EXECUTIVE SUMMARY

A Management Plan for Geneva Lake

The Lake Management Plan for Geneva Lake is the third comprehensive management plan for this Lake and was developed to provide a set of targeted, specific recommendations to improve Geneva Lake, its tributaries, and ecological conditions throughout the watershed. This plan supplements and builds upon previous plans and recommendations, such as the 1985 and 2008 lake management plans and studies by the Wisconsin Department of Natural Resources (WDNR) and the United States Geological Survey (USGS). Many recommended management measures from the previous editions of this plan, such as educational programming, implementing agricultural best management practices, and enhancing native shoreline vegetation, have been incorporated into past and ongoing Lake management practices.

Characteristics of Geneva Lake and its Watershed

Geneva Lake has long been renowned for its natural beauty and clear, clean water and is one of the premiere tourism destinations in Wisconsin. The Lake, the largest and deepest in southeastern Wisconsin, enjoys excellent water clarity, a healthy aquatic plant community, and is among the most popular fisheries in southeastern Wisconsin. Located between Milwaukee, Chicago, and Madison, its visitors and residents engage in a wide variety of recreational pursuits including recreational boating, sailing, fishing, swimming, water-skiing, and other activities. Although the Lake remains in relatively good health, Lake residents and managers are concerned about the lake's ecology, including changes in the lake's water quality and aquatic plant community, development of open space, the recent introduction of starry stonewort and quagga mussels, and impacts from climate change and recreational stress on the lake's fishery.

Geneva Lake supports many recreational pursuits, including recreational boating, fishing, swimming, sailing, and paddling.

The Lake is fed by surface-water runoff draining from a 30 square mile watershed. The watershed is located entirely within Walworth County but is divided between several cities, villages, and towns. Agricultural and residential land uses occupy the largest amount of land area within the watershed. Overall lake ecosystem health is commonly a direct reflection of watershed land use and management.

Multiple named tributaries and unnamed tributaries contribute water to the Lake, but these tributaries are also the major source of pollutants. Increasingly intense rainfall events have worsened stream erosion issues, which contribute sediments and pollutants to the Lake. These pollutants are having a measurable effect on the lake's water quality and on its aquatic plant community, which in turn can affect the lake's fishery, recreational use, and the communities and businesses that rely on the Lake's continued health.

Justification for Plan

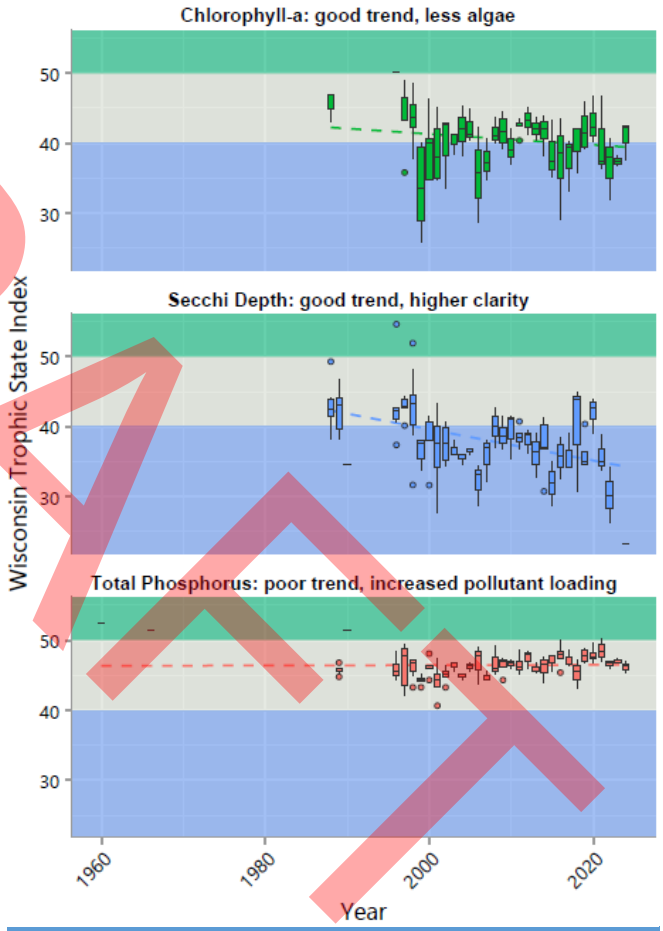
Despite human-induced stressors, the Lake enjoys generally good water quality and conditions supporting a wide variety of use. Nevertheless, water resource features are vulnerable to disturbance from human activity. In recognition of this concern, members of the Lake community are interested in evaluating topics that can be used to evaluate changes in the Lake's community value and ecological health. Examples of some topics of particular and widespread interest include the following:

