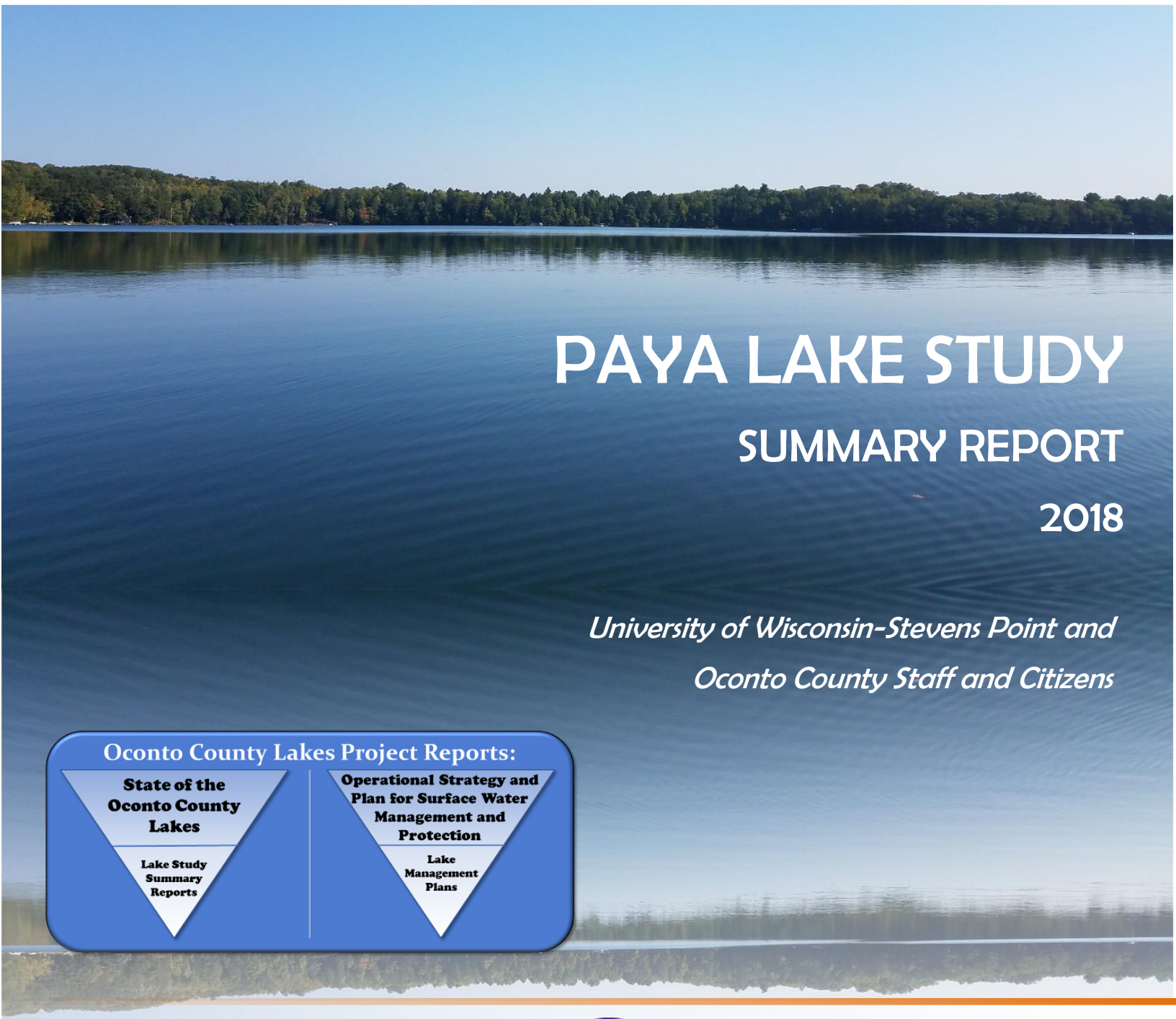
Oconto County Lakes Project



PAYA LAKE STUDY

SUMMARY REPORT

2018

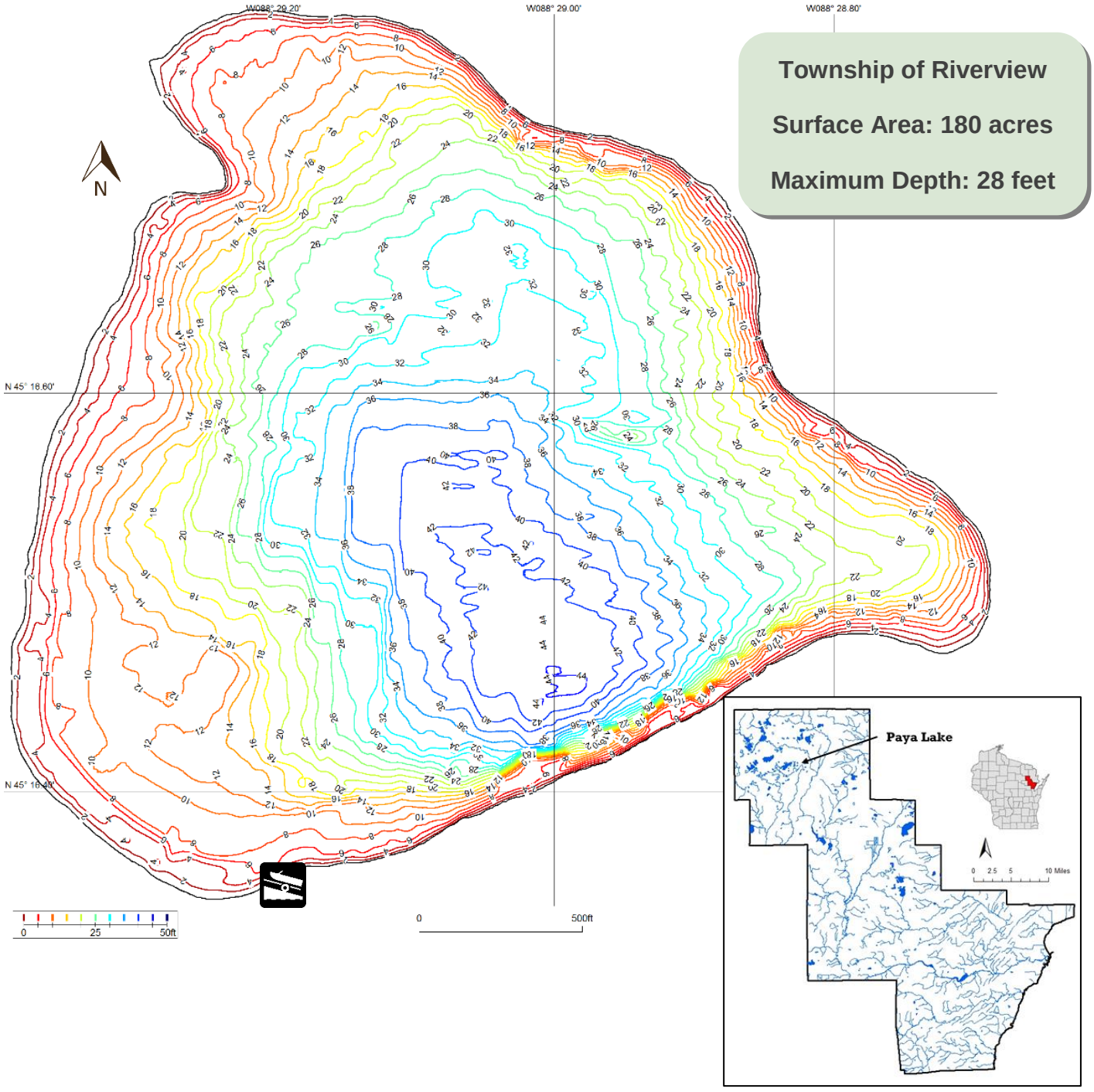
University of Wisconsin-Stevens Point and

