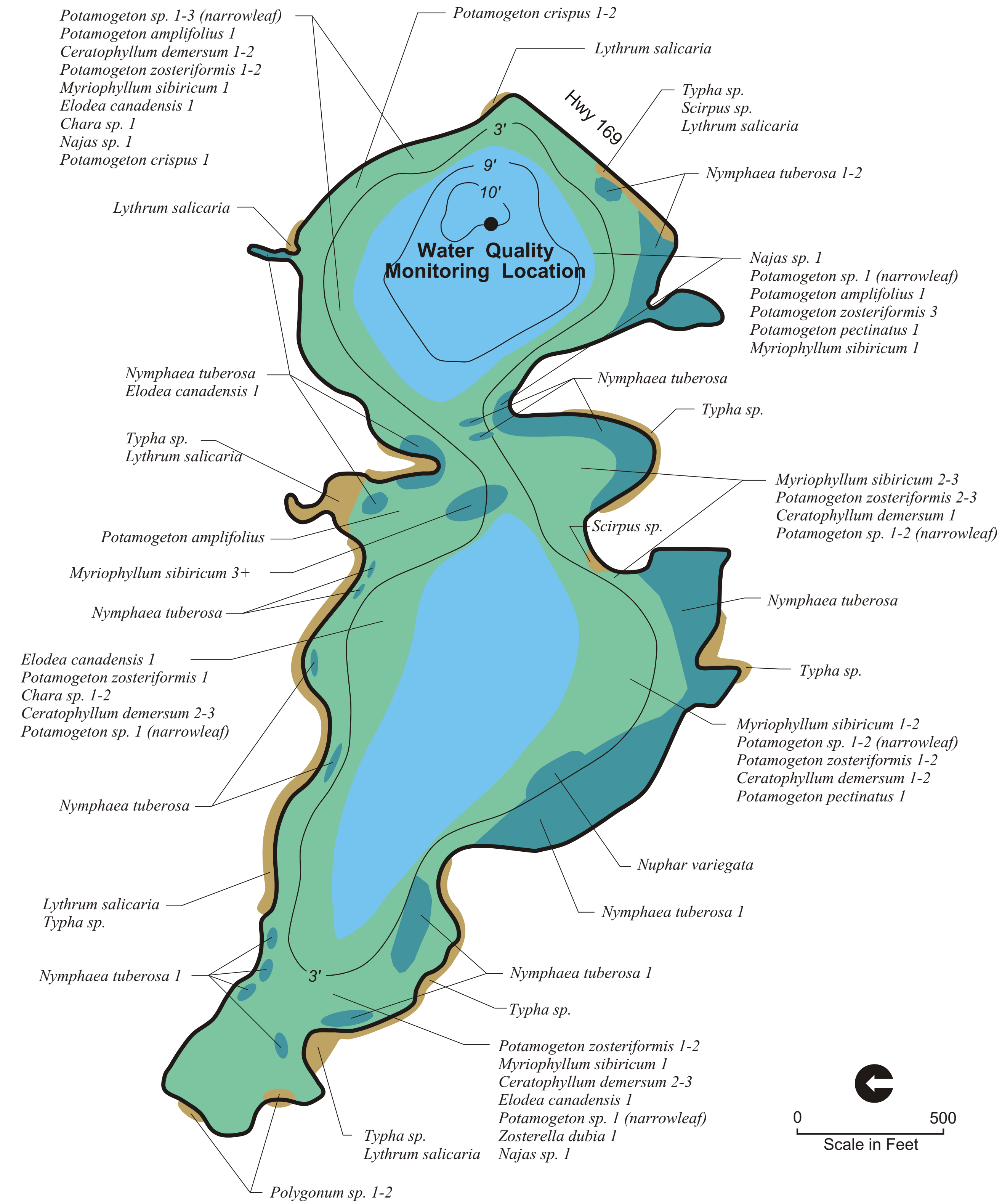
- No Macrophytes Found in Water > 5.0'-6.0'
- Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Curlyleaf pondweed | *Potamogeton crispus* |
| | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Water stargrass | *Zosterella dubia* |
| | Bushy pondweed and naiad | *Najas sp.* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Yellow waterlily | *Nuphar variegata* |
| Emergent: | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Water smartweed | *Polygonum sp.* |
| | Purple loosestrife | *Lythrum salicaria* |
| No Aquatic Vegetation Found: | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 28, 2000

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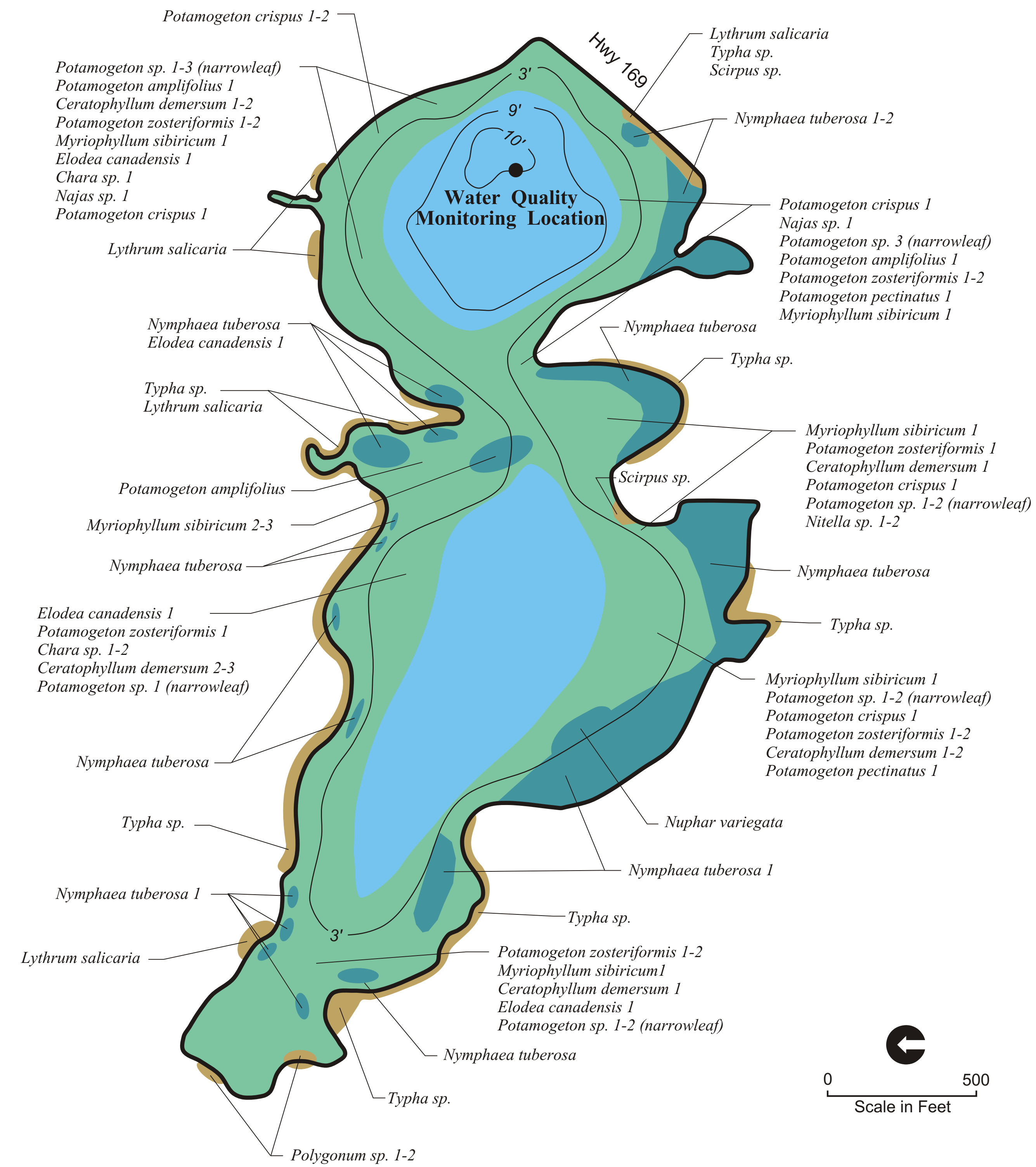
- No Macrophytes Found in Water > 5.0'-6.0'
- Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Bushy pondweed and naiad | *Najas sp.* |
| | Stonewort | *Nitella sp.* |
| Floating Leaf: | White water lily | *Nymphaea tuberosa* |
| | Yellow water lily | *Nuphar variegata* |
| Emergent: | Water smartweed | *Polygonum sp.* |
| | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Purple Loosestrife | *Lythrum salicaria* |
| No Aquatic Vegetation Found: | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 13, 2001

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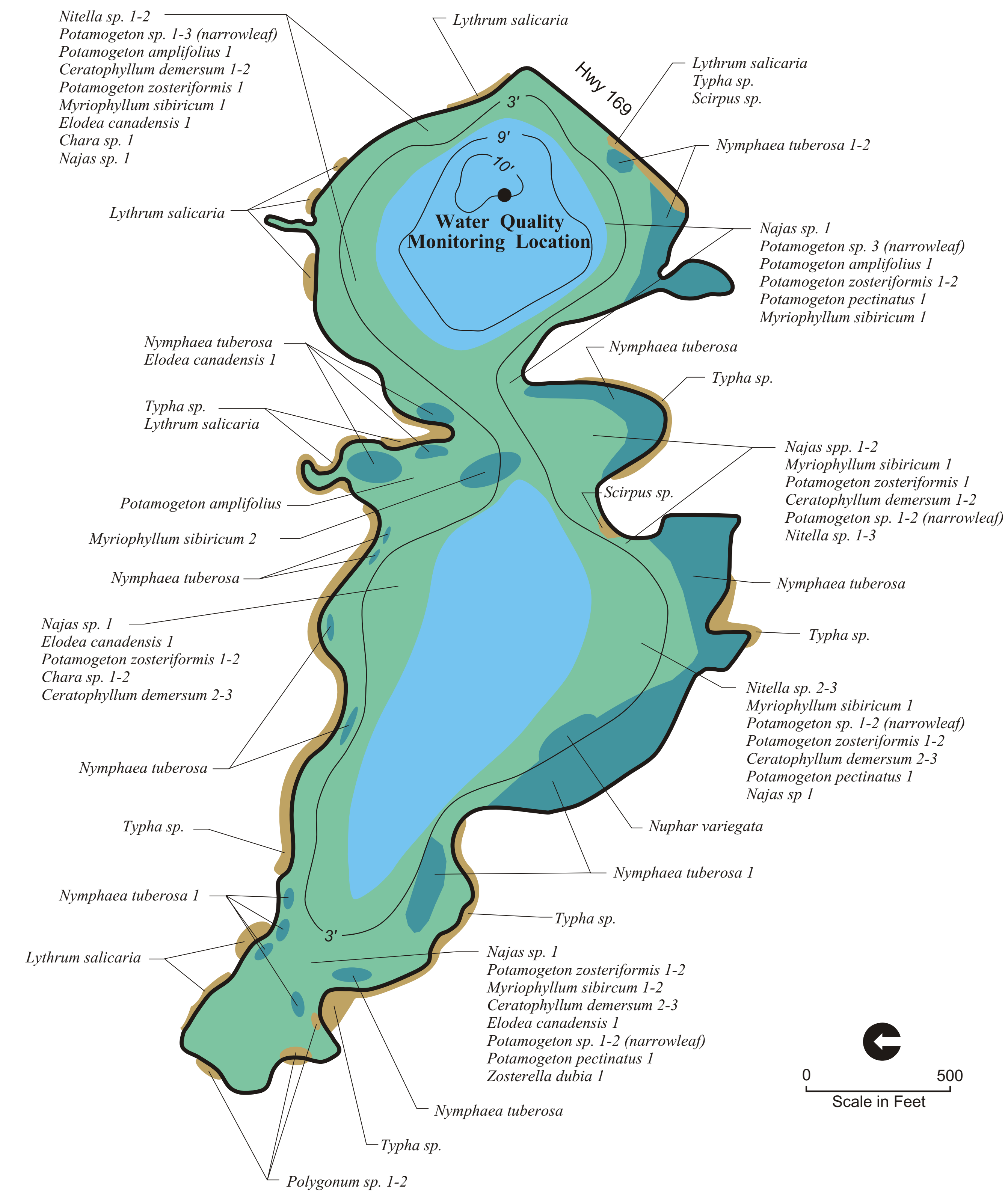
• No Macrophytes Found in Water > 5.0'-6.0'
• Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Water stargrass | *Zosterella dubia* |
| | Bushy pondweed and naiad | *Najas sp.* |
| | Stonewort | *Nitella sp.* |
| Floating Leaf: | White water lily | *Nymphaea tuberosa* |
| | Yellow water lily | *Nuphar variegata* |
| Emergent: | Water smartweed | *Polygonum sp.* |
| | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Purple Loosestrife | *Lythrum salicaria* |
| No Aquatic Vegetation Found: | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 23, 2001

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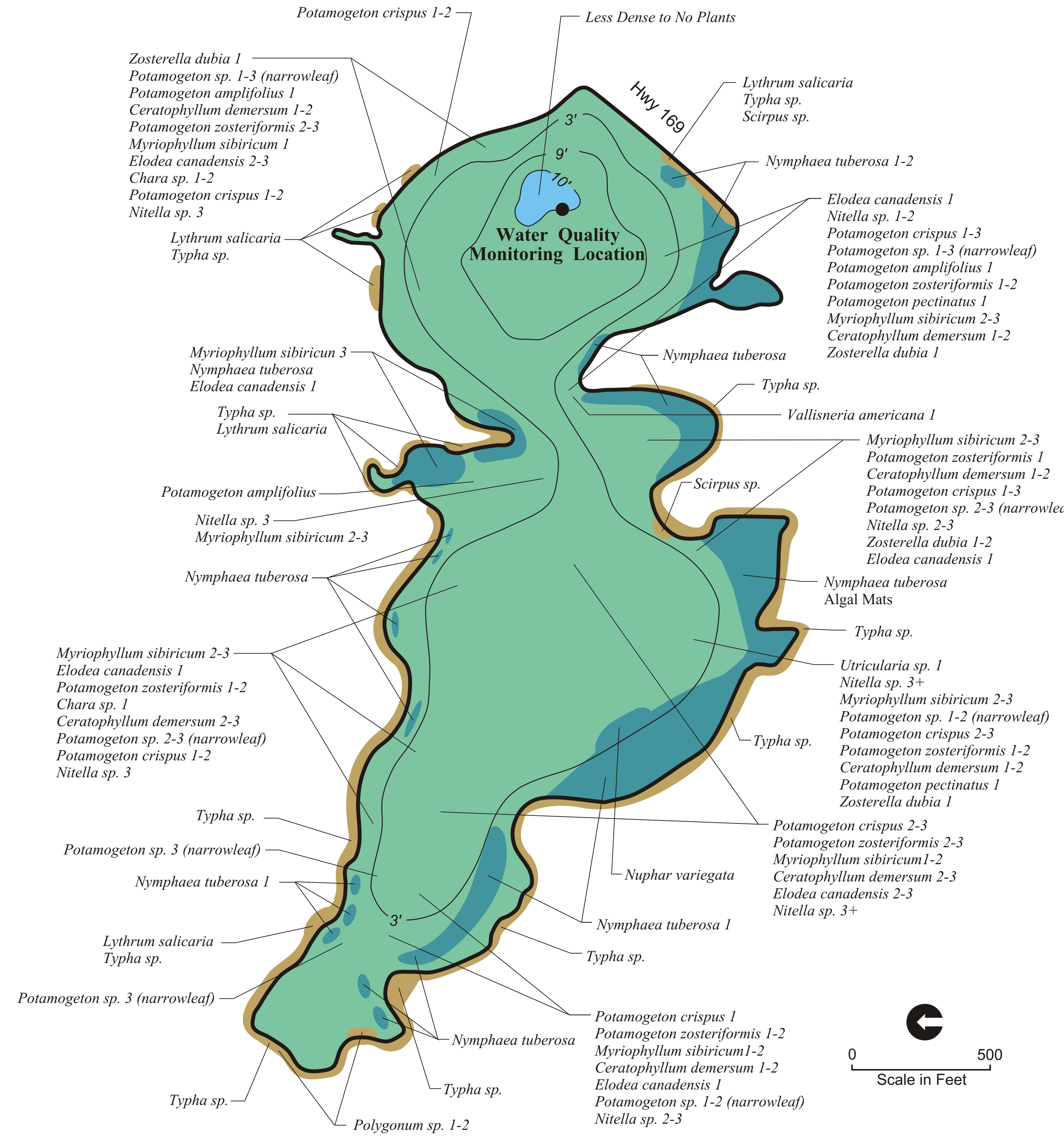
- No Macrophytes Found in Water > 10.0'-11.0'
- Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy

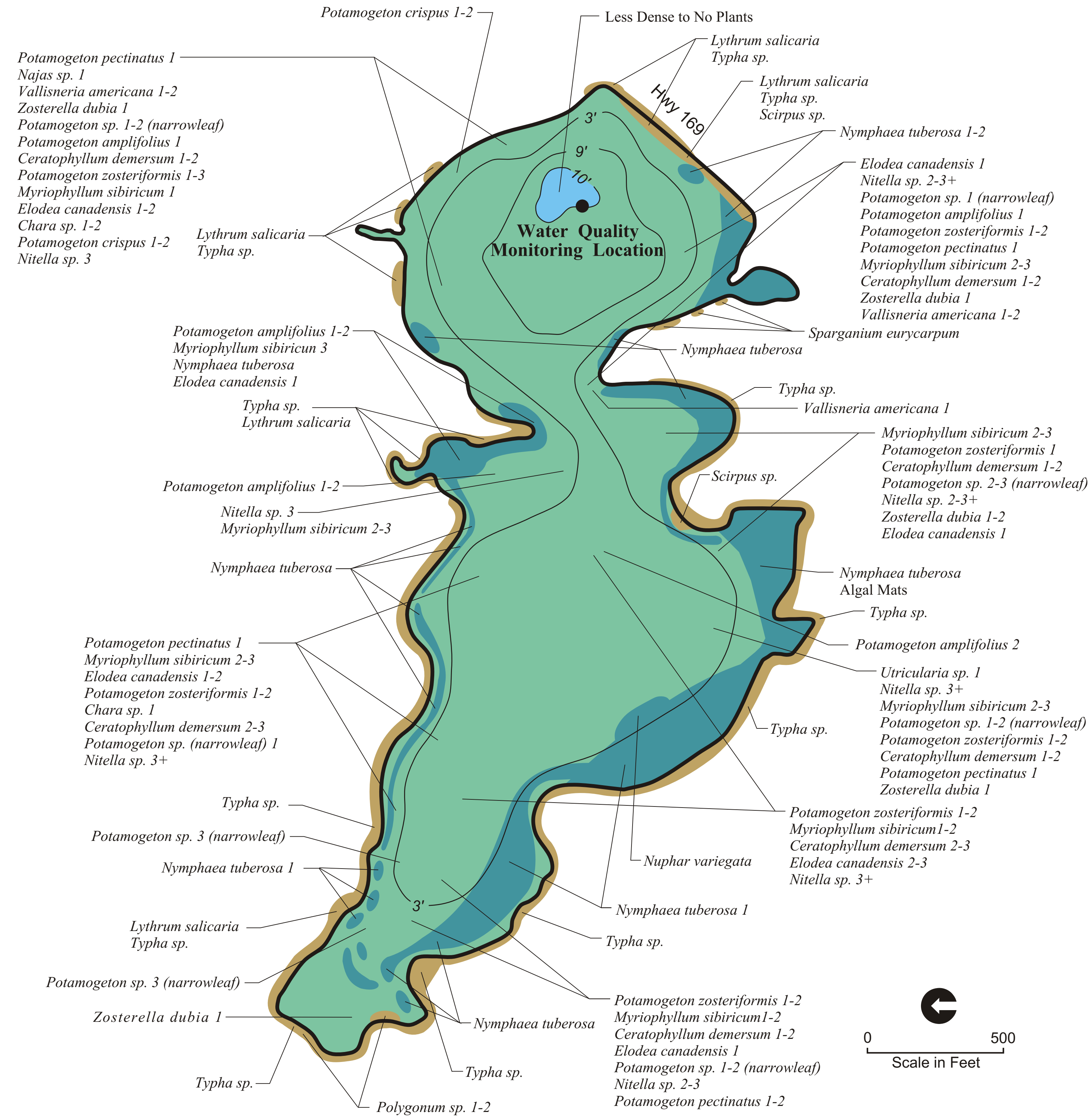
| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Water celery | *Vallisneria americana* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Water star grass | *Zosterella dubia* |
| | Bushy pondweed and naiad | *Najas sp.* |
| | Stonewort | *Nitella sp.* |
| | Bladderwort | *Utricularia sp.* |
| Floating Leaf: | White water lily | *Nymphaea tuberosa* |
| | Yellow water lily | *Nuphar variegata* |
| | Little yellow water lily | *Nuphar microphyllum* |
| Emergent: | Water smartweed | *Polygonum sp.* |
| | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Purple Loosestrife | *Lythrum salicaria* |
| No Aquatic Vegetation Found: | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 2, 2007

- No Macrophytes Found in Water > 10.0'-11.0'
- Macrophyte Densities Estimated as Follows: 1 = Light; 2 = Moderate; 3 = Heavy
- Algal Mats Present

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Water celery | *Vallisneria americana* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Water star grass | *Zosterella dubia* |
| | Bushy pondweed and naiad | *Najas sp.* |
| | Stonewort | *Nitella sp.* |
| | Bladderwort | *Utricularia sp.* |
| Floating Leaf: | White water lily | *Nymphaea tuberosa* |
| | Yellow water lily | *Nuphar variegata* |
| | Little yellow water lily | *Nuphar microphyllum* |
| Emergent: | Water smartweed | *Polygonum sp.* |
| | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Purple Loosestrife | *Lythrum salicaria* |
| | Common bur-reed | *Sparganium eurycarpum* |
| No Aquatic Vegetation Found: | | |




NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 15, 2007

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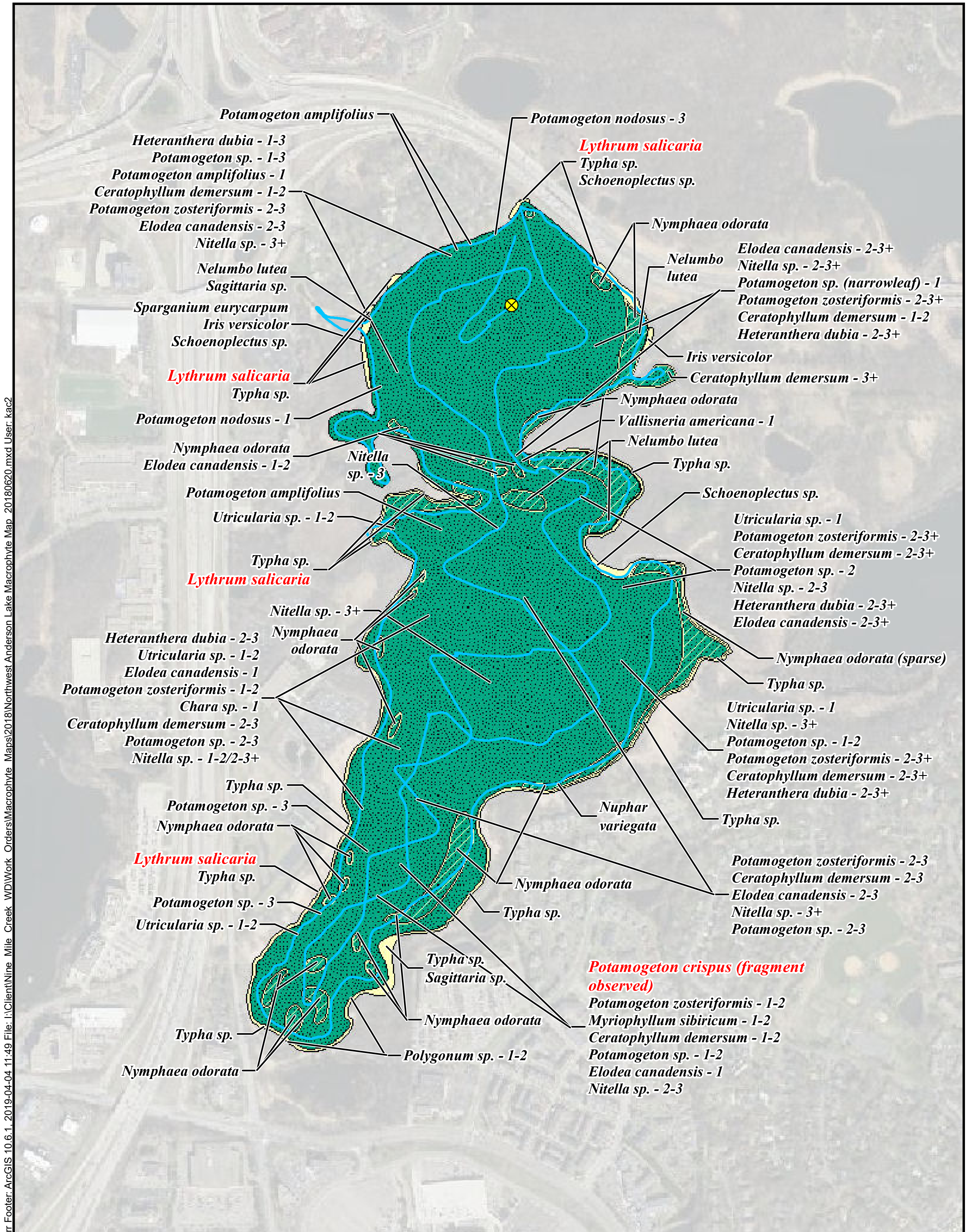





