

Big Sand Lake

Report produced: September 24, 2026

County, State	Burnett, WI
Coordinates	45.82459, -92.21951
Alternative lake name(s) 	None available
Lake ID 	4565
Trophic state	Mesotrophic
Lake type	Natural lake
Lake area	1,434 acres
Lake perimeter 	8.5 miles
Maximum depth	55 feet
Average depth 	No data
Maximum fetch 	2.7 miles
Ecoregion 	Upper Mississippi
Glacial history 	Late Wisconsinan
Ratio of watershed area to lake area	1.1



This lake report is designed to provide information as a starting point for understanding, assessing, and conserving the health of a lake. The data in the report are compiled from the best available sources of regional data in the Upper Midwest. In some cases, more complete, thorough, or accurate data are available from local sources. The information in this report should complement those additional sources, filling in gaps where they may exist. To learn more about the data in this report and how they were collected, please see the Conservation Planner User Manual available on the Midwest Glacial Lakes Partnership website (midwestglaciallakes.org). Does this report motivate you to take action? Start by contacting lake professionals in your state, available on the MGLP Resources for Conservation page. <http://midwestglaciallakes.org/resources-for-conservation>

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Thermal habitat

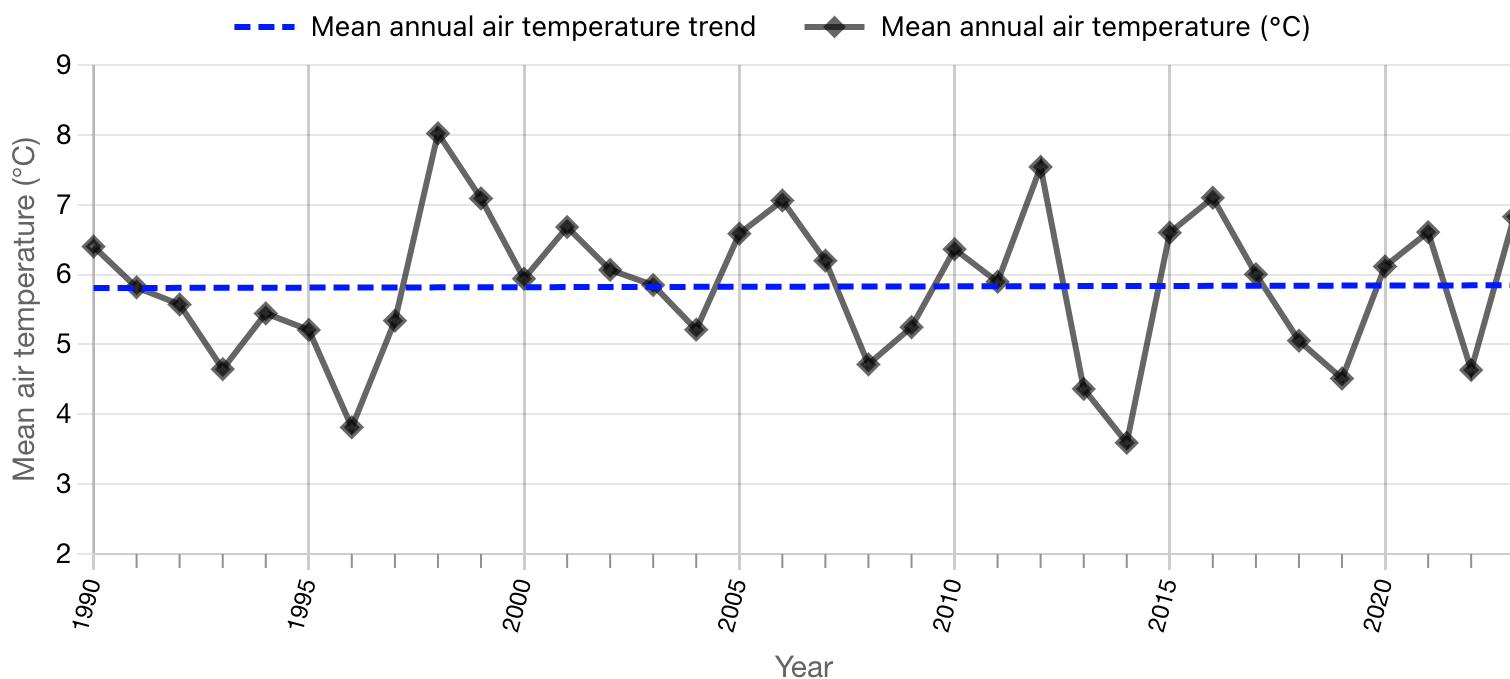
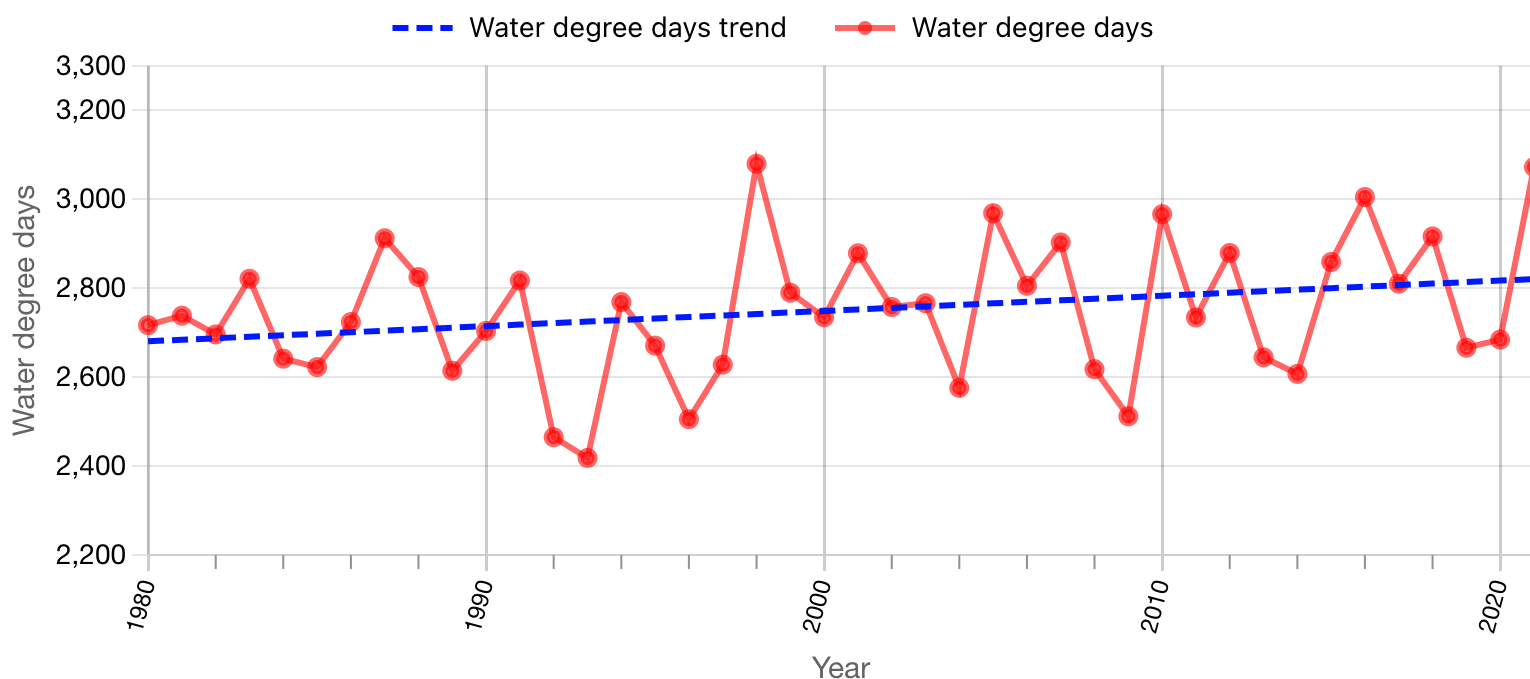
A fish's body is generally the same temperature as the water in which it swims, and different species have become adapted to specific temperature environments. Fishes tend to be healthy and grow quickly at their preferred temperature; temperatures above or below these preferences can result in slow growth, stress, disease, or death. Furthermore, fish rely on seasonal temperatures among a host of other factors to time their spawning periods, migrate to more beneficial habitats, and complete other changes that help them to thrive.

Across more than 11,000 Midwestern lakes, scientists used statistical models to identify six distinct lake types that describe how current water temperatures behave through the year (Sullivan et al. 2025). These range from cool, steady northern lakes that warm slowly and begin stratifying early in the season, to very warm southern lakes with long, stable summers and mild winters. In between are lakes that warm quickly but keep a short cool season, lakes with a balanced mix of hot and cold days, lakes prone to sudden, short bursts of intense heat, and lakes that stay unusually warm into fall. By century's end, most lakes are projected to shift toward the warmer, more variable types, with a small number, concentrated in southern Illinois, Indiana, and western Michigan, expected to develop conditions unlike any lake type seen in the region today. Where available, these temperature descriptions provide an excellent starting point for understanding the likely current and future thermal habitat for fishes. Please note that the terms warm, cool, and cold are used in these descriptions, but are not formally referring to thermal classes delineated by some fisheries biologists (e.g., Magnuson et al. 1979).

Time period	Characterization	Summary
Current	Cool, balanced lakes with moderate warming	A cool lake that warms gradually and has a short summer season, with a fairly even mix of cold days and hot days across the year. It stratifies at a typical, mid-range time, and in spring and fall its temperature is more likely to swing with short-term weather rather than follow a smooth seasonal curve.
Mid-century (2040-2059)	Cool, variable lakes with short growing seasons	A cool lake with a short summer season that warms up quickly once spring arrives. Summer temperatures can swing a lot from year to year, and it's slower to stratify (forms layers later in the season) than most lakes.
Late-century (2080-2099)	Warm, variable lakes with rapid warming and stratification	A warm lake that heats up quickly and is prone to sudden, short bursts of very hot water. Spring, summer, and fall temperatures are all unpredictable year to year, and it's slow to stratify.

Another measure of the thermal habitat in a lake is water degree days. Water degree days are an indicator of both how warm a lake is and how long it is warm. Scientists estimated water degree days using air temperature data from past years to estimate water temperatures (Corson-Dosch et al. 2023). For each day of the year, they calculated the difference between the surface water temperature and 5°C and then added up all of those amounts for the year. So, the more warm days there were or the warmer the days were over the 5°C benchmark, the higher the number of degree days. Analyzed over time, degree days can provide an indication of how thermal habitat in the lake is changing as the climate changes.