Oconto County Staff and Citizens

Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Background

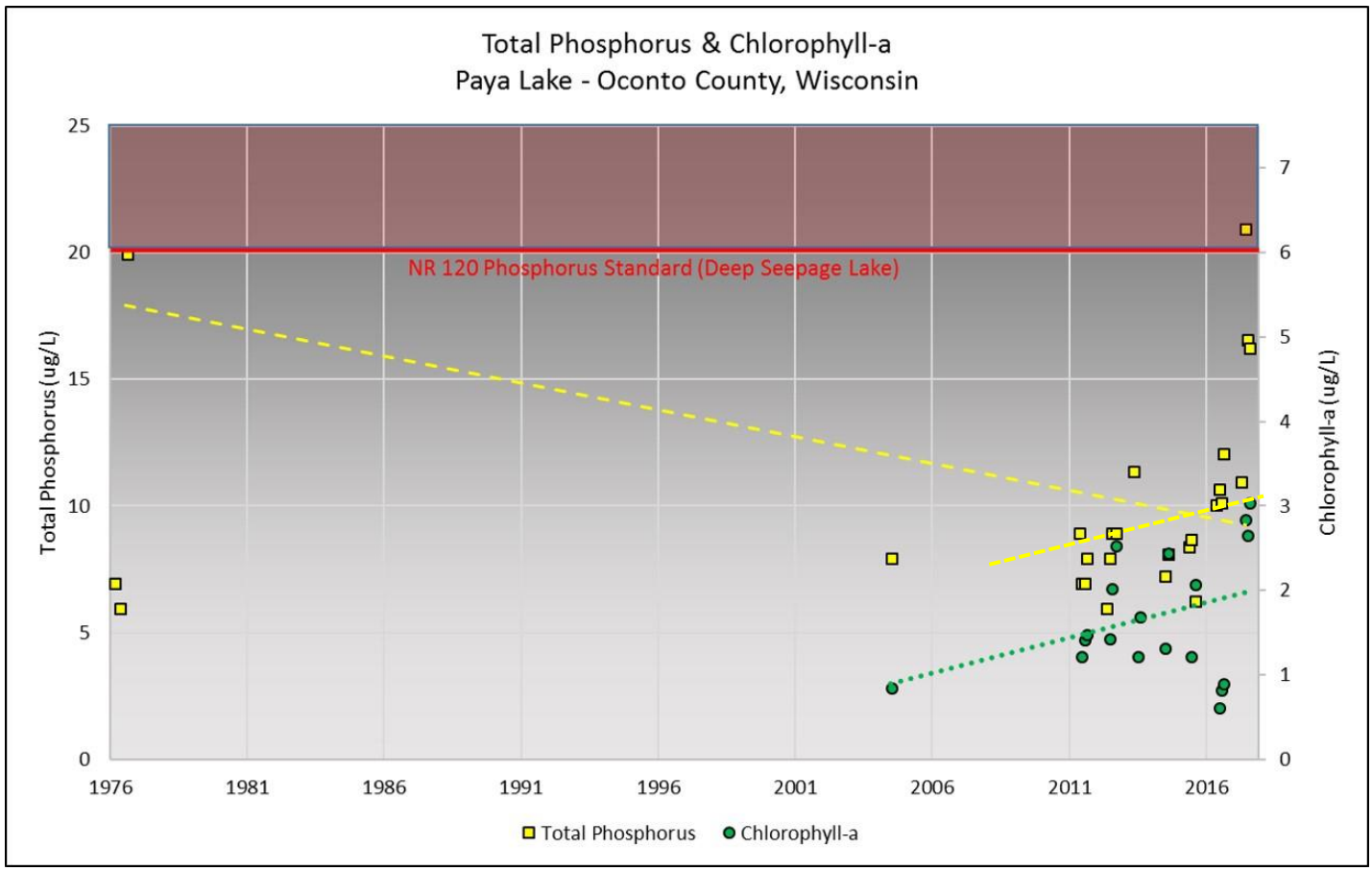
- Paya Lake is a 105-acre seepage lake in northern Oconto County with a maximum depth of 40 feet.
- Most water enters Paya Lake via groundwater. Surface water runoff, direct precipitation and groundwater also contribute water to lesser extents.
- Visitors have access to the lake from one public boat landing on the south side.
- This report summarizes data collected during the 2016-2017 lake study.