**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Canada waterweed | *Elodea canadensis* |
| Coontail | *Ceratophyllum demersum* |
| **Curly-leaf pondweed** | ***Potamogeton crispus*** |
| Flat-stem pondweed | *Potamogeton zosteriformis* |
| Muskgrass | *Chara sp.* |
| Large-leaf pondweed | *Potamogeton amplifolius* |
| Long-leaf pondweed | *Potamogeton nodosus* |
| Narrow-leaf pondweed | *Potamogeton sp. (narrowleaf)* |
| Northern watermilfoil | *Myriophyllum sibiricum* |
| Water celery | *Vallisneria americana* |
| Water stargrass | *Heteranthera dubia* |
| Stonewort | *Nitella sp.* |
| Bladderwort | *Utricularia sp.* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| American lotus | *Nelumbo lutea* |
| Yellow waterlily | *Nuphar variegata* |
| Forked duckweed | *Lemna trisulca* |
| White waterlily | *Nymphaea odorata* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Water smartweed | *Polygonum sp.* |
| Bulrush | *Schoenoplectus sp.* |
| Cattail | *Typha sp.* |
| **Purple loosestrife** | ***Lythrum salicaria*** |
| Common bur-reed | *Sparganium eurycarpum* |
| Northern blueflag | *Iris versicolor* |
| Arrowhead | *Sagittaria sp.* |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

Water Quality Monitoring Station
Emergent
Floating Leaf
Submerged Aquatic Plants
No Aquatic Vegetation
GPS Survey Location Path

Imagery Source: Twin Cities 2016 (MnGeo WMS)

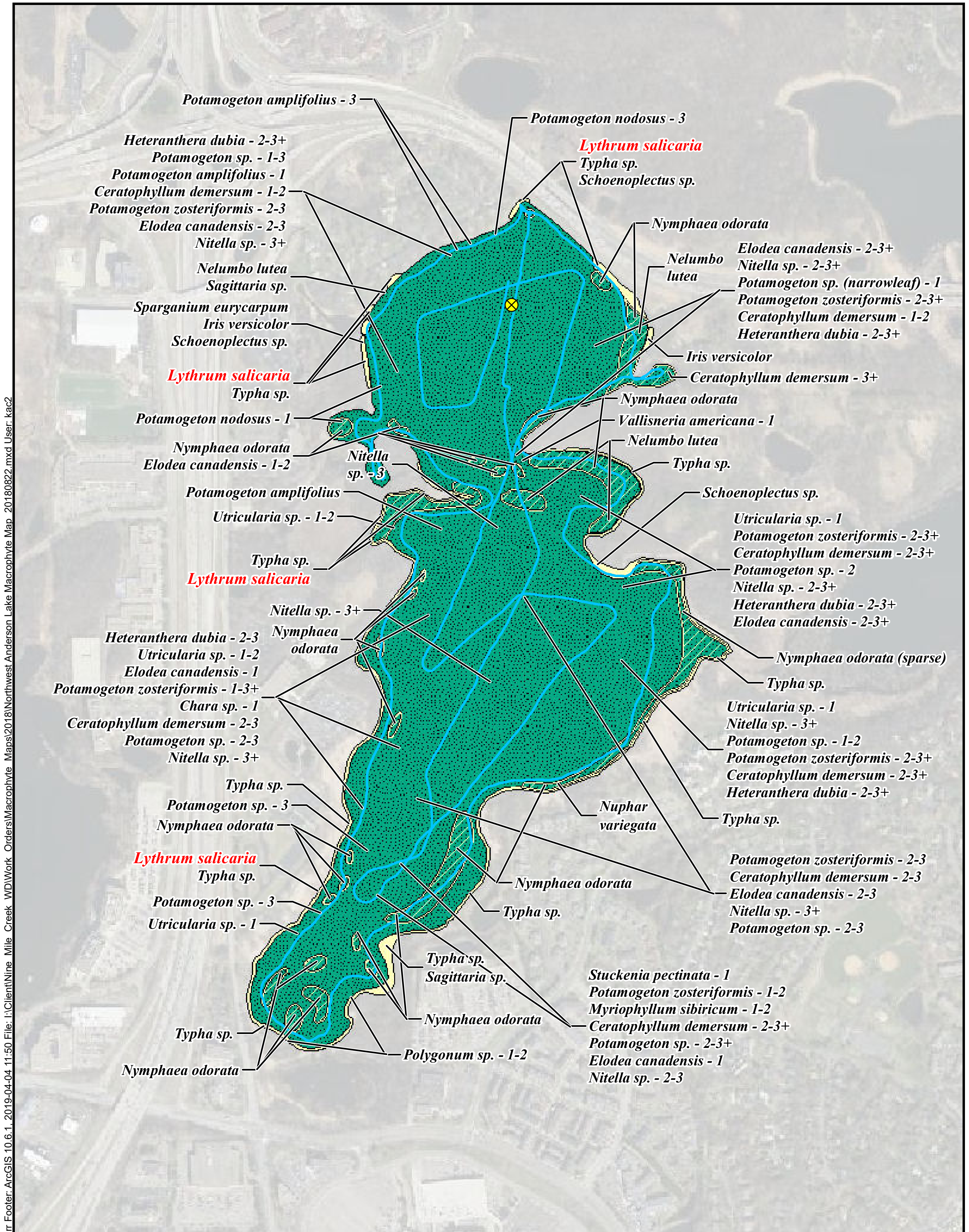
0 800 1,600 Feet
0 250 500 Meters

FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- *Nymphaea odorata* is sporadic around entire lake perimeter.
- *Lemna trisulca* is present throughout entire lake (dense in areas)
- One *Potamogeton crispus* fragment was observed on west side of lake. No rooted plants were observed or sampled.

BARR

NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY

June 20, 2018
Nine Mile Creek Watershed District




**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Canada waterweed | *Elodea canadensis* |
| Coontail | *Ceratophyllum demersum* |
| Flat-stem pondweed | *Potamogeton zosteriformis* |
| Muskgrass | *Chara sp.* |
| Large-leaf pondweed | *Potamogeton amplifolius* |
| Long-leaf pondweed | *Potamogeton nodosus* |
| Narrow-leaf pondweed | *Potamogeton sp. (narrowleaf)* |
| Northern watermilfoil | *Myriophyllum sibiricum* |
| Water celery | *Vallisneria americana* |
| Water stargrass | *Heteranthera dubia* |
| Stonewort | *Nitella sp.* |
| Bladderwort | *Utricularia sp.* |
| Sago pondweed | *Stuckenia pectinata* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| American lotus | *Nelumbo lutea* |
| Yellow waterlily | *Nuphar variegata* |
| Forked duckweed | *Lemna trisulca* |
| White waterlily | *Nymphaea odorata* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Water smartweed | *Polygonum sp.* |
| Bulrush | *Schoenoplectus sp.* |
| Cattail | *Typha sp.* |
| **Purple loosestrife** | ***Lythrum salicaria*** |
| Common bur-reed | *Sparganium eurycarpum* |
| Northern blueflag | *Iris versicolor* |
| Arrowhead | *Sagittaria sp.* |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

Water Quality Monitoring Station
Emergent
Floating Leaf
Submerged Aquatic Plants
No Aquatic Vegetation
GPS Survey Location Path

Imagery Source: Twin Cities 2016 (MnGeo WMS)

0 800 1,600
Feet

0 250 500
Meters

FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- *Nymphaea odorata* is sporadic around entire lake perimeter.
- *Lemna trisulca* is present throughout entire lake (dense in areas)

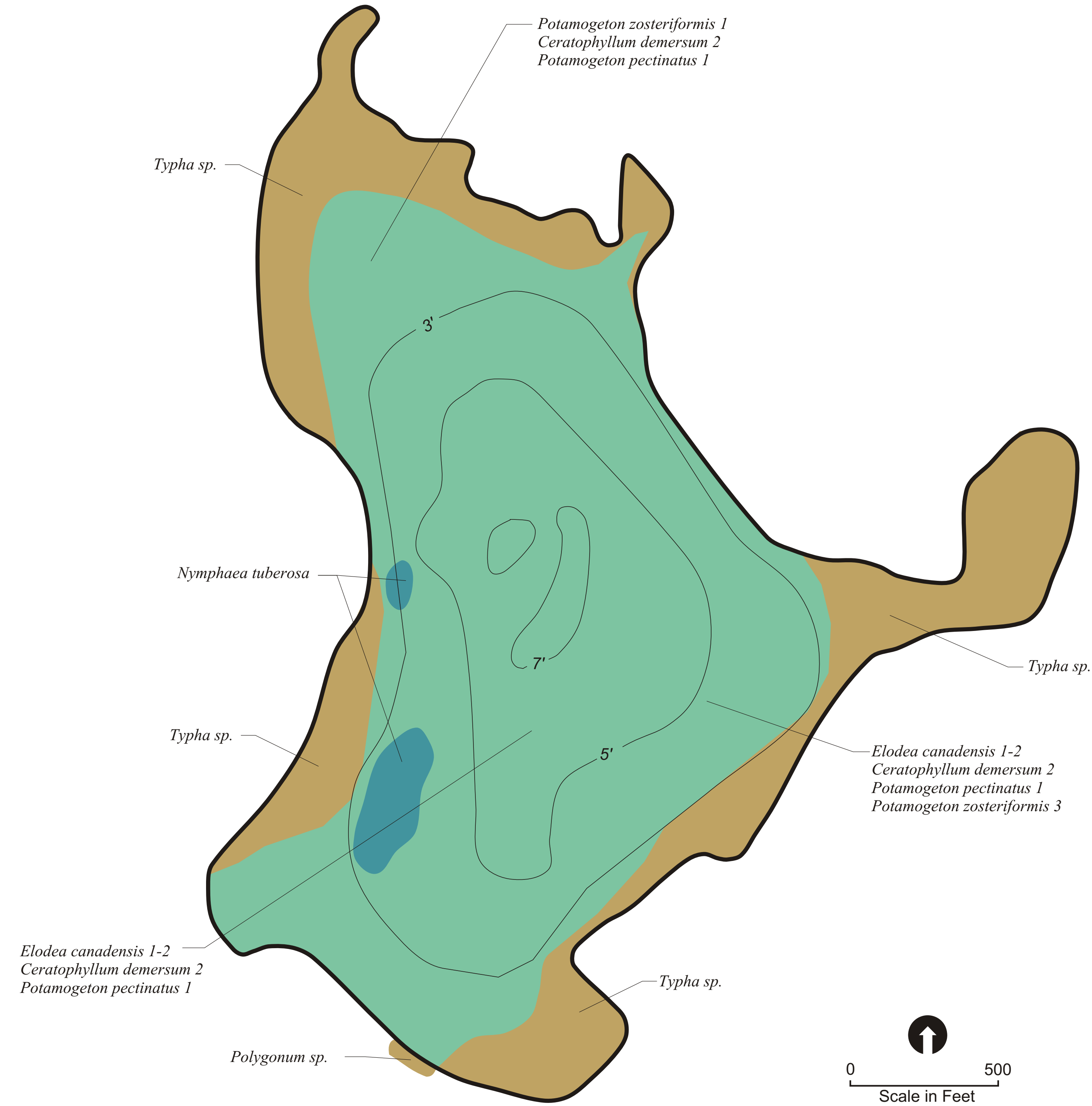
BARR

NORTHWEST ANDERSON LAKE
MACROPHYTE SURVEY

August 22, 2018
Nine Mile Creek Watershed District

- Macrophytes Were Found to Extend Throughout the Entire Lake Basin.
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Elodea<br>Coontail<br>Sago pondweed<br>Flatstem pondweed | *Elodea canadensis*<br>*Ceratophyllum demersum*<br>*Potamogeton pectinatus*<br>*Potamogeton zosteriformis* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| Emergent: | Cattail<br>Water smartweed | *Typha spp.*<br>*Polygonum sp.* |
| No Aquatic Vegetation Found: | | |




SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 20, 1996

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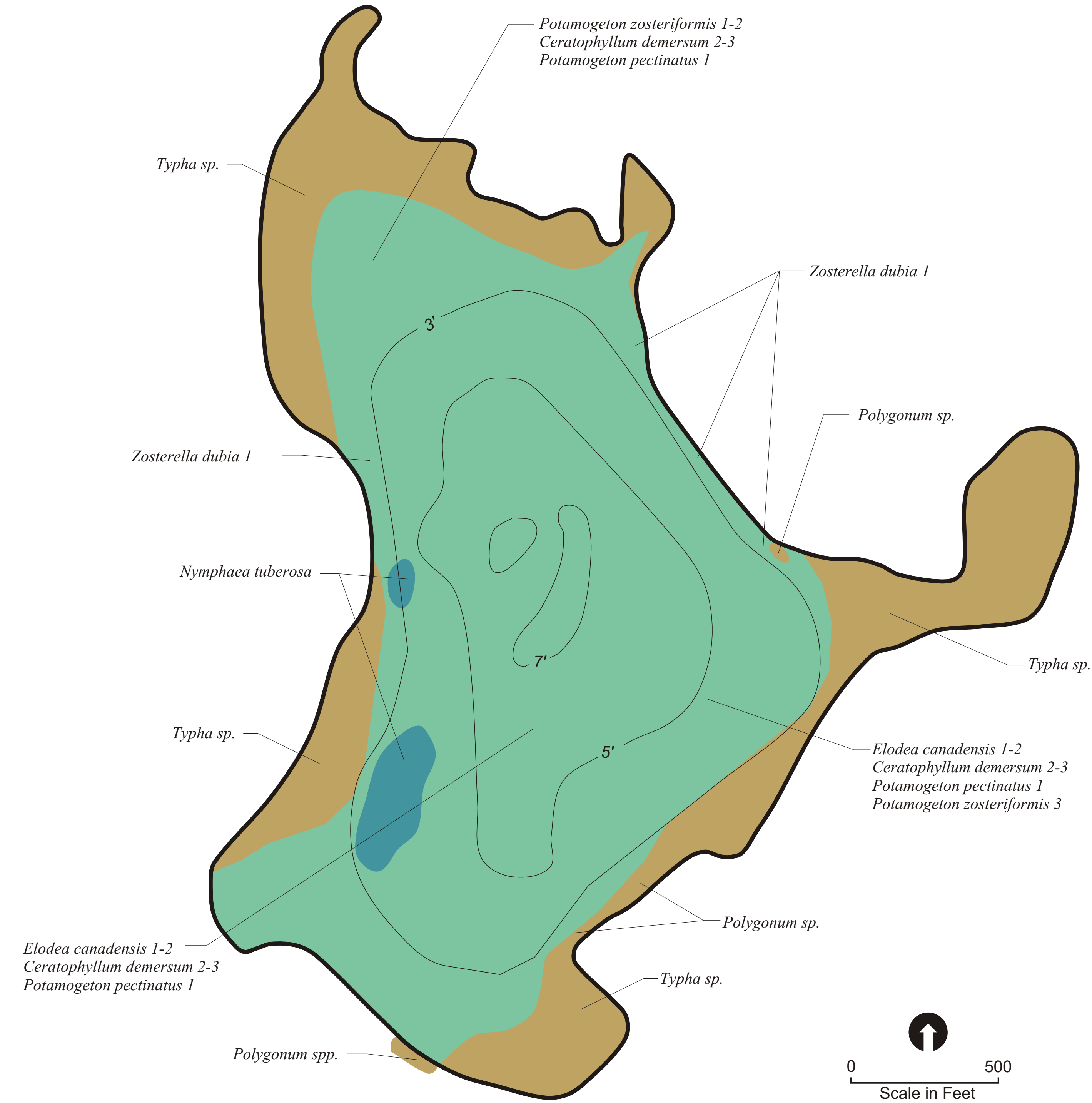
- Macrophytes Were Found to Extend Throughout the Entire Lake Basin.
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

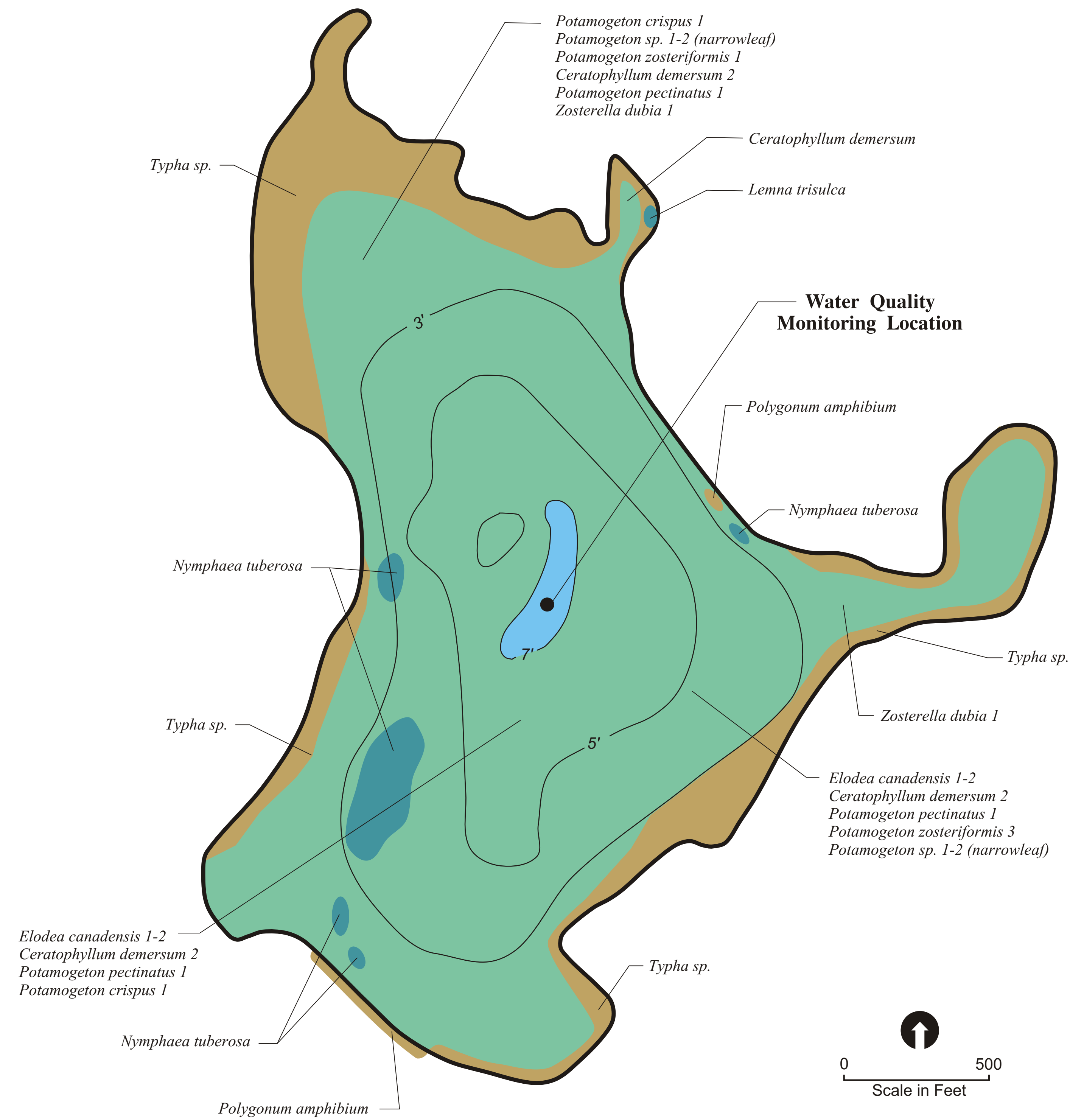
| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Elodea<br>Coontail<br>Sago pondweed<br>Flatstem pondweed<br>Water stargrass | *Elodea canadensis*<br>*Ceratophyllum demersum*<br>*Potamogeton pectinatus*<br>*Potamogeton zosteriformis*<br>*Zosterella dubia* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| Emergent: | Cattail<br>Water smartweed | *Typha sp.*<br>*Polygonum sp.* |
| No Aquatic Vegetation Found: | | |




SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 21, 1996

- No Macrophytes Found in Water >6.0-7.0
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Elodea | *Elodea canadensis* |
| | Coontail | *Ceratophyllum demersum* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Water stargrass | *Zosterella dubia* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Star duckweed | *Lemna trisulca* |
| Emergent: | Cattail | *Typha sp.* |
| | Water smartweed | *Polygonum amphibium* |
| No Aquatic Vegetation Found: | | |

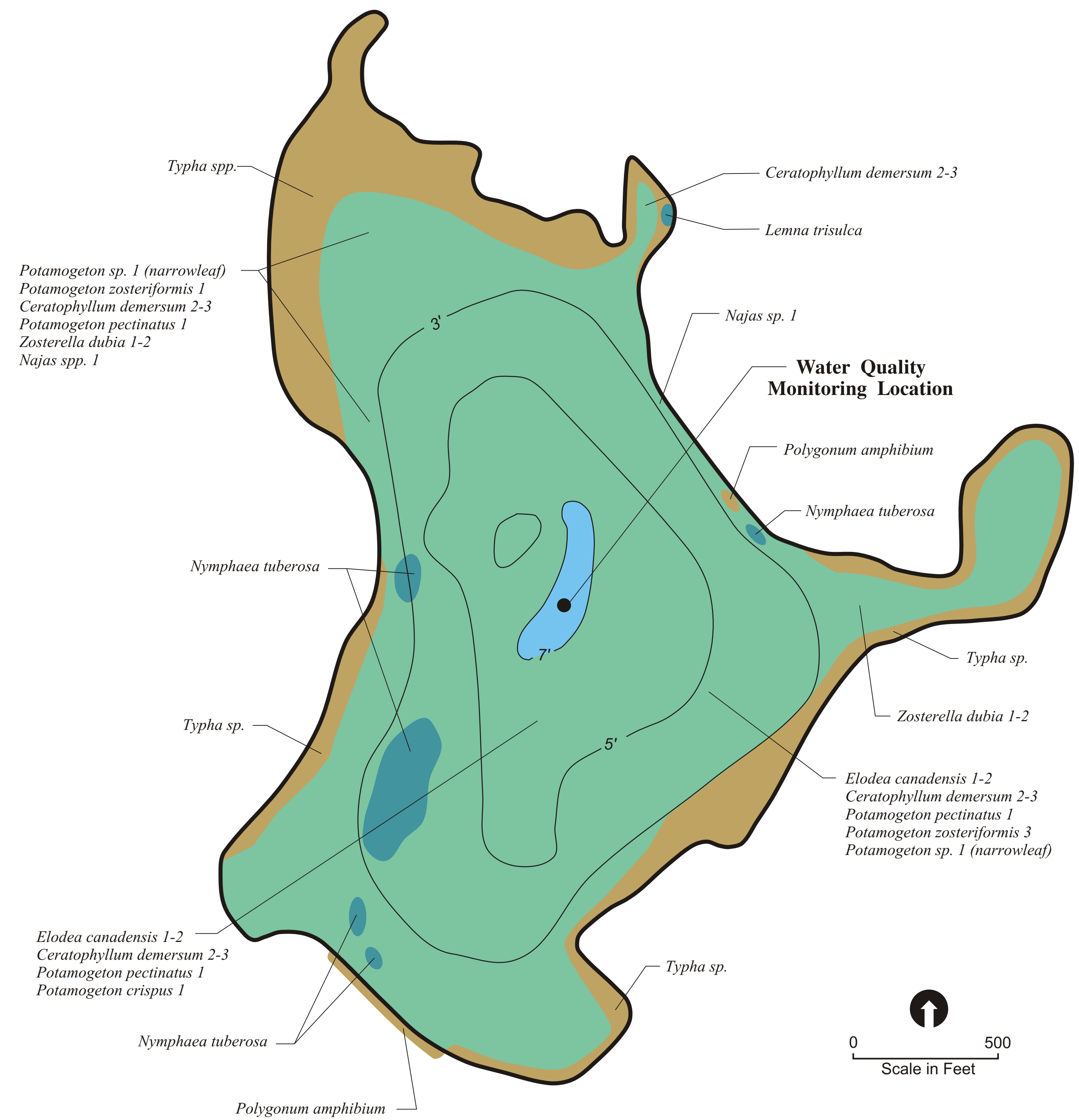



SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 12, 2000

P:23\27\003\LAKEMACROPHYTEMAPS\SOUTHWESTANDERSON\2000\JUNE2000.CDR RLG 06-21-04

- No Macrophytes Found in Water >6.0-7.0
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Elodea | *Elodea canadensis* |
| | Coontail | *Ceratophyllum demersum* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Bushy pondweed and naiad | *Najas sp.* |
| | Water stargrass | *Zosterella dubia* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Star duckweed | *Lemna trisulca* |
| Emergent: | Cattail | *Typha sp.* |
| | Water smartweed | *Polygonum amphibium* |
| No Aquatic Vegetation Found: | | |