Water degree days 	2795 days
Average annual precipitation 	31.3 in
Average annual air temperature 	5.8°C
Average summer bottom water temperature 	12.7°C



Fish catch and habitat suitability

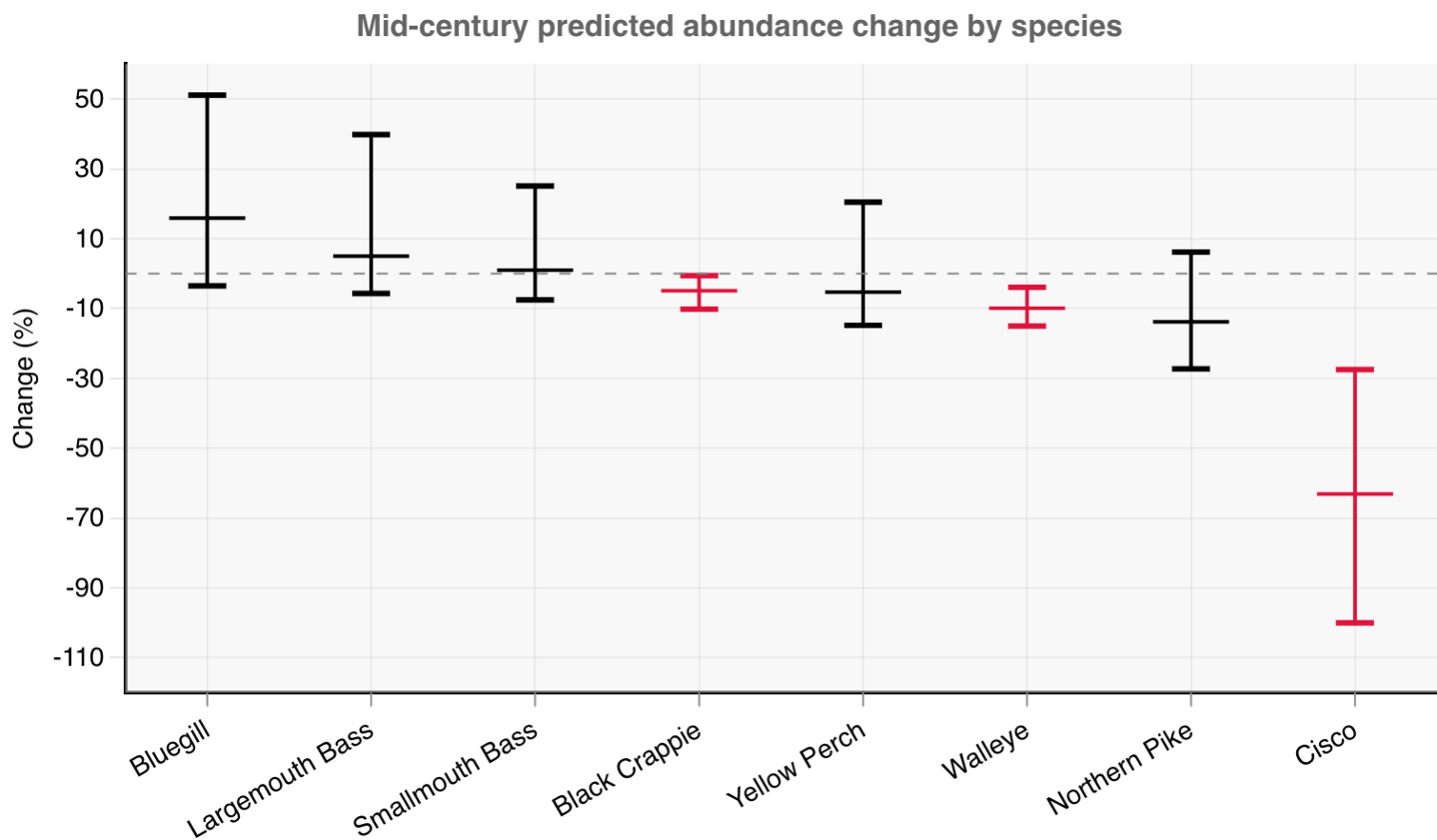
Fish surveys conducted by state, tribal, and museum staff have been compiled for eight common species (Link et al. 2026). Species listed as "confirmed present" in the table below have had at least one individual of that species caught in surveys on the lake prior to 2023. If appropriate surveys have been conducted, but the species was not caught, the species is classified as "likely absent". If there is no record of the species in the lake and there are no appropriate surveys that have been shared with the MGLP, the species is classified as "unknown". For species listed as likely absent or unknown, it is important to consider historical surveys, angler reports, and other anecdotal information before determining whether the species is absent from the lake.

As the climate generally warms across the Midwest Glacial Lakes Partnership's region, increased temperatures and longer ice-off periods reduce the amount of cool- and coldwater habitat to support these fishes (Hansen et al 2022). Researchers have used statistical models of habitat suitability based on climate change and lake characteristics to predict the thermal habitat available for each fish species now and into the future (Hansen et al. in prep). We suggest using the survey history provided in the table below alongside the predictions of thermal habitat suitability and your own knowledge of species occupying this lake and its water thermal habitat to assess potential future changes to the lake's fish community.

Species	Catch history (date of last capture)	Current habitat suitability	Mid-century habitat suitability	Late-century habitat suitability
Bluegill	Confirmed present (2022)	Moderate to high	Moderate to high	Moderate to high
Largemouth Bass	Confirmed present (2022)	Moderate to high	Moderate to high	Moderate to high
Smallmouth Bass	Likely absent	Moderate to high	Moderate to high	Moderate to high
Yellow Perch	Unknown	Low	Low	Low
Black Crappie	Unknown	Moderate to high	Moderate to high	Moderate to high
Walleye	Confirmed present (2022)	Moderate to high	Moderate to high	Moderate to high
Northern Pike	Unknown	Moderate to high	Moderate to high	Moderate to high
Cisco	Unknown	Moderate to high	Moderate to high	Zero

Changes in fish abundance

Lake water temperatures affect all fish species. Because each species has its own preferred temperature and a range of suitable temperatures, climate change will affect each species differently. Some populations of warmwater fishes like Bluegill, Largemouth Bass, Smallmouth Bass, Yellow Perch, and Black Crappie may increase in a warming climate, while coolwater species like Walleye and Northern Pike or coldwater species like Cisco may decline. Scientists have developed statistical models that estimate the abundance of eight representative fish species based on characteristics of the lake such as its depth, area, and predicted water temperatures (Hansen et al. in prep 2). These models can use data from future climate models to estimate potential changes in the abundance of those fishes by mid-century. In the figure below, predicted mid-century abundance is shown for eight representative species as a percentage change relative to current abundance. Boxplots for each species show the median (bold horizontal line) change and the 95% confidence interval (top and bottom brackets). Box plots in red indicate a statistically significant decline in abundance for that species, and box plots in blue indicate a statistically significant gain in abundance.



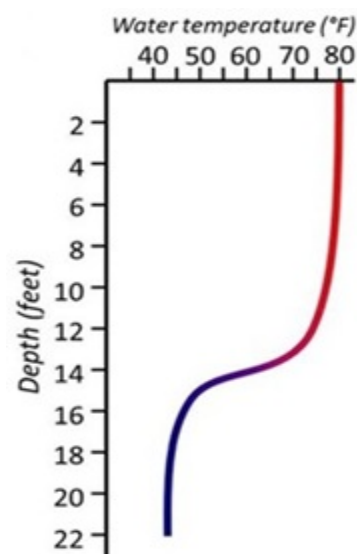
Stratification

During the summertime, the waters of many lakes across the Midwest Glacial Lakes Partnership region become stratified, with layers of warmer waters near the surface (the epilimnion), colder waters near the bottom (the hypolimnion), and a midwater zone of rapid transition called the thermocline. This phenomenon is called thermal stratification, and it can be measured by recording the water temperature throughout the profile of the water column similar to the figure on the right. Stratification is a physical condition that is driven by air temperatures, lake depth, and lake surface area among other factors. Statistical models that consider these factors have been used to create the prediction below of whether this lake stratifies (Corson-Dosch et al. 2023). If there are no direct water temperature profile data for your lake, this prediction may be helpful in understanding whether your lake stratifies.

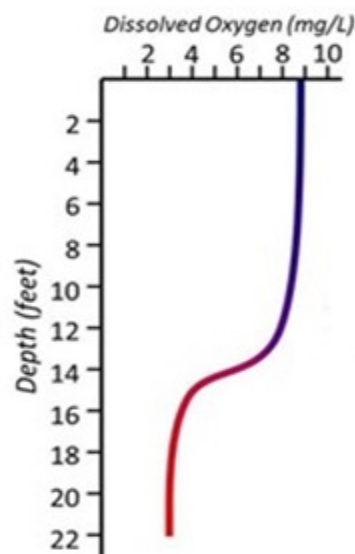
Thermal stratification **Yes**

The lake's surface waters mix with the atmosphere, so the epilimnion typically has sufficient oxygen for fishes. Down deeper, the hypolimnion is relatively cold. It also is often too dark for photosynthesis to occur and produce the oxygen that fish and other species require to live. Decomposition of organic material in the hypolimnion may cause oxygen levels to decline, sometimes to the point that fish avoid or cannot survive in this part of the lake. Of course, for a species that requires colder water, it may prefer to use colder bottom waters if they are oxygenated. Such fish face a conundrum, preferring to move down to avoid warm surface waters and move up to avoid low oxygen conditions. This phenomenon is called "oxythermal squeeze", and it is exacerbated by nutrient pollution that increases decomposition of organic materials in bottom waters and climate change that warms surface waters and lengthens stratification.

Hypothetical water temperature profile



Hypothetical oxygen profile



Scientists need a way to describe the coldest water in the lake that still has sufficient oxygen for fish, which is a strong predictor of the lake's ability to support coldwater fishes. This measurement is referred to as oxythermal habitat. While there are a number of thresholds that scientists have considered, 3 mg/L of dissolved oxygen is a commonly used benchmark for the minimum amount of oxygen necessary. This dissolved oxygen typically declines from the lake surface toward the bottom waters. Imagine swimming down deeper and deeper in a lake until the oxygen levels are at exactly 3 mg/L. The water temperature at that depth is a measure of the coldest suitable habitat. This is referred to as the temperature at dissolved oxygen of 3 mg/L, or TDO₃ for short. Researchers have used current and future local climate predictions along with lake depth, surface area, and other characteristics to predict TDO₃ and assess the decline of coldwater habitats due to climate change (Hansen et al 2022).

Temperature at dissolved oxygen of 3 mg/L (TDO₃)

Modeled current TDO ₃	19.8 mg/L
Modeled TDO ₃ midcentury	23.1 mg/L

Researchers have used projections of coldwater habitat that are influenced by both climate change and nutrient pollution to classify lakes into tiers for conservation purposes (Hansen et al. 2022). Coldwater habitat tiers were created for Cisco, a coldwater fish that serves as an indicator species for other coldwater species. Coldwater habitat tiers reflect the suitability of a lake for coldwater species, with Tier 1 lakes having the coldest oxygenated habitats (TDO₃ less than 13.64°C) that provide suitable habitat for Cisco. Tier 2 lakes have marginal coldwater habitats (TDO₃ between 13.64 - 23.17°C) that are at risk for supporting Cisco if conditions degrade. Tier 3 lakes are generally considered unsuitable (TDO₃ greater than 23.17°C), although exceptions do exist. These coldwater classifications were applied to many lakes across the partnership to provide an assessment of coldwater habitat for any coldwater species, regardless of whether Cisco were present in each lake. Hansen et al. (2022) also developed coldwater habitat management classes based on resilience of coldwater, oxygenated habitat to changes in watershed disturbance and projected mid-century July air temperatures.

It is impossible to create statistical models that perfectly predict coldwater habitat conditions, so scientists and managers must interpret these results in relation to the uncertainty associated with them. The current coldwater habitat tier below is the tier that was most likely, but it may also be helpful to know what the chance is that the lake is a Tier 1 (suitable) lake. Interpreting this current probability of Tier 1 coldwater habitat alongside other complementary data that you may have, especially temperature and dissolved oxygen data collected in the summer, will help assess the true status of the lake.