Water Quality

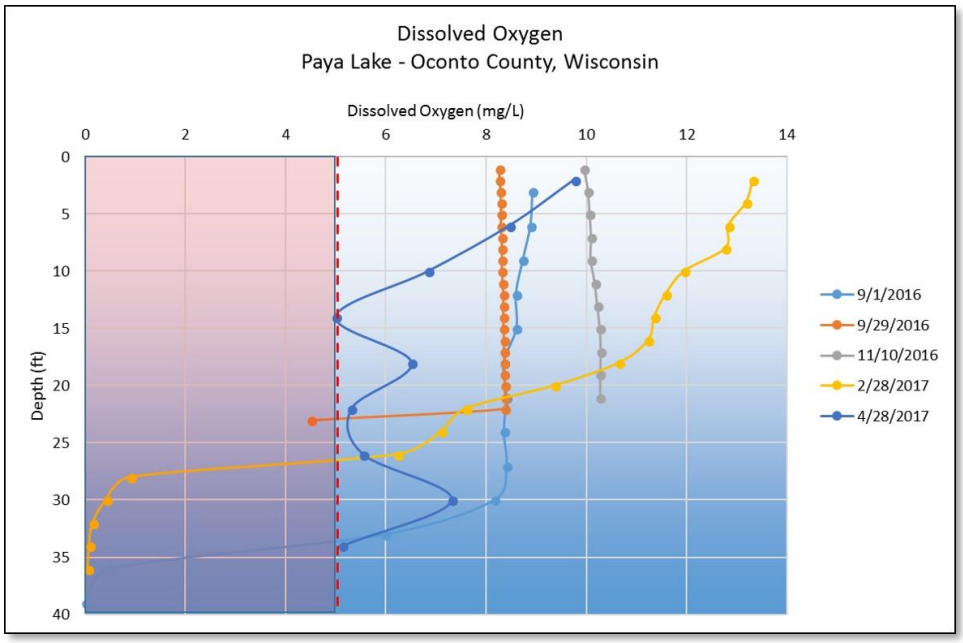
Nutrients such as phosphorus and nitrogen are what feed aquatic plants and algae in a lake. Excessive amounts of nutrients delivered to a lake will result in abundant plant and algae growth. Disturbance within a watershed combined with the landscape's inability to infiltrate and filter runoff is what primarily delivers nutrients to a lake.

- Total Phosphorus was typically **below** the Wisconsin state phosphorus standard of 20 ug/L for deep seepage lakes during the two-year study. Though the long-term trend (based on few samples) shows a decreasing trend, data within the past 6 years suggests concentrations may be on the rise.
- Inorganic nitrogen (0.02 mg/L) was below the threshold of 0.3 mg/L when algal blooms increase.
- Chlorophyll-a, an indirect measure of algae, remained well below the threshold of 6 ug/L during the study, however, the short-term trend suggests increasing concentrations.



Water Quality

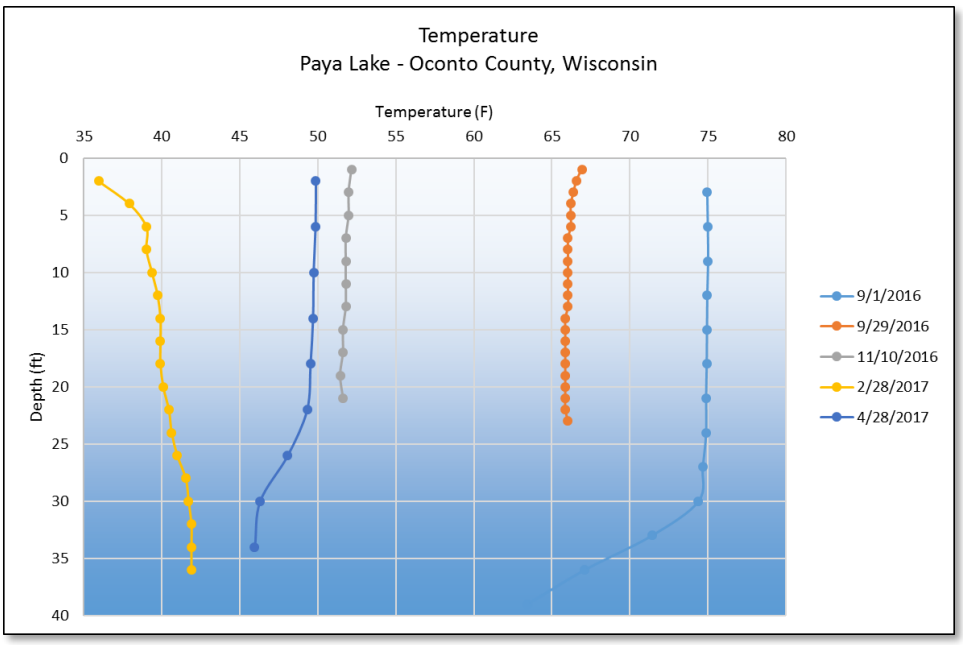
Sufficient **dissolved oxygen** in lake water is essential to the survival of aquatic organisms. The amount of dissolved oxygen present within a lake varies by season and depth. It is determined by the biological activity that consumes or produces oxygen, by water mixing through wind, changes in temperature, and inputs of surface and groundwater. Generally, at least 5 mg/L oxygen is required for fish.



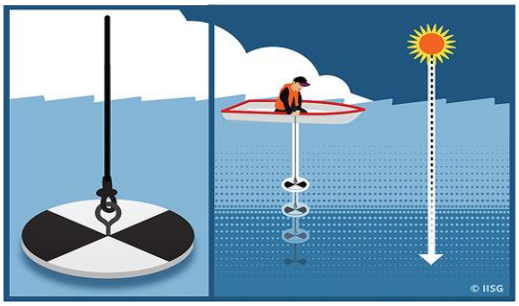
- During most of the year, sufficient oxygen is available in Paya Lake throughout the water column. Oxygen is depleted during the winter while the lake is ice covered, however, with the only the upper 10 feet having enough to support fish.
- Bumps in dissolved oxygen concentrations at 20-30 feet suggest mild algal activity.

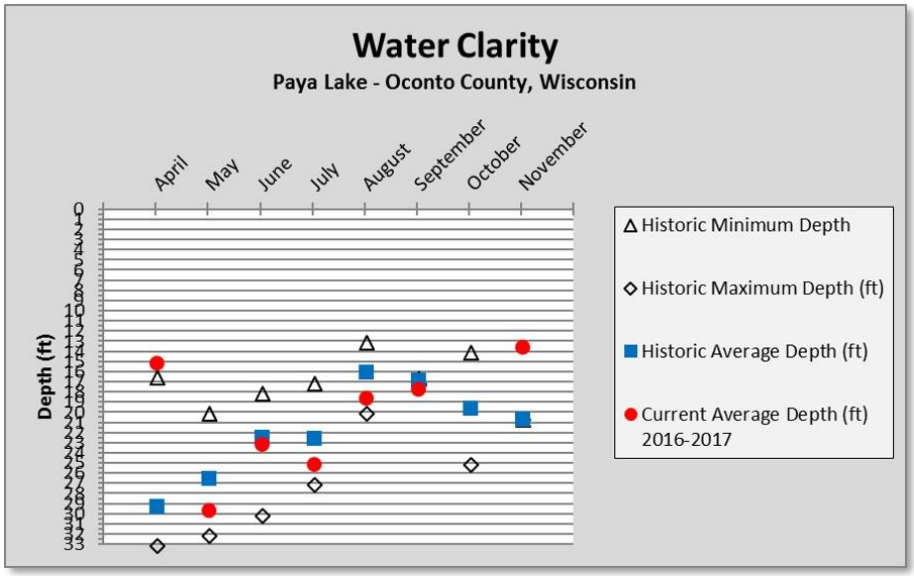
Lake water **temperature** has a significant impact on water chemistry, spatial distribution of fish, microbial growth and oxygen content.

