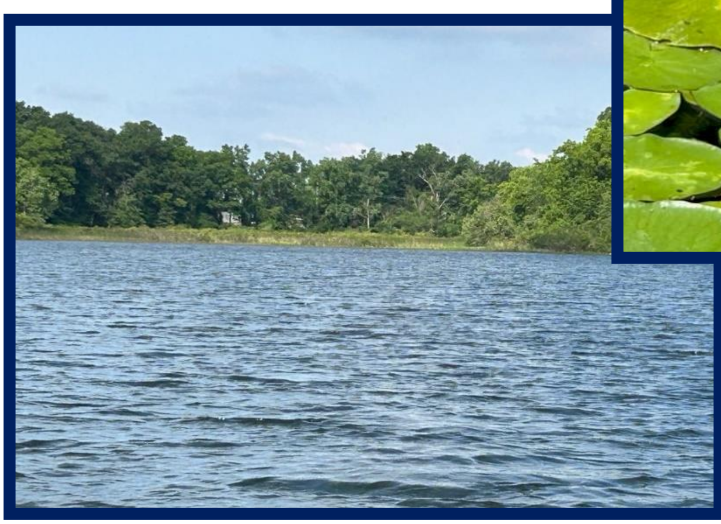
Perch and Crystal Lakes Limnological Study and Management Plan Hillsdale County, Michigan



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1.0 EXECUTIVE SUMMARY

Perch and Crystal Lake are both located in Somerset Township in Hillsdale County, Michigan (T.5S, R.1W, Section 3; Figure 1). The Perch Lake basin is comprised of 45 acres and the Crystal Lake basin consists of 129 acres (RLS, 2023) at the current lake levels. The Perch Lake basin has nearly 1.3 miles of shoreline and the Crystal Lake basin has nearly 3.7 miles of shoreline. The mean depth of the Perch Lake basin is approximately 5.9 feet, and the mean depth of the Crystal Lake basin is approximately 13.6 feet. The maximum depth of the Perch Lake basin is approximately 9.7 feet, and the maximum depth of the Crystal Lake basin is approximately 62.4 feet (RLS, 2023 bathymetric scan data).

The Perch Lake basin also has a fetch (longest distance across the lake) of approximately 0.5 miles and the Crystal Lake basin has a fetch of approximately 0.7 miles (RLS, 2023). The Perch Lake basin has an approximate water volume of 242.2 acre-feet and the Crystal Lake basin has an approximate water volume of 1,980.9 acre-feet (RLS, 2023 bathymetric data). The immediate watershed, which is the area directly draining into the lakes, differs for each lake with Perch Lake being approximately 113.7 acres and Crystal Lake being is approximately 365.3 acres which is about 2.4 times the size of the lake for Perch Lake and about 2.5 times the size of the lake for Crystal Lake. Both immediate watersheds are considered small and favorable. Both lakes are considered closed-basin (seepage) systems, but Crystal Lake does drain into a wetland at the west end of the lake and may enter Lake LeAnn during periods of intense rainfall.

Based on the current study, Perch Lake contains one invasive aquatic plant species which includes the submersed Starry Stonewort and Crystal Lake contains hybrid Eurasian Watermilfoil (EWM), and Curly-leaf Pondweed (CLP). Continued surveys and vigilance are needed to assure that additional invasives do not enter both lakes. Recommendations for prevention of invasives are offered later in this management plan report. Extensive whole-lake aquatic vegetation surveys and biovolume scans were conducted on both lakes on June 13, 2023. Perch Lake contained 5 native submersed, 3 floating-leaved, and 4 emergent aquatic plant species, for a total of 12 native aquatic plant species. Crystal Lake contained 10 native submersed, 3 floating-leaved, and 5 emergent aquatic plant species, for a total of 18 native aquatic plant species .

This represents a fair to good biodiversity that could be enhanced with continued control of the submersed invasives. Aquatic herbicide treatments are recommended on a spot-treatment basis to effectively reduce the invasives over time. Only systemic herbicides should be used on the invasive milfoil for sustained root control. In addition, Curly-leaf Pondweed naturally declines in mid-summer but contact herbicides can also be used to reduce it in the spring. Algaecides should be used sparingly on only dense, green, filamentous algal blooms since many favorable algae are present in both lakes and are critical food for zooplankton and ultimately the fisheries.