Coldwater Habitat

Current coldwater habitat tier ⓘ	Tier 2
Current probability of supporting Tier 1 coldwater habitat	9 %
Midcentury coldwater habitat tier	Tier 3
Coldwater habitat management class ⓘ	Limited potential

These lakes are predicted to have unsuitable (Tier 3) oxythermal habitat conditions for coldwater fishes under mid-century climate conditions regardless of watershed disturbance.

Non-native aquatic species

Non-native aquatic species can affect the way that lake ecosystems function. Some species such as zebra mussels filter the water column and remove the plankton that are the base of the food web for many species. Other species such as Eurasian watermilfoil expand aggressively and can crowd out native plants, degrading habitat for fish and other aquatic life. Knowing which non-native species are present in a lake is important for setting and pursuing management goals to conserve the lake as well as understanding the risks of transporting the species to or from the lake. The USGS Nonindigenous Aquatic Species database provides a national compilation of known non-native species occurrences. Due to the rapid spread of invasive species and the impossibility for agencies to monitor each of the 88,000+ lakes across the Midwest Glacial Lakes Partnership region, the list of known non-native species reports below does not contain all actual occurrences. Does your lake have a non-native species present that isn't listed below? We suggest that you report the species through the [iNaturalist](#) program on your phone or computer; these reports are evaluated and potentially included in the Nonindigenous Aquatic Species database. The Nonindigenous Aquatic Species data used in this report are from 2024 and will be updated intermittently.

Plants and algae ⓘ

purple loosestrife (*Lythrum salicaria*)

Fish ⓘ

No data

Molluscs ⓘ

Chinese mysterysnail (*Cipangopaludina chinensis*)

Invertebrates ⓘ

Chinese mysterysnail (*Cipangopaludina chinensis*)

Other ⓘ

No data

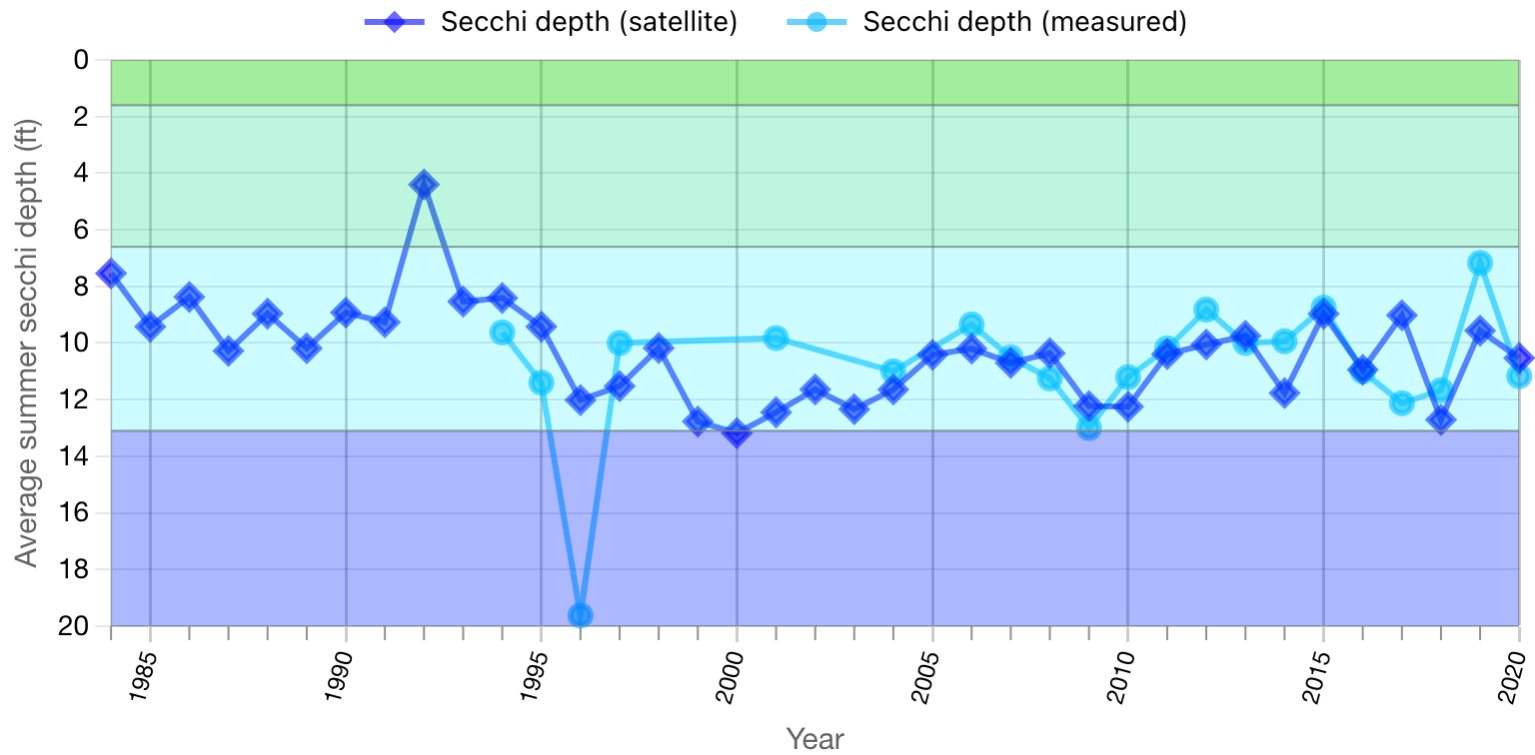
Water clarity and color

The most basic measure of water quality is clarity. Water clarity is like an overview of the lake’s water quality in that it is affected by many components of water quality discussed below such as suspended solids, turbidity, and nutrients like phosphorus and nitrogen that affect algal growth. This catchall indicator of water quality is also the easiest to measure. The simplest method to assess water clarity is to lower a black-and-white disc called a Secchi disc into the water and record the maximum depth at which it can be seen (Shuvo et al. 2023). With advances in satellite technology, Secchi depth can now be estimated remotely (Hanly et al. 2025). These estimates dramatically increase the number of lakes with information about water clarity, but direct measurements are always the most accurate indicators of clarity

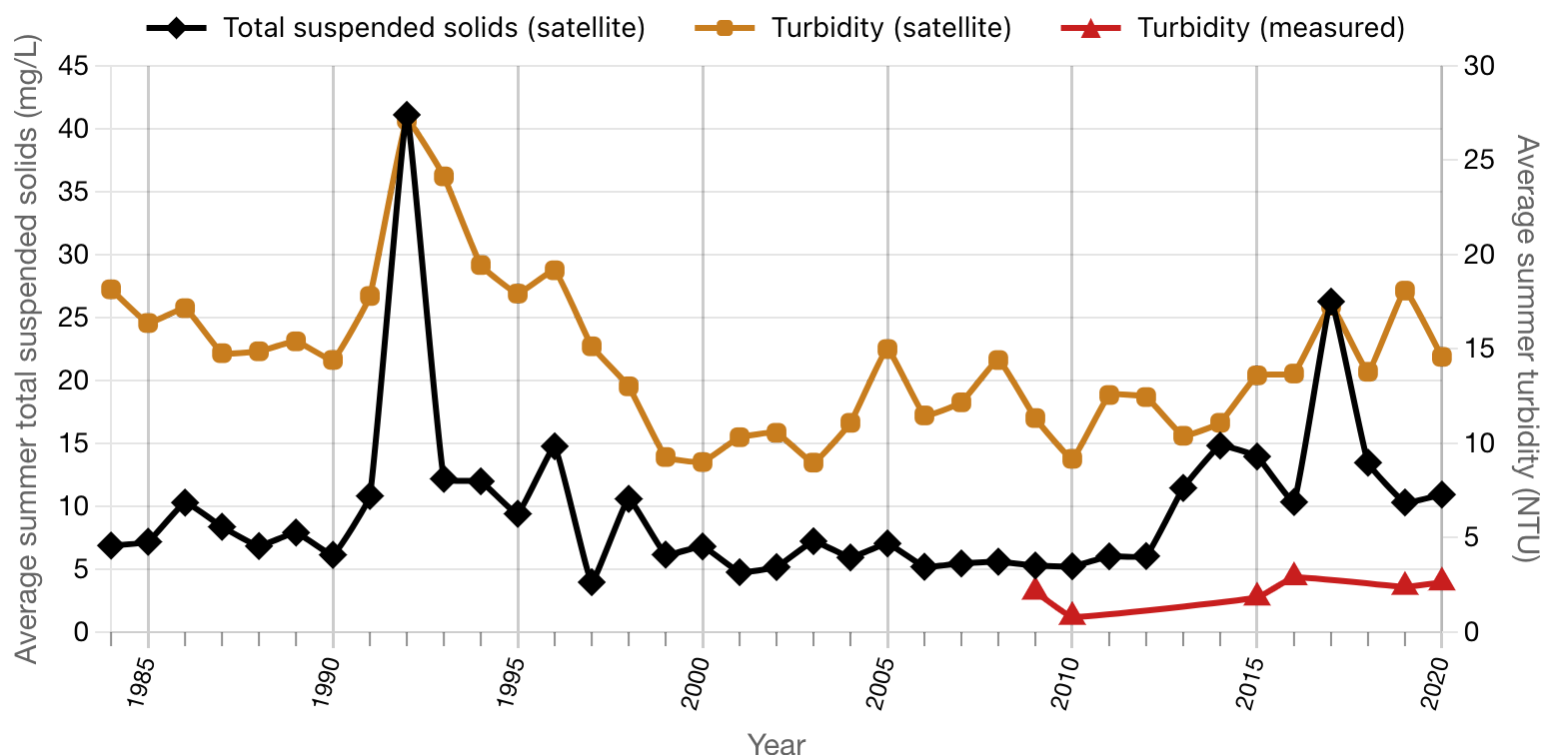
Water clarity

Measured Secchi depth (2020) ⓘ 11.2 ft
Satellite estimated Secchi depth (2020) ⓘ 10.5 ft

- Hypereutrophic (<1.6 ft)
- Eutrophic (1.6 to <6.6 ft)
- Mesotrophic (6.6 to <13.1 ft)
- Oligotrophic (>=13.1 ft)