- The temperature gradient in Paya Lake is relatively uniform most of the year, typical of a shallow, mixed lake.



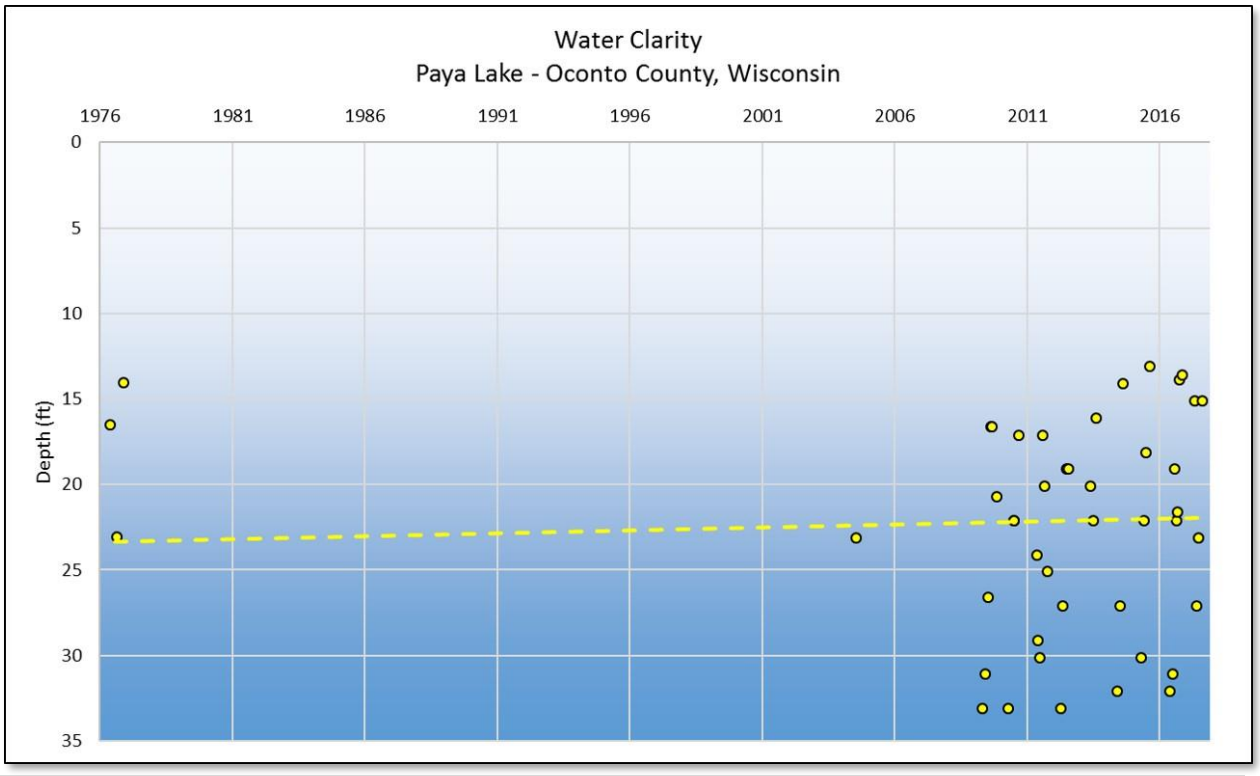
Water Quality





Water clarity is a measure of how deep light can penetrate (Secchi depth). Clarity is affected by water color, turbidity (suspended sediment), and algae. Water clarity helps determine where rooted aquatic plants can grow. It is typical for water clarity to vary throughout the year.

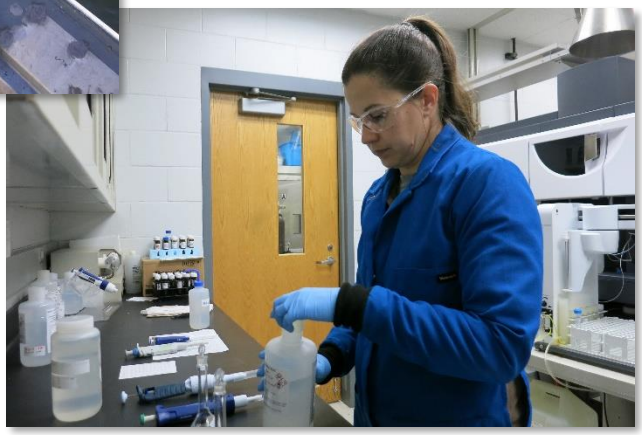
- The graph to the left shows water clarity measurements taken between April and November.
- During 2016-17, on average, the poorest water clarity in Paya Lake was in April and November (well below historic averages) and the best was in May. The long-term trend (based on July data) is similar to the short-term trend and appears stable.



Water Quality

Other chemistry data was collected from lake water samples, such as basic cations, pollutants and acid rain input, and physical parameters. Results of such analyses can provide insights into a variety of other potential impacts to the lake. While concentrations of these compounds in lake water is usually low, higher concentrations can be indicators of other potential issues.