Two deep basin water quality sampling locations were sampled in each of the lakes on July 25, 2023. These basins were monitored for physical water quality parameters such as water temperature, dissolved oxygen, pH, specific conductivity, total dissolved solids (TDS), and Secchi transparency. Chemical water quality parameters were also measured at each site and included total Kjeldahl nitrogen (TKN), total inorganic nitrogen (TIN; which consists of ammonia, nitrate, and nitrite), chlorophyll-a, total phosphorus (TP), and ortho (ORP; soluble reactive) phosphorus, total alkalinity, and total suspended solids (TSS). The overall water quality of Perch Lake was measured as fair with high nutrients such as phosphorus (TP) and fair water clarity and elevated chlorophyll-*a*. Perch Lake had elevated concentrations of chlorophyll-a and thus is more productive than Crystal Lake. The water quality of Crystal Lake was measured as good with elevated phosphorus at the lake bottom and good water clarity and low chlorophyll-*a*. Both lakes also have a healthy population of favorable algae and zooplankton. Annual water quality monitoring in addition to the current CLMP scope is advised to monitor the bottom nutrient concentrations which are high for both lakes. In Crystal Lake, this high phosphorus at the lake bottom is present with dissolved oxygen depletion during summer months. This can create internal loading of phosphorus and lead to increased aquatic plant and algae growth over time. The historical CLMP values correspond with RLS measurements, but the CLMP method does not account for nutrients at the lake bottom, which is critical for understanding the true function of the lake relative to eutrophication over time. The majority of the data collected by RLS falls into the same ranges previously collected by lake volunteers through the CLMP program for surface nutrients, chlorophyll-*a*, and Secchi transparency.

Both lakes have multiple land uses such as wetlands, beaches, and riparian properties. The largest threats to both lakes are shoreline erosion and septic system inputs. RLS recommends that the local community implement Best Management Practices (BMP's) discussed in the immediate watershed management section to reduce the nutrient and sediment loads being transported into the lake from areas with high erosion and septic systems.

It would be beneficial to include the riparian community in the improvement program which could be initiated by holding a community-wide lake education and improvement workshop to introduce residents to the key lake impairments and garner support for continued lake protection. A septic tank and drain field maintenance program is needed to help riparians reduce nutrients such as nitrogen and phosphorus to the lakes. This could include an annual septic tank pump out and maintenance day for all residents.

RLS also recommends aquatic invasive species (AIS) educational signage and/or a boat washing station at the access sites. This is to prevent the transfer of invasive species into or out of the lakes. Regular whole-lake aquatic vegetation surveys are critical in the early detection of all invasives and for determining the efficacy of herbicide treatments.

2.0 LAKE ECOLOGY BACKGROUND INFORMATION

2.1 Introductory Concepts

Limnology is a multi-disciplinary field which involves the study of the biological, chemical, and physical properties of freshwater ecosystems. A basic knowledge of these processes is necessary to understand the complexities involved and how management techniques are applicable to current lake issues. The following terms will provide riparians with a more thorough understanding of the forthcoming lake management recommendations for Perch and Crystal lakes.

2.1.1 Lake Hydrology

Aquatic ecosystems include rivers, streams, ponds, lakes, and the Laurentian Great Lakes. There are thousands of lakes in the state of Michigan, and each possesses unique ecological functions and socio-economic contributions. In general, lakes are divided into four categories:

- Seepage Lakes,
- Drainage Lakes,
- Spring-Fed Lakes, and
- Drained Lakes.

Some lakes (seepage lakes) contain closed basins and lack inlets and outlets, relying solely on precipitation or groundwater for a water source. Seepage lakes generally have small watersheds with long hydraulic retention times that render them sensitive to pollutants. Drainage lakes receive significant water quantities from tributaries and rivers. Drainage lakes contain at least one inlet and an outlet and generally are confined within larger watersheds with shorter hydraulic retention times. As a result, they are less susceptible to pollution. Spring-fed lakes rarely contain an inlet but always have an outlet with considerable flow. The majority of water in this lake type originates from groundwater and is associated with a short hydraulic retention time. Drained lakes are similar to seepage lakes, yet rarely contain an inlet and have a low-flow outlet. The groundwater and seepage from surrounding wetlands supply the majority of water to this lake type and the hydraulic retention times are rather high, making these lakes relatively more vulnerable to pollutants. The water quality of a lake may thus be influenced by the quality of both groundwater and precipitation, along with other internal and external physical, chemical, and biological processes.