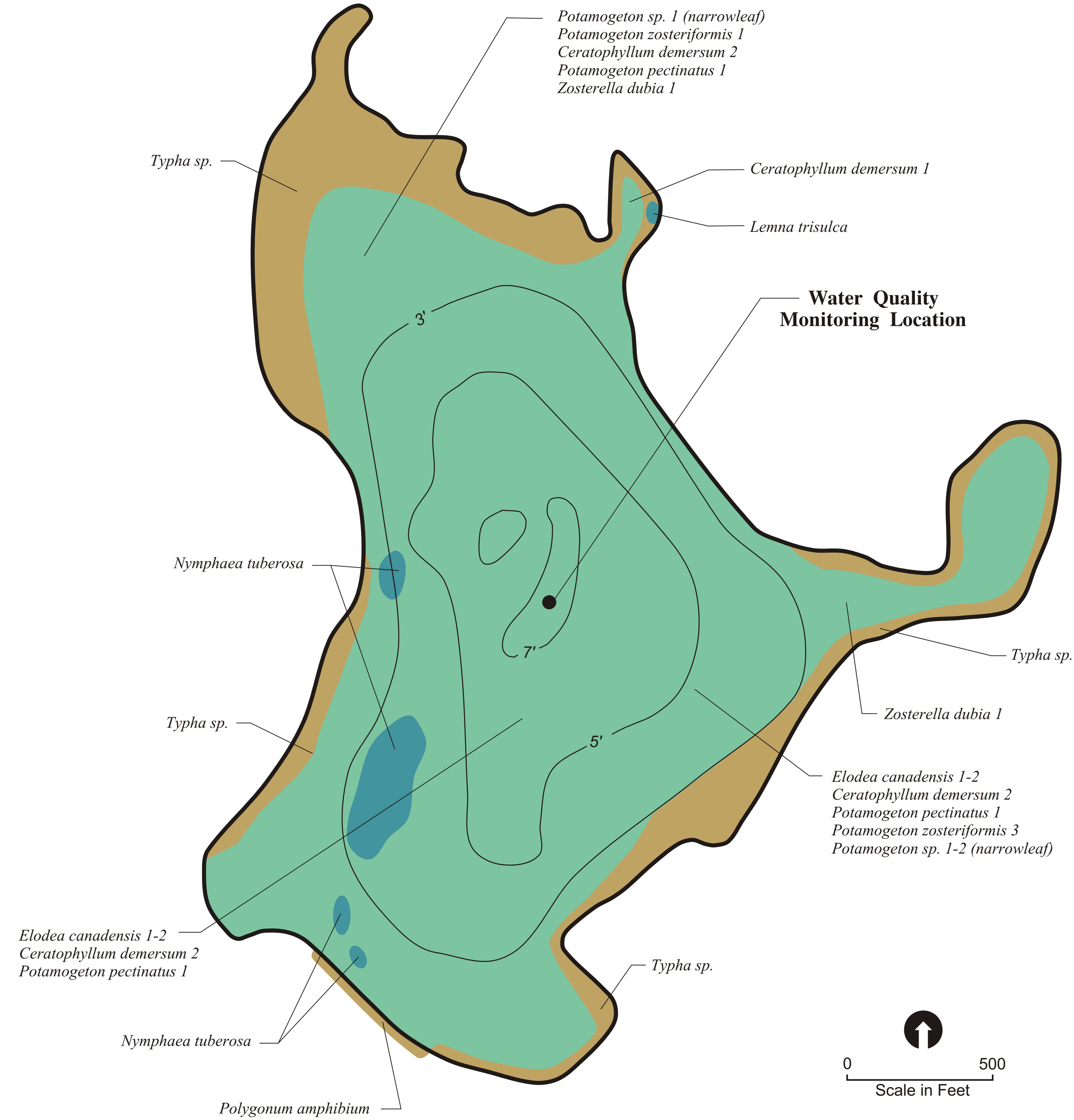



SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 28, 2000

P:\23\27\003\LAKEMACROPHYTEMAPS\SOUTHWESTANDERSON\2000\AUGUST2000.CDR RLG 06-21-04

- Macrophytes Observed Throughout Entire Water Body
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

| | | Common Name | Scientific Name |
|---|---|---|---|
| Submerged Aquatic Plants: | | Narrowleaf pondweed<br>Elodea<br>Coontail<br>Sago pondweed<br>Flatstem pondweed<br>Water stargrass | *Potamogeton sp. (narrowleaf)*<br>*Elodea canadensis*<br>*Ceratophyllum demersum*<br>*Potamogeton pectinatus*<br>*Potamogeton zosteriformis*<br>*Zosterella dubia* |
| Floating Leaf: | | White waterlily<br>Star duckweed | *Nymphaea tuberosa*<br>*Lemna trisulca* |
| Emergent: | | Cattail<br>Water smartweed | *Typha sp.*<br>*Polygonum amphibium* |
| No Aquatic Vegetation Found: | | | |

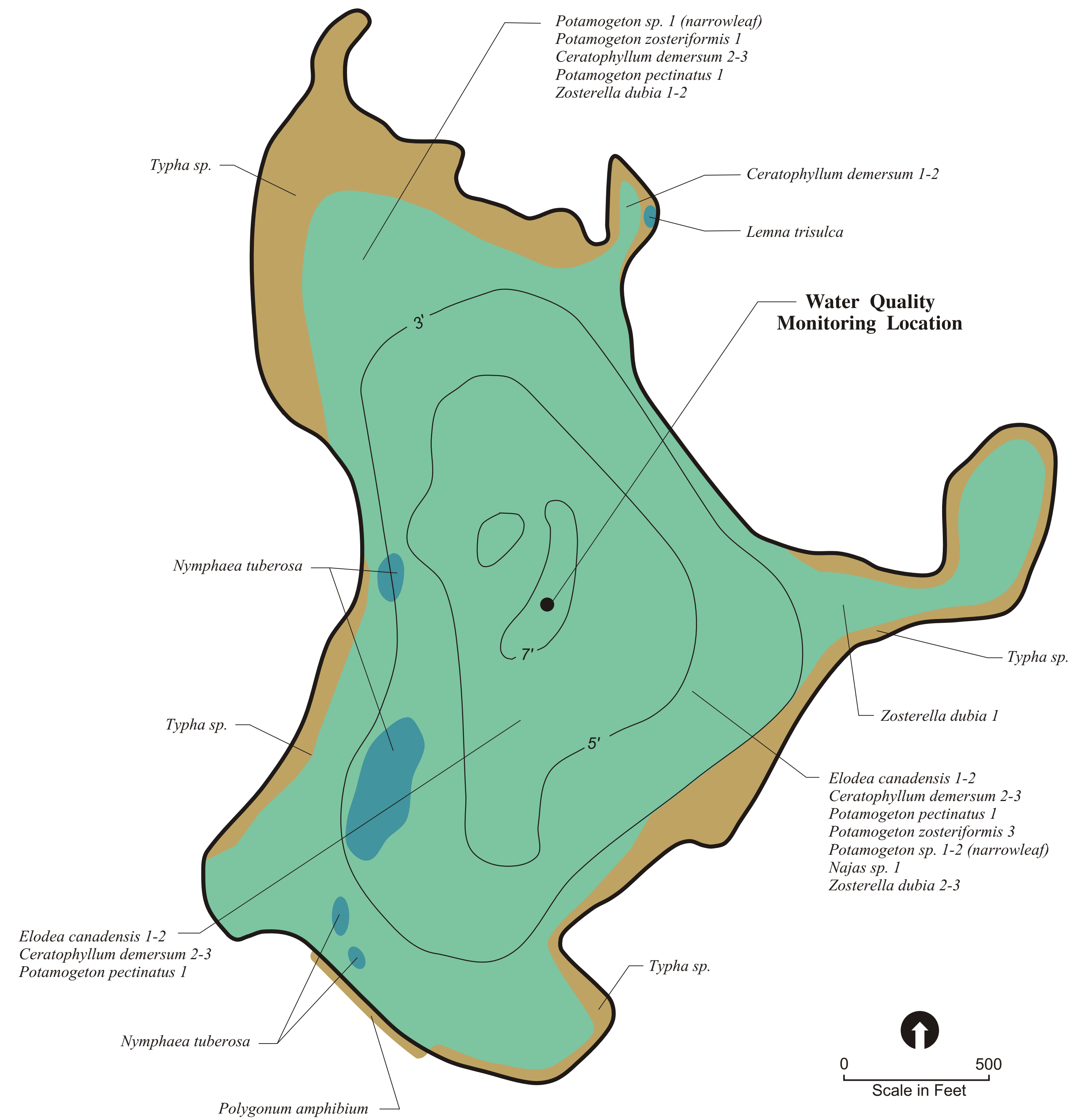



SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 13, 2001

P:\23\27\003\LAKEMACROPHYTEMAPS\SOUTHWESTANDERSON\2001\JUNE2001.CDR RLG 06-21-04

- Macrophytes Observed Throughout Entire Water Body
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Elodea | *Elodea canadensis* |
| | Coontail | *Ceratophyllum demersum* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Bushy pondweed and naiad | *Najas sp.* |
| | Water stargrass | *Zosterella dubia* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Star duckweed | *Lemna trisulca* |
| Emergent: | Cattail | *Typha sp.* |
| | Water smartweed | *Polygonum amphibium* |
| No Aquatic Vegetation Found: | | |




SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 23, 2001

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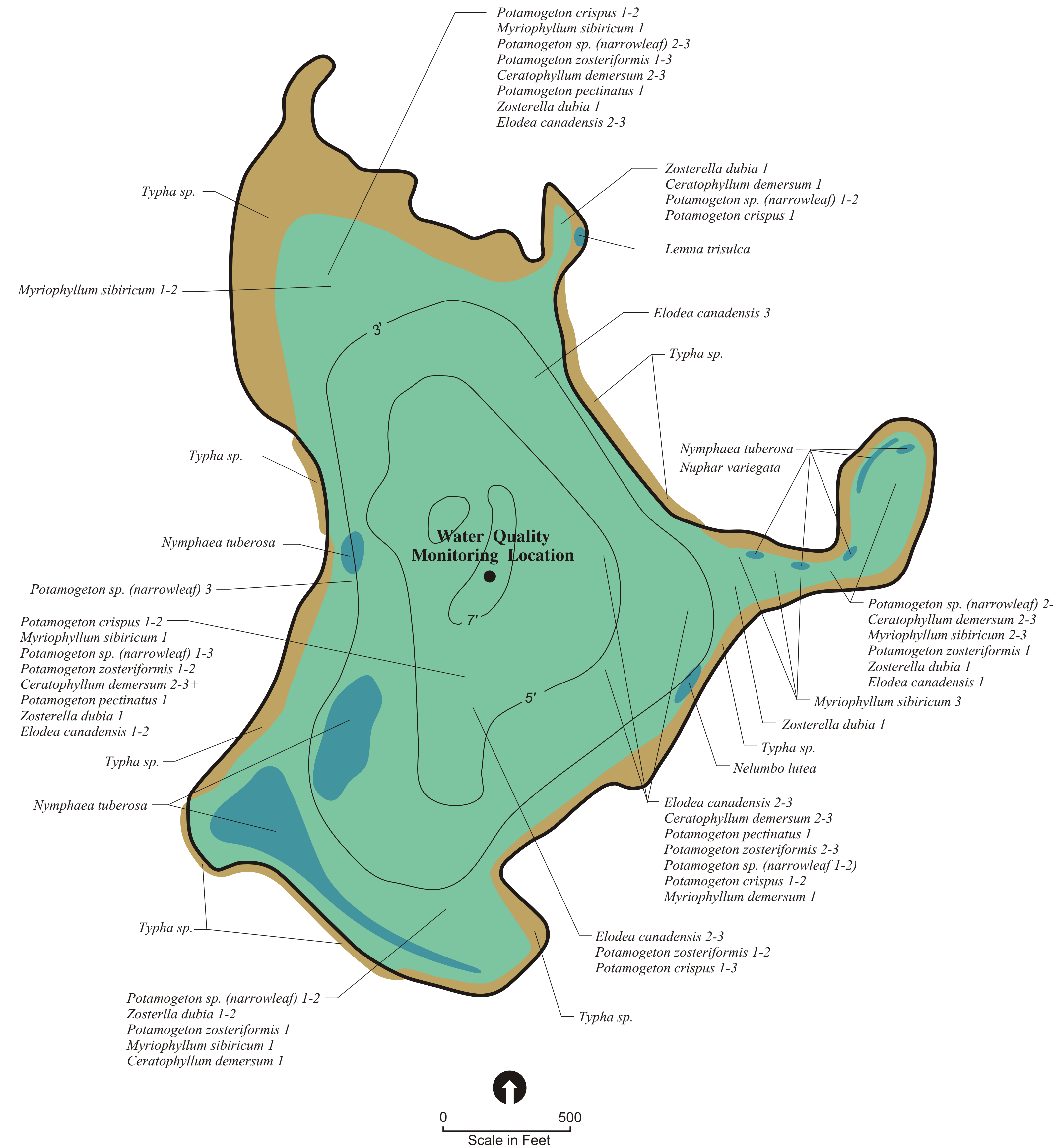
- Macrophytes Observed Throughout Entire Water Body.
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy.
- Algal Mats Present.
- *Potamogeton crispus* (Curly leaf pondweed) is More Dense Near Center of Lake.
- *Nymphaea tuberosa* (White waterlily) is Sporadic (light) Around Lake. Areas are Marked Where it is More Dense.

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Curly leaf pondweed | *Potamogeton crispus* |
| | Elodea | *Elodea canadensis* |
| | Coontail | *Ceratophyllum demersum* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern milfoil | *Myriophyllum sibiricum* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Water stargrass | *Zosterella dubia* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Yellow waterlily | *Nuphar variegata* |
| | Star duckweed | *Lemna trisulca* |
| | Lotus | *Nelumbo lutea* |
| Emergent: | Cattail | *Typha sp.* |
| | Purple loosestrife | *Lythrum salicaria* |
| No Aquatic Vegetation Found: | | |

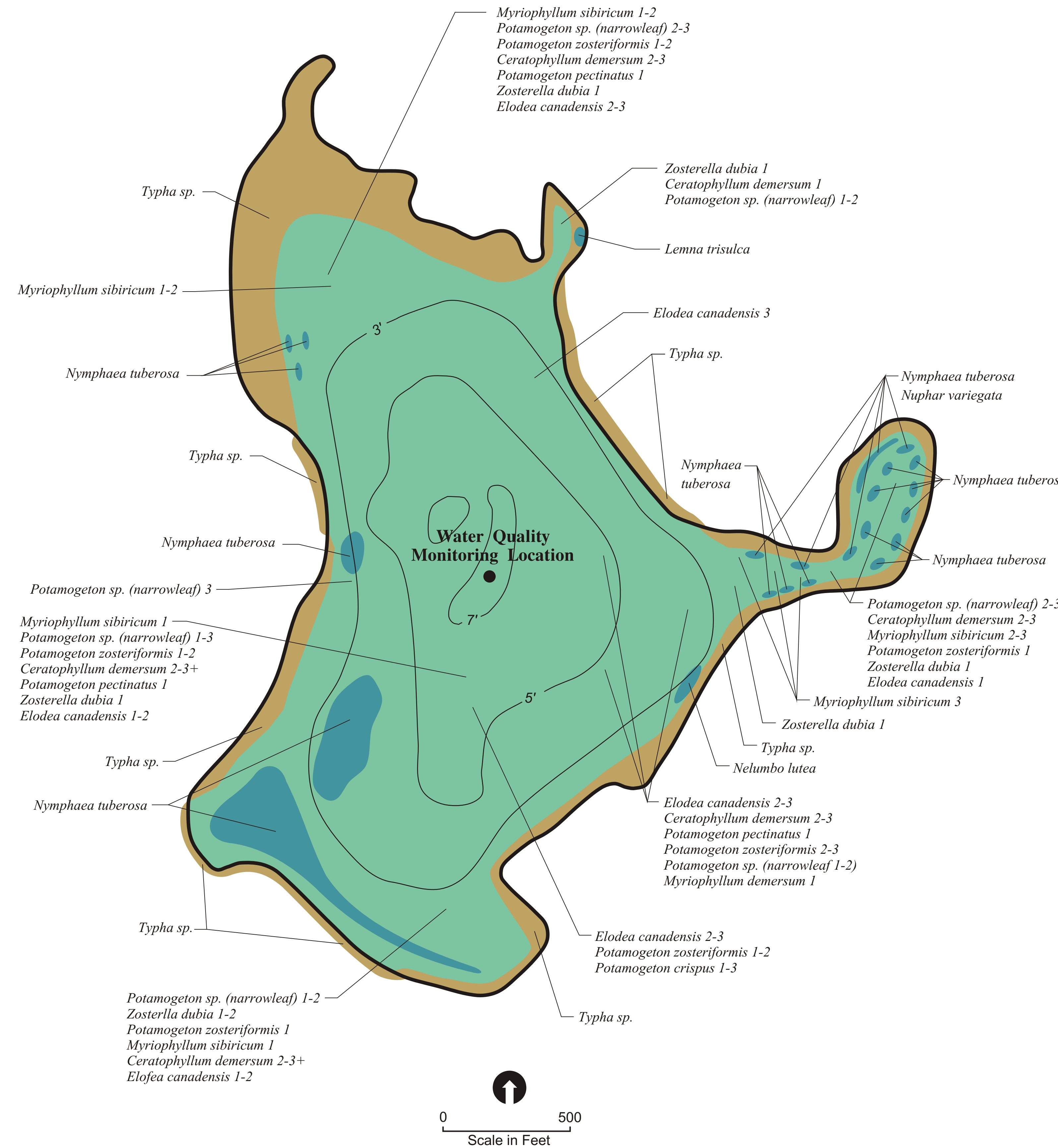



SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 2, 2007

P:\Mpls\23 MN\27\23270031MovedFromMpls P\LakeMacrophyteMaps\SW Anderson\2007\SW Anderson Lake JUNE 2007.CDR RLG 10-04-07

- Macrophytes Observed Throughout Entire Water Body.
- Macrophyte Densities Estimated As Follows: 1 = light; 2 = moderate; 3 = heavy.
- Algal Mats Present.
- *Nymphaea tuberosa* (White waterlily) is Sporadic (light) Around Lake. Areas are Marked Where it is More Dense.

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed<br>Curly leaf pondweed<br>Elodea<br>Coontail<br>Sago pondweed<br>Northern milfoil<br>Flatstem pondweed<br>Water stargrass | *Potamogeton sp. (narrowleaf)*<br>*Potamogeton crispus*<br>*Elodea canadensis*<br>*Ceratophyllum demersum*<br>*Potamogeton pectinatus*<br>*Myriophyllum sibiricum*<br>*Potamogeton zosteriformis*<br>*Zosterella dubia* |
| Floating Leaf: | White waterlily<br>Yellow waterlily<br>Star duckweed<br>Lotus | *Nymphaea tuberosa*<br>*Nuphar variegata*<br>*Lemna trisulca*<br>*Nelumbo lutea* |
| Emergent: | Cattail<br>Purple loosestrife | *Typha sp.*<br>*Lythrum salicaria* |
| No Aquatic Vegetation Found: | | |




SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 15, 2007

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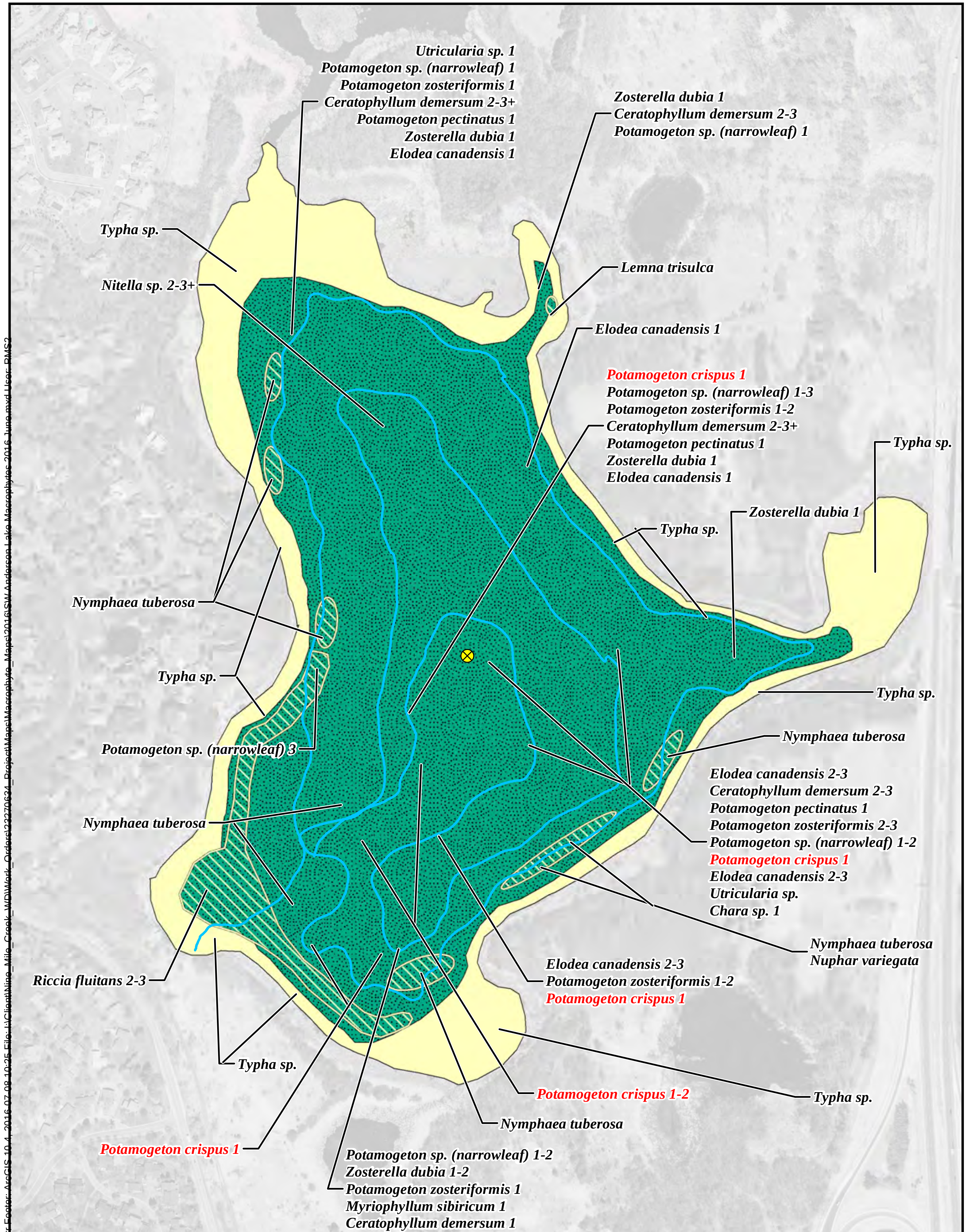



**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Muskgrass | *Chara sp.* |
| Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| **Curlyleaf Pondweed** | ***Potamogeton crispus*** |
| Elodea | *Elodea canadensis* |
| Coontail | *Ceratophyllum demersum* |
| Sago pondweed | *Potamogeton pectinatus* |
| Northern milfoil | *Myriophyllum sibiricum* |
| Flatstem pondweed | *Potamogeton zosteriformis* |
| Water stargrass | *Zosterella dubia* |
| Bladderwort | *Utricularia sp* |
| Stonewart | *Nitella sp.* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| White waterlily | *Nymphaea tuberosa* |
| Yellow waterlily | *Nuphar variegata* |
| Star duckweed | *Lemna trisulca* |
| Slender riccia | *Riccia fluitans* |
| Small duckweed | *Lemna minor* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Cattail | *Typha sp.* |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

Water Quality Monitoring Station
GPS Survey Location Path
Emergent Plants
Floating Leaf Plants
Submerged Aquatic Plants
No Aquatic Vegetation

N

0 400 800
Feet

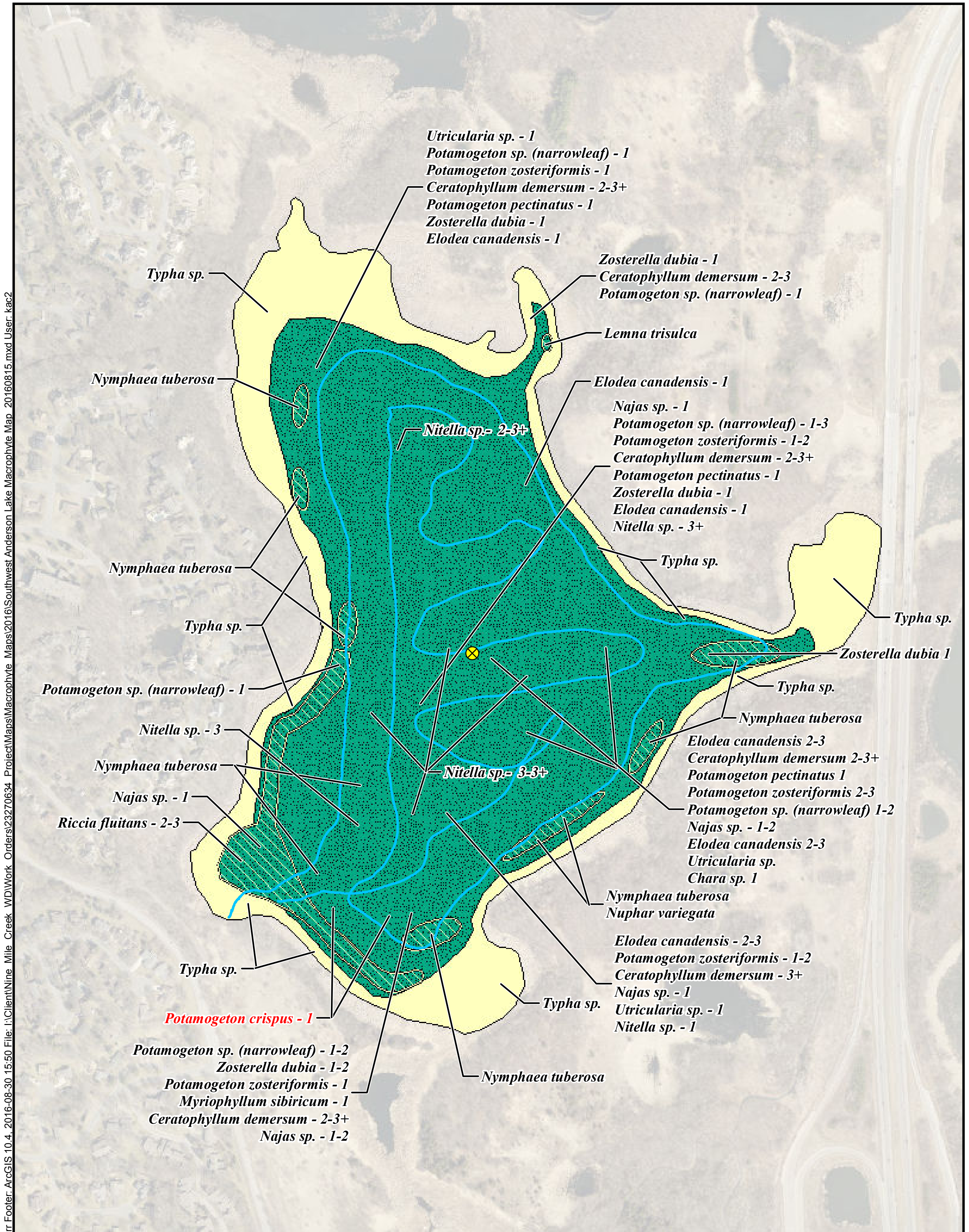
0 100 200 300
Meters

FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- Algal mats present.
- ***Potamogeton crispus*** (Curlyleaf pondweed) is more dense near center of lake.
- *Nymphaea tuberosa* (White waterlily) is sporadic (light) around lake. Areas are marked where more dense.
- *Riccia fluitans*, *Lemna trisulca* and *Lemna minor* present throughout the lake.