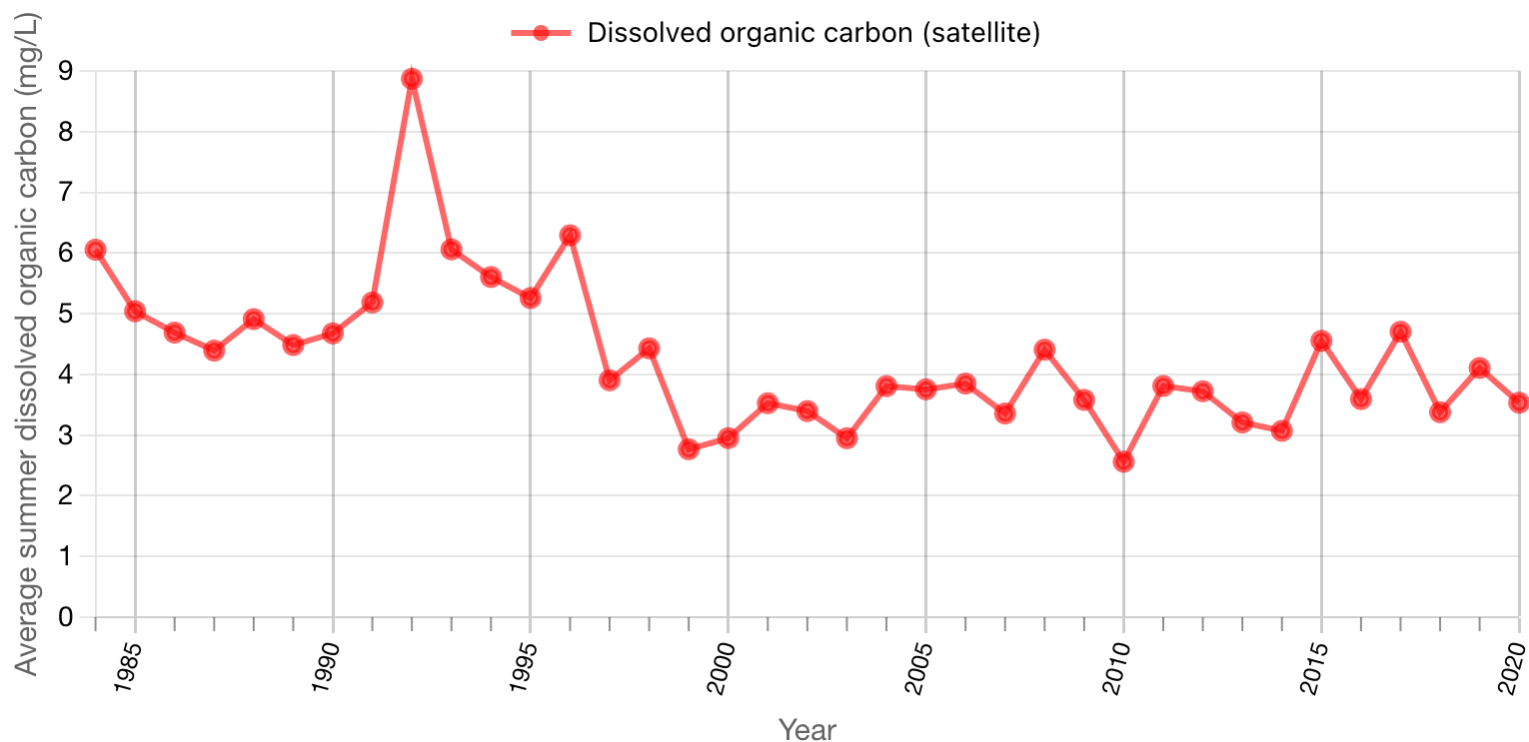
Another assessment of clarity is turbidity, which measures the amount of light that is scattered by material in the water such as clay, silt, suspended inorganic and organic material, dissolved organic compounds, and plankton. Low turbidity levels (e.g., less than 25 NTU) indicate relatively clear water while higher values (e.g., greater than 50 NTU) indicate relatively opaque water. A component of turbidity is total suspended solids, which include small solid particles that are suspended (i.e., not dissolved) in the water. The amount of total suspended solids is measured through the dry weight of the material that can be filtered out using a 2 micron filter. The figure below presents turbidity data from satellite-derived sources (Hanly et al. 2025) and directly-measured sources (Shuvo et al. 2023), if available.



Water color and clarity (2020)

Dissolved organic carbon 	3.5 mg/L
Turbidity 	2.1 NTU
Total suspended solids 	10.9 mg/L

In contrast to total suspended solids, dissolved organic material also affects the clarity and color of the water. Lakes with higher levels (e.g., above 5-10 mg/L) of dissolved organic carbon appear more brown, while lakes with lower levels appear more blue or green (e.g., below 5 mg/L). Sometimes these lakes with high dissolved organic carbons are called stained or tannic, as the high levels are often driven by the tannins released by decaying plant material. Dissolved organic carbon is a key component of lake ecosystems, because it influences how energy and nutrients move through the food web. Dissolved organic carbon provides an important carbon source for bacteria and microorganisms, which form the base of microbial food webs that ultimately support zooplankton and fish. Dissolved organic carbon can also influence the growth and productivity of aquatic plants, phytoplankton, and fish indirectly through its effects on water color and decreased light penetration. The figure below presents dissolved organic carbon data from satellite-derived sources (Hanly et al. 2025) and directly-measured sources (Shuvo et al. 2023), if available.

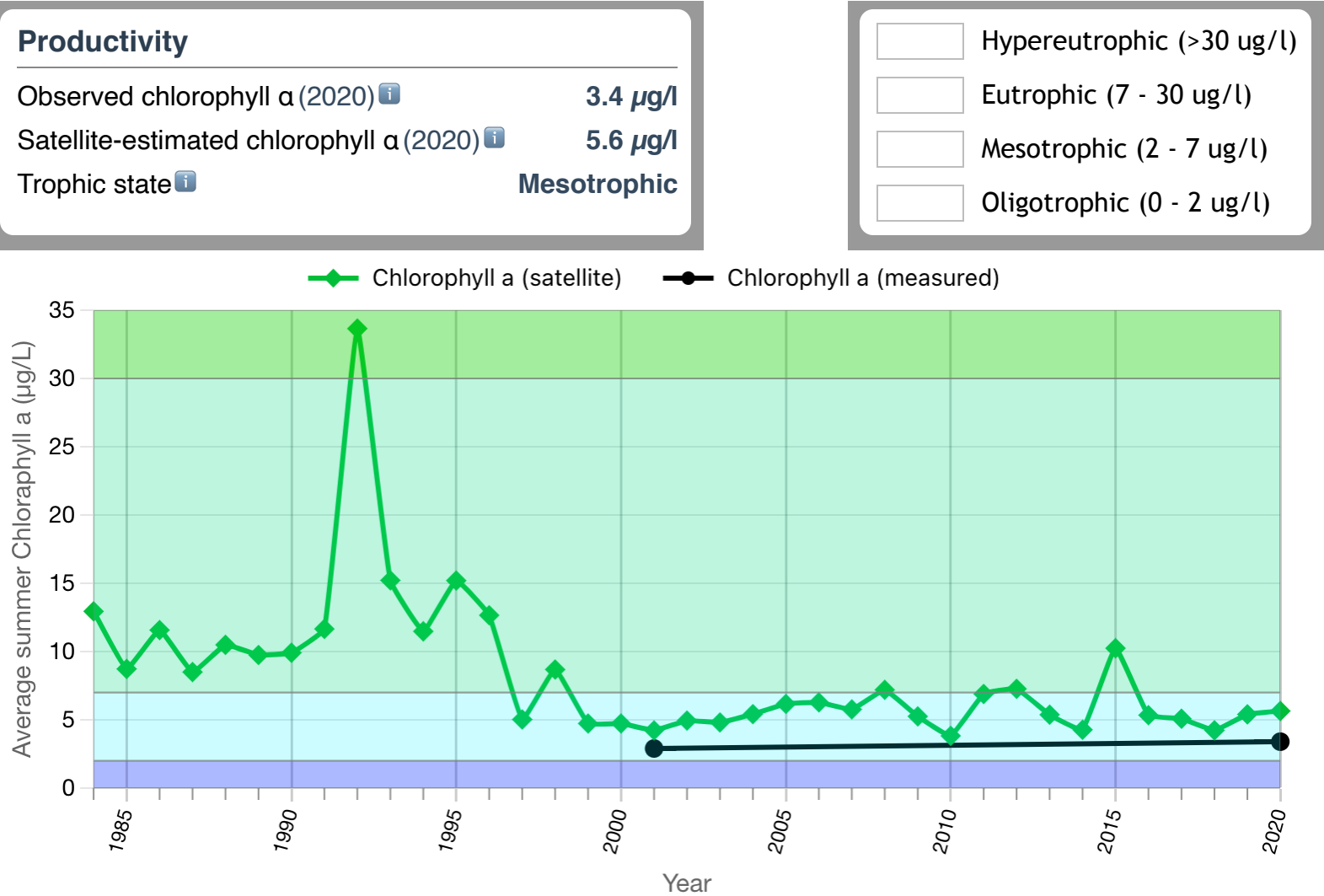


The food web in lakes is driven in large part by the nutrients in the water. These nutrients fuel photosynthesis and the growth of rooted aquatic plants and small floating algae called phytoplankton. This photosynthetic production provides energy for animals that consume plants and algae, including microscopic invertebrates called zooplankton and planktivorous fish. In turn, these animals provide prey for fishes, supporting the fisheries that people enjoy. In most lakes, the nutrient that is in the highest demand and thus can serve as the “bottleneck” that puts an upper limit on the amount of productivity in the lake is phosphorus. Total phosphorus is a measure of all forms of phosphorus in the water column. Total phosphorus values greater than 50 µg/L correspond to very high levels of production and indicate that the lake is hypereutrophic. Total phosphorus levels between 25-50 µg/L typically correspond to high levels of production (eutrophic lakes), 10-25 µg/L correspond to moderate levels of production (mesotrophic lakes), and less than 10 µg/L correspond to low levels of production (oligotrophic lakes; USEPA 2016). Another very important nutrient is nitrogen, which can sometimes limit overall production as well. Total nitrogen levels above 1400 µg/L typically correspond to very high levels of production, between 1400 - 750 µg/L typically correspond to high levels of production, 350 - 750 µg/L correspond to moderate levels of production, and less than 350 µg/L correspond to low levels of production (USEPA 2016).

Nutrients (2020)	
Total phosphorus ⓘ	No data
Total nitrogen ⓘ	No data

The nutrients, water clarity, temperature, species present, and other factors determine how much photosynthesis occurs in the water column of the lake. Referred to as primary productivity, this photosynthetic activity is driven by microscopic organisms called phytoplankton and is often the foundation of the food web in the lake; more productivity can support more fish biomass. However, if productivity increases to unnaturally high levels, it may have negative effects on the lake. Harmful algal blooms and oxygen-poor bottom waters are often associated with lakes that have higher productivity. Productivity is measured directly by assessing the amount of chlorophyll α in a water sample. Chlorophyll α is the chemical that plants use for photosynthesis and thus is a good indicator of the amount of photosynthetic activity occurring in the water column. The figure below presents chlorophyll α data from satellite-derived sources (Hanly et al. 2025) and directly-measured sources (Shuvo et al. 2023), if available.

Just as there are an infinite number of colors, lake productivity exists across a spectrum from very low productivity lakes to very high productivity lakes. To simplify comparisons among lakes, scientists generally classify lakes by their productivity using categories called trophic states. Lakes with chlorophyll α levels less than 2 $\mu\text{g/L}$ are the lowest productivity lakes and are referred to as oligotrophic, lakes with chlorophyll α between 2 and 7 $\mu\text{g/L}$ have moderate productivity (mesotrophic), lakes with chlorophyll α between 7 and 30 $\mu\text{g/L}$ have high productivity (eutrophic), and lakes with chlorophyll α greater than 30 $\mu\text{g/L}$ have very high productivity (hypereutrophic; EPA 2024).



