

Pilgrim Lake

Orleans, MA

2001-2023 Water Quality Summary

POND SETTING

Pilgrim Lake is a 46 acre Great Pond, located east of Monument Road and south of Lonnie's Pond with public access at a beach off Herring Brook Way. It has a herring run stream connected to Lonnie's Pond and has a maximum depth of 33 ft (9.5 m), based on a 2019 bathymetric survey completed during the Pilgrim Lake Management Plan. The Plan showed 1) impaired ecosystem conditions and 2) identified watershed septic systems as the primary source of the impairments. Watershed sewerage is planned and a preventative alum treatment was completed in March 2024.

SAMPLING HISTORY

Water column sampling has been completed at least annually since 2000. Citizen volunteers have participated in the annual Cape Cod Pond and Lake Stewardship (PALS) Snapshots each August/September and more recently added Spring sampling. Snapshot protocols include: dissolved oxygen and temperature profiles, Secchi clarity readings, and water sample analysis for pH, alkalinity, photosynthetic pigments, and nutrients [total phosphorus (TP) and total nitrogen]. The 2019 Management Plan completed more detailed ecosystem sampling, reviewed historical results, and addressed important data gaps for management, including sediment analysis, phytoplankton sampling, and stream measurements.



2023 WATER QUALITY STATUS

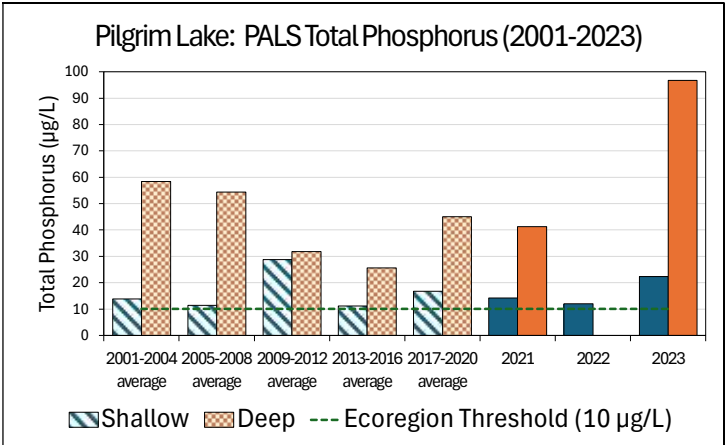
The Pilgrim Lake Management Plan reviewed historical water column data and 2017 collection of complementary measures (e.g., sediments, stream flows and nutrient loads, watershed land use). The plan review showed that the lake had notably impaired deep conditions (i.e., anoxia) that were slowly making shallow conditions more impaired (i.e., loss of clarity). Phosphorus controls water quality conditions and watershed septic systems were the largest TP source (56%). In August 2023, an extensive algal bloom occurred when deep anoxia released sediment TP that was mixed into the shallow water column. Watershed sewerage is necessary to address the ecosystem impairments and is planned in Phase 3 of the Town wastewater plan. In the interim, the Town completed a March 2024 alum treatment to reduce the chance of future algal blooms while awaiting sewerage.

ECOSYSTEM STATUS: IMPAIRED

by excessive phosphorus and chlorophyll levels, loss of clarity, and deep anoxia.

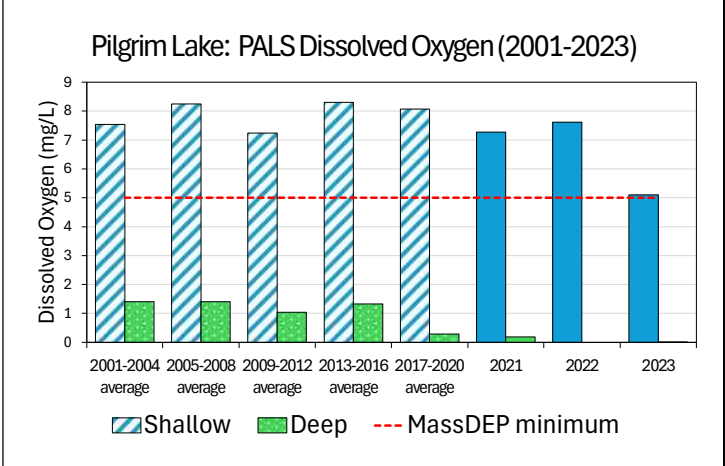
Pilgrim Lake Management Plan is available on the Town website:

<https://town.orleans.ma.us/DocumentCenter/View/1626/Pilgrim-Lake-Management-Plan-October-2019-PDF>



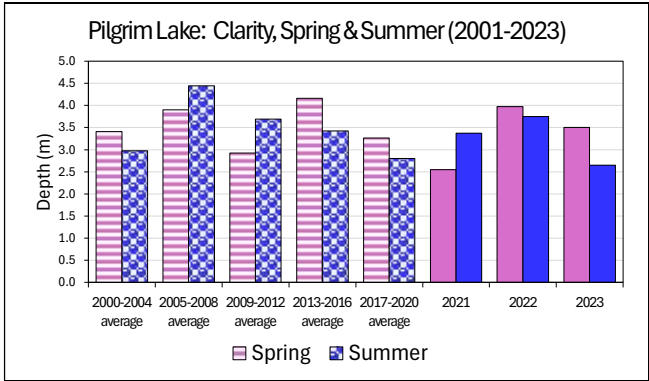
TOTAL PHOSPHORUS

Phosphorus determines the amount of plant growth in freshwater ponds. Excessive phosphorus harms ecosystem health and causes algal blooms and bottom anoxia. On Cape Cod, a regional threshold goal of 10 µg/L total phosphorus (TP) was developed. In Pilgrim Lake, both shallow (16 µg/L) and deep (84 µg/L) TP concentrations exceed this threshold. The higher deep reading were the result of sediment TP additions.



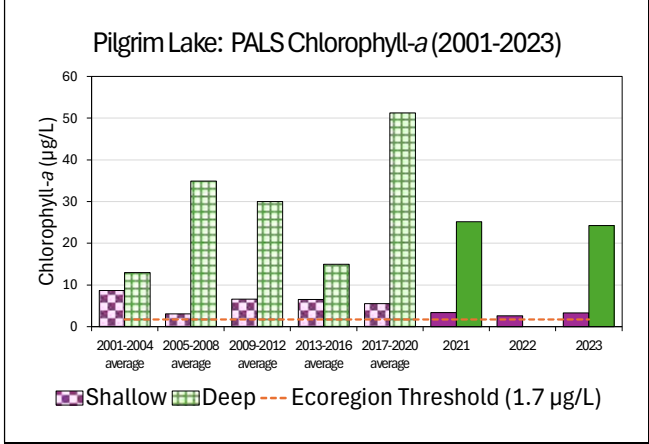
DISSOLVED OXYGEN

Dissolved oxygen (DO) is a primary regulatory criteria used to assess the ecological health of freshwater bodies. MassDEP regulations require warm water ponds, like Pilgrim Lake, to have DO concentrations greater than 5 mg/L. Pilgrim Lake generally has acceptable shallow DO concentrations throughout the year and acceptable deep DO levels in the spring. However, during the summer, when the lake has a shallow warm layer and a deep cold layer, the deep layer often becomes anoxic (DO <1 mg/L; happens in 63% of summer readings) and when this happens P is released from the deep sediments.



Water Clarity

Water clarity measured with a Secchi disk is an easy way to measure how deep light can penetrate into a pond water column. Clarity is an indirect measure of phytoplankton density and where plants can grow on a pond bottom. In Cape Cod ponds and lakes, clarity tends to be greater in the spring and reduced in the summer as phytoplankton populations increase. Average clarity in Pilgrim Lake has decreased ~ 1.2 m (3.9 ft) since 2000.



Chlorophyll-a

Chlorophyll-a (CHL) is the primary pigment that most plants use for photosynthesis, so its concentration is often used as an indirect measure for the size of the phytoplankton population. Phytoplankton are a natural portion of all pond ecosystems, but nuisance populations or “blooms” may occur when excessive nutrients are present. On Cape Cod, a regional threshold goal of 1.7 µg/L CHL was developed. The average summer Pilgrim Lake shallow CHL level (5.7 µg/L) is well above the regional threshold.