BARR

SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY

June 10, 2016
Nine Mile Creek Watershed District




**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Coontail | *Ceratophyllum demersum* |
| Muskgrass | *Chara sp.* |
| Elodea | *Elodea canadensis* |
| Northern milfoil | *Myriophyllum sibiricum* |
| Bushy pondweed | *Najas sp.* |
| Stonewart | *Nitella sp.* |
| **Curlyleaf Pondweed** | ***Potamogeton crispus*** |
| Sago pondweed | *Potamogeton pectinatus* |
| Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| Flatstem pondweed | *Potamogeton zosteriformis* |
| Bladderwort | *Utricularia sp* |
| Water stargrass | *Zosterella dubia* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| Small duckweed | *Lemna minor* |
| Star duckweed | *Lemna trisulca* |
| Yellow waterlily | *Nuphar variegata* |
| White waterlily | *Nymphaea tuberosa* |
| Slender riccia | *Riccia fluitans* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Cattail | *Typha sp.* |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

Water Quality Monitoring Station
Emergent Plants
Floating Leaf Plants
Submerged Aquatic Plants
No Aquatic Vegetation
GPS Survey Location Path

Imagery Source: Hennepin County (2015)

N

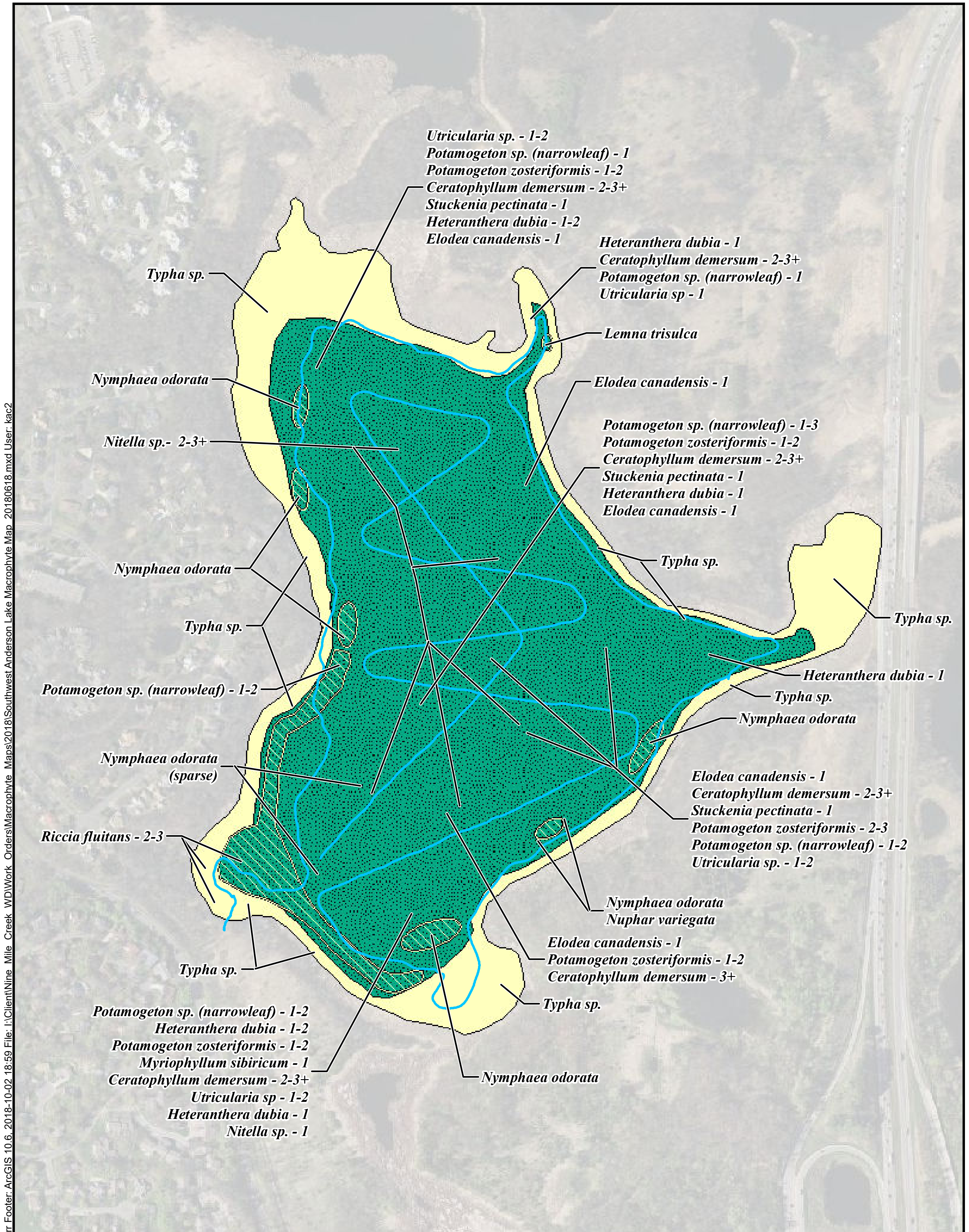
0 500 1,000
Feet
0 150 300
Meters

FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- Algal mats present.
- ***Potamogeton crispus* (Curlyleaf pondweed)** was not sampled or observed except where noted in one location.
-*Nymphaea tuberosa* (White waterlily) is sporadic (light) around lake. Areas are marked where more dense.
- *Riccia fluitans*, *Lemna trisulca* and *Lemna minor* present throughout the lake.
- *Nitella sp.* is dense 3-3+ in deeper waters in center of lake.
- *Ceratophyllum demersum* is dense along the western shoreline.

BARR

SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY

August 15, 2016
Nine Mile Creek Watershed District






**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Coontail | *Ceratophyllum demersum* |
| Elodea | *Elodea canadensis* |
| Northern milfoil | *Myriophyllum sibiricum* |
| Stonewort | *Nitella sp.* |
| Sago pondweed | *Stuckenia pectinata* |
| Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| Flatstem pondweed | *Potamogeton zosteriformis* |
| Bladderwort | *Utricularia sp* |
| Water stargrass | *Heteranthera dubia* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| Small duckweed | *Lemna minor* |
| Forked duckweed | *Lemna trisulca* |
| Yellow waterlily | *Nuphar variegata* |
| White waterlily | *Nymphaea odorata* |
| Slender riccia | *Riccia fluitans* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Cattail | *Typha sp.* |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

Water Quality Monitoring Station
Emergent Plants
Floating Leaf Plants
Submerged Aquatic Plants
No Aquatic Vegetation
GPS Survey Location Path

Imagery Source: Twin Cities 2016 (MnGeo WMS)

N

0 500 1,000
Feet

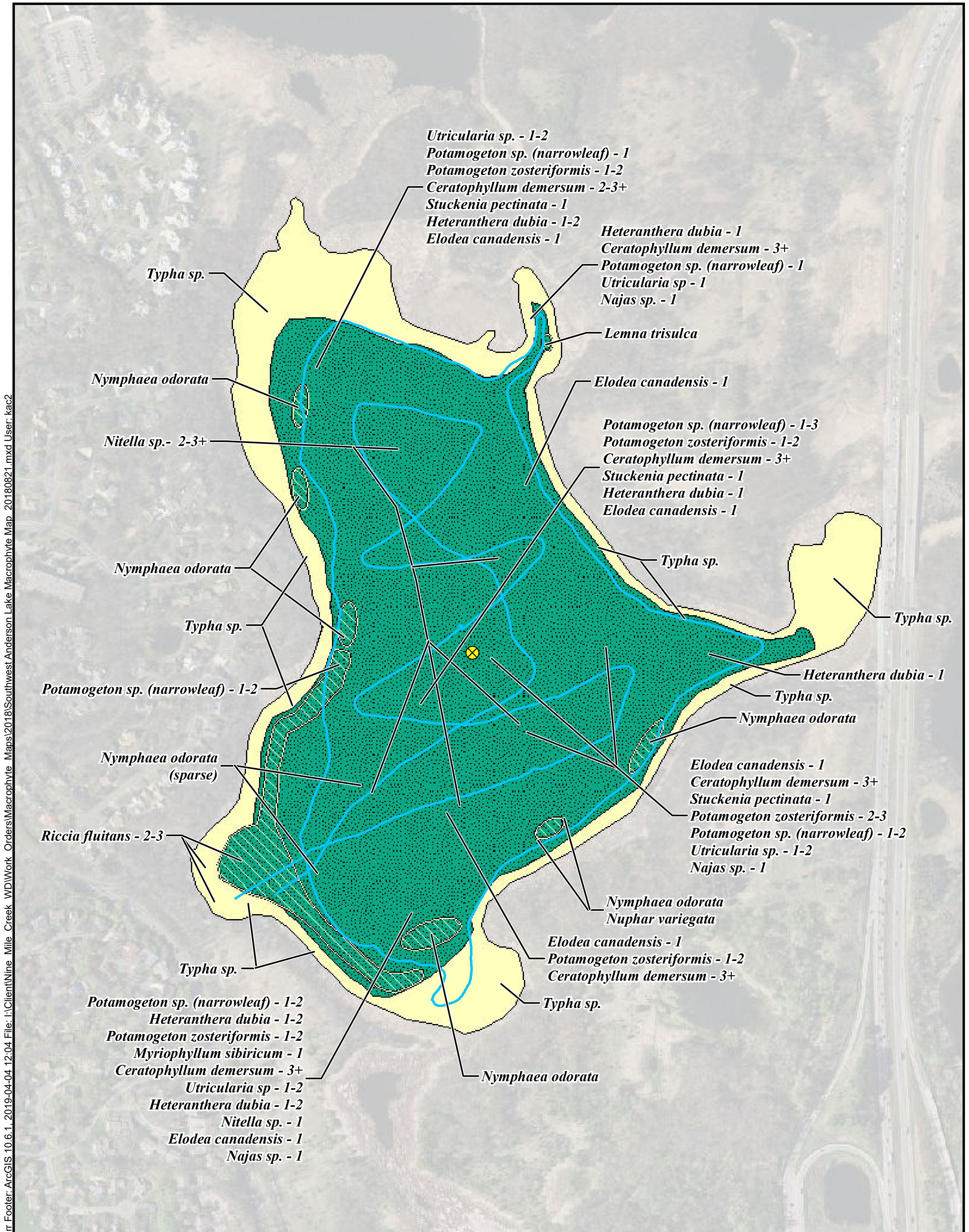
0 150 300
Meters

FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- Algal mats present.
-*Nymphaea odorata* (White waterlily) is sporadic (light) around lake. Areas are marked where more dense.
- *Riccia fluitans*, *Lemna trisulca* and *Lemna minor* present throughout the lake.

BARR

SOUTHWEST ANDERSON LAKE
MACROPHYTE SURVEY

June 18, 2018
Nine Mile Creek Watershed District






**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Coontail | *Ceratophyllum demersum* |
| Elodea | *Elodea canadensis* |
| Water stargrass | *Heteranthera dubia* |
| Northern milfoil | *Myriophyllum sibiricum* |
| Bushy pondweed and naiads | *Najas sp.* |
| Stonewort | *Nitella sp.* |
| Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| Flatstem pondweed | *Potamogeton zosteriformis* |
| Sago pondweed | *Stuckenia pectinata* |
| Bladderwort | *Utricularia sp* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| Small duckweed | *Lemna minor* |
| Forked duckweed | *Lemna trisulca* |
| Yellow waterlily | *Nuphar variegata* |
| White waterlily | *Nymphaea odorata* |
| Slender riccia | *Riccia fluitans* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Cattail | *Typha sp.* |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

- Water Quality Monitoring Station
- Emergent Plants
- Floating Leaf Plants
- Submerged Aquatic Plants
- No Aquatic Vegetation
- GPS Survey Location Path

Imagery Source: Twin Cities 2016 (MnGeo WMS)

N

0 500 1,000
Feet

0 150 300
Meters

BARR

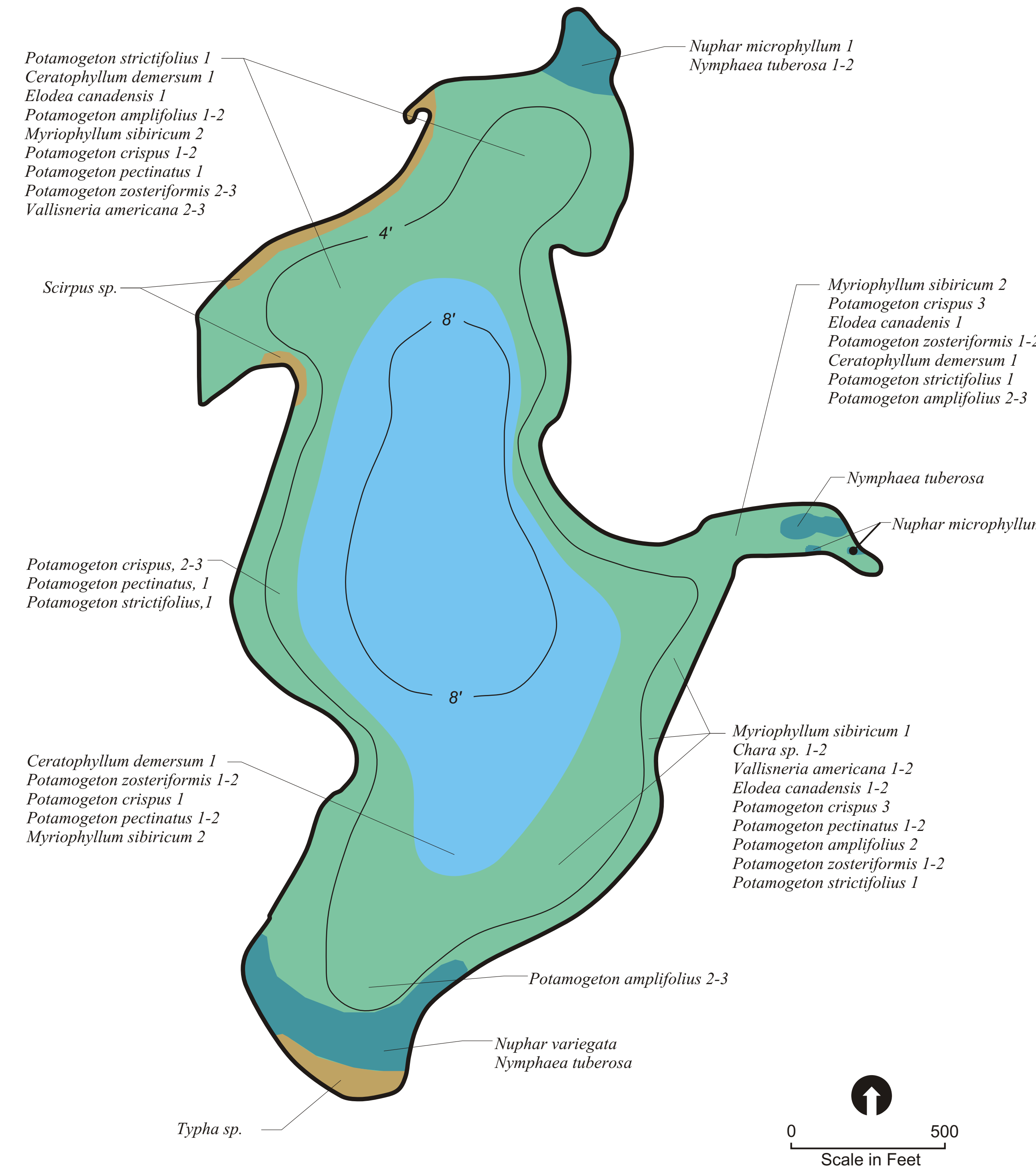
FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- Algal mats present.
- *Nymphaea odorata* (White waterlily) is sporadic (light) around lake. Areas are marked where more dense.
- *Riccia fluitans*, *Lemna trisulca* and *Lemna minor* present throughout the lake.

# SOUTHWEST ANDERSON LAKE MACROPHYTE SURVEY

August 21, 2018
Nine Mile Creek Watershed District

- No Macrophytes Found in Water >7.0'.
- Macrophyte Densities Estimated as Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Coontail | *Ceratophyllum demersum* |
| | Stiff pondweed | *Potamogeton strictifolius* |
| | Muskgrass | *Chara sp.* |
| | Wild celery | *Vallisneria americana* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Little yellow waterlily | *Nuphar microphyllum* |
| | Yellow waterlily | *Nuphar variegata* |
| Emergent: | Cattail | *Typha sp.* |
| | Bulrush | *Scirpus sp.* |
| No Aquatic Vegetation Found: | | |

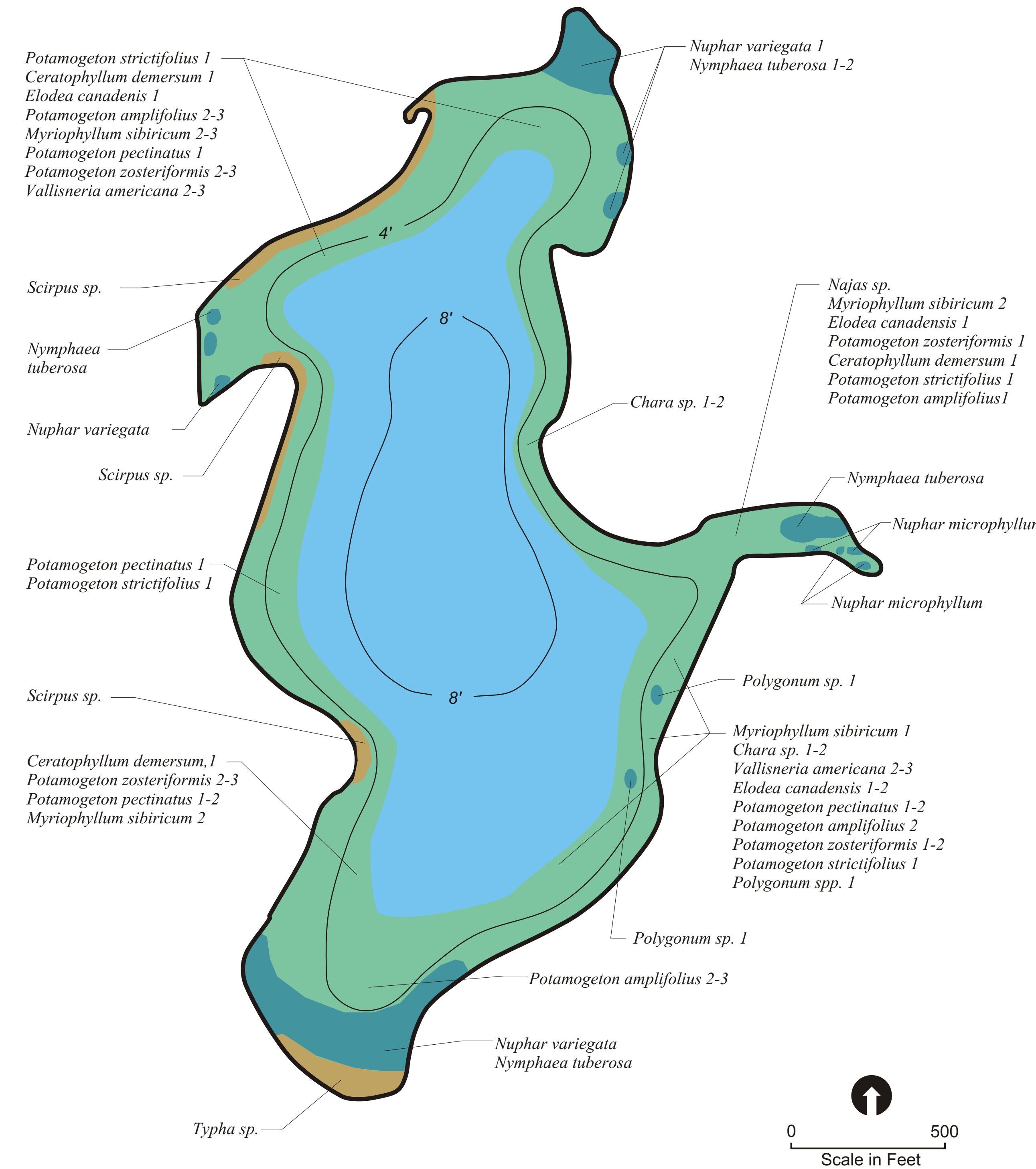



SOUTHEAST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 20, 1996

P:\23\27\003\LAKEMACROPHYTEMAPS\SOUTHEASTANDERSON\1996\JUNE1996.CDR RLG 06-21-04

- No Macrophytes Found in Water >4.0'-5.0'.
- Macrophyte Densities Estimated as Follows: 1 = light; 2 = moderate; 3 = heavy
- *Lythrum salicaria* (Purple loosestrife) Observed Along Shoreline.
- Spoardic *Saggitaria sp.* (Arrowhead) Also Observed Along Areas of Shoreline.