High productivity isn't necessarily a bad thing; some lakes are naturally more productive than others. However, in many cases, humans contribute nutrient pollution from agricultural and urban sources in the watershed as well as sources along the shoreline like fertilizer, septic systems, and runoff. This abnormally high productivity for the lake can threaten the natural balance of the ecosystem and sensitive species that may be adapted to thrive in lower-productivity systems. For example, greater productivity may increase the amount of decaying organic material in the deep waters of the lake, reducing or eliminating oxygen in the habitats for fishes such as Walleye, Northern Pike, or Cisco that require cool- and cold-water habitats. Analyzing the shoreline and watershed land cover around the lake with the information in the land use/land cover section of this report can help provide insights into potential sources for nutrient pollution.

Shoreland land use summary

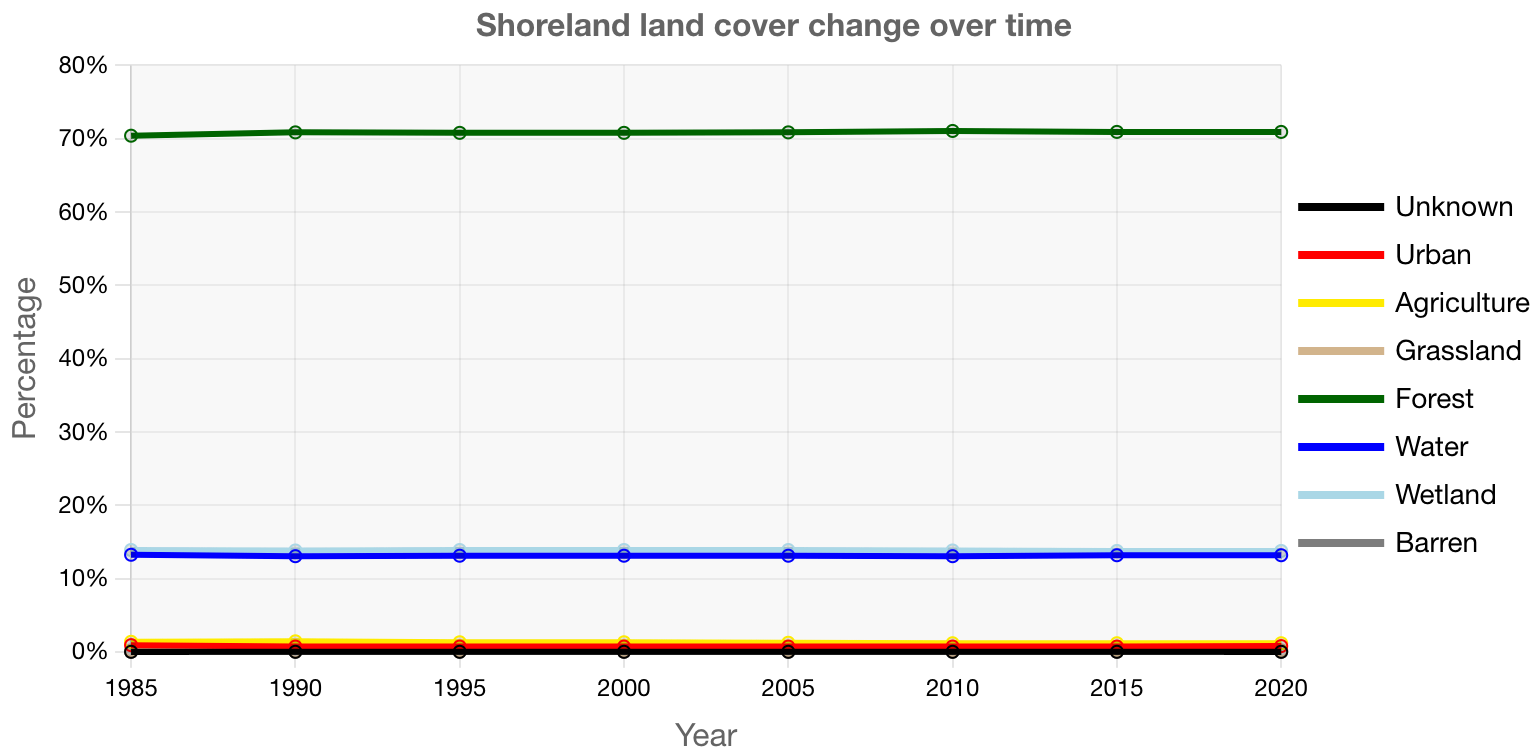
Lake shorelines are ecologically important areas, with the nearshore areas providing nursery and feeding habitats for many fishes and vegetated uplands filtering runoff from the land and contributing woody habitat to the water. A helpful indicator of shoreline health is shoreland land use. The shoreland land cover summary below shows the amount of the area within 300 feet of the lake’s shoreline in each 2023 National Land Cover Database land cover class (e.g., forest). The National Land Cover Database is a map of land use and land cover created from satellite imagery and available nationwide. In addition, we are sharing assessments of the protection status for the shoreland land using the Protected Areas Database of the United States (PAD-US). We’ve classified areas that are managed for biodiversity with permanent ecological protections as fully protected (GAP status 1 & 2 in the PAD-US), areas with some permanent ecological protections that are managed for multiple uses including potential logging or mining as partially protected (GAP 3), and areas without such measures as not protected (GAP 4).

The blue cells in the table below are protected, natural land cover types that should be monitored to ensure they continue to provide ecological benefits to the lake. The yellow cells are natural land cover types that are not protected; these areas should be identified for land use protection through easement, acquisition, and other means. The green cells represent the sum of all natural land cover types in the watershed, which contribute to the health of the watershed. The land cover in agricultural (orange) and urban (red) categories represent potential contributors to nonpoint source pollution (e.g., sediments and nutrients), potential degradation of nearshore habitat such as large woody debris, and potential prevalence of structures like docks and seawalls. These areas represent opportunities to work with private landowners to reduce runoff through riparian buffer zones, increase woody habitat, minimize aquatic vegetation treatments, and minimize human-caused degradation through other mechanisms. Importantly, agricultural and urban landcover are only indicators of a subset of potential sources of habitat degradation; impervious surfaces underneath the tree canopy, seawalls, septic tank effluent, and other threats should be considered as well.

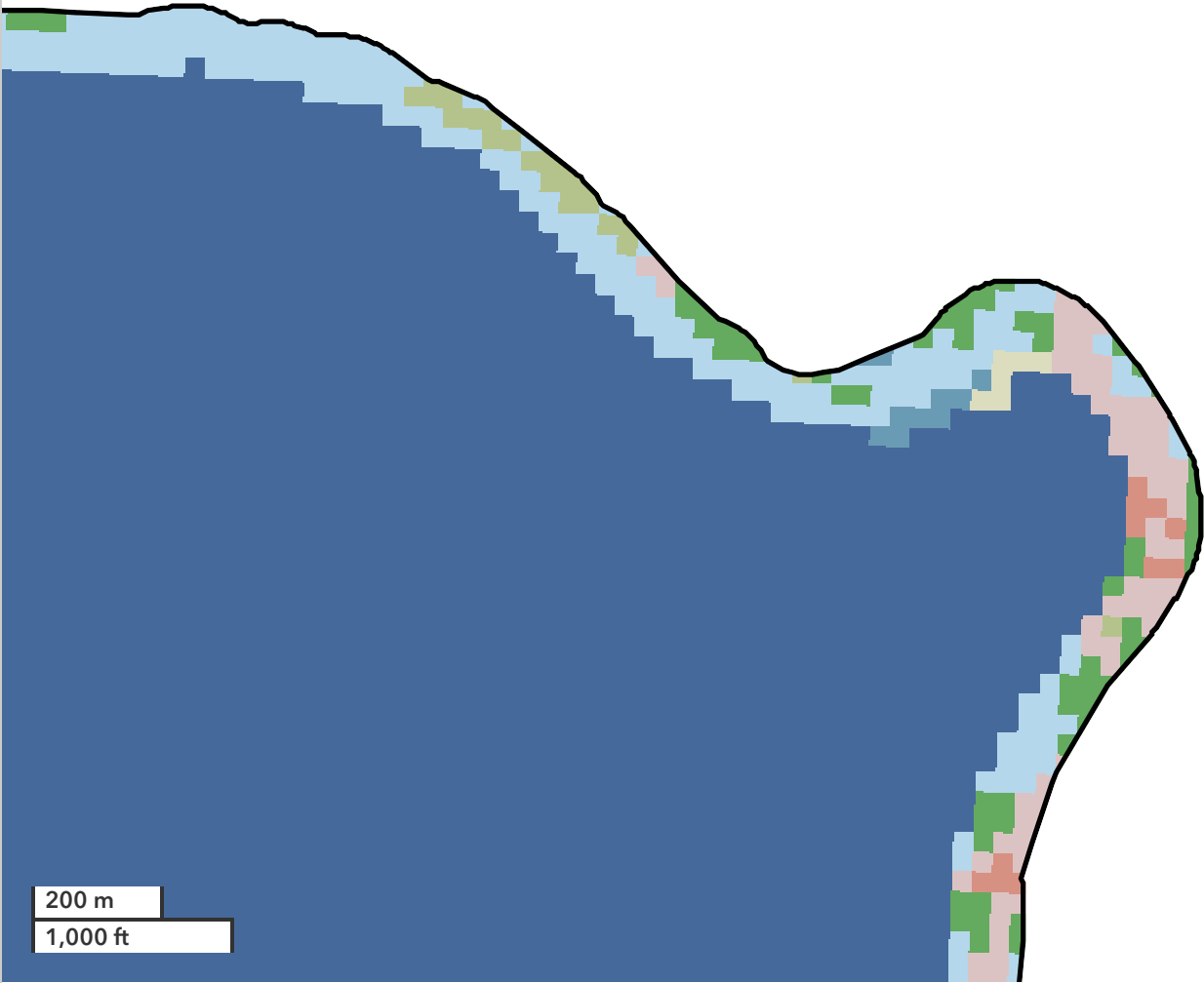
Protection status	Forest	Wetland	Grassland	Water	Other	Agriculture	Urban	Total
Fully protected	1.8 ac (0.5%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.4 ac (0.1%)	2.2 ac (0.6%)
Partially protected	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)
No protection	115.9 ac (34.1%)	133.7 ac (39.4%)	2.4 ac (0.7%)	14.1 ac (4.1%)	0.2 ac (0.1%)	1.1 ac (0.3%)	70.0 ac (20.6%)	337.4 ac (99.4%)
Total	117.7 ac (34.6%)	133.7 ac (39.4%)	2.4 ac (0.7%)	14.1 ac (4.1%)	0.2 ac (0.1%)	1.1 ac (0.3%)	70.5 ac (20.7%)	339.6 ac (100.0%)

Monitoring the changes in land cover around this lake can be helpful for understanding potential changes in the ecosystem. The time series figure below uses the Land Change Monitoring, Assessment, and Projection database to assess these changes. Because this dataset is slightly different from the National Land Cover Database, the percentages may differ slightly. The National Land Cover Database is considered as the best representation of current land cover, while the Land Change Monitoring, Assessment, and Projection database is the best representation of change over time.

A different land cover summary can be used to track land use and land cover change over time. The Land Change Monitoring, Assessment, and Projection (LCMAP) program has compiled historical land use data from 1985 - 2020, and these data have been summarized along the shoreland to show how the land around the lake has changed over time. As a reminder, these data only capture land cover change, so habitat degradation such as removal of in-lake woody habitat or installation of docks or seawalls may be occurring and/or increasing over time.



Click a land cover type in the legend to show or hide it in the chart.