- **Water Quality Trends**
- **Pollutant Loading**
- **Invasive Species**
- **Nearshore and Two-Story Fishery**
- **Recreational Use**
- **Lake Management and Funding**

Water Quality Trends

In general, overall Lake water quality remains good but there are concerning indicators of worsening conditions. Although the Lake clarity has increased with lower algal abundance, the total phosphorus concentrations in the Lake continue to increase, especially in deep waters. This disconnect between increasing total phosphorus, a limiting nutrient for algal growth, and algal abundance likely indicates increased filter feeding by zebra and quagga mussels populations in the Lake. Increases in certain aquatic plant species, such as forked duckweed, and the notable occurrence of a large algal bloom in August 2024 also indicate eutrophication due to increased phosphorus concentrations. Chloride concentrations, which are predominantly contributed by road salt and pavement deicers, are also steadily increasing in the Lake and have exceeded thresholds that can cause harm to aquatic life. The lake's temperature and dissolved oxygen concentrations support its two-story fishery, but warming water temperatures and eutrophication could threaten this fishery in the coming years.

Decades of water quality monitoring provides invaluable insight to the Lake's health. Continued monitoring is essential for tracking progress and identifying threats.



Disconnect between increased total phosphorus with high clarity and lower algal abundance may indicate zebra and quagga mussel impact.

These insights are only possible thanks to the continued monitoring efforts by the Geneva Lake Conservancy, Geneva Lake Environmental Agency, Wisconsin Department of Natural Resources, and the United States Geological Survey. These organizations and other lake stakeholders are taking action to enhance lake water quality by continuing to monitor water quality and by implementing practices and programs that reduce pollutant loads from the lake watershed.

The Lake tributaries are a major focus for phosphorus and sediment reduction efforts.

Pollutant Loading

Water quality measurements and watershed modeling both indicate that the Lake's tributaries are the primary sources of pollutants, particularly total phosphorus and sediment, to Geneva Lake. Agricultural land uses are the primary source of phosphorus to the Lake while severely eroding tributaries are also contributing phosphorus and sediment. This plan prioritizes the tributaries based on the available water quality data and modeling output to identify the most significant pollutant sources and recommends practices to help reduce those pollutants. Bigfoot Creek, which has long been recognized as a major contributor to phosphorus pollution in the Lake, was identified as the highest priority stream; the plan recommends a major wetland restoration project to reduce phosphorus and iron loading and to enhance stream water quality conditions. Other tributaries of note include Birches Creek, Abbey Springs, Trinke Creek, Gardens Creek, Southwick Creek, and Potawatomi and Van Slyke Creeks. Many of these tributaries suffer from excessive stream bank and bed erosion after intense rainfall events; this erosion sends the phosphorus-laden sediment directly into Geneva Lake. Consequently, the plan recommends techniques to slow the water velocity, shore up the stream morphology, and reduce pollutants. Other recommended practices focus on stormwater and agricultural best management practices to reduce pollutants from residential and agricultural land uses, respectively. Protecting primary environmental corridors and areas with high groundwater recharge from development will also help protect the Lake's water quality.

Climate Change Impact
Increasingly intense rain events worsen stream erosion and contribute more pollutants to the Lake. More pollutants and warmer water temperatures can stress fish species.

Invasive Species

Exotic invasive species can be a detriment to lake ecology and hinder recreational use. The Lake sustains populations of several invasive species, including species that have been present for decades, such as Eurasian water milfoil and zebra mussels, and more recently introduced species, like starry stonewort and

Lake managers continue to monitor and manage populations of quagga mussels (left), zebra mussels (middle), and starry stonewort (two right) in Geneva Lake.

quagga mussels. Despite the introduction of these species, the Lake aquatic plant community remains in good condition, with many native species and a low overall coverage by invasive species.

Major aquatic plant management is not recommended at this time. The plan recommends continued monitoring of the invasive species populations with small-scale treatment of nuisance populations as necessary. The Geneva Lake Environmental Agency and the Lake municipalities continue to staff municipal launches and remove invasive species from watercraft through their participation in the Clean Boats, Clean Waters program. These efforts help protect the integrity of the Lake's ecosystem and reduce spread of invasive species to other waterbodies.