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Coontail | *Ceratophyllum demersum* |
| | Stiff pondweed | *Potamogeton strictifolius* |
| | Muskgrass | *Chara sp.* |
| | Wild celery | *Vallisneria americana* |
| | Bushy pondweed and naiad | *Najas sp.* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Little yellow waterlily | *Nuphar microphyllum* |
| | Yellow waterlily | *Nuphar variegata* |
| | Water smartweed | *Polygonum sp.* |
| Emergent: | Cattail | *Typha sp.* |
| | Bulrush | *Scirpus sp.* |
| No Aquatic Vegetation Found: | | |



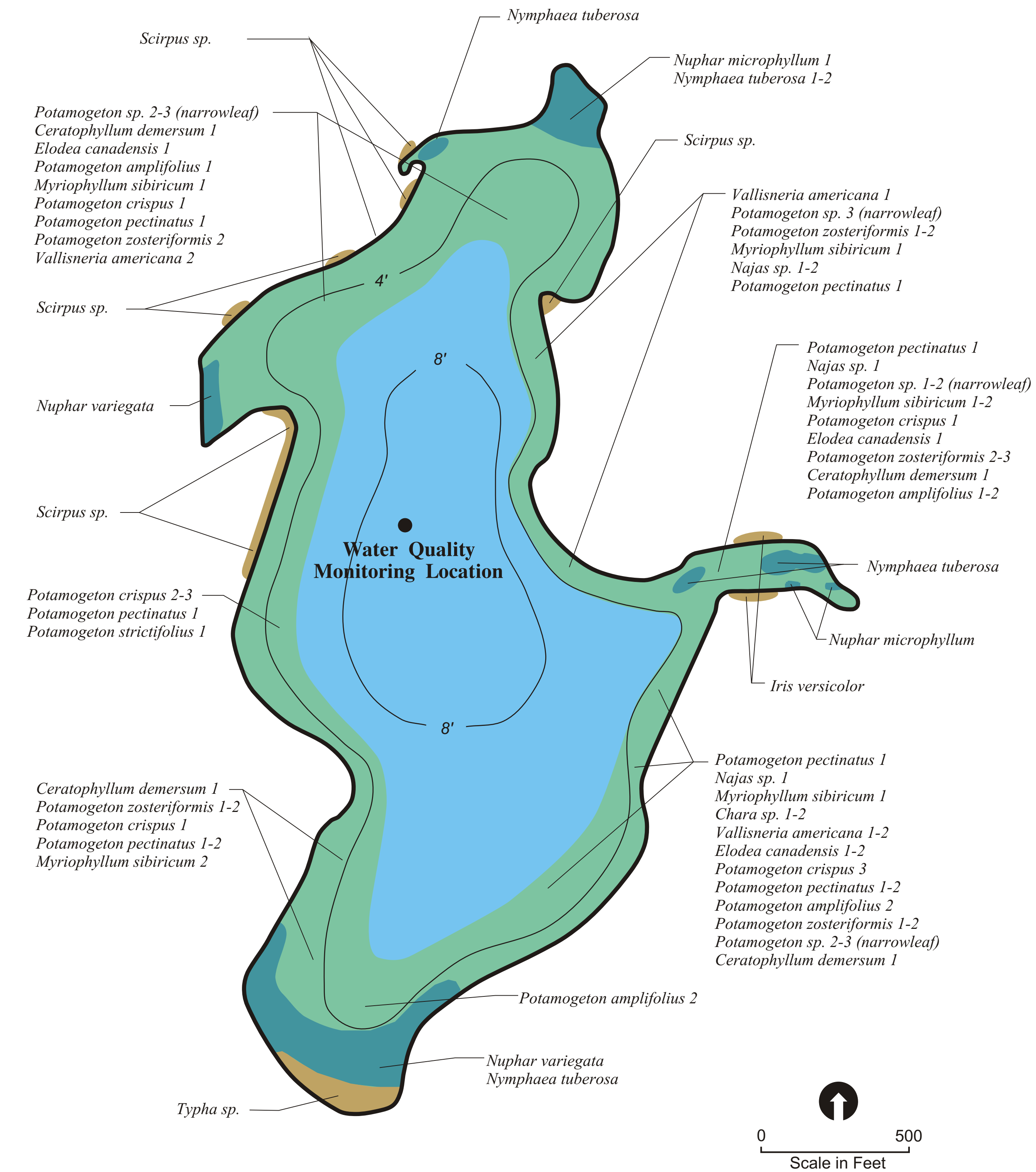

SOUTHEAST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 21, 1996

P:\23\27\003\LAKEMACROPHYTEMAPS\SOUTHEASTANDERSON\1996\AUGUST1996.CDR RLG 06-21-04

# SOUTHEAST ANDERSON LAKE MACROPHYTE SURVEY JUNE 12, 2000

- No Macrophytes Found in Water >5.0'-6.0'.
- Macrophyte Densities Estimated as Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Coontail | *Ceratophyllum demersum* |
| | Stiff pondweed | *Potamogeton strictifolius* |
| | Muskgrass | *Chara sp.* |
| | Wild celery | *Vallisneria americana* |
| | Bushy pondweed and naiad | *Najas sp.* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Little yellow waterlily | *Nuphar microphyllum* |
| | Yellow waterlily | *Nuphar variegata* |
| Emergent: | Cattail | *Typha sp.* |
| | Bulrush | *Scirpus sp.* |
| | Blue flag iris | *Iris vericolor* |
| No Aquatic Vegetation Found: | | |

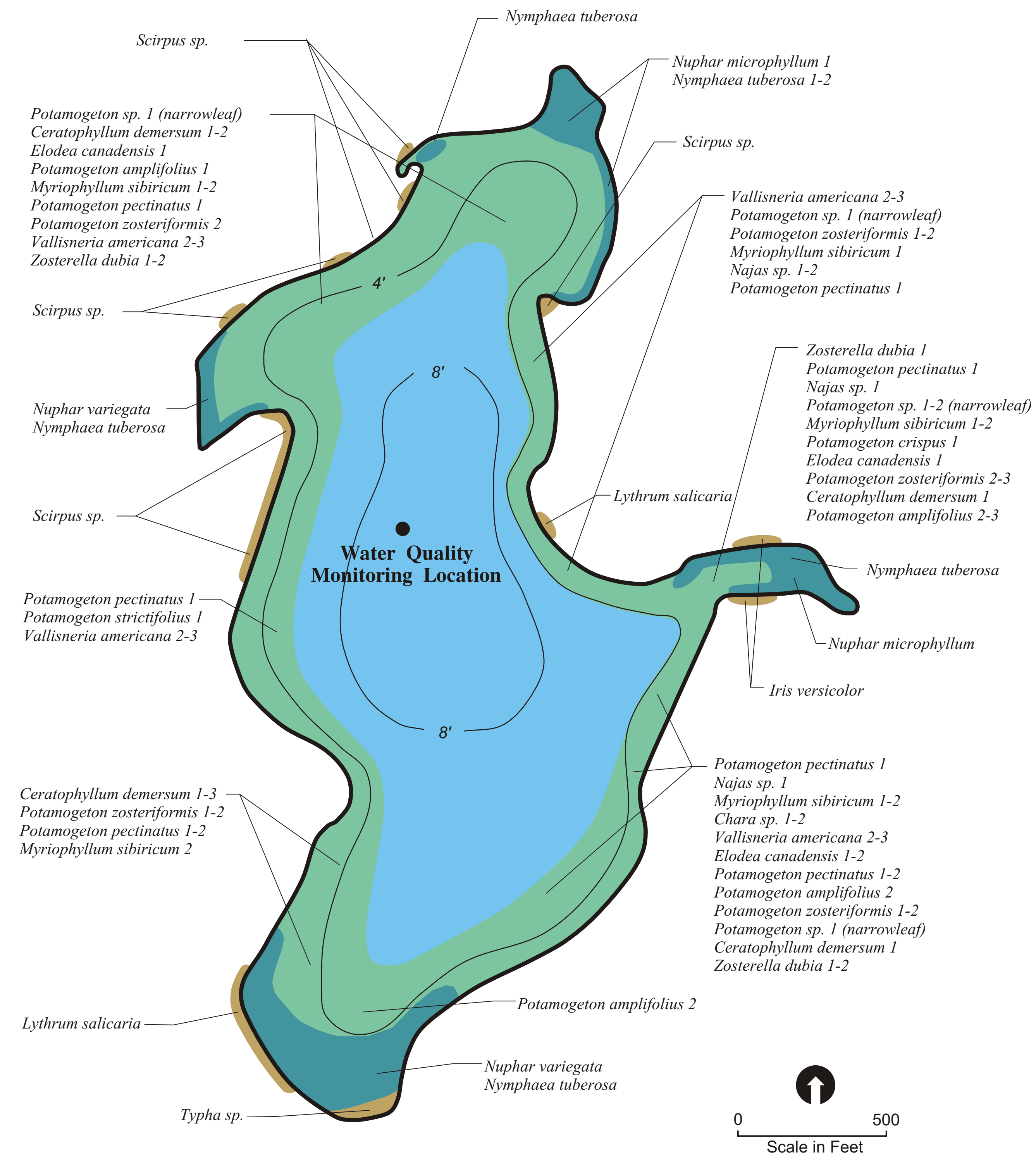



SOUTHEAST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 12, 2000

P:\23\27\003\LAKEMACROPHYTEMAPS\SOUTHEASTANDERSON\2000\JUNE2000.CDR RLG 06-21-04

- No Macrophytes Found in Water >5.0'-6.0'.
- Macrophyte Densities Estimated as Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Elodea | *Elodea canadensis* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Coontail | *Ceratophyllum demersum* |
| | Stiff pondweed | *Potamogeton strictifolius* |
| | Muskgrass | *Chara sp.* |
| | Water celery | *Vallisneria americana* |
| | Water stargrass | *Zosterella dubia* |
| | Bushy pondweed and naiad | *Najas sp.* |
| Floating Leaf: | White waterlily | *Nymphaea tuberosa* |
| | Little yellow waterlily | *Nuphar microphyllum* |
| | Yellow waterlily | *Nuphar variegata* |
| Emergent: | Cattail | *Typha sp.* |
| | Bulrush | *Scirpus sp.* |
| | Purple loosestrife | *Lythrum salicaria* |
| | Blue flag iris | *Iris vericolor* |
| No Aquatic Vegetation Found: | | |

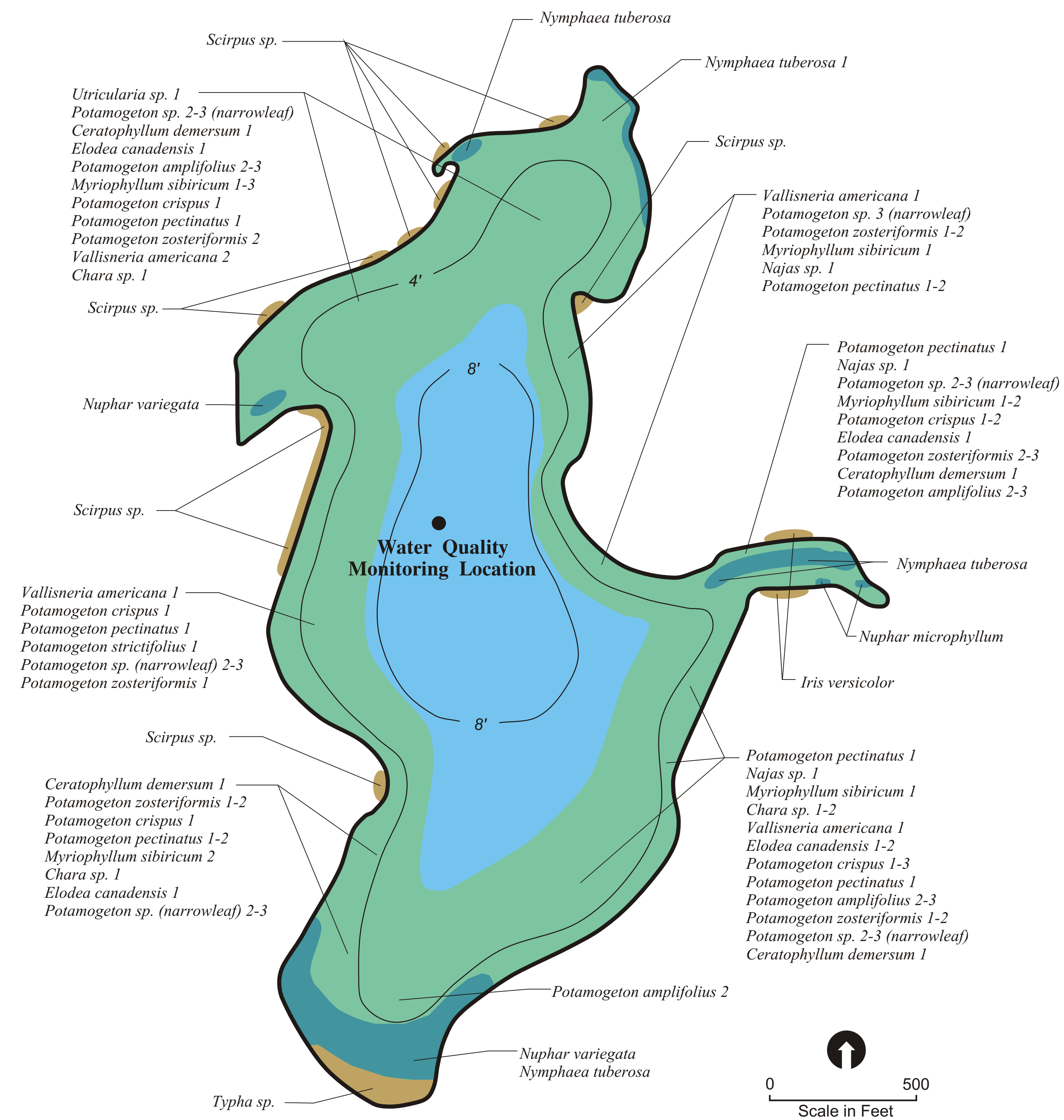



# SOUTHEAST ANDERSON LAKE MACROPHYTE SURVEY AUGUST 28, 2000

P:\23\27\003\LAKEMACROPHYTEMAPS\SOUTHEASTANDERSON\2000AUGUST2000.CDR RLG 06-21-04

- No Macrophytes Found in Water >7.0'-8.0'.
- Macrophyte Densities Estimated as Follows: 1 = light; 2 = moderate; 3 = heavy

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Stiff pondweed | *Potamogeton strictifolius* |
| | Curlyleaf pondweed | *Potamogeton crispus* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Wild celery | *Vallisneria americana* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Bushy pondweed and naiads | *Najas sp.* |
| | Bladderwort | *Utricularia sp.* |
| Floating Leaf: | White water lily | *Nymphaea tuberosa* |
| | Yellow water lily | *Nuphar variegata* |
| | Little yellow water lily | *Nuphar microphyllum* |
| Emergent: | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Blue flag iris | *Iris versicolor* |
| No Aquatic Vegetation Found: | | |




SOUTHEAST ANDERSON LAKE
MACROPHYTE SURVEY
JUNE 13, 2001

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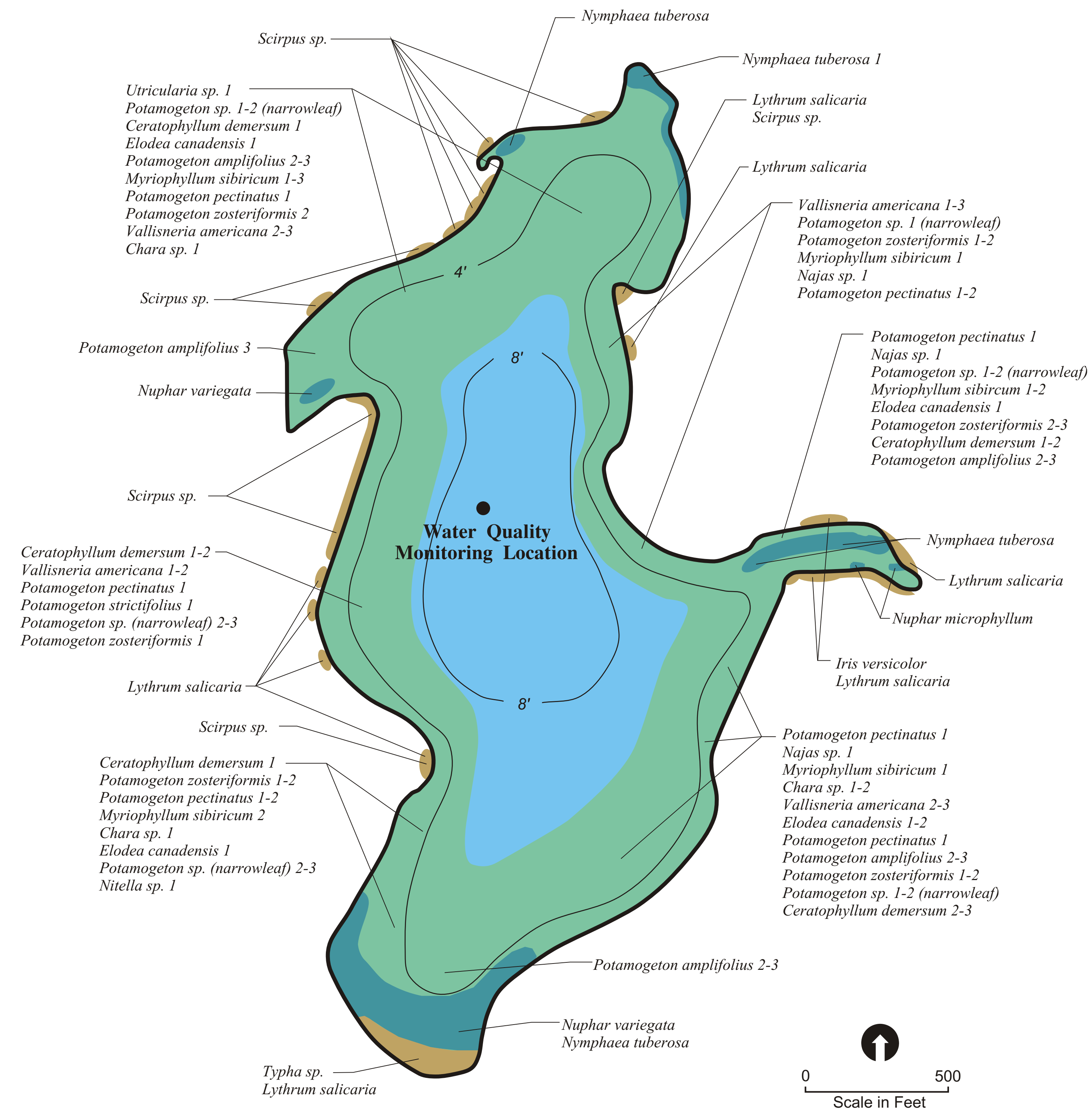
- No Macrophytes Found in Water >7.0'-8.0'.
- Macrophyte Densities Estimated as Follows: 1 = light; 2 = moderate; 3 = heavy
- *Polygonum sp., Sagittaria sp.* Sporadic Along Shoreline of Entire Lake.

| | Common Name | Scientific Name |
|---|---|---|
| Submerged Aquatic Plants: | Narrowleaf pondweed | *Potamogeton sp. (narrowleaf)* |
| | Stiff pondweed | *Potamogeton strictifolius* |
| | Flatstem pondweed | *Potamogeton zosteriformis* |
| | Large-leaf pondweed | *Potamogeton amplifolius* |
| | Sago pondweed | *Potamogeton pectinatus* |
| | Northern watermilfoil | *Myriophyllum sibiricum* |
| | Coontail | *Ceratophyllum demersum* |
| | Water celery | *Vallisneria americana* |
| | Elodea | *Elodea canadensis* |
| | Muskgrass | *Chara sp.* |
| | Bushy pondweed and naiads | *Najas sp.* |
| | Bladderwort | *Utricularia sp.* |
| | Stonewort | *Nitella sp.* |
| Floating Leaf: | White water lily | *Nymphaea tuberosa* |
| | Yellow water lily | *Nuphar variegata* |
| | Little yellow water lily | *Nuphar microphyllum* |
| Emergent: | Bulrush | *Scirpus sp.* |
| | Cattail | *Typha sp.* |
| | Purple loosestrife | *Lythrum salicaria* |
| | Blue flag iris | *Iris versicolor* |
| No Aquatic Vegetation Found: | | |




SOUTHEAST ANDERSON LAKE
MACROPHYTE SURVEY
AUGUST 23, 2001

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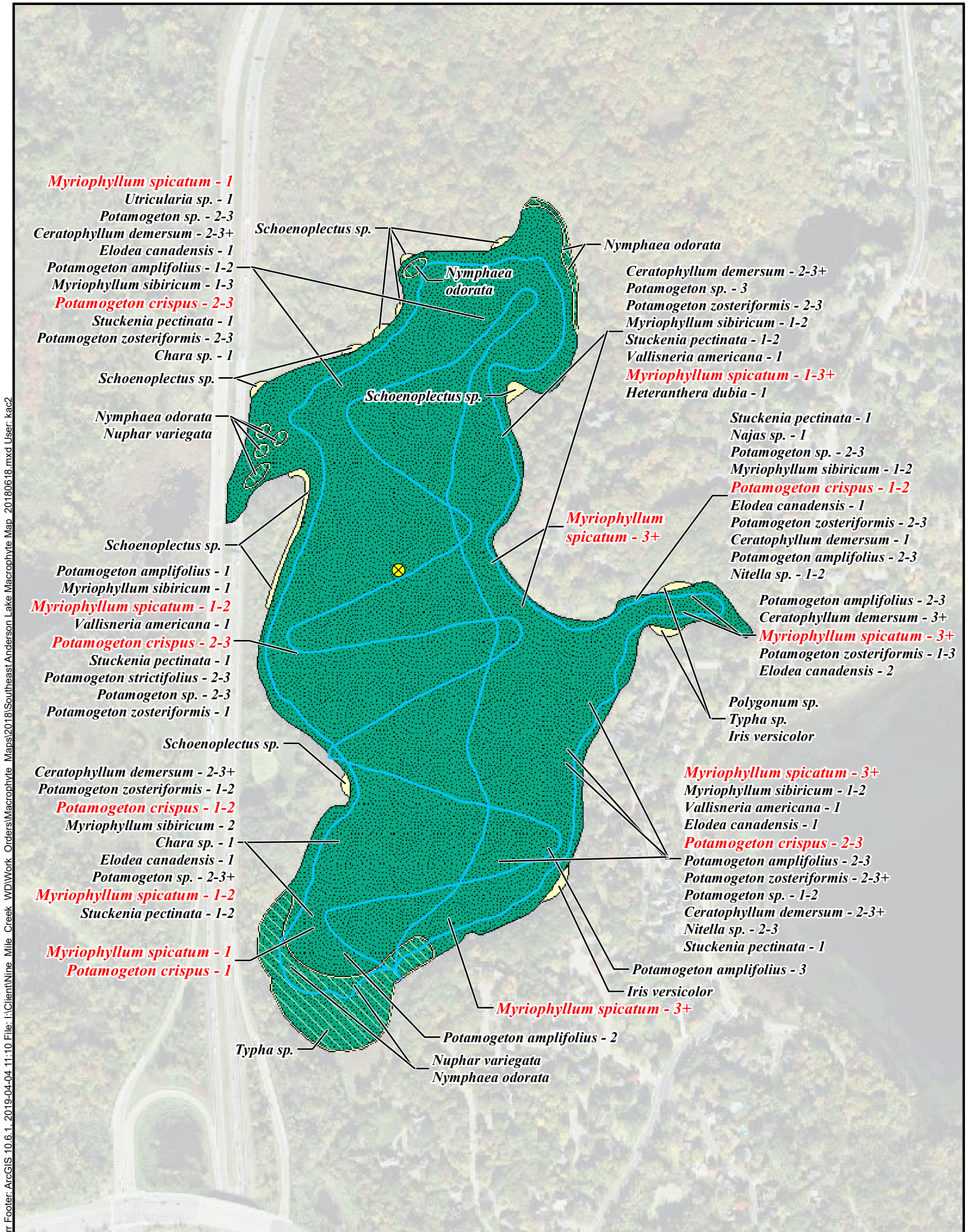





**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Bladderwort | *Utricularia sp.* |
| Bushy pondweed and naiads | *Najas sp.* |
| Canada waterweed | *Elodea canadensis* |
| Coontail | *Ceratophyllum demersum* |
| **Curly-leaf pondweed** | ***Potamogeton crispus*** |
| **Eurasian Watermilfoil** | ***Myriophyllum spicatum*** |
| Flat-stem pondweed | *Potamogeton zosteriformis* |
| Large-leaf pondweed | *Potamogeton amplifolius* |
| Muskgrass | *Chara sp.* |
| Narrow-leaf pondweed | *Potamogeton sp. (narrowleaf)* |
| Narrow-leaf pondweed | *Potamogeton strictifolius* |
| Northern milfoil | *Myriophyllum sibiricum* |
| Sago pondweed | *Stuckenia pectinata* |
| Stonewort | *Nitella sp.* |
| Water celery | *Vallisneria americana* |
| Water stargrass | *Heteranthera dubia* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| White waterlily | *Nymphaea odorata* |
| Yellow waterlily | *Nuphar variegata* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Water smartweed | *Polygonum sp.* |
| Bulrush | *Schoenoplectus sp.* |
| Cattail | *Typha sp.* |
| Blue flag iris | *Iris versicolor* |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

Water Quality Monitoring Station
Emergent Plants
Floating Leaf Plants
Submerged Aquatic Plants
No Aquatic Vegetation
GPS Survey Location Path