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Open Water	Developed, Medium Intensity	Evergreen Forest	Pasture/Hay
Perennial Ice/Snow	Developed, High Intensity	Mixed Forest	Cultivated Crops
Developed, Open Space	Barren Land (Rock/Sand/Clay)	Shrub/Scrub	Woody Wetlands
Developed, Low Intensity	Deciduous Forest	Grassland/Herbaceous	Emergent Herbaceous Wetlands

The shapefiles used to create these maps are available upon request by emailing Joe Nohner (nohnerj@michigan.gov).

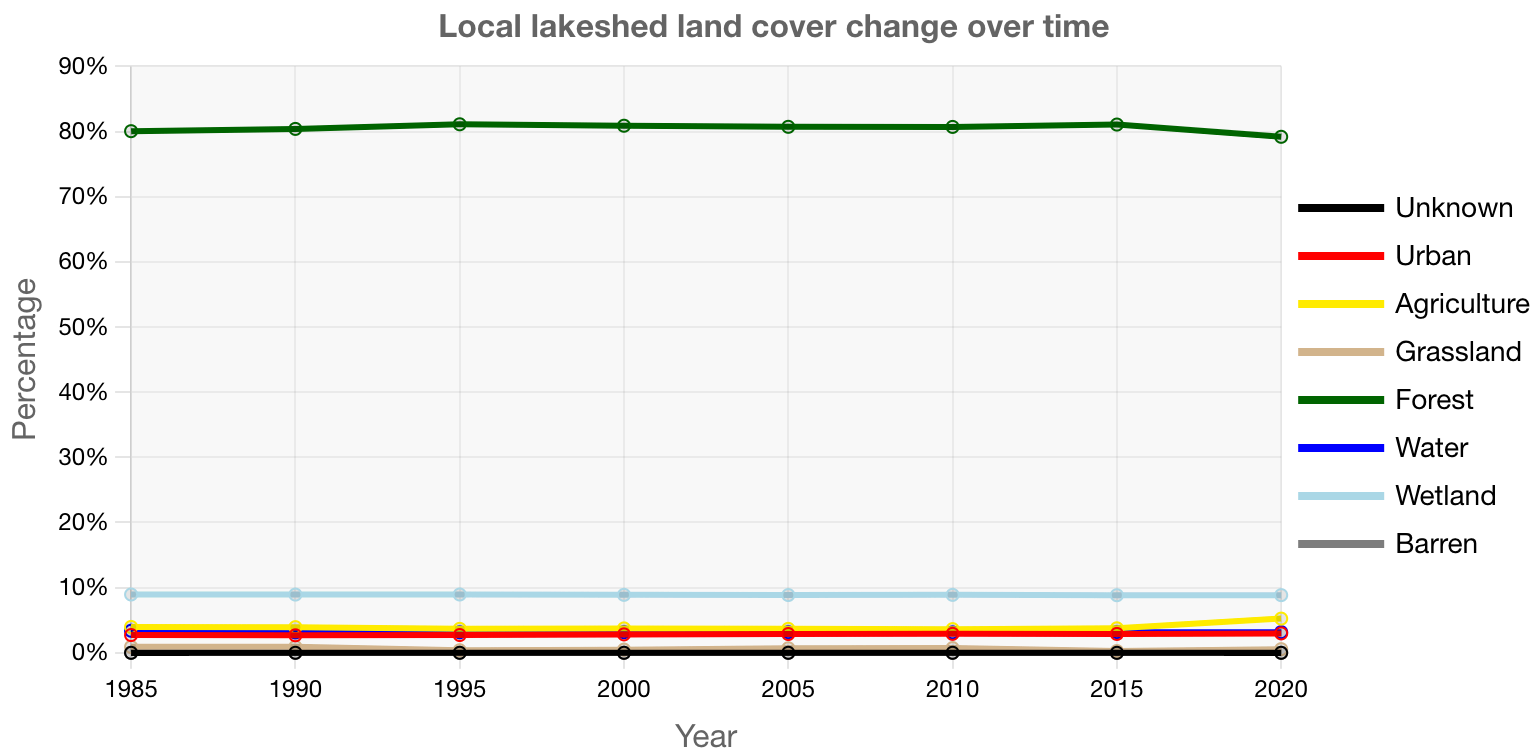
Lake water quality is determined in large part by the nutrients and sediments the lake receives from its watershed. In general, watersheds are all of the upstream and upland areas that drain into a particular location. Sometimes there may be lakes in that watershed that intercept and store some nutrients and sediment before it can be transported downstream. To provide an indication of the nutrient and sediment contributions that flow directly into Big Sand Lake without passing through another upstream lake, we have analyzed and provided maps of each lake's local watershed. A lake's local watershed includes the upstream land area that drains directly into the lake and any streams that feed directly into it but does not include those areas that drain directly into any upstream lake(s).

This local lake watershed land cover summary characterizes the land use and land cover based on the 2023 National Land Cover Database and land protection based on the Protected Areas Database of the United States (PAD-US) as described in the section above. The blue cells in the table are protected, natural land cover types that should be monitored to ensure they continue to provide ecological benefits to the watershed. The yellow cells are natural land cover types that are not protected; these areas should be identified for land use protection through easement, acquisition, and other means. The green cells represent the sum of all natural land cover types in the watershed and contribute to the health of the watershed. The land cover in agricultural (orange) and urban (red) categories represent potential contributors to nonpoint source pollution (e.g., sediments and nutrients), and in general are correlated with nonpoint source pollution. These areas represent opportunities to work with private landowners to reduce runoff through riparian buffer zones, no-till farming, native landcover restoration, establishment of working forests, and other mechanisms.

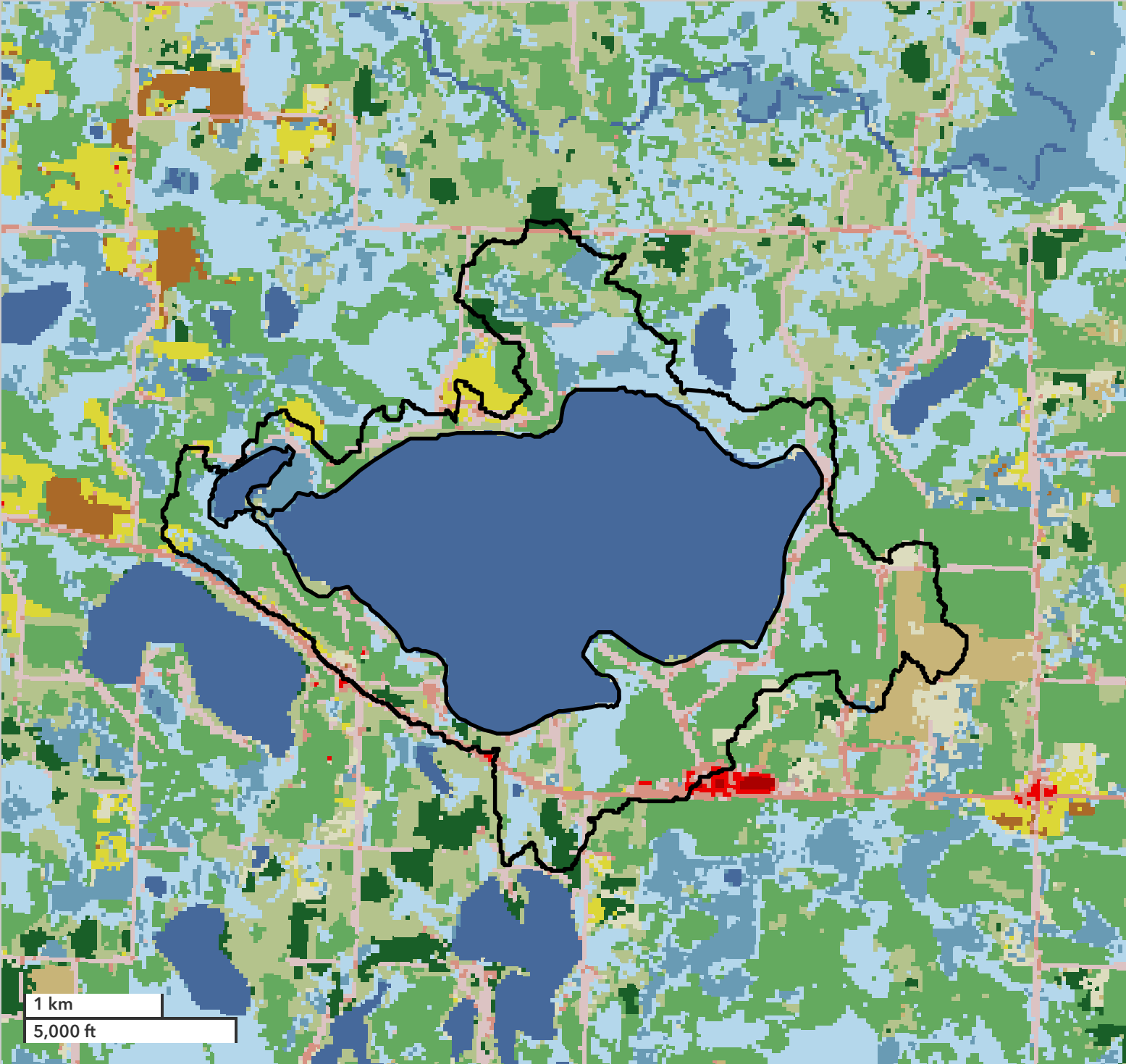
Protection status	Forest	Wetland	Grassland	Water	Other	Agriculture	Urban	Total
Fully protected	2.2 ac (0.1%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	1.6 ac (0.1%)	3.8 ac (0.2%)
Partially protected	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)
No protection	812.3 ac (50.8%)	430.7 ac (27.0%)	40.5 ac (2.5%)	16.0 ac (1.0%)	37.4 ac (2.3%)	27.1 ac (1.7%)	230.4 ac (14.4%)	1594.3 ac (99.8%)
Total	814.5 ac (51.0%)	430.7 ac (27.0%)	40.5 ac (2.5%)	16.0 ac (1.0%)	37.4 ac (2.3%)	27.1 ac (1.7%)	231.9 ac (14.5%)	1598.0 ac (100.0%)

Monitoring the changes in land cover around this lake can be helpful for understanding potential changes in the ecosystem. The time series figure below uses the Land Change Monitoring, Assessment, and Projection database to assess these changes. Because this dataset is slightly different from the National Land Cover Database, the percentages may differ slightly. The National Land Cover Database is considered as the best representation of current land cover, while the Land Change Monitoring, Assessment, and Projection database is the best representation of change over time.

A different land cover summary can be used to track land use and land cover change over time. The Land Change Monitoring, Assessment, and Projection (LCMAP) program has compiled historical land use data from 1985 - 2020, and these data have been summarized by the local watershed to show how the land around the lake has changed over time.



Click a land cover type in the legend to show or hide it in the chart.



MN Dept Natural Resources, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USD... Powered by Esri

Open Water	Developed, Medium Intensity	Evergreen Forest	Pasture/Hay
Perennial Ice/Snow	Developed, High Intensity	Mixed Forest	Cultivated Crops
Developed, Open Space	Barren Land (Rock/Sand/Clay)	Shrub/Scrub	Woody Wetlands
Developed, Low Intensity	Deciduous Forest	Grassland/Herbaceous	Emergent Herbaceous Wetlands

The shapefiles used to create these maps are available upon request by emailing Joe Nohner (nohnerj@michigan.gov).