Nearshore and Two-Story Fishery

Recent surveys indicate that the nearshore fishery of the Lake has declined over the past fifty years, with several sensitive species either no longer observed in the Lake or having severely reduced populations. These nearshore areas are important not only for harboring sensitive species but also provide an important nursery for young game fish that comprise much of the Lake's sport fishery. This nearshore fishery decline has been attributed to loss of nearshore aquatic habitat, including aquatic plant beds and coarse woody habitat, combined with stress from wave activity. The plan recommends measures to protect remaining high-quality habitats in the Lake as well as programs and practices, such as introduction of coarse wood along less developed shorelines, to restore nearshore habitats to support the Lake fishery.

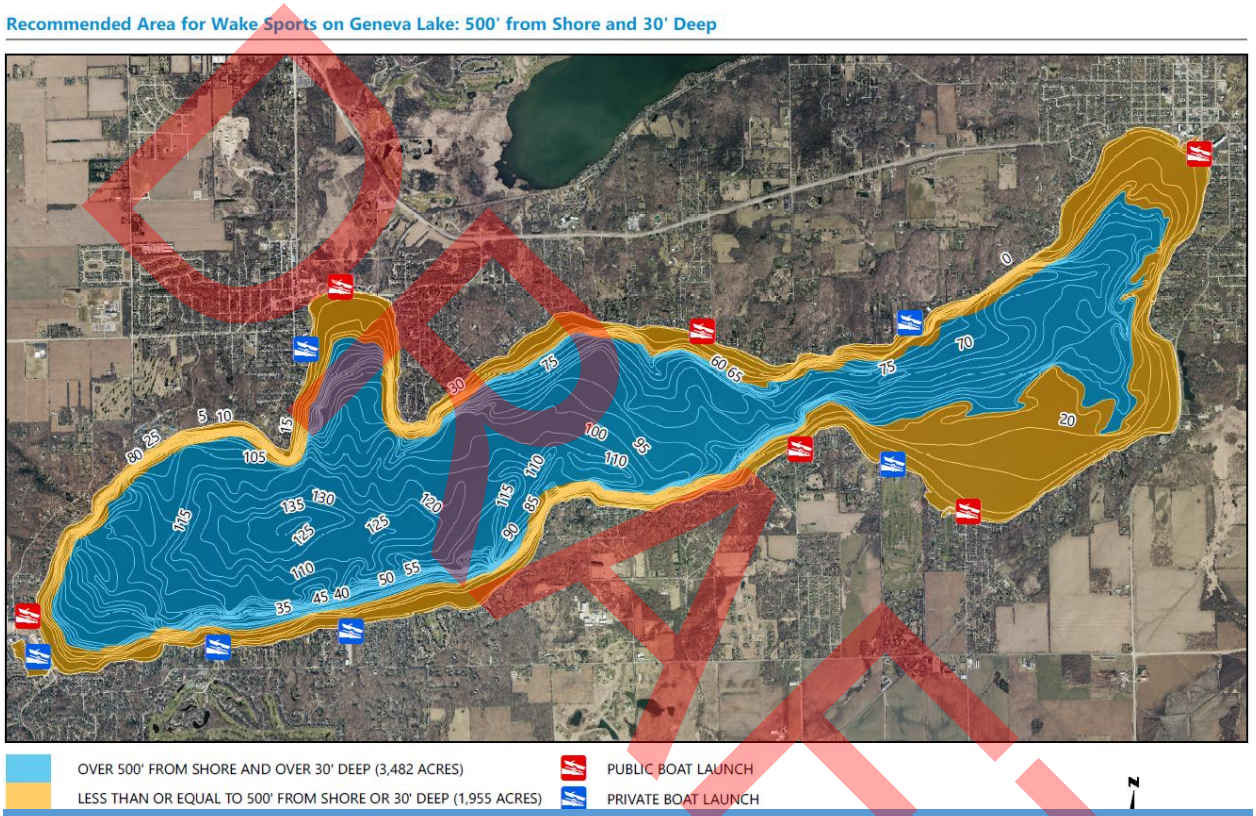
Species like the Iowa darter (left) and cisco (right) are not only important indicators of the Lake's ecological health but are important foundational components of the Lake's sport fishery.

Another vital component of the Lake fishery is its status as a two-story lake, meaning that it supports a deep, cold, well-oxygenated layer of water that sustains coldwater species like lake trout and cisco during stressful summer months. Cisco are a coldwater, schooling forage fish that WDNR fishery reports describe as the foundation of the Lake's productive fishery due to its dense population and its preference by game fish. The plan examines the existing oxythermal habitat in the Lake and considers the implications of warming water temperatures on the future for these and other coolwater species in the Lake.