Imagery Source: Twin Cities 2016 (MnGeo WMS)

N

0 500 1,000
Feet

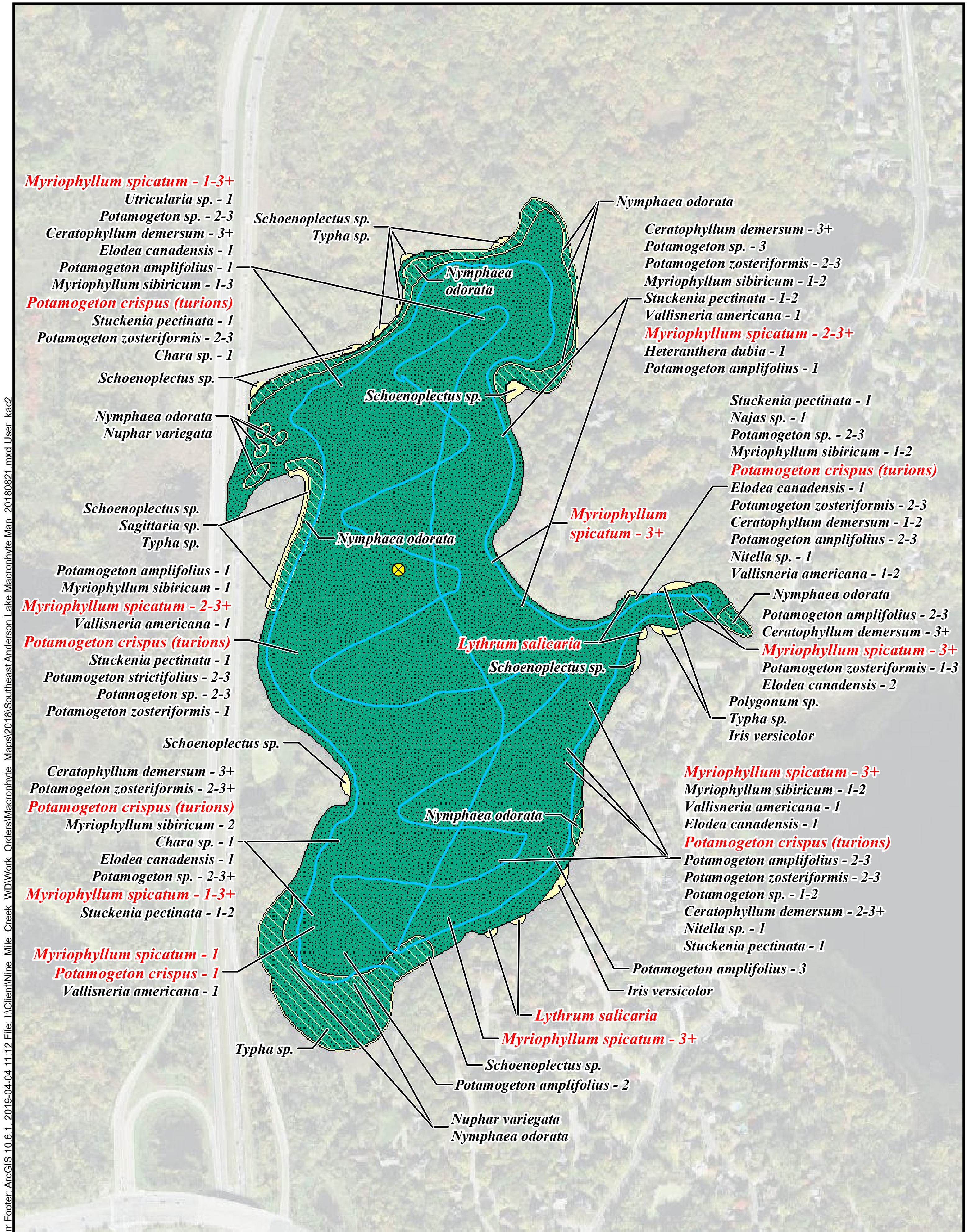
0 150 300
Meters

BARR

FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
1=light; 2=moderate; 3=heavy

# SOUTHEAST ANDERSON LAKE MACROPHYTE SURVEY

June 18, 2018
Nine Mile Creek Watershed District






**Submerged Aquatic Plants**

| Common Name | Scientific Name |
|---|---|
| Bladderwort | *Utricularia sp.* |
| Bushy pondweed and naiads | *Najas sp.* |
| Canada waterweed | *Elodea canadensis* |
| Coontail | *Ceratophyllum demersum* |
| **Curly-leaf pondweed** | ***Potamogeton crispus*** |
| **Eurasian Watermilfoil** | ***Myriophyllum spicatum*** |
| Flat-stem pondweed | *Potamogeton zosteriformis* |
| Large-leaf pondweed | *Potamogeton amplifolius* |
| Muskgrass | *Chara sp.* |
| Narrow-leaf pondweed | *Potamogeton sp. (narrowleaf)* |
| Narrow-leaf pondweed | *Potamogeton strictifolius* |
| Northern milfoil | *Myriophyllum sibiricum* |
| Sago pondweed | *Stuckenia pectinata* |
| Stonewort | *Nitella sp.* |
| Water celery | *Vallisneria americana* |
| Water stargrass | *Heteranthera dubia* |

**Floating Leaf Plants**

| Common Name | Scientific Name |
|---|---|
| White waterlily | *Nymphaea odorata* |
| Yellow waterlily | *Nuphar variegata* |

**Emergent Plants**

| Common Name | Scientific Name |
|---|---|
| Water smartweed | *Polygonum sp.* |
| Bulrush | *Schoenoplectus sp.* |
| Cattail | *Typha sp.* |
| Blue flag iris | *Iris versicolor* |
| Arrowhead | *Sagittaria sp* |
| **Purple loosestrife** | ***Lythrum salicaria*** |

*Note: Bold red name indicates extremely aggressive/invasive introduced species.

Water Quality Monitoring Station
Emergent Plants
Floating Leaf Plants
Submerged Aquatic Plants
No Aquatic Vegetation
GPS Survey Location Path

Imagery Source: Twin Cities 2016 (MnGeo WMS)

N

0 500 1,000
Feet

0 150 300
Meters

FIELD NOTES:
- Macrophytes observed throughout the entire waterbody.
- Macrophyte densities estimated as follows:
  1=light; 2=moderate; 3=heavy
- Abundant ***Potamogeton crispus*** turions observed throughout lake.
- Algal mats present.

BARR

# SOUTHEAST ANDERSON LAKE MACROPHYTE SURVEY

August 21, 2018
Nine Mile Creek Watershed District

# Appendix B

## Fisheries Report

2/28/2025

# NMCWD: 2024 Three Lakes Assessment

## Common Carp and Goldfish Survey Results: Adelman Pond, Mirror Lake, and Anderson Lakes

Southeast Anderson Lake, Hennepin County, Minnesota


Mary Newman
SENIOR ENVIRONMENTAL SCIENTIST, WSB

Phil Carson
SENIOR ENVIRONMENTAL SCIENTIST, WSB

Kourtney Craft
ENVIRONMENTAL SCIENTIST, WSB

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# SUMMARY

Adelman Pond, Mirror Lake, and Anderson Lakes (Northwest, Southwest, and Southeast) are located within the Nine Mile Creek Watershed District Boundary near Edina and Bloomington and the surrounding area, Hennepin County, Minnesota. A project workplan was developed with collaboration between NMCWD staff and WSB to develop a further understanding of the carp and/or goldfish populations in these basins and to gain a better understanding of the overall fish assemblage. Electrofishing surveys were completed to either determine the presence or absence of carp and/or goldfish (Adelman Pond, Anderson Lakes) or to determine a catch per unit effort (CPUE) estimate of the population size and biomass of goldfish (Mirror Lake).

Goldfish and carp were found in Adelman Pond, goldfish were found and a population estimate was developed for Mirror Lake, and no carp or goldfish were found in Anderson Lakes. In total, 136 goldfish were marked with uniquely numbered Passive Integrated Transponder (PIT) tags in Adelman Pond that can be used in subsequent years to track the population and movement. In Mirror Lake, 50 goldfish were collected to complete an aging study of the population there. These activities and results are described in this document.

## BACKGROUND AND OBJECTIVES

Goldfish are classified as a regulated invasive species in Minnesota, meaning introduction into the wild is prohibited. They are closely related to common carp and are assumed to have negative impacts to water quality in similar ways. Feeding behavior of carp is known to uproot native aquatic vegetation and suspend sediments into the water column, leading to a decline in water quality and ecological integrity. The smaller body size of an adult goldfish compared to that of an adult carp may limit the depth and subsequent impact of goldfish feeding habits, but this has not been studied.

Due to the similarities between common carp and wild goldfish, we assume that goldfish impact aquatic ecosystems in similar ways, however, there are no studies that provide a method to quantify these impacts nor estimate abundance. Therefore, we have applied existing established methods for estimating carp abundance and impacts to goldfish as part of this report. A critical threshold to where carp are thought to be damaging to an ecosystem is 89.9 pounds per acre. A similar threshold for goldfish has not been established.

The suspension of sediments and reduction in rooted submergent aquatic vegetation caused by carp leads to increased turbidity and increases the internal load of phosphorous, a primary nutrient in lake ecosystems and one of the primary pollutants in midwestern waters. Excess phosphorous leads to increased algal production, reduced water clarity, and inhibits waterbodies from meeting numerical and narrative state water quality standards.

The Nine Mile Creek Watershed District have incorporated fish survey and management on a number of waterbodies within the district in an effort to improve water quality. Surveys of the lakes in this study are designed to focus management efforts where carp and or goldfish populations may be impacting lake water quality. Lakes in this study include Adelman Pond, Mirror Lake, and Anderson Lakes (Northwest, Southwest, Southeast).

Adelman Pond is not listed or impaired for excess nutrients. However, it is connected upstream to Penn Lake which is on the Minnesota Pollution Control Agency (MPCA)'s list of impaired waters for excess nutrients having an impact on aquatic recreation. Previous fish surveys in Penn Lake have confirmed the presence of carp and goldfish, though the current extent of the population is unknown. Adelman Pond is suspected to serve as a nursery site for carp and/or goldfish that migrate between it and Penn Lake. Electrofishing efforts aim to determine the presence or absence of carp, goldfish, and young carp and goldfish in Adelman Pond, and tagging efforts are designed to track the population and movement of these fish in subsequent years if desired.

Mirror Lake is not listed on the MPCA's list of impaired waters. The watershed district water quality results indicate that the basin is not meeting state water quality standards. No previous fish surveys had been completed on Mirror Lake, however, observations of goldfish have been reported.

Anderson Lakes are not listed on the MPCA's list of impaired waters. Previous fish surveys have been completed on Southeast Anderson Lakes but not on Northwest Anderson or Southwest Anderson. Fish surveys were completed by the MN DNR in 1978, 1983, and 1993. The most recent survey did not sample carp and/or goldfish but reports that catch rates of black bullhead are above average for this lake type. Other fish species sampled were black crappie – low, and green sunfish – high.

Fish stocking has occurred in Northwest Anderson Lake by local groups, the last event in 2016. At this time, black crappie, bluegill sunfish, largemouth bass, and yellow perch were stocked. None of these fish species were sampled in the 2024 survey, indicating low survival or reproduction of those fish species. Fish stocking has also occurred in Southeast Anderson Lake by local groups through 2016 and most recently by the MN DNR. The MN DNR stocked walleye fry in the basin in both 2023 and 2024. Fish species that were stocked historically were not sampled in the 2024 surveys.

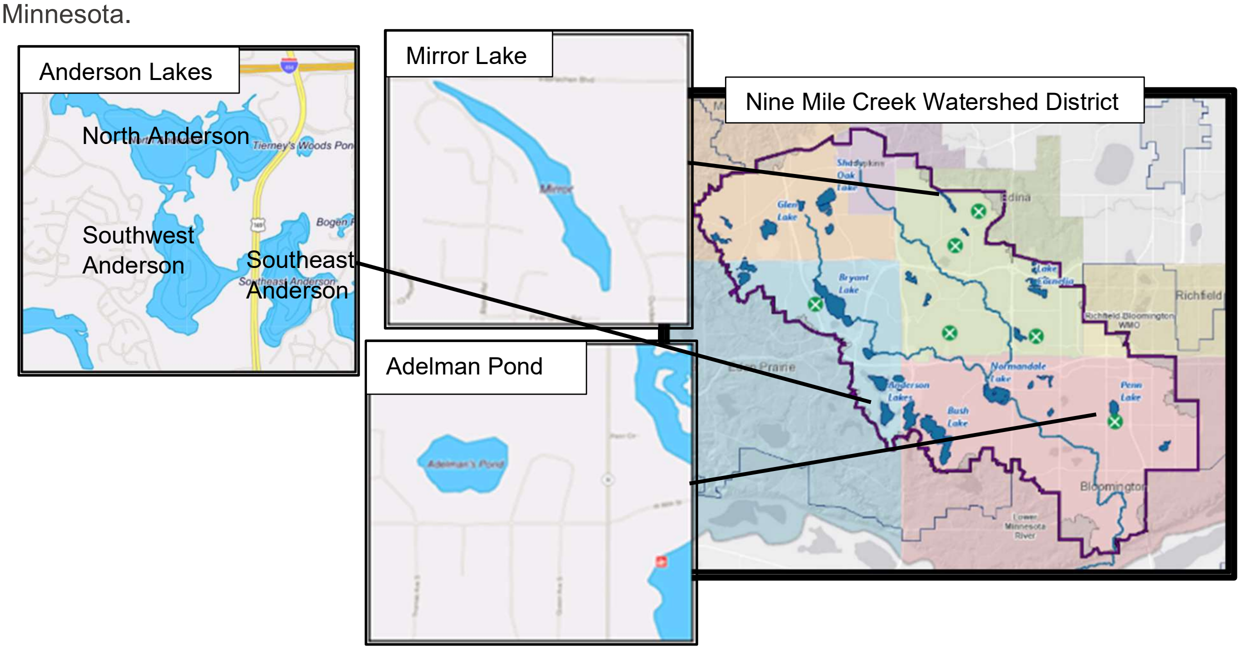
This project had three (3) primary objectives. These included:

1) Determine presence/absence of carp and or goldfish in Adelman Pond.
2) Develop abundance estimate for goldfish in Mirror Lake. Gather information on the size and age structure in Mirror Lake.
3) Determine presence/absence of carp and or goldfish in Anderson Lakes. Determine assemblage of fish species in Anderson Lakes.

Table 1 – Lakes in project area.

| LAKE NAME | Basin | DOW ID | Total Acreage | Littoral Acres |
|---|---|---|---|---|
| Adelman's Pond | | 27105000 | 5.2 | 5.2 |
| Mirror Lake | | 27005500 | 21.29 | 21.29 |
| Anderson Lakes | North | 27006201 | 98.5 | 98.5 |
| | Southwest | 27006203 | 55.89 | 55.89 |
| | Southeast | 27006202 | 82.04 | 82.04 |

Figure 1. Project Area: Mirror Lake, Adelman Pond, Anderson Lakes, Edina, Hennepin County, Minnesota.



# METHOD and RESULTS

## Adelman Pond

### Boat Electrofishing

To determine if goldfish or carp were present in Adelman Pond, a boat electrofishing was conducted on two dates in 2024. These dates were September 4, and October 18, 2024. Carp and goldfish were captured on each survey date, confirming the presence of these species in Adelman Pond. All fish species were noted in the October survey and reveals that young of the year carp, green sunfish, black bullhead, and minnows were also present in the basin.

Catch rates in the September 4 survey were consistent around the cattail fringe of Adelman Pond (Table 2). Catch rates were more variable in the October 18th survey as goldfish and carp were found to be aggregated in the middle of the pond in the October 18th survey, this was discovered during the third and final transect.

Table 2 – Adelman Pond boat electrofishing results.

| DATE | Transect | ELECTROFISHING TIME (MINUTES) | GOLDFISH CAUGHT | CARP CAUGHT | HYBRID | YOY CARP |
|---|---|---|---|---|---|---|
| *9/4/2024* | *1* | *10* | *31* | *11* | *0* | *0* |
| *9/4/2024* | *2* | *10* | *70* | *8* | *0* | *0* |
| *9/4/2024* | *3* | *10* | *31* | *9* | *1* | *0* |
| *10/18/2024* | *1* | *11* | *0* | *0* | *0* | *0* |
| *10/18/2024* | *2* | *10* | *0* | *2* | *0* | *0* |
| *10/18/2024* | *3* | *10* | *43* | *1* | *0* | *9* |

### PIT tag carp and/or goldfish

Goldfish and/or carp that were sampled during the electrofishing surveys were to be implanted with a Passive Integrated Transponder (PIT) tag. These tags can be used to run a mark-recapture estimate of the population if a largescale capture event is pursued and can provide a way to track movement of these fish using recapture data and/or using a stationary antenna designed to detect PIT tags as they move through an area.

In total, 136 carp and goldfish were tagged with uniquely numbered PIT tags on September 4, 2024. Of these 108 were goldfish, 27 were carp, and 1 was a hybrid carp/goldfish. All goldfish, carp, and hybrid carp/goldfish were checked for tags in the October 18th survey and none were recaptured. A record of PIT tagged fish collected in this survey period is included in Appendix A.

Figure 2. Goldfish sampled in Adelman Pond, September 4, 2024.

## Mirror Lake

### Boat Electrofishing - CPUE Survey

To begin estimating the population and biomass of goldfish in Mirror Lake, a boat electrofishing survey was completed. To complete the survey, Mirror Lake was visited on three dates in 2024 and the littoral zone was sampled. Time spent electrofishing, number of goldfish, and lengths and weights were recorded. Electrofishing equipment is suspected to not have been performing optimally on the August 7th electrofishing survey date, therefore this data is not being used to calculate the CPUE for Mirror Lake.

A CPUE model of estimation that was developed for carp is being used in this study to describe the population of goldfish in the basin. The Mirror Lake goldfish biomass estimate is 21.7 +/- 8.2 pounds per acre. At 21.7 lbs/acre and an average weight of 0.15 pounds, this equates to a population of over 4,600 individual goldfish in Mirror Lake (Table 3).

Table 3 – 2024 goldfish population summary, Mirror Lake. August 7th survey data is not being used in the Mirror Lake CPUE calculation.

| Mean Length (in) | Mean Weight (lb) | Lake Area (acre) | Population Estimate | SE | Biomass (lbs/acre) | SE |
|---|---|---|---|---|---|---|
| *5.5* | *0.10* | *21.29* | *4,626* | *1,753* | *21.7* | *8.2* |

During the August 7 boat electrofishing survey, all fish were collected and a subset measured for length. In total, three species were sampled including goldfish, black bullhead, and fathead minnows (Table 4). Only carp or goldfish encountered on subsequent surveys were collected and no observations of other fish species were made in the August 26 or September 3 survey.

Table 4 – Mirror Lake boat electrofishing results. All fish species were sampled via electrofishing on August 7, 2024.

| Date (2024) | Transect | Time (Minutes) | Species and number sampled | | |
|---|---|---|---|---|---|
| | | | Goldfish | Black Bullhead | Fathead Minnow |
| *August 7* | *1* | *20* | *5* | *14* | *16* |
| *August 7* | *2* | *20* | *4* | *9* | *4* |
| *August 7* | *3* | *20* | *2* | *11* | *n/a* |
| August 26 | *1* | *15* | *34* | *n/a* | *n/a* |
| August 26 | *2* | *20* | *38* | *n/a* | *n/a* |
| August 26 | *3* | *20* | *49* | *n/a* | *n/a* |
| August 26 | *4* | *20* | *76* | *n/a* | *n/a* |
| September 3 | *1* | *20* | *29* | *n/a* | *n/a* |
| September 3 | *2* | *20* | *22* | *n/a* | *n/a* |

| | | | | | |
|---|---|---|---|---|---|
| September 3 | *3* | *20* | *19* | *n/a* | *n/a* |

### Mirror Lake Goldfish Aging Analysis

Aging analysis is coupled with a histogram of lengths collected in this project period to begin describing the age classes present in the lake. Understanding age classes can help to determine how often recruitment of young carp or goldfish occurs and can be used to guide management actions.

Goldfish that were collected during the electrofishing sampling events were euthanized and brought to WSB laboratory to process for otolith extraction. Otoliths are ear bones found within the skull cavity and are commonly used as a fish aging structure. Growth rings (annuli) are visible under a microscope when otoliths have been processed and mounted on a slide. These annuli are similar to growth rings that can be found within a tree trunk.

Otoliths were sectioned and annuli counted under a microscope by two independent readers in order to reduce bias. Any otoliths for which there was a discrepancy in age between the two readers were analyzed a third time in a “concert read.” This consisted of the two readers aging the otolith together and coming to agreement on the number of annuli present. Agreed upon age from the “concert read” was considered the final age estimate and was used in analysis.

Of the 50 goldfish analyzed, lengths ranged from 2.7 in to 12 in with a mean length of 5.4 in and a mean weight of 1.7 oz (0.12 lbs) (Figure 3; Figure 6). Fish ranged in age from 0 to 4 years old, but the sample was largely comprised of age-1 individuals (60%) (Figure 4; Figure 5).

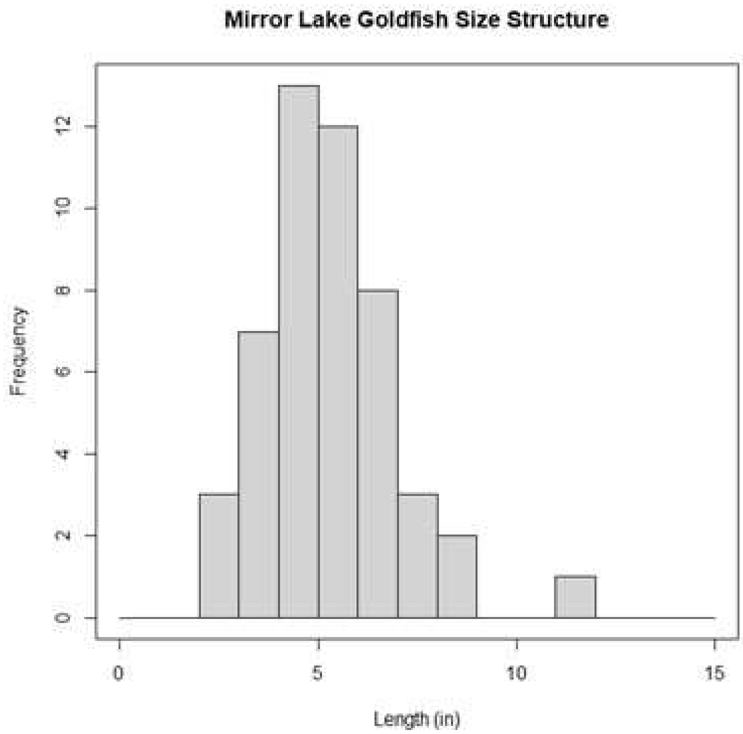



Figure 3. Length Histogram of goldfish captured in 2024 boat electrofishing surveys in Mirror Lake.

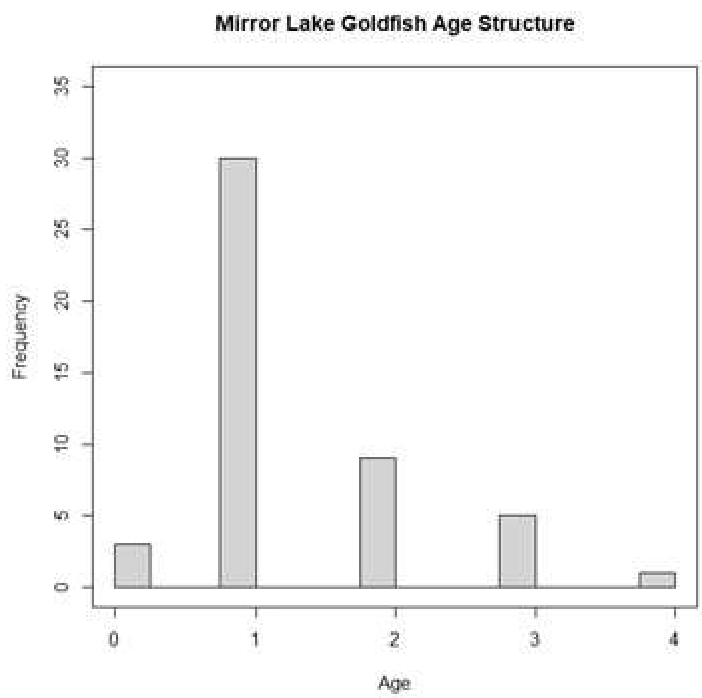



Figure 4. Age structure of goldfish sampled at Mirror Lake.