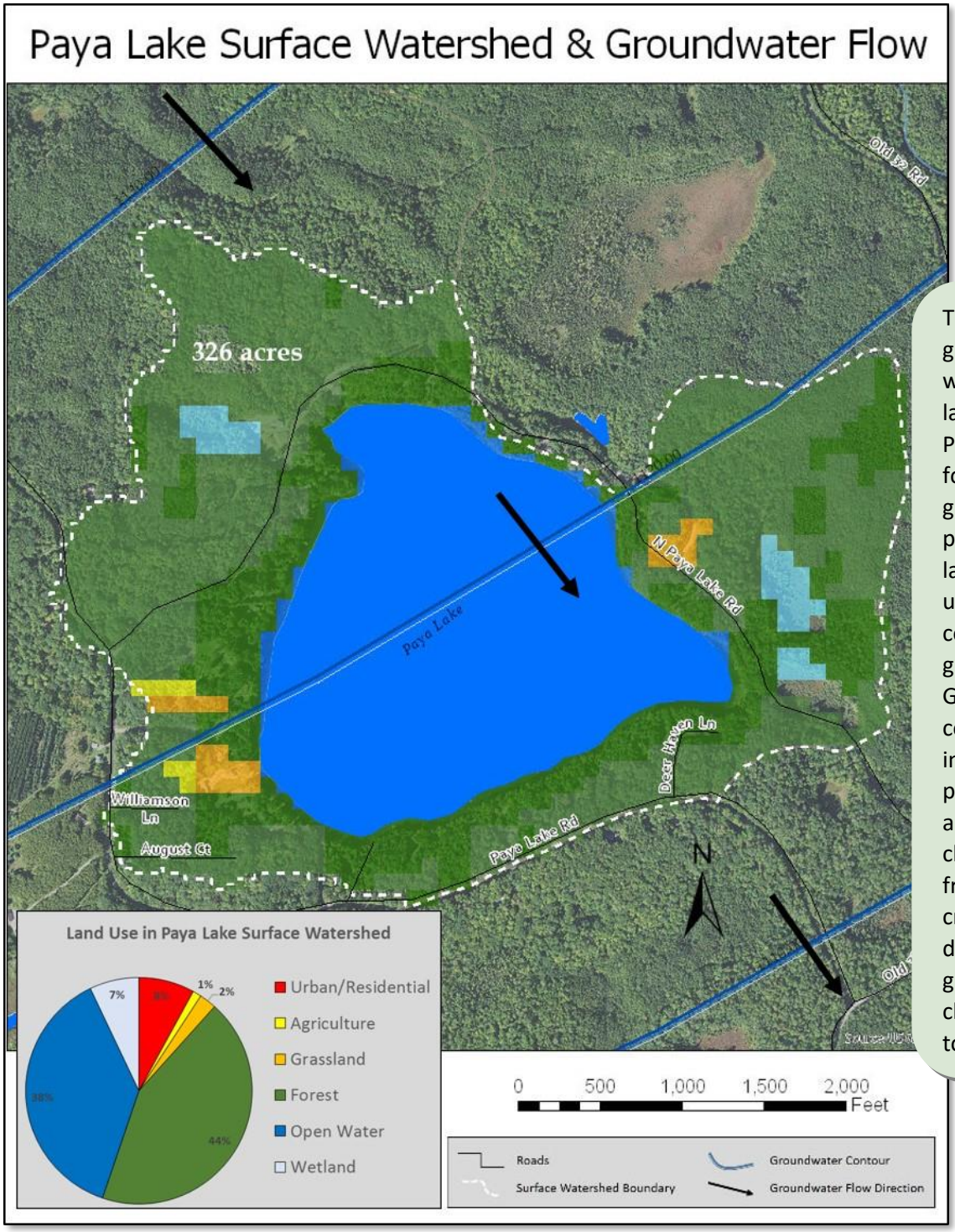
- Concentrations of potassium 1.5 mg/L), chloride (1.2 mg/L) and sodium (1.2 mg/L) were all low. This suggests minimal impact from septic systems, road salt, animal waste and fertilizers.
- DACT, a screening tool to determine if your lake is being impacted by pesticides, was not detected.
- Water in Paya Lake is moderately hard (106 mg/L $CaCO_3$), having an elevated level of dissolved minerals. Hard water lakes tend to produce more fish and aquatic plants than soft water lakes and have clearer water as the minerals can bind with phosphorus making it unavailable to algae blooms.

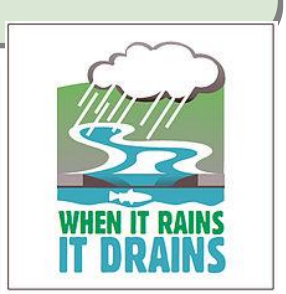


For more information on how to interpret your lake's water quality data, please refer to the "State of the Oconto County Lakes Report" that is on file with Oconto County.

Watershed

Groundwater provides water to lakes in Oconto County throughout the entire year. Hard surfaces on the landscape prevent water from soaking into the ground and becoming groundwater. This results in less water flowing to the lake during snowmelt and rain events. Water that does not infiltrate to groundwater becomes **surface runoff** flowing across the surface of the landscape where it can move sediment and contaminants to the lake from within its watershed.





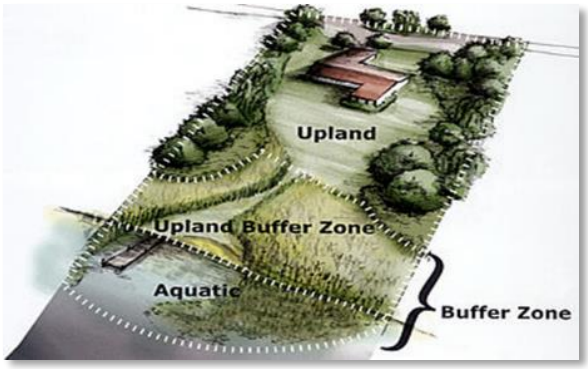
The quality of groundwater reflects what is happening on the land surface. Precipitation falling on forests produces clean groundwater, whereas precipitation falling on land that has chemical use can leach contaminants to groundwater. Groundwater contamination may include nitrogen, pesticides, herbicides and other soluble chemicals originating from septic systems, crops, barnyards, road de-icing, etc. Once in the groundwater, these chemicals move slowly towards a lake or river.

Shorelands

Shoreland vegetation is critical to a healthy lake's ecosystem. It provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and many small and large mammals. It also helps to improve the quality and quantity of the runoff that flows across the landscape towards the lake. Healthy shoreland vegetation includes a mix of tall, native grasses/flowers, shrubs and trees.

- Shorelands around Paya Lake were surveyed in September 2017. Much of Paya Lake's shoreland is healthy, but some stretches are in need of restoration.