Recreational Use

Geneva Lake is among the most popular recreational lakes in southeastern Wisconsin, and it sustains a variety of recreational activities and number of users beyond what most other lakes in Wisconsin can support. Despite this significant capacity for recreational use, these uses impact the Lake's ecology. Intense recreational use was identified as a concern by Lake residents and users during the plan kickoff meeting and the 2023 lake user survey. Using drone-based surveys and aerial imagery, the plan inventoried the

number and types of recreational activities on the Lake in 2023 and 2024 to examine whether the Lake exceeds its recommended carrying capacity (number of recreational watercraft active on the lake) based on published models. The Lake did exceed recommended carrying capacity during one observation but otherwise the capacity was within recommended levels for the useable area on the Lake. The plan recommends educational campaigns to inform boaters about responsible boating and protecting nearshore habitats by reducing the intensity of recreational use near the Lake's shorelines. Enhancing nearshore aquatic habitat can also help to reduce the stressors from intense recreational use and shoreline development on fish and other aquatic life.



Extensive shoreline development and intense boating pressure are impacting the ecological quality of the Geneva Lake and are a concern for lake users. Enhancing nearshore habitat and educating boaters on responsible boating practices can help protect the Lake while sustaining recreational use.

Lake Management and Funding

A primary interest among the partners involved in the development of the plan has been in the structure of organizations involved in lake management. To facilitate discussions regarding lake management, the plan describes the current roles and responsibilities assumed by organizations involved in lake management and provides alternative structures and pathways for lake management and governance. These pathways include sustaining current management roles, reinforcing the Geneva Lake Environmental Agency, creating a lake district, and forming a water commission. This section of the plan does not include a recommendation but provides information to assist the Geneva Lake community in deciding how best to manage the Lake.

Established partnerships and actionable plans enhance funding opportunities to implement plan elements. As described in the plan, lake stakeholders have already established programs and implement practices that protect the Lake's water quality and enhance aquatic habitat. However, more management practices and

funding are needed to continue to sustain and improve the Lake's ecological health, particularly against increasingly intense climate and recreational stressors. A variety of federal and state funding sources promote conservation practices and protect water quality, including programs by the Natural Resource Conservation Service, WDNR, and the Wisconsin Department of Agriculture, Trade and Consumer Protection. The plan recommends practices and programs, identifies priority stakeholders for each recommendation under the existing lake management structure, and suggests potential funding opportunities for these recommendations.

The Geneva Lake Conservancy, Geneva Lake Environmental Agency, and the Geneva Lake Association have led efforts to protect the lake's water quality and fishery through educational programs and implementing best management practices in the Lake and its watershed.

The plan also recommends practices that individual property owners, businesses, and homeowner associations can employ. Reducing fertilizer, pesticide, and deicing salt use, particularly on riparian properties; creating a rain garden; practicing safe and responsible boating; replacing buckthorn and honeysuckle with native vegetation; and incorporating native vegetation into shoreline protection can also help protect and enhance the Lake. Lake residents can also advocate for local government policies and programs that protect the Lake as well as donate to organizations that are active in lake management and protection.

Help Protect Geneva Lake
Plant native vegetation
Reduce deicing salt use
Limit fertilizer applications
Practice responsible boating
Advocate for protective policies
Support lake management

Conclusion

Geneva Lake has significant economic, aesthetic, quality-of-life, and ecological value. Protecting these values requires active management from dedicated stakeholders. Lake stakeholders should utilize this plan to help implement practices and guide policy decisions that will help protect Geneva Lake. The measures presented in this plan primarily focus on those that can be implemented through collaboration between local organizations and individuals, such as the Lake residents; Geneva Lake Conservancy; the Geneva Lake Association; the Geneva Lake Environmental Agency; the City of Lake Geneva; the Villages of Williams Bay and Fontana-on-Geneva-Lake; the Town of Linn; Walworth County; and the WDNR. The plan must be adaptable to address challenges that will arise during implementation. Widespread plan endorsement and/or plan adoption can be used to demonstrate the broader community's united resolve to achieve tangible goals, a situation that commonly results in greater plan implementation and which can help foster receipt of grant funding. Implementing this plan will help protect the quality of the Lake and ensure that it remains a treasured resource to enjoy.