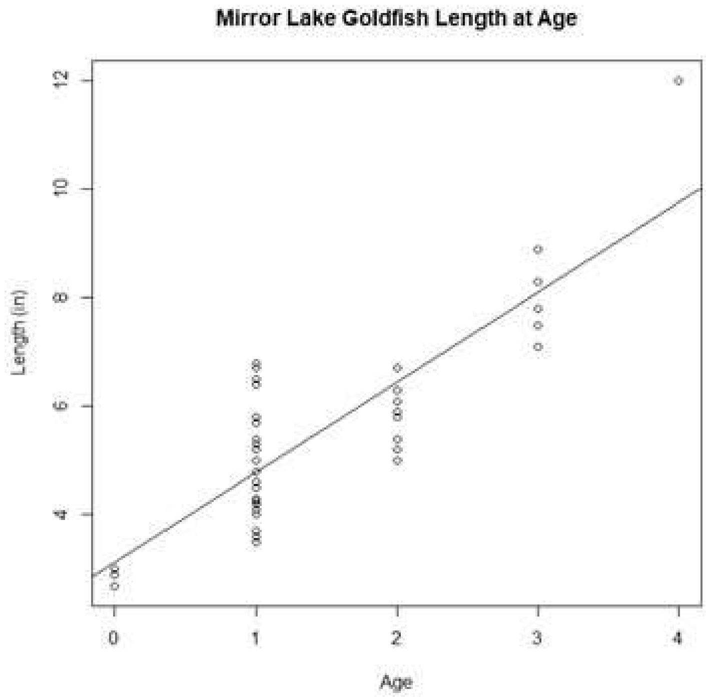



Figure 5. Length at age of goldfish sampled at Mirror Lake.

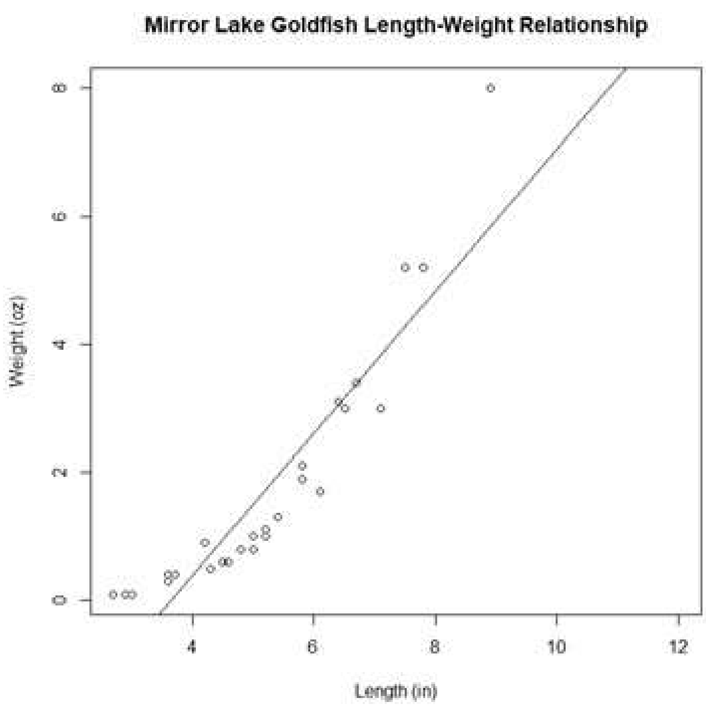



Figure 6. Relationship of length and weight of a subsample of goldfish from Mirror Lake.

Figure 7. Photo of a NMCWD staff and volunteers helping to process fish sampled on Mirror Lake on August 7, 2024.

## Anderson Lakes (North, Southeast, and Southwest)

### Boat Electrofishing

To determine if goldfish or carp were present in Anderson Lakes, a boat electrofishing survey was planned for one sampling day in all basins in 2024. As sampling began it was discovered that Southwest Anderson Lakes could not be accessed via boat as there is no public access and any walk-in sites that were discovered had a wide cattail fringe to maneuver through. A screen to prevent the spread of aquatic macrophytes between Southwest Anderson Lake and Southeast Anderson Lake. Lake morphology is similar but we do not know what the fish assemblage is nor have we confirmed the presence absence of carp or goldfish in southwest Anderson as it was not sampled in 2024.

#### *North Anderson Lake*

North Anderson Lake was visited on September 10 and September 11, 2024. Trap nets were set and an electrofishing survey was conducted on September 10. Fish collected in the electrofishing survey included black bullhead, central mudminnow, fathead minnow, and sticklebacks (Table 5). No goldfish or carp were netted or observed during the boat electrofishing survey on North Anderson Lake.

Table 5 – North Anderson Lake boat electrofishing results.

| Date (2024) | Transect | Time (minutes) | Species and number sampled | | | |
|---|---|---|---|---|---|---|
| | | | Black Bullhead | Central Mudminnow | Fathead Minnow | Stickleback |
| *September 10* | *1* | *15* | *2* | *2* | *17* | *2* |
| *September 10* | *2* | *14* | *5* | *1* | *133* | *0* |
| *September 10* | *3* | *15* | *6* | *1* | *376* | *0* |

#### *Southeast Anderson Lake*

Southeast Anderson Lake was visited on September 9, 10, and 11, 2024. A boat electrofishing survey was conducted on September 10. Fish collected in the electrofishing survey included black bullhead, and fathead minnow (Table 6). No goldfish or carp were netted or observed during the boat electrofishing survey on Southeast Anderson Lake.

Table 6 – Southeast Anderson Lake boat electrofishing results.

| Date (2024) | Transect | Time (minutes) | Species and number sampled | |
|---|---|---|---|---|
| | | | Black Bullhead | Fathead Minnow |
| *September 10* | *1* | *10* | *23* | *200* |
| *September 10* | *2* | *10* | *13* | *160* |
| *September 10* | *3* | *5* | *8* | *90* |

## Trap-net Survey

### *North Anderson Lake*

Trap nets were set in North Anderson Lake on September 10 and checked and removed from the lake on September 11, 2024. The lake was sampled with both standard and mini trap nets. The assemblage of fish sampled in a trap net survey on North Anderson Lake was the same as that sampled during the boat electrofishing survey. Black bullheads were sampled above the MN DNR normal range for this gear type and in similar lake types (Table 7).

Table 7 – North Anderson Lake trap net survey results.

| DATE | Species | CPUE one net night | | MN DNR Normal Range | |
|---|---|---|---|---|---|
| | | Standard Trap Net | Mini Trap Net | Standard Trap Net | Mini Trap Net |
| *September, 2024* | *Black Bullhead* | *0* | *31* | *0.1-0.5* | *n/a* |
| | *Central Mud Minnow* | *0* | *8* | *n/a* | *n/a* |
| | *Fathead Minnow* | *0* | *38* | *n/a* | *n/a* |
| | *Stickleback* | *0* | *1* | *0.1-0.2* | *n/a* |

### *Southeast Anderson Lake*

Trap nets were set in Southeast Anderson Lake on September 9, checked and reset on the 10th, and checked and removed from the lake on September 11, 2024. The lake was sampled with both standard and mini trap nets. The assemblage of fish sampled in a trap net survey on Southeast Anderson Lake included Central Mud Minnows and Green sunfish, these fish were not sampled during the boat electrofishing survey. Black bullheads were sampled above the MN DNR normal range for this gear type and in similar lake types, only one green sunfish was sampled in the trap net survey (Table 8).

Table 8 – Southeast Anderson Lake trap net survey results.

| DATE | Species | CPUE | | MN DNR Normal Range | |
|---|---|---|---|---|---|
| | | Standard Trap Net | Mini Trap Net | Standard Trap Net | Mini Trap Net |
| *September, 2024* | *Black Bullhead* | *13* | *43.3* | *0.1-0.5* | *n/a* |
| | *Central Mud Minnow* | *0.5* | *0.5* | *n/a* | *n/a* |
| | *Fathead Minnow* | *0.5* | *3.7* | *n/a* | *n/a* |
| | *Green Sunfish* | *0* | *0.3* | *0.1-0.2* | *n/a* |

## Anderson Lakes Aging Analysis

No carp or goldfish were collected from Anderson Lakes; therefore, no aging analysis was completed.

Figure 8. Trap net set in North Anderson Lake.

Figure 9. Bullheads captured in Southeast Anderson Lake 2024 survey.

# DISCUSSION AND RECOMMENDATIONS

## Discussion

This discussion and recommendations section uses methods and thresholds that have been established for common carp, a close relative to the goldfish. These metrics have not been established for goldfish as more studies are needed to determine the effects this species has on water quality and ecological integrity and to determine the best method of estimating abundance.

Carp and goldfish are present in Adelman Pond and young of the year carp were also sampled there. It is hypothesized that fish may move to and from Adelman Pond and nearby Penn Lake and could serve as a nursery site. This hypothesis could be tested with the use of PIT antenna stations in the connecting stream to detect 2024 tagged fish. This effort should follow a desktop review of infrastructure that connects these basins hydraulically to determine if any barriers to movement exist. If movement can and does occur between the basins, an effort to manage the population in Adelman Pond is recommended, if management in and between Penn Lake is pursued.

The population and biomass of goldfish in Mirror Lake is below the critical threshold where carp are known to be damaging to water quality. This threshold has been established for carp and is applied to goldfish in this study. We believe that goldfish and black bullheads that are present in the basin may have a low-moderate impact to water quality in Mirror Lake.

In Mirror Lake, the low diversity of fish species (black bullhead, minnows, and goldfish) and the relatively high abundance of goldfish to other fish species, does not indicate a healthy fish population. If a diverse and abundant fish population in Mirror Lake is desired, stocking desired fish species and aerating the basin may help to sustain populations. Native fish species such as largemouth bass and northern pike may help to limit the number of goldfish in the basin while bluegill sunfish would limit recruitment of young goldfish by predating on eggs and larvae. Removal of goldfish is recommended if recruitment of goldfish is also addressed.

Anderson Lakes supports a low diversity of fish species and fish species present are especially tolerant of low oxygen conditions and poor water quality. Winter dissolved oxygen monitoring may inform if the basin could support a more diverse fishery. If this is the desired outcome in Anderson Lakes, an aeration unit may need to be employed to support any stocking efforts in the basin. No carp or goldfish were sampled in the 2024 survey. Educating the public about the harm of releasing these species would help to reduce the chance for their introduction.

## Recommendations

1.) Management of the carp and goldfish population in Adelman pond if management in nearby Penn Lake is pursued.
    a. Study movement between lakes using PIT tags implanted in the 2024 study period.
    b. Refine population estimates with marked fish as opportunities arise. This can only be pursued in the short term as mortality and movement of PIT tagged fish in the interim could influence a mark/recapture estimate of the population.
2.) Determine if Mirror Lake will be managed to support a diverse and abundant native fish population. And if so:
    a. Study winter dissolved oxygen to determine if an aerator is needed.

    b. Pursue removal of goldfish at the same time or after an effort to control recruitment has been established
        i. Stock desired fish species and monitor the population periodically with fish surveys
        ii. Monitor goldfish abundance in the basin as the native fishery establishes. If it appears that native fish cannot control the population, goldfish removal activities may be pursued.

3.) Determine if Anderson Lakes will be managed to support a diverse and abundant native fish population, and if so:
    a. Study winter dissolved oxygen to determine if an aerator is needed.
    b. Stock desired fish species and monitor the population periodically with fish surveys.
    c. Educate the public about the dangers of the introduction of carp and or goldfish to the basin to help prevent their introduction.

To focus goldfish and carp management in the Nine Mile Creek Watershed District as a whole, we would recommend an integrated pest management plan be drafted. This would help to define applicable strategies to control the populations including but not limited to biomass removal, barriers to movement, biocontrol measures, drawdowns to promote die offs, and even rotenone treatment options.

## Appendix A:

## Adelman Pond: Record of 2024 PIT Tagged Fish

| Lake | Date | EventType | Fish | Length (in) | PIT Tag # |
|---|---|---|---|---|---|
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.1 | 900226001511828 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.2 | 900226001511884 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.3 | 900226001511826 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.8 | 900226001511866 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5 | 900226001511893 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.6 | 900226001511855 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.5 | 900226001511877 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.4 | 900226001511847 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.4 | 900226001511894 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 3.6 | 900226001511850 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.9 | 900226001511880 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.2 | 900226001511891 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.1 | 900226001511820 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5 | 900226001511888 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4 | 900226001511833 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 3.6 | 900226001511865 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.1 | 900226001511876 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.1 | 900226001511835 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.9 | 900226001511862 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 3.9 | 900226001511857 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 8.2 | 900226001511834 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.1 | 900226001511840 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 7 | 900226001511816 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.7 | 900226001511872 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.3 | 900226001511881 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4 | 900226001511859 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.7 | 900226001511821 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 3.9 | 900226001511839 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.5 | 900226001511822 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.6 | 900226001511873 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4 | 900226001511808 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 17.3 | 900226001511848 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 21 | 900226001511858 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 21.2 | 900226001511806 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 20.1 | 900226001511805 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 16 | 900226001511811 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 5.7 | 900226001511815 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 5.9 | 900226001511897 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 7.7 | 900226001511849 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 5 | 900226001511801 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 5.6 | 900226001511861 |

| Lake | Date | EventType | Fish | Length (in) | PIT Tag # |
|---|---|---|---|---|---|
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 8.1 | 900226001511867 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.7 | 900226001511856 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.5 | 900226001511889 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.1 | 900226001511887 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.2 | 900226001511870 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.2 | 900226001511841 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.1 | 900226001511836 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.1 | 900226001511851 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.5 | 900226001511898 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.5 | 900226001511838 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.8 | 900226001511845 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.8 | 900226001511802 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.6 | 900226001511895 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5 | 900226001511842 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4 | 900226001511875 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.5 | 900226001511827 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.5 | 900226001511813 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.2 | 900226001511814 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.2 | 900226001511823 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.1 | 900226001511852 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 3.7 | 900226001511812 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 10.2 | 900226001511831 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.1 | 900226001511819 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.6 | 900226001511854 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.9 | 900226001511843 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.2 | 900226001511829 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.8 | 900226001511879 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5 | 900226001511868 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.9 | 900226001511886 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.3 | 900226001511864 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5 | 900226001511860 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 3.8 | 900226001511883 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.5 | 900226001511896 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.2 | 900226001511803 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 16.4 | 900226001511818 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 15.9 | 900226001511885 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 16.1 | 900226001511890 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 15.7 | 900226001511863 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 9.2 | 900226001511809 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 6.2 | 900226001511844 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 7.9 | 900226001511817 |

| Lake | Date | EventType | Fish | Length (in) | PIT Tag # |
|---|---|---|---|---|---|
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 5.2 | 900226001511899 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 15.8 | 900226001511853 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 6.7 | 900226001511837 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 7.2 | 900226001511846 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 6.2 | 900226001511825 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | HYB CAP/GOLD | 9.8 | 900226001511878 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 9.7 | 900226001511810 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 6.5 | 900226001511800 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 6.5 | 900226001511874 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.7 | 900226001511869 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.8 | 900226001511871 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.2 | 900226001511824 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | CAP | 5.4 | 900226001511882 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.2 | 900226001511832 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.5 | 900226001511892 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 4.9 | 900226001511807 |
| Adelman's | 9/4/2024 | CPUE/PIT tag | GOLD | 5.1 | 900226001511804 |

# Appendix C

## Public Meeting Comments

Anderson Lake Chain Public Meeting August 19, 2025

Public Engagement Questions and Answers -

Q: What are your current concerns regarding the health?

- Water lilies abundance (many people spoke about this)
- Invasive cattails abundance (many people spoke about this)
- The desire for water levels on Southeast Anderson to return to how it was before drawdown
- Fish Biodiversity
- Nesting habitat for turtles
- Upland habitat (e.g. Buckthorn abundance)

Q: What does a healthy Anderson Lakes system look like to you?

- Higher lake levels
- More on-water use
- More biodiversity, less cattails
- Good, dissolved oxygen levels
- Reduced buckthorn for better habitat for wildlife
- Increase in waterfowl
- Reduction of barriers to managing invasive cattails
- Well-oxygenated lake
- Open fish passage between SW & SE Anderson Lakes

Q: What does recreation look like for you on Anderson Lakes?

- On-water activities -kayaking, paddleboarding etc.
- How it used to be 30+ years ago- sandy beaches

# Appendix D

## Engineer's Opinion of Costs

BARR

| | | | | | | |
|---|---|---|---|---|---|---|
| **ENGINEER'S OPINION OF PROBABLE PROJECT COST** | | SHEET: | 1 | OF | 1 |
| | | CREATED BY: | KJN2 | DATE: | 11/25/2025 |
| | | CHECKED BY: | JMK2 | DATE: | 1/15/2026 |
| PROJECT: Anderson Lakes Protection Strategy | | APPROVED BY: | JMK2 | DATE: | 1/15/2026 |
| LOCATION: Nine Mile Creek Watershed District - Bloomington | ISSUED: | | | DATE: | |
| PROJECT #: 23272119.00 | ISSUED: | | | DATE: | |
| **OPINION OF COST - SUMMARY** | ISSUED: | | | DATE: | |

# Engineer's Opinion of Probable Project Cost

## Southeast Anderson Lake Aquatic Invasive Species Management - Herbicides Only

## Concept Design

| Cat. No. | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| **Year 1** | | | | | | |
| Y1-A | Fluridone Herbicide Treatment | LS | 1 | $11,100 | $11,100 | 1,2,3,4,5 |
| Y1-B | Post-treatment plant surveys | LS | 1 | $2,400 | $2,400 | 1,2,3,4,5 |
| | | | | **Year 1 Subtotal** | **$13,500** | 1,2,3,4,5,6 |
| **Year 2** | | | | | | |
| Y2-A | Fluridone Herbicide Treatment | LS | 1 | $11,550 | $11,550 | 1,2,3,4,5 |
| Y2-B | Post-treatment plant surveys | LS | 1 | $2,400 | $2,400 | 1,2,3,4,5 |
| | | | | **Year 2 Subtotal** | **$14,000** | 1,2,3,4,5,6 |
| **Year 3** | | | | | | |
| Y3-A | Galleon SC Herbicide Treatment | LS | 1 | $31,018 | $31,018 | 1,2,3,4,5 |
| Y3-B | Pre- and Post-treatment plant surveys | LS | 1 | $3,600 | $3,600 | 1,2,3,4,5 |
| | | | | **Year 3 Subtotal** | **$34,700** | 1,2,3,4,5,6 |
| **Year 4** | | | | | | |
| Y4-A | Galleon SC Herbicide Treatment | LS | 1 | $32,260 | $32,260 | 1,2,3,4,5 |
| Y4-B | Pre- and Post-treatment plant surveys | LS | 1 | $3,600 | $3,600 | 1,2,3,4,5 |
| | | | | **Year 4 Subtotal** | **$35,900** | 1,2,3,4,5,6 |
| **Year 5** | | | | | | |
| Y5-A | Galleon SC Herbicide Treatment | LS | 1 | $33,550 | $33,550 | 1,2,3,4,5 |
| Y5-B | Pre- and Post-treatment plant surveys | LS | 1 | $3,800 | $3,800 | 1,2,3,4,5 |
| | | | | **Year 5 Subtotal** | **$37,400** | 1,2,3,4,5,6 |
| **Year 6** | | | | | | |
| Y6-A | Galleon SC Herbicide Treatment | LS | 1 | $34,891 | $34,891 | 1,2,3,4,5 |
| Y6-B | Pre- and Post-treatment plant surveys | LS | 1 | $3,800 | $3,800 | 1,2,3,4,5 |
| | | | | **Year 6 Subtotal** | **$38,700** | 1,2,3,4,5,6 |
| | | | | | | |
| | **SIX YEARS HERBICIDE TREATMENT SUBTOTAL** | | | | **$175,000** | 1,2,3,4,5,7 |
| | CONTINGENCY (5%) | | | | $9,000 | 3,5,7 |
| | **SIX YEARS HERBICIDE TREATMENT TOTAL** | | | | **$184,000** | 1,2,3,4,5,7 |
| | ENGINEERING, DESIGN, ADMIN, PERMITTING (30%) | | | | $56,000 | 3,5,7 |
| | **SIX YEARS HERBICIDE TREATMENT + ENGINEERING** | | | | **$240,000** | 1,2,3,4,5,7 |
| | *-15%* | | | | *$204,000* | 3,5,7 |
| | *20%* | | | | *$288,000* | 3,5,7 |

Notes

[1] Quantities based on design work completed (concept design).

[2] Unit prices based on information available at this time.

[3] This concept-level (Class 4, 1-15% design completion per ASTM E 2516-11) cost estimate is based on feasibility-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -15% to +20%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[4] Estimate assumes that Southeast Anderson is at normal water level (NWL).

[5] Estimated costs are to design, permit, perform herbicide treatments, and complete plant monitoring. The estimated costs do not include maintenance, water quality monitoring, or additional tasks following treatment.

[6] Estimated costs are reported to nearest hundred dollars.

[7] Estimated costs are reported to nearest thousand dollars.

| BARR | | | SHEET: | 1 | OF | 1 |
|---|---|---|---|---|---|---|
| **ENGINEER'S OPINION OF PROBABLE PROJECT COST** | | | CREATED BY: | JJH2 | DATE: | 2/6/2026 |
| PROJECT: | Anderson Lakes Protection Strategy | | CHECKED BY: | KJN2 | DATE: | 2/9/2026 |
| LOCATION: | Nine Mile Creek Watershed District - Bloomington | | APPROVED BY: | JMK2 | DATE: | 2/10/2026 |
| PROJECT #: | 23272119.00 | ISSUED: | | | DATE: | |
| **OPINION OF COST - SUMMARY** | | ISSUED: | | | DATE: | |
| | | ISSUED: | | | DATE: | |

## Engineer's Opinion of Probable Project Cost

**Southeast Anderson Lake Aquatic Invasive Species Management - Whole-lake Drawdown**

**Planning-level Design**

| Cat. No. | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| A | Mobilization/Demobilization | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5,6,7 |
| B | Pump set-up, rental, and removal (2,500 gpm pump) | LS | 1 | $275,000 | $275,000 | 1,2,3,4,5,6,7 |
| C | Daily servicing (including refueling, maintenance, and labor) during initial 30-day drawdown period | DAY | 30 | $2,000 | $60,000 | 1,2,3,4,5,6,7,8 |
| D | Periodic servicing (including refueling, maintenance, and labor) to maintain drawdown) | DAY | 85 | $2,000 | $170,000 | 1,2,3,4,5,6,7,8 |
| E | Site Restoration | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5,6,7 |
| F | HDPEP Inlet and Outlet Pipes | LF | 2,100 | $20 | $42,000 | 1,2,3,4,5,6,7 |
| G | Turtle Fencing | LF | 5,800 | $5 | $29,000 | 1,2,3,4,5,6,7 |
| | CONSTRUCTION SUBTOTAL | | | | $596,000 | 1,2,3,4,5,6,7,9 |
| | CONSTRUCTION CONTINGENCY (30%) | | | | $179,000 | 1,5,9 |
| | ***ESTIMATED CONSTRUCTION COST*** | | | | ***$775,000*** | *1,2,3,4,5,6,7,9* |
| | | | | | | |
| | PLANNING, ENGINEERING & DESIGN (25%) | | | | $155,000 | 1,2,3,4,5,9 |
| | PERMITTING (5%) | | | | $39,000 | |
| | **ESTIMATED TOTAL PROJECT COST** | | | | **$969,000** | 1,2,3,4,5,7,9 |
| | **ESTIMATED ACCURACY RANGE** | **-30%** | | | **$679,000** | 5,7,9 |
| | | **50%** | | | **$1,454,000** | 5,7,9 |

Notes

[1] Limited design work completed.

[2] Quantities based on design work completed (planning-level)

[3] Unit prices based on information available at this time.

[4] Limited Field Investigation Information Available.

[5] This planning-level (Class 5, 0-2% design completion per ASTM E 2516-11) cost estimate is based on screening-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -30% to +50%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[6] Estimate assumes that projects will not be located on contaminated soil.

[7] Estimated costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.

[8] Cost estimate assumes one month of continuous pumping (August 15 through September 15) followed by 6.5 months of intermittent pumping (September 15 through March 1) to keep the lake drawn down. The cost estimate assumes pumping 50% of the time during the intermittent period but this could vary widely depending on precipitation and climate conditions.

[9] Estimated costs are reported to nearest thousand dollars.