Network watershed land use summary

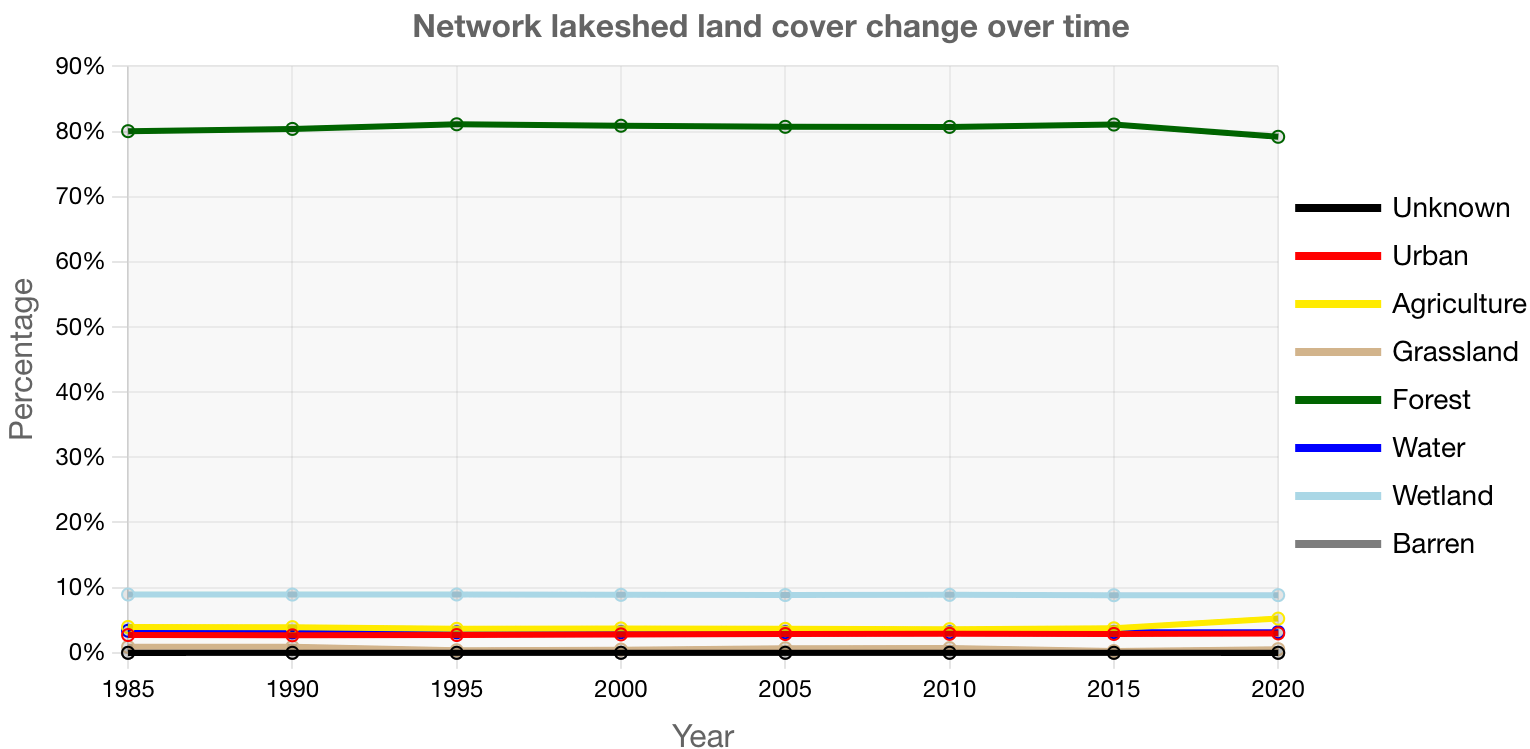
21

A lake's network watershed includes all of the land area that drains into the lake, including areas that drain into any potential upstream lakes. This network watershed land cover summary shows the amount lake watershed each 2023 National Land Cover Database classification as well as the land protection based on the Protected Areas Database of the United States (PAD-US) as described above. The blue cells in the table are protected, natural land cover types that should be monitored to ensure they continue to provide ecological benefits to the watershed. The yellow cells are natural land cover types that are not protected; these areas should be identified for land use protection through easement, acquisition, and other means. The green cells represent the sum of all natural land cover types in the watershed and contribute to the health of the watershed. The land cover in agricultural (orange) and urban (red) categories represent potential contributors to nonpoint source pollution (e.g., sediments and nutrients), and in general are correlated with nonpoint source pollution. These areas represent opportunities to work with private landowners to reduce runoff through riparian buffer zones, no-till farming, native landcover restoration, establishment of working forests, and other mechanisms.

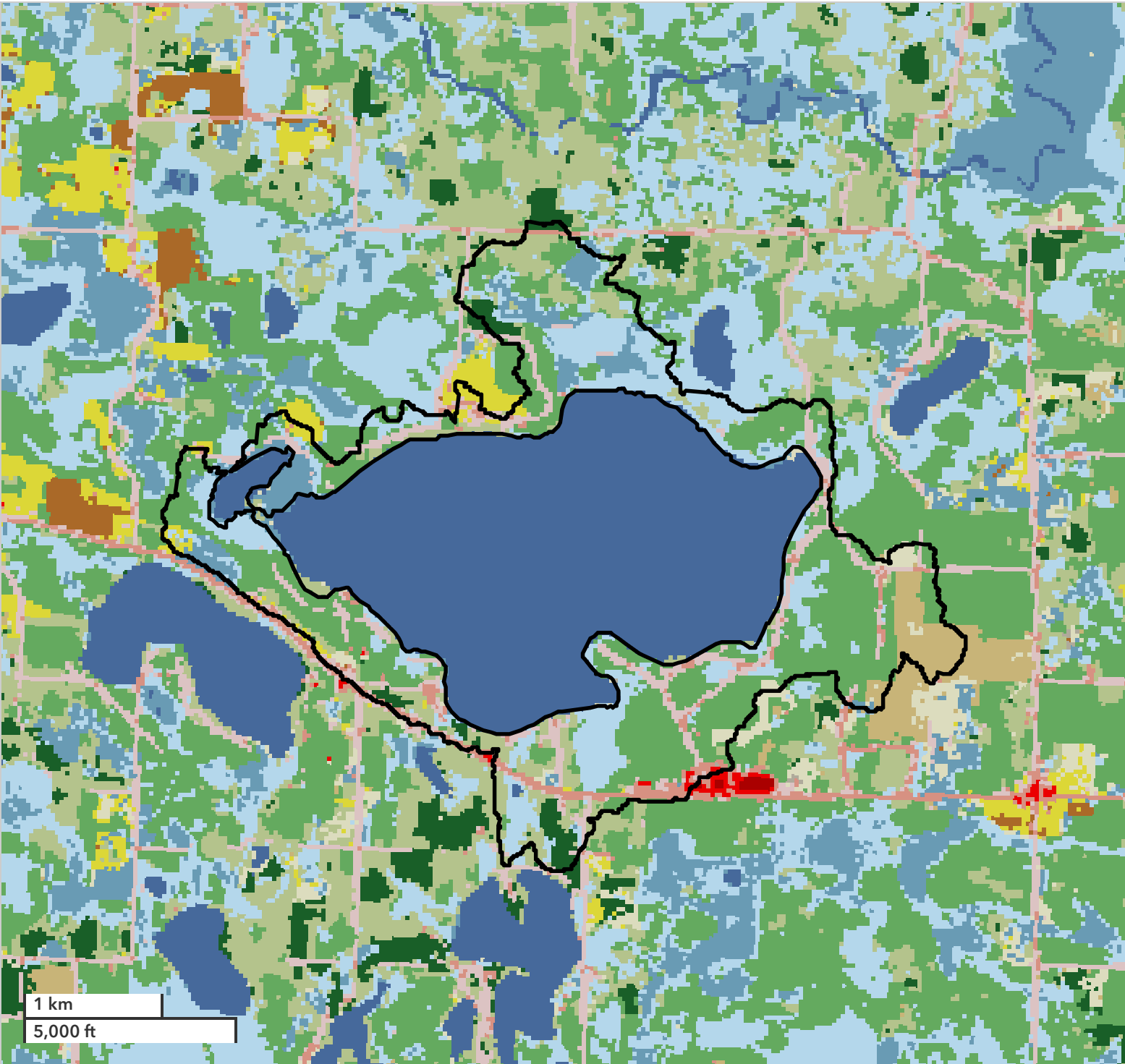
Protection status	Forest	Wetland	Grassland	Water	Other	Agriculture	Urban	Total
Fully protected	2.2 ac (0.1%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	1.6 ac (0.1%)	3.8 ac (0.2%)
Partially protected	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)	0.0 ac (0.0%)
No protection	812.3 ac (50.8%)	430.7 ac (27.0%)	40.5 ac (2.5%)	16.0 ac (1.0%)	37.4 ac (2.3%)	27.1 ac (1.7%)	230.4 ac (14.4%)	1594.3 ac (99.8%)
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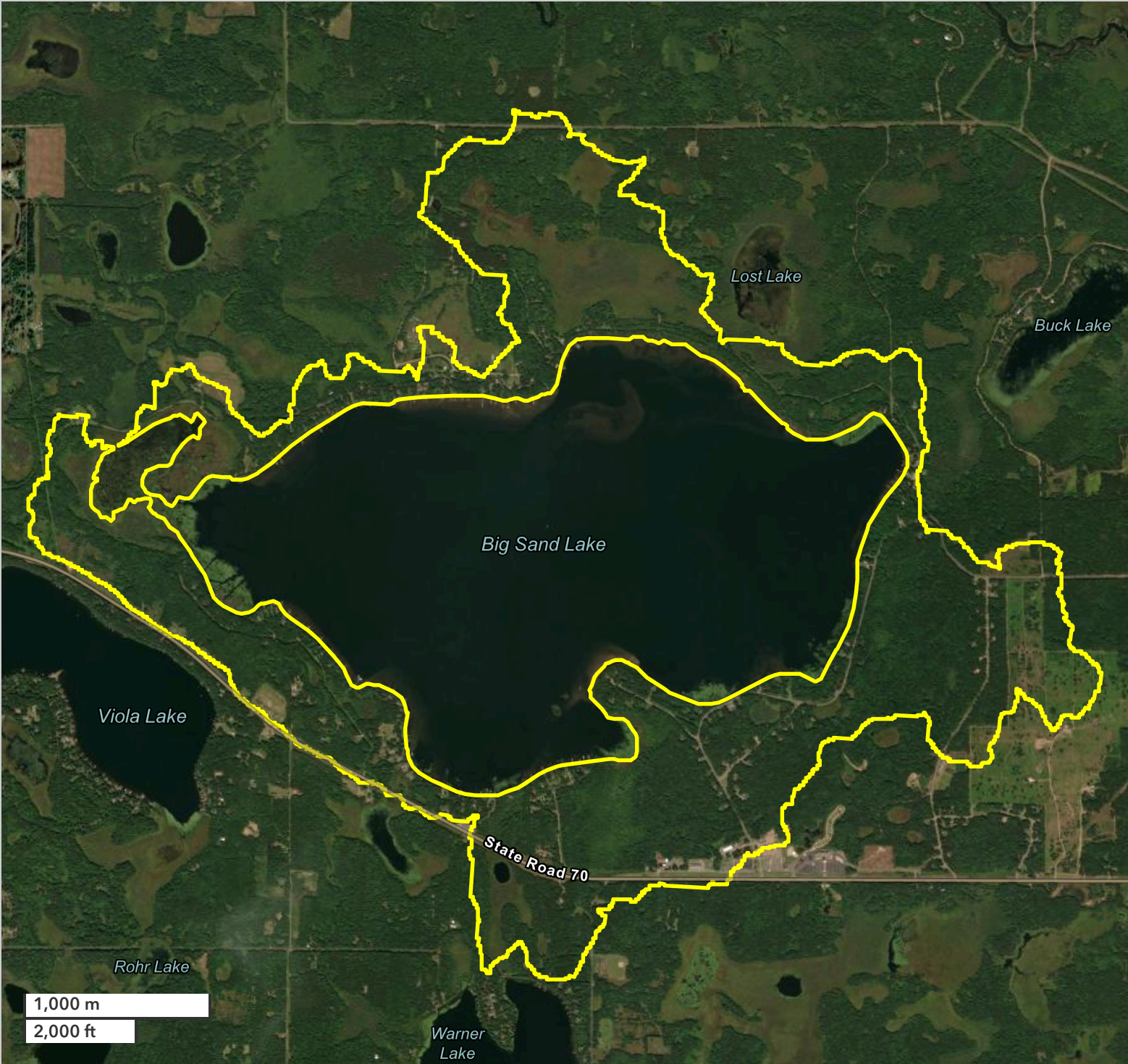
Click a land cover type in the legend to show or hide it in the chart.