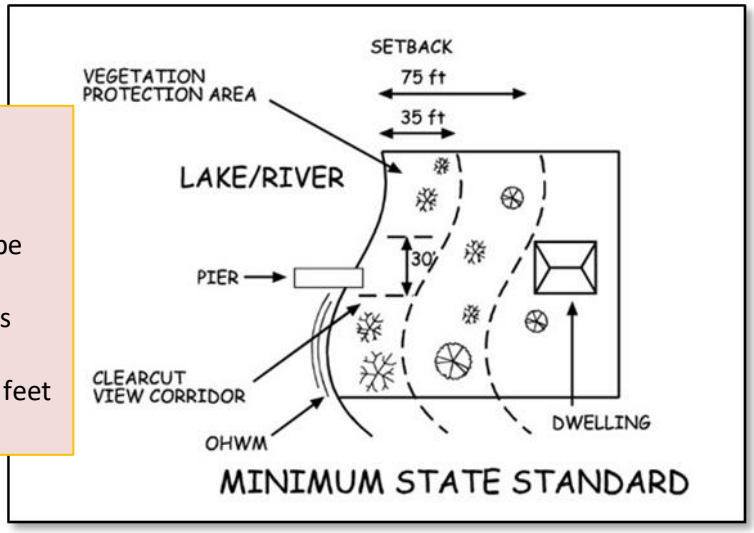
Total lakefront footage	No. Riparian lots	Measured shoreland disturbance (feet)	Measured shoreland disturbance (%)
8,884	65	4,465	50%



State Shoreland Zoning Ordinance
NR 115 Wisc. Adm. Code for Unincorporated Municipalities

No vegetation within 35 feet of the lake's edge shall be removed except for:

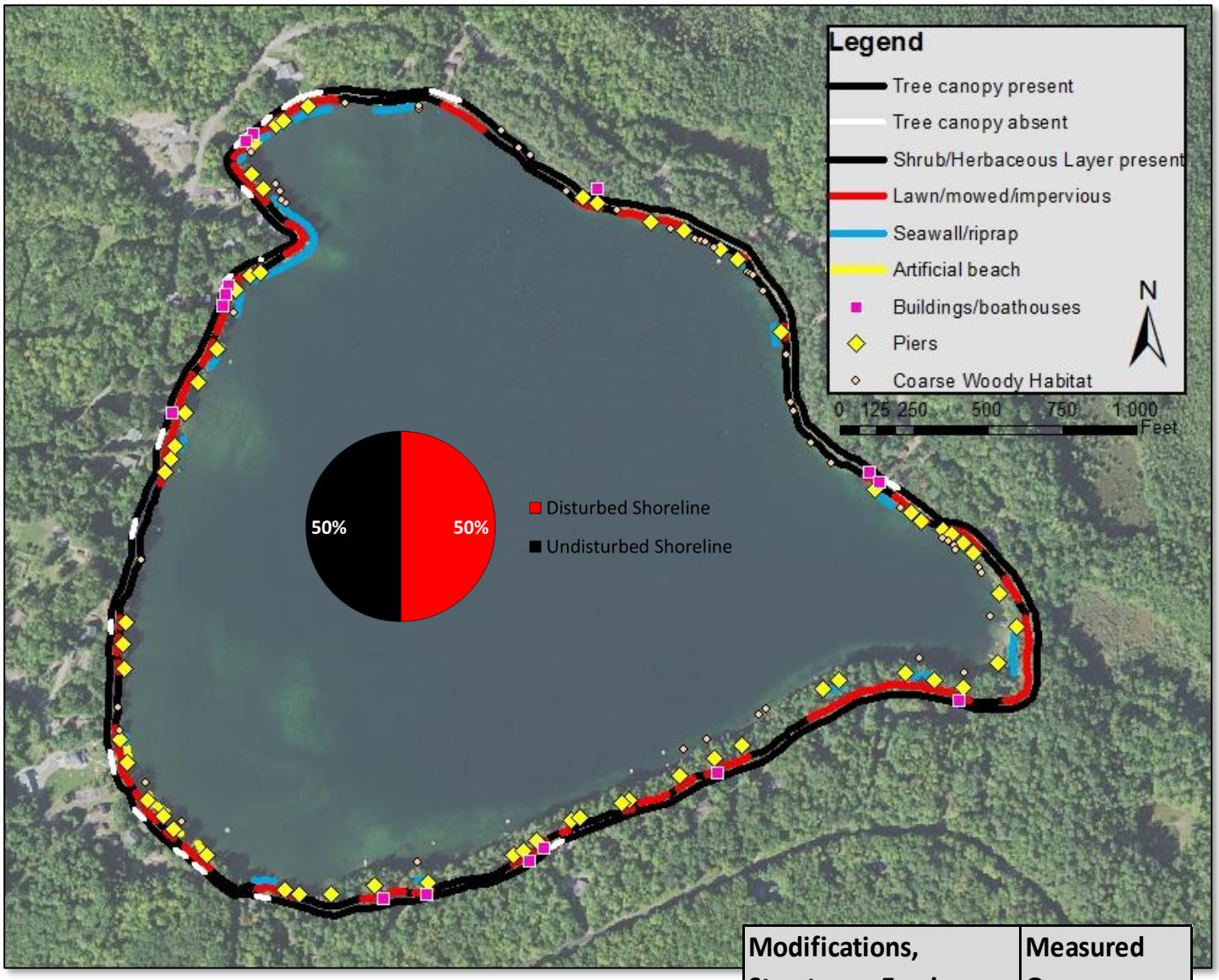
- Up to 30% of shoreline may be removed of shrubs and trees for a view corridor
- A mowed or constructed pedestrian path up to 5 feet wide to access lake



What Can You Do To Help Paya Lake?

- ✓ Leave natural shoreland vegetation in place or restore if it has been removed.
- ✓ Learn to identify and look invasive plants and animals and know who to contact if found.
- ✓ Do not purchase prohibited and restricted species. Purchase native plants when possible.
- ✓ Never transplant water garden or aquarium plants into lakes, streams or wetlands. Properly dispose of them.
- ✓ Remove invasive exotic plants from your landscape and replace them with native plants or non-invasive exotics. Scout regularly for new invasive plants.
- ✓ Avoid using garden plants from other regions whose invasive potential is poorly understood.