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**ENGINEER'S OPINION OF PROBABLE PROJECT COST**

| | | | | | |
|---|---|---|---|---|---|
| | | SHEET: | 1 | OF | 1 |
| | | CREATED BY: | KJN2 | DATE: | 11/25/2025 |
| | | CHECKED BY: | JMK2 | DATE: | 1/15/2026 |
| PROJECT: Anderson Lakes Protection Strategy | | APPROVED BY: | JMK2 | DATE: | 1/15/2026 |
| LOCATION: Nine Mile Creek Watershed District | ISSUED: | | | DATE: | |
| PROJECT #: 23272119.00 | ISSUED: | | | DATE: | |
| **OPINION OF COST - SUMMARY** | ISSUED: | | | DATE: | |

# Engineer's Opinion of Probable Project Cost

## Anderson Lakes Whole-Lake Cattail Management - Herbicide, Cut, and Biomass Removal

## Planning-Level Design

| Cat. No. | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| | **Northwest Anderson Lake** | | | | | |
| NW-A | Pre-cutting herbicide | AC | 39 | $380 | $14,820 | 1,2,3,4,5,6 |
| NW-B | Cutting + biomass burn piles | AC | 39 | $5,500 | $214,500 | 1,2,3,4,5,6 |
| NW-C | Post-cutting herbicide | AC | 39 | $380 | $14,820 | 1,2,3,4,5,6 |
| NW-D | Emergent seeding | AC | 39 | $1,500 | $58,500 | 1,2,3,4,5,6 |
| *NW-E* | **Alt Cutting + Biomass Removal* | *AC* | *39* | *$12,000* | *$468,000* | *1,2,3,4,5,6* |
| | | | | **Northwest Anderson Lake Subtotal** | **$303,000** | 1,2,3,4,5,6,7 |
| | | | | ***Northwest Anderson Lake Alternate Subtotal*** | ***$557,000*** | 1,2,3,4,5,6,7 |
| | **Southwest Anderson Lake** | | | | | |
| SW-A | Pre-cutting herbicide | AC | 40 | $380 | $15,200 | 1,2,3,4,5,6 |
| SW-B | Cutting + biomass burn piles | AC | 40 | $5,500 | $220,000 | 1,2,3,4,5,6 |
| SW-C | Post-cutting herbicide | AC | 40 | $380 | $15,200 | 1,2,3,4,5,6 |
| SW-D | Emergent seeding | AC | 40 | $1,500 | $60,000 | 1,2,3,4,5,6 |
| *SW-E* | **Alt Cutting + Biomass Removal* | *AC* | *40* | *$12,000* | *$480,000* | *1,2,3,4,5,6* |
| | | | | **Southwest Anderson Lake Subtotal** | **$311,000** | 1,2,3,4,5,6,7 |
| | | | | ***Southwest Anderson Lake Alternate Subtotal*** | ***$571,000*** | 1,2,3,4,5,6,7 |
| | **Southeast Anderson Lake** | | | | | |
| SE-A | Pre-cutting herbicide | AC | 18 | $380 | $6,840 | 1,2,3,4,5,6 |
| SE-B | Cutting + biomass burn piles | AC | 18 | $5,500 | $99,000 | 1,2,3,4,5,6 |
| SE-C | Post-cutting herbicide | AC | 18 | $380 | $6,840 | 1,2,3,4,5,6 |
| SE-D | Emergent seeding | AC | 18 | $1,500 | $27,000 | 1,2,3,4,5,6 |
| *SE-E* | **Alt Cutting + Biomass Removal* | *AC* | *18* | *$12,000* | *$216,000* | *1,2,3,4,5,6* |
| | | | | **Southeast Anderson Lake Subtotal** | **$140,000** | 1,2,3,4,5,6,7 |
| | | | | ***Southeast Anderson Lake Alternate Subtotal*** | ***$257,000*** | 1,2,3,4,5,6,7 |
| | | | | | | |
| | **ALL THREE LAKES CONSTRUCTION SUBTOTAL** | | | | **$754,000** | 1,2,3,4,5,6,7 |
| | CONSTRUCTION CONTINGENCY (20%) | | | | $151,000 | 4,6,7 |
| | **ALL THREE LAKES CONSTRUCTION TOTAL** | | | | **$905,000** | 1,2,3,4,5,6,7 |
| | ENGINEERING, DESIGN, ADMIN, PERMITTING (15%) | | | | $136,000 | 4,6,7 |
| | **CONSTRUCTION + ENGINEERING** | | | | **$1,041,000** | 1,2,3,4,5,6,7 |
| | *-30%* | | | | *$729,000* | 4,6,7 |
| | *50%* | | | | *$1,562,000* | 4,6,7 |
| ***Alternative*** | **ALL THREE LAKES CONSTRUCTION SUBTOTAL** | | | | **$1,385,000** | 1,2,3,4,5,6,7 |
| | CONSTRUCTION CONTINGENCY (20%) | | | | $277,000 | 4,6,7 |
| | **ALL THREE LAKES CONSTRUCTION TOTAL** | | | | **$1,662,000** | 1,2,3,4,5,6,7 |
| | ENGINEERING, DESIGN, ADMIN, PERMITTING (10%) | | | | $167,000 | 4,6,7 |
| | **CONSTRUCTION + ENGINEERING** | | | | **$1,829,000** | 1,2,3,4,5,6,7 |
| | *-30%* | | | | *$1,280,000* | 4,6,7 |
| | *50%* | | | | *$2,744,000* | 4,6,7 |

Notes

[1] Quantities based on design work completed (planning-level design).

[2] Unit prices based on information available at this time.

[3] Limited field investigation information available.

[4] This planning-level (Class 5, 0-2% design completion per ASTM E 2516-11) cost estimate is based on screening-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -30% to +50%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[5] Estimate assumes that projects will not be located on contaminated soil.

[6] Estimated costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.

[7] Estimated costs are reported to nearest thousand dollars.

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|---|---|---|---|---|---|
| | SHEET: | 1 | OF | 1 |
| | CREATED BY: | KJN2 | DATE: | 11/25/2025 |
| | CHECKED BY: | JMK2 | DATE: | 1/15/2026 |
| | APPROVED BY: | JMK2 | DATE: | 1/15/2026 |
| | ISSUED: | | DATE: | |
| | ISSUED: | | DATE: | |
| | ISSUED: | | DATE: | |

**ENGINEER'S OPINION OF PROBABLE PROJECT COST**

PROJECT: Anderson Lakes Protection Strategy

LOCATION: Nine Mile Creek Watershed District - Bloomington

PROJECT #: 23272119

**OPINION OF COST - SUMMARY**

## Engineer's Opinion of Probable Project Cost

### Southeast Anderson Lake Whole-Lake Cattail Management - Controlled Burn

### Planning-level Design

| Cat. No. | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| | **Southeast Anderson Lake** | | | | | |
| SE-A | Mobilization | LS | 1 | $16,000 | $16,000 | 1,2,3,4,5,6 |
| SE-B | Controlled burn | AC | 18 | $1,900 | $34,200 | 1,2,3,4,5,6 |
| SE-C | Post-burning herbicide | AC | 9 | $380 | $3,420 | 1,2,3,4,5,6 |
| SE-D | Emergent seeding | AC | 18 | $1,500 | $27,000 | 1,2,3,4,5,6 |
| | | | | | | |
| | **SOUTHEAST ANDERSON CONSTRUCTION SUBTOTAL** | | | | **$81,000** | 1,2,3,4,5,6,7 |
| | CONSTRUCTION CONTINGENCY (30%) | | | | $24,000 | 4,6,7 |
| | **SOUTHEAST ANDERSON CONSTRUCTION TOTAL** | | | | **$105,000** | 1,2,3,4,5,6,7 |
| | ENGINEERING, DESIGN, ADMIN, PERMITTING (30%) | | | | $32,000 | 4,6,7 |
| | **CONSTRUCTION + ENGINEERING** | | | | **$137,000** | 1,2,3,4,5,6,7 |
| | *-30%* | | | | *$96,000* | 4,6,7 |
| | *50%* | | | | *$206,000* | 4,6,7 |

Notes

[1] Quantities based on design work completed (planning-level design).

[2] Unit prices based on information available at this time.

[3] Limited field investigation information available.

[4] This planning-level (Class 5, 0-2% design completion per ASTM E 2516-11) cost estimate is based on screening-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -30% to +50%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[5] Estimate assumes that projects will not be located on contaminated soil.

[6] Estimated costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.

[7] Estimated costs are reported to nearest thousand dollars.

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**ENGINEER'S OPINION OF PROBABLE PROJECT COST**

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|---|---|---|---|---|---|---|
| | | SHEET: | 1 | OF | 1 |
| | | CREATED BY: | KJN2 | DATE: | 12/16/2025 |
| | | CHECKED BY: | JMK2 | DATE: | 1/15/2026 |
| PROJECT: | Anderson Lakes Protection Strategy | APPROVED BY: | JMK2 | DATE: | 1/15/2026 |
| LOCATION: | Nine Mile Creek Watershed District | ISSUED: | | DATE: | |
| PROJECT #: | 23272119.00 | ISSUED: | | DATE: | |
| **OPINION OF COST - SUMMARY** | | ISSUED: | | DATE: | |

# Engineer's Opinion of Probable Project Cost

## Anderson Lakes Flow Obstructed Zones Cattail Management - Herbicide, Cut, and Biomass Removal

## Planning-Level Design

| Cat. No. | ITEM DESCRIPTION | UNIT | ESTIMATED QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| | **All Anderson Lakes - Flow Obstructed Areas Only** | | | | | |
| NW-A | Pre-cutting herbicide | AC | 22 | $380 | $8,360 | 1,2,3,4,5,6 |
| NW-B | Cutting + biomass burn piles | AC | 22 | $5,500 | $121,000 | 1,2,3,4,5,6 |
| NW-C | Post-cutting herbicide | AC | 22 | $380 | $8,360 | 1,2,3,4,5,6 |
| NW-D | Emergent seeding | AC | 22 | $1,500 | $33,000 | 1,2,3,4,5,6 |
| *NW-E* | **Alt Cutting + Biomass Removal* | *AC* | *22* | *$12,000* | *$264,000* | *1,2,3,4,5,6* |
| | | | | | | |
| | **FLOW OBSTRUCTED AREAS CONSTRUCTION SUBTOTAL** | | | | **$171,000** | 1,2,3,4,5,6,7 |
| | CONSTRUCTION CONTINGENCY (30%) | | | | $51,000 | 4,6,7 |
| | **CONSTRUCTION TOTAL** | | | | **$222,000** | 1,2,3,4,5,6,7 |
| | ENGINEERING, DESIGN, ADMIN, PERMITTING (30%) | | | | $67,000 | 4,6,7 |
| | **CONSTRUCTION + ENGINEERING** | | | | **$289,000** | 1,2,3,4,5,6,7 |
| | *-30%* | | | | *$202,000* | 4,6,7 |
| | *50%* | | | | *$434,000* | 4,6,7 |
| ***Alternative*** | **FLOW OBSTRUCTED AREAS CONSTRUCTION SUBTOTAL** | | | | **$313,720** | 1,2,3,4,5,6,7 |
| | CONSTRUCTION CONTINGENCY (30%) | | | | $94,000 | 4,6,7 |
| | **CONSTRUCTION TOTAL** | | | | **$407,720** | 1,2,3,4,5,6,7 |
| | ENGINEERING, DESIGN, ADMIN, PERMITTING (20%) | | | | $82,000 | 4,6,7 |
| | **CONSTRUCTION + ENGINEERING** | | | | **$489,720** | 1,2,3,4,5,6,7 |
| | *-30%* | | | | *$343,000* | 4,6,7 |
| | *50%* | | | | *$735,000* | 4,6,7 |

Notes

[1] Quantities based on design work completed (planning-level design).

[2] Unit prices based on information available at this time.

[3] Limited field investigation information available.

[4] This planning-level (Class 5, 0-2% design completion per ASTM E 2516-11) cost estimate is based on screening-level designs, alignments, quantities and unit prices. Costs will change with further design. Time value-of-money escalation costs are not included. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -30% to +50%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[5] Estimate assumes that projects will not be located on contaminated soil.

[6] Estimated costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.

[7] Estimated costs are reported to nearest thousand dollars.

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|---|---|---|---|---|---|---|
| | | | SHEET: | 1 | OF | 1 |
| | | | CREATED BY: | JPP | DATE: | 1/19/2026 |
| CLIENT: | Nine Mile Creek Watershed District (NMCWD) | | CHECKED BY: | JMK2 | DATE: | 1/19/2026 |
| PROJECT: | Anderson Lakes Protection Strategy | | APPROVED BY: | JMK2 | DATE: | 1/19/2026 |
| LOCATION: | Bloomington, MN | ISSUED: | | | DATE: | |
| PROJECT #: | 23272119.00 | ISSUED: | | | DATE: | |
| **OPINION OF COST - SUMMARY** | | ISSUED: | | | DATE: | |

# Engineer's Opinion of Probable Project Cost

## Southeast Anderson Lake Culvert Retrofit Option 1 (Increased Maintenance - Screen Cleaning)

## Planning-Level Design

| ITEM NO. | ITEM DESCRIPTION | UNIT | EST. QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| | **Operation and Maintenance (During Aquatic Invasive Species Management)** | | | | | |
| 1 | Screen Cleaning (twice per week) - NMCWD Intern | HR | 1,134 | $25 | $28,350 | 1,2,3,4,5,9 |
| *1A* | *Alt. Screen Cleaning (twice per week) - Subcontracted* | *HR* | *1,134* | *$120* | *$136,080* | *1,2,3,4,5,9* |
| | | | | **Operation and Maintenance Subtotal** | **$29,000** | 1,2,3,4,5,6,7,8,9 |
| | | | | | | |
| | **Permanent Improvements (After Aquatic Invasive Species Management)** | | | | | |
| 2 | Mobilization | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| 3 | Erosion and Sediment Control | LS | 1 | $5,000 | $5,000 | 1,2,3,4,5 |
| 4 | Control of Water | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| 5 | Remove and Dispose of Storm Sewer | LF | 115 | $20 | $2,300 | 1,2,3,4,5 |
| 6 | Remove and Dispose of Control Structure | EA | 1 | $1,200 | $1,200 | 1,2,3,4,5 |
| 7 | Grade New Drainage Channel | LS | 1 | $25,000 | $25,000 | 1,2,3,4,5 |
| 8 | Site Restoration | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| | | | | Construction Contigency (35%) | $22,000 | 1,6,7,8 |
| | | | | **Construction Total** | **$85,500** | |
| | | | | **Engineering, Design, Admin, Permitting (35%)** | **$30,000** | 1,2,3,4,5,6,7,8 |
| | | | | **Permanent Improvements Subtotal** | **$116,000** | 1,2,3,4,5,6,7,8 |
| | | | | | | |
| | OPERATION AND MAINTENANCE SUBTOTAL | | | | $29,000 | 1,2,3,4,5,6,7,8,9 |
| | PERMANENT IMPROVEMENTS SUBTOTAL | | | | $116,000 | 1,2,3,4,5,6,7,8 |
| | **TOTAL PROJECT COST** | | | | **$145,000** | 1,2,3,4,5,6,7,8,9 |
| | *-15%* | | | | *$123,000* | 6,7,8 |
| | *25%* | | | | *$181,000* | 6,7,8 |

Notes

[1] Limited design work completed (Concept Study or Feasibility: 1-15%). Quantities based on design work completed.

[2] Unit prices based on information available at this time.

[3] Limited soil borings and field investigation information available at this time.

[4] Estimate assumes that projects will not be located on contaminated soil.

[5] Time value-of-money escalation (inflation) costs are not included.

[6] This planning-level (Class 4, 1-15% design completion per ASTM E 2516-11) cost estimate is based on screening-level designs, alignments, quantities and unit prices. Costs will change with further design. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -15% to +25%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[7] Estimated costs are reported to nearest thousand dollars.

[8] Estimated costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.

[9] Estimated screen cleaning hours assume two site visits per week May - October for 7 years of aquatic invasive species management.

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| | | | SHEET: | 1 | OF | 1 |
| | | | CREATED BY: | JPP | DATE: | 1/19/2026 |
| CLIENT: | Nine Mile Creek Watershed District (NMCWD) | | CHECKED BY: | JMK2 | DATE: | 1/19/2026 |
| PROJECT: | Anderson Lakes Protection Strategy | | APPROVED BY: | JMK2 | DATE: | 1/19/2026 |
| LOCATION: | Bloomington, MN | ISSUED: | | | DATE: | |
| PROJECT #: | 23272119.00 | ISSUED: | | | DATE: | |
| **OPINION OF COST - SUMMARY** | | ISSUED: | | | DATE: | |

# Engineer's Opinion of Probable Project Cost

## Southeast Anderson Lake Culvert Retrofit Option 2 (Increased Maintenance - Screen lifts/Cleaning)

## Planning-Level Design

| ITEM NO. | ITEM DESCRIPTION | UNIT | EST. QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| | **Temporary Improvements (Before/During Aquatic Invasive Species Management)** | | | | | |
| 1 | Mobilization | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| 2 | Control of Water | LS | 1 | $3,000 | $3,000 | 1,2,3,4,5 |
| 3 | Remove Existing Stop Logs | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| | | | | Construction Contigency (35%) | $8,000 | 1,2,3,4,5,6,7,8 |
| | | | | **Construction Total** | **$31,000** | 1,2,3,4,5,6,7,8 |
| | | | | **Engineering, Design, Admin, Permitting (35%)** | **$11,000** | 1,2,3,4,5,6,7,8 |
| | | | | **Temporary Improvements Subtotal** | **$42,000** | 1,2,3,4,5,6,7,8 |
| | | | | | | |
| | **Operation and Maintenance (During Aquatic Invasive Species Management)** | | | | | |
| 4 | Annually Lift, Clean, and Reinstall Macrophyte Screen | EA | 7 | $8,000 | $56,000 | 1,2,3,4,5 |
| 5 | Screen Cleaning (twice per month) - NMCWD Intern | HR | 252 | $25 | $6,300 | 1,2,3,4,5,9 |
| *5A* | *Alt. Screen Cleaning (twice per month) - Subcontracted* | *HR* | *252* | *$120* | *$30,240* | *1,2,3,4,5,9* |
| | | | | **Operation and Maintenance Subtotal** | **$63,000** | 1,2,3,4,5,6,7,8,9 |
| | | | | | | |
| | **Permanent Improvements (After Aquatic Invasive Species Management)** | | | | | |
| 6 | Mobilization | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| 7 | Erosion and Sediment Control | LS | 1 | $5,000 | $5,000 | 1,2,3,4,5 |
| 8 | Control of Water | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| 9 | Remove and Dispose of Storm Sewer | LF | 115 | $20 | $2,300 | 1,2,3,4,5 |
| 10 | Remove and Dispose of Control Structure | EA | 1 | $1,200 | $1,200 | 1,2,3,4,5 |
| 11 | Grade New Drainage Channel | LS | 1 | $25,000 | $25,000 | 1,2,3,4,5 |
| 12 | Site Restoration | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| | | | | Construction Contigency (35%) | $22,000 | 1,2,3,4,5,6,7,8 |
| | | | | **Construction Total** | **$85,500** | 1,2,3,4,5,6,7,8 |
| | | | | **Engineering, Design, Admin, Permitting (35%)** | **$30,000** | 1,2,3,4,5,6,7,8 |
| | | | | **Permanent Improvements Subtotal** | **$116,000** | 1,2,3,4,5,6,7,8 |
| | | | | | | |
| | TEMPORARY IMPROVEMENTS SUBTOTAL | | | | $42,000 | 1,2,3,4,5,6,7,8 |
| | OPERATION AND MAINTENANCE SUBTOTAL | | | | $63,000 | 1,2,3,4,5,6,7,8,9 |
| | PERMANENT IMPROVEMENTS SUBTOTAL | | | | $116,000 | 1,2,3,4,5,6,7,8 |
| | **TOTAL PROJECT COST** | | | | **$221,000** | 1,2,3,4,5,6,7,8,9 |
| | *-15%* | | | | *$188,000* | 6,7,8 |
| | *25%* | | | | *$276,000* | 6,7,8 |

Notes

[1] Limited design work completed (Concept Study or Feasibility: 1-15%). Quantities based on design work completed.

[2] Unit prices based on information available at this time.

[3] Limited soil borings and field investigation information available at this time.

[4] Estimate assumes that projects will not be located on contaminated soil.

[5] Time value-of-money escalation (inflation) costs are not included.

[6] This planning-level (Class 4, 1-15% design completion per ASTM E 2516-11) cost estimate is based on screening-level designs, alignments, quantities and unit prices. Costs will change with further design. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -15% to +25%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[7] Estimated costs are reported to nearest thousand dollars.

[8] Estimated costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.

[9] Estimated screen cleaning hours assume two site visits per month for May - October for 7 years of aquatic invasive species management.

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|---|---|---|---|---|---|---|
| | | | SHEET: | 1 | OF | 1 |
| | | | CREATED BY: | JPP | DATE: | 1/19/2026 |
| CLIENT: | Nine Mile Creek Watershed District (NMCWD) | | CHECKED BY: | JMK2 | DATE: | 1/19/2026 |
| PROJECT: | Anderson Lakes Protection Strategy | | APPROVED BY: | JMK2 | DATE: | 1/19/2026 |
| LOCATION: | Bloomington, MN | ISSUED: | | | DATE: | |
| PROJECT #: | 23272119.00 | ISSUED: | | | DATE: | |
| **OPINION OF COST - SUMMARY** | | ISSUED: | | | DATE: | |

# Engineer's Opinion of Probable Project Cost

### Southeast Anderson Lake Culvert Retrofit Option 3 (Outlet Reconstruction)

### Planning-Level Design

| ITEM NO. | ITEM DESCRIPTION | UNIT | EST. QUANTITY | UNIT COST | ITEM COST | NOTES |
|---|---|---|---|---|---|---|
| | **Permanent Improvements (Before/During Aquatic Invasive Species Management)** | | | | | |
| 1 | Mobilization | LS | 1 | $20,000 | $20,000 | 1,2,3,4,5 |
| 2 | Erosion and Sediment Controls | LS | 1 | $5,000 | $5,000 | 1,2,3,4,5 |
| 3 | Control of Water | LS | 1 | $10,000 | $10,000 | 1,2,3,4,5 |
| 4 | Remove and Dispose of Storm Sewer | LF | 115 | $150 | $17,250 | 1,2,3,4,5 |
| 5 | Remove and Dispose of Control Structure | EA | 1 | $3,000 | $3,000 | 1,2,3,4,5 |
| 6 | 60-inch Dia. Control Structure, Weir, Backflow Preventor | EA | 1 | $15,000 | $15,000 | 1,2,3,4,5 |
| 7 | 48-inch RC Storm Sewer Pipe | LF | 115 | $400 | $46,000 | 1,2,3,4,5 |
| 8 | 48-inch FES | EA | 2 | $3,200 | $6,400 | 1,2,3,4,5 |
| 9 | Random Riprap Class III | CY | 50 | $125 | $6,250 | 1,2,3,4,5 |
| 10 | Site Restoration | LS | 1 | $8,000 | $8,000 | 1,2,3,4,5 |
| | | | | Construction Contigency (35%) | $48,000 | 1,2,3,4,5,6,7,8 |
| | | | | **Construction Total** | **$184,900** | 1,2,3,4,5,6,7,8 |
| | | | | **Engineering, Design, Admin, Permitting (35%)** | **$65,000** | 1,2,3,4,5,6,7,8 |
| | | | | **Permanent Improvements Subtotal** | **$250,000** | 1,2,3,4,5,6,7,8 |
| | | | | | | |
| | **Operation and Maintenance (During Aquatic Invasive Species Management)** | | | | | |
| 11 | Screen Cleaning (three times per year) - NMCWD Intern | HR | 63 | $25 | $1,575 | 1,2,3,4,5,9 |
| *11A* | *Alt. Screen Cleaning (three times per year) - Subcontracted* | *HR* | *63* | *$120* | *$7,560* | *1,2,3,4,5,9* |
| | | | | **Operation and Maintenance Subtotal** | **$2,000** | 1,2,3,4,5,6,7,8,9 |
| | | | | | | |
| | PERMANENT IMPROVEMENTS SUBTOTAL | | | | $250,000 | 1,2,3,4,5,6,7,8 |
| | OPERATION AND MAINTENANCE SUBTOTAL | | | | $2,000 | 1,2,3,4,5,6,7,8,9 |
| | **TOTAL PROJECT COST** | | | | **$252,000** | 1,2,3,4,5,6,7,8,9 |
| | *-15%* | | | | *$214,000* | 6,7,8 |
| | *25%* | | | | *$315,000* | 6,7,8 |

Notes

[1] Limited design work completed (Concept Study or Feasibility: 1-15%). Quantities based on design work completed.

[2] Unit prices based on information available at this time.

[3] Limited soil borings and field investigation information available at this time.

[4] Estimate assumes that projects will not be located on contaminated soil.

[5] Time value-of-money escalation (inflation) costs are not included.

[6] This planning-level (Class 4, 1-15% design completion per ASTM E 2516-11) cost estimate is based on screening-level designs, alignments, quantities and unit prices. Costs will change with further design. A construction schedule is not available at this time. Contingency is an allowance for the net sum of costs that will be in the final total project cost at the time of the completion of design, but are not included at this level of project definition. The estimated accuracy range for the total project cost as the project is defined is -15% to +25%. The accuracy range is based on professional judgement considering the level of design completed, the complexity of the project and the uncertainties in the project as scoped. The contingency and the accuracy range are not intended to include costs for future scope changes that are not part of the project as currently scoped or costs for risk contingency. Operation and maintenance costs are not included.

[7] Estimated costs are reported to nearest thousand dollars.

[8] Estimated costs are to design, construct, and permit each alternative. The estimated costs do not include maintenance, monitoring or additional tasks following construction.

[9] Estimated screen cleaning hours assume three site visits per year (during May - October) for 7 years of aquatic invasive species management.