MN Dept Natural Resources, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USD... Powered by Esri

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Network watershed boundary

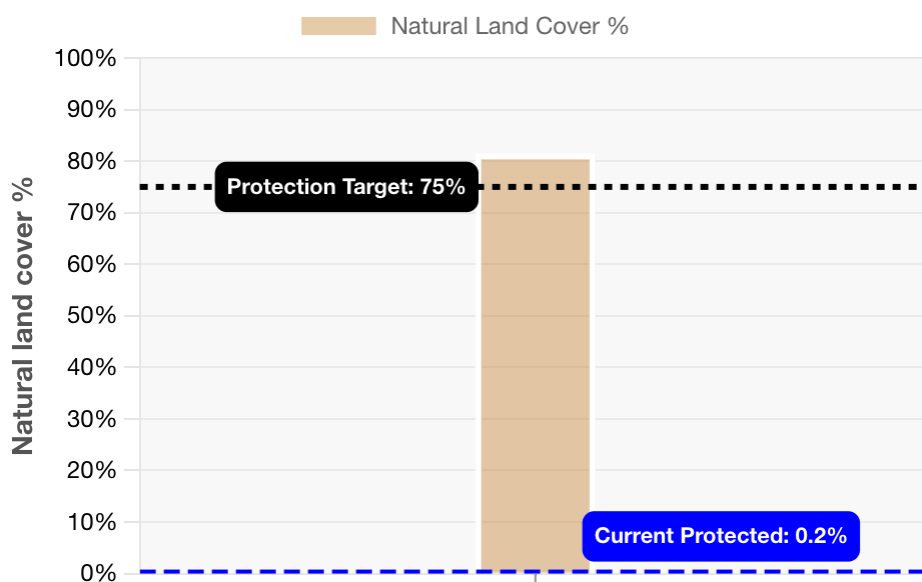
Catchment data provided by LAGOS-US LOCUS v1.0 (Cheruvelil et al. 2021). Catchments are delineated remotely based on land surface elevations; modifications such as storm sewers may affect delineation.

The shapefiles used to create these maps are available upon request by emailing Joe Nohner (nohnerj@michigan.gov).

Land cover protection

Protecting land cover like forests, wetlands, and grasslands in the lake's watershed is critical to maintaining water quality for people and the ecosystem. The figure on the right illustrates the current status of Big Sand Lake's lakeshed protection. In general, where the goal is to maintain lake water quality, a protection target of 75% is recommended based on studies identifying increased nutrient levels below 75% natural land cover (Jacobson et al. 2016). For many lakes that are likely to support coldwater fishes, specialized, lake-specific protection targets have been estimated. These

targets reflect what would be necessary to make that lake likely to support coldwater fishes in the future (Hansen et al 2022). For Big Sand Lake, we recommend that at least 75% of the watershed's natural land cover be protected. The watershed is currently 81% natural land cover. However, only 0% of the lake watershed is protected from development that may threaten this land cover, so more protection is recommended to maintain high water quality on this lake.



Tile drainage

One factor that may significantly increase the nutrient and sediment load delivered to the lake from upstream agricultural sources is the installation of tile drains. Tile drains are pipes installed below the ground with openings that allow them to collect shallow groundwater. Tile drains are often installed in a network that can quickly drain a field, and their coverage has increased dramatically in recent years. Researchers have created maps to predict tile drain coverage based on a census of tiles at the county level, information about soil drainage, slope, and land cover (Valayamkunnath et al. 2020). At the time these data were created, they were 83-94% accurate. These data can provide helpful information for conservationists considering nutrient sources to the lake, especially when considered at the watershed level. Best practices do exist to reduce the nutrient pollution that is exacerbated by tile drains; conservation projects related to tile drains should confirm their presence on site.

Estimated network watershed coverage by tile drains ⓘ 0%

Water flows over the landscape through a network of rivers. These river watersheds provide an organizing structure to describe the location of a lake. While these river watersheds are not the best spatial units to predict upstream nutrient loading for lakes, in many cases, watershed management plans are created for these river watersheds. Such plans typically address the mainstem river and its tributaries as well as the lakes and wetlands within the river’s watershed. Therefore, it may be helpful to know the watershed (United States Geological Survey hydrologic unit) in which this lake is found. These hydrologic units are nested hierarchically, so the 10-digit hydrologic unit code above provides information about the fine-scale and larger scale watersheds in which a lake is located.

10-digit hydrologic unit name

10-digit hydrologic unit code

Big Sand Lake-Yellow River

7030001050

Point source pollution

The diffuse sources of nutrient pollution coming from the watershed described above are referred to as nonpoint source pollution, whereas sources of pollution that originate from a pipe or a specific location are referred to as point sources. The following table provides data on a subset of potential point sources for which we have data (Smith 2022). These include Superfund sites identified by the Environmental Protection Agency for remediation due to pollution, stormwater discharge locations, sewage treatment discharges, and other sources that require a National Pollutant Discharge Elimination System (NPDES) permit to discharge pollutants into waterways. Mining operations that may be a source of pollution are also included.

Within network lake watershed:	
Superfund sites	0
Stormwater discharge	0
Sewage treatments/NPDES discharges	0.2
Mining operations	0

A lake's connection to other lakes and streams affects which fish species can persist in the lake, the availability of spawning habitats, the ability for fish to repopulate the lake after potential fish kills, and the general diversity of fish species to be found in the lake. The lake connectivity class provided here describes the type of connections this lake has to any upstream lakes and streams. Isolated lakes have no inflowing or outflowing streams, representing the least connected lake category. Headwater lakes are more connected than isolated lakes, having outflowing (but not inflowing) streams. Drainage lakes are more connected systems that have both inflowing and outflowing streams; these lakes may or may not have an upstream lake. Another metric provided is the lake network number, which is the position of a lake in reference to other potential upstream lakes. A lake with no lakes upstream would have a lake network number of 1, the next lake downstream would be a 2, and so on. If a lake has more than one lake upstream, its lake network number is determined by using the highest lake network number of the upstream lakes.

Lake connectivity class 	Headwater
Lake network number 	1

Fish migrate among streams, lakes, and wetlands throughout their lives to spawn, seek better food resources, and utilize habitats with more preferred temperatures or other characteristics. Dams, some culverts, and other structures on the landscape can block this essential fish passage, sometimes with large, negative effects to fish populations.

Known dams	No data
Known culverts	No data

There may be other dams or fish passage barriers such as lake level control structures or improperly built culverts. Assessment of the dams, culverts, and other barriers in the lake. Restoring fish passage past these barriers through dam removal, replacement of dams with rock ramps that maintain lake levels, replacing or removing culverts, and other techniques can restore the ecosystem's ability to produce and maintain healthy fish populations. The list of known dams and culverts provided here are drawn from the National Aquatic Connectivity Collaborative's barrier inventory. You can find a complete list of dams and barriers in the watershed or explore and prioritize these barriers for removal at the [National Aquatic Connectivity Collaborative's](#) website.

Local community

The US census provides information about the people who live in an area. These data can be used to better understand the local population. This table provides information about the community in the census block containing the lake. In some cases, such as very large lakes in densely populated areas, there may be multiple census blocks touching a lake; in these cases the census block with the greatest portion of the area around the lake is reported. Importantly, many lake communities have properties that are not the primary residence; such property owners who consider these cottages and cabins second homes are likely not reflected in the census block summary.

Demographics	
Total population in census block ⓘ	1356
Black or African American ⓘ	0.4 %
White ⓘ	73.8 %
American Indian or Alaska Native ⓘ	17.4 %
Asian ⓘ	0.2 %
Native Hawaiian or Pacific Islander ⓘ	0.1 %
Some other race ⓘ	0.2 %
Hispanic ⓘ	1 %
Non-Hispanic ⓘ	99 %

Indigenous communities have lived in the Great Lakes region for thousands of years, hunting, fishing, and caring for the ecosystems that support them and their way of life. Many of these tribal communities share the worldview that plants and animals on the landscape are relatives and seek long-term protection and conservation for these beings and their habitats for the next seven generations. These conservation goals often align with the goals of state managers and local organizations, opening avenues for collaborative partnerships across entities. Much of the geographic region covered by the Midwest Glacial Lakes Partnership is governed by treaties between the federal government and tribal nations established at the time of settlement. In a number of these treaties - specifically the 1836 Treaty of Washington, the 1837 Treaty of St. Peter's, and the 1842 and 1854 treaties of LaPointe - tribal nations ceded the land to the United States but retained ownership of certain lands (i.e. reservations) and reserved the rights to hunt, fish, and gather in off-reservation areas within the Treaty boundaries (i.e. Ceded Territories). In these Ceded Territories, tribal nations are regarded as co-managers of natural resources with state government agencies, and requesting their input and collaboration is highly encouraged when planning projects affecting ecosystems within these regions. Individual tribal nations have home territories where their members have a long-standing cultural relationship with the land, and therefore projects on certain lakes may be of particular interest to a tribe. If you do not know which tribe to contact to gather feedback on a project in your area, consider reaching out to the Great Lakes Indian Fish & Wildlife Commission (1837, 1842, and 1854 Ceded Territories), 1854 Treaty Authority, or the Chippewa-Ottawa Resource Authority (1836 Ceded Territory).

Ceded Territory ⓘ Treaty of 1837

Angler access

Boat ramps provide angler access to a lake. Researchers have compiled a nationwide list of boat ramps; every known boat ramp within 100 meters of a lake is included in this count. Often boat ramp locations are not known due to being on private land or not being included in the known databases, so in reality there may be more boat ramps than shown here. When using this boat ramp information, we recommend that you independently verify the presence of a boat ramp prior to attempting to launch your boat to confirm the boat ramp's presence and identify any other considerations for the boat ramp's use, such as cost, condition, public permission to use, etc.

Boat ramps ⓘ 1

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