Shorelands

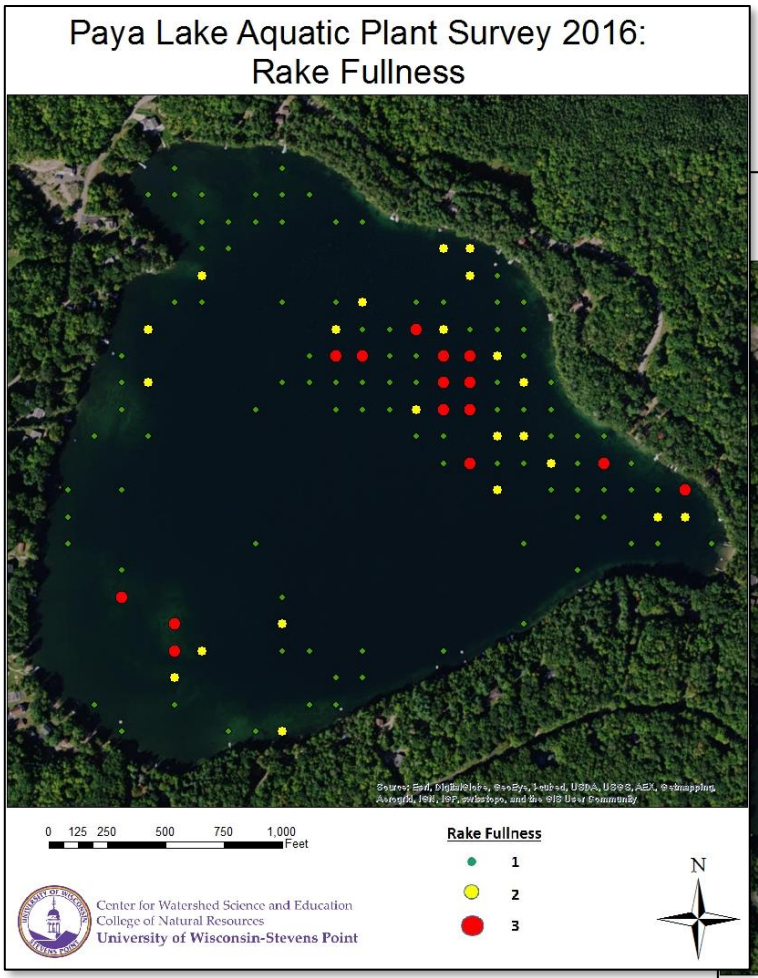


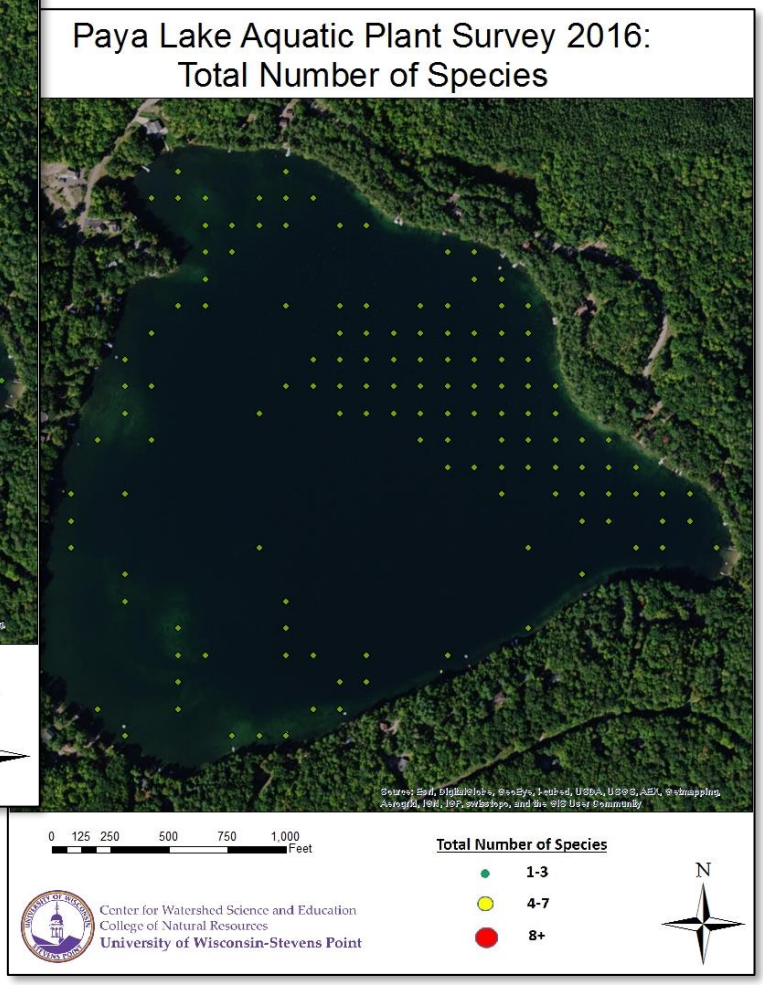
Modifications, Structures, Erosion	Measured Occurrence
Artificial Beach	140 ft
Rip Rap	745 ft
Sea Wall	140 ft
Impervious Surface	76 ft
Mowed Lawn	1,715 ft
Erosion	55 ft
Nonconforming Buildings	15
Piers	61
Coarse Woody Habitat	29 logs/mile

Aquatic Plants

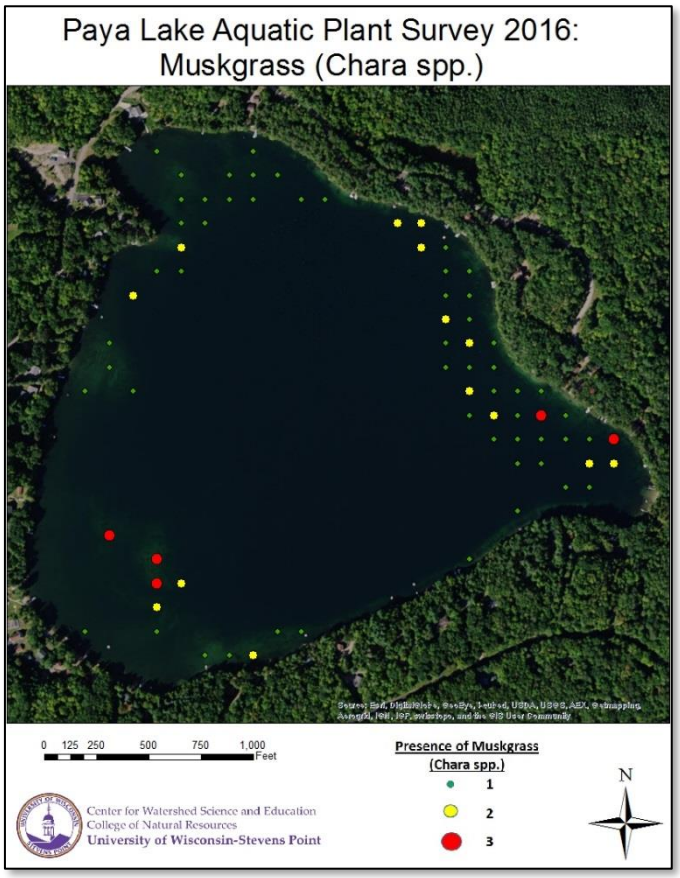
Aquatic plants are the forest landscape within a lake. They provide food and habitat for terrestrial and aquatic creatures such as fish, ducks, turtles, invertebrates and other animals. They increase oxygen levels in the water and utilize nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plant species creating diversity that can help to prevent the establishment of aquatic invasive species.

- The aquatic plant community in Paya Lake is characterized by low quality vegetation with a floristic quality index (17) below the regional average. A total of 6 species were observed in the 2016 survey.
- During the 2016 aquatic plant survey of Paya Lake, 39% of the sites had vegetative growth. The maximum depth of vegetation was 35 feet.
- The most frequently encountered plant species were chara (54%), nitella (37%), and slender naiad (11%). All three species are native to Wisconsin.

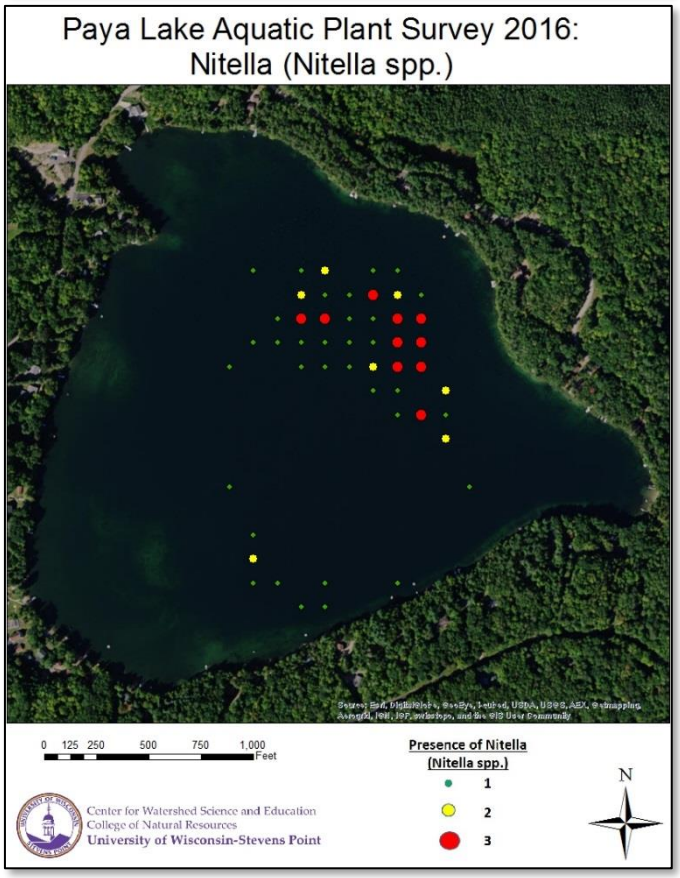




Aquatic Plants

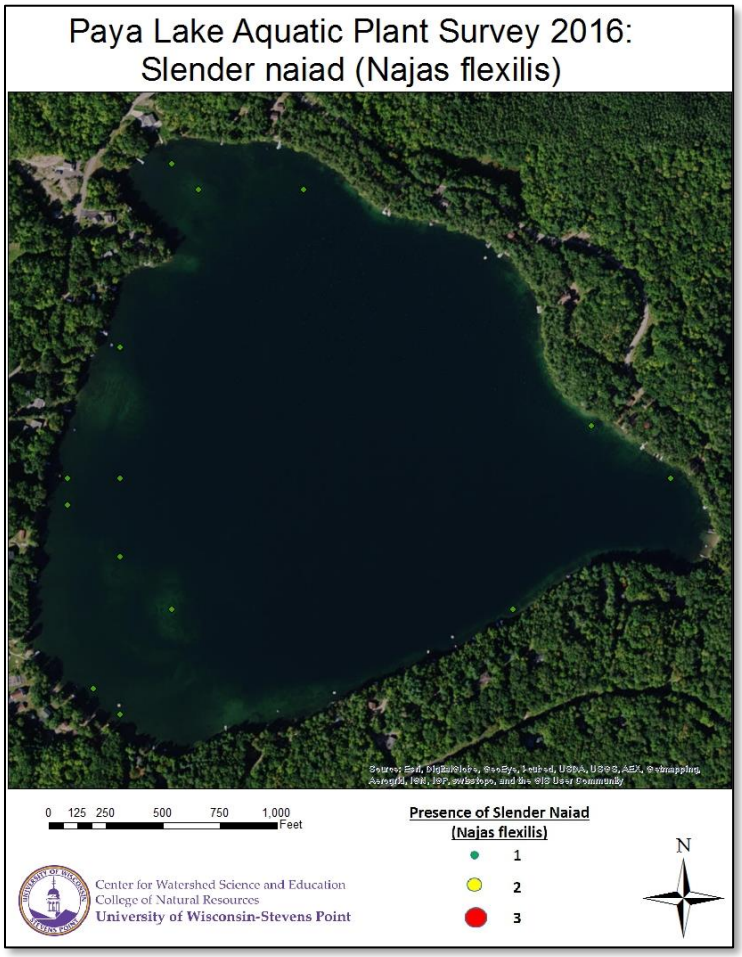


Chara is a type of macro algae that grows attached to muddy lake bottoms and has a musky odor. Muskgrass, as it is known, filters the lake water and is helpful in preventing the establishment of invasive species.



Like chara, **nitella** is a macroalgae that similarly grows along lake bottoms and can benefit a lake by filtering nutrients from water and preventing establishment of invasive species.

Aquatic Plants



Slender naiad has glossy, finely toothed leaves appearing as whorls near the end of stems. Also known as the water-nymph, the whole plant is eaten by waterfowl and provides shelter for small fish and insects.

Aquatic **invasive species** are non-native aquatic plants and animals that are most often unintentionally introduced into lakes by lake users. In some lakes, aquatic invasive plant species can exist as a part of the plant community, while in other lakes populations explode, creating dense beds that can damage boat motors, make areas non-navigable, inhibit activities like swimming and fishing, and disrupt the lakes' ecosystems.

- ✓ No invasive species were observed during the 2016 aquatic plant survey.
- ✓ Rusty crayfish was previously documented by the Department of Natural Resources in Paya lake in 2016.

Rusty crayfish displace native crayfish and reduce aquatic plant abundance leading to decreased water clarity and loss of habitat.

Acknowledgments

This report was prepared as an appendix to the **Oconto County State of the Lakes Report**, which is on file with the Oconto County Land Conservation Department.
Written and prepared by the Center for Watershed Science and Education at the University of Wisconsin-Stevens Point.

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