8.6 White Birch Lake

An Introduction to White Birch Lake

White Birch Lake, Vilas County, is a 116-acre deep, oligo-mesotrophic lowland drainage lake with a maximum depth of 27 feet and a mean depth of 12 feet (White Birch Lake – Map 1). Its watershed encompasses approximately 2,683 acres within the Manitowish River Watershed and is comprised mainly of intact forests and wetlands. Water enters White Birch Lake from the east from Ballard Lake and leaves through White Birch Creek. In 2018, 37 native aquatic plant species were located within the lake, of which fern-leaf pondweed (*Potamogeton robbinsii*) was the most common. One NHI-Listed species was found – Northeastern bladderwort (*Utricularia resupinata*).

Lake at a Glance - White Birch Lake

Morphometry		Vegetation	
Lake Type	Deep Lowland Drainage Lake	Number of Native Species	37
Surface Area (Acres)	116	NHI-Listed Species	Northeastern bladderwort (*Utricularia resupinata*)
Max Depth (feet)	27	Exotic Species	-
Mean Depth (feet)	12	Average Conservatism	6.9
Perimeter (Miles)	2.6	Floristic Quality	33.9
Shoreline Complexity	3.1	Simpson's Diversity (1-D)	0.8
Watershed Area (Acres)	2,683		
Watershed to Lake Area Ratio	22:1		

Water Quality	
Trophic State	Oligo-Mesotrophic
Limiting Nutrient	Phosphorus
Avg Summer P (μg/L)	13
Avg Summer Chl-α (μg/L)	4
Avg Summer Secchi Depth (ft)	14
Summer pH	7.8
Alkalinity (mg/L as $CaCO_3$)	30.3

8.6.1 White Birch Lake Water Quality

Water quality data was collected from White Birch Lake on six occasions in 2018/2019. Onterra staff sampled the lake for water quality parameters including total phosphorus, chlorophyll-*a*, Secchi disk clarity, temperature, and dissolved oxygen. Please note that the data in these graphs represent concentrations and depths taken during the growing season (April-October), summer months (June-August) or winter (February-March) as indicated with each dataset. Furthermore, unless otherwise noted the phosphorus and chlorophyll-*a* data represent only near-surface samples. In addition to sampling efforts completed in 2018/2019 any historical data was researched and are included within this report as available.

Near-surface total phosphorus data from White Birch Lake are available from 1926-1929, 1984, 1999-2000, and 2018 (Figure 8.6.1-1). Values from the 1920s were excluded from this analysis since there was only one sample taken for each of the years and may not be representative of summer averages. The weighted summer average total phosphorus concentration is 13.3 µg/L and falls into the *excellent* category for deep lowland drainage lakes in Wisconsin. White Birch Lake's summer average total phosphorus concentrations are lower than the median value for deep lowland drainage lakes in the state and below the median value for all lake types in the Northern Lakes and Forests (NLF) ecoregion. Total phosphorus data were also collected in 1926-1929 by Birge and

Juday (Splitt 2001). The average summer concentration during this period was 18.5 µg/L, higher than the more recent measured average of 13.3.3 µg/L. It's important to note that phosphorus concentrations can be variable from year to year and over longer periods of time due to changes in precipitation. Higher concentrations measured in 1926-1929 can be considered a snap-shot of this period, and indicate that phosphorus concentrations likely fluctuate in White Birch Lake over longer periods of time.

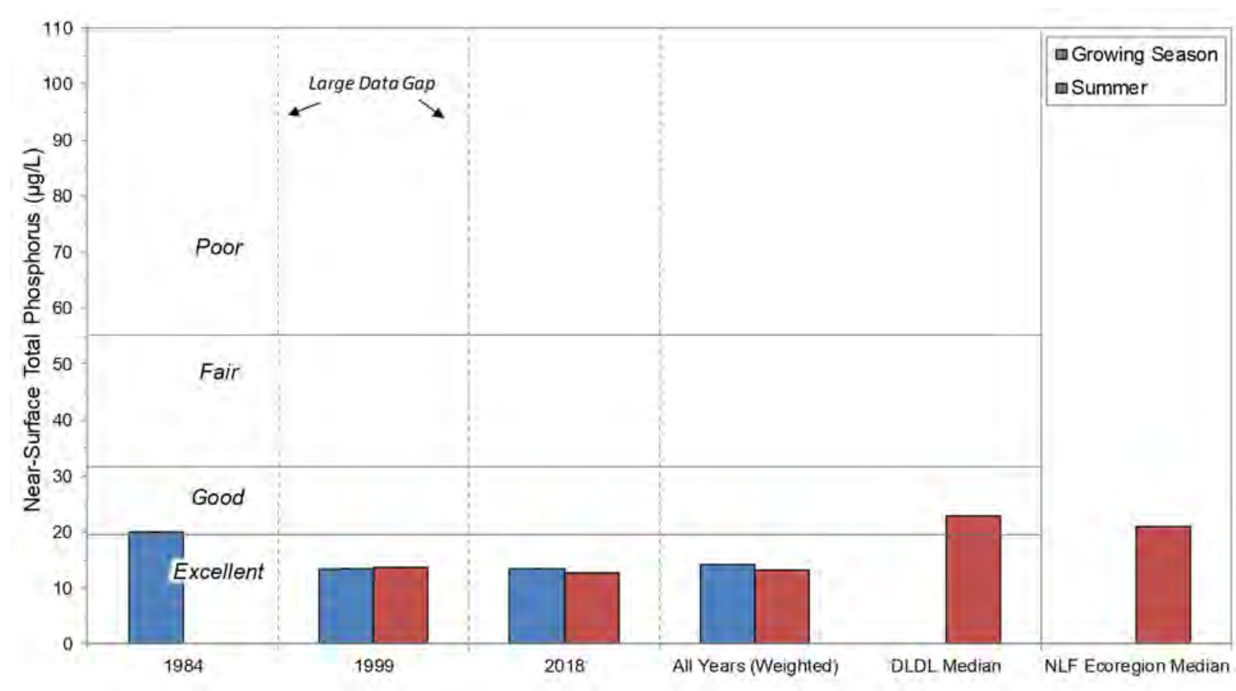


Figure 8.6.1-1. White Birch Lake, statewide deep lowland drainage lakes, and regional total phosphorus concentrations. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

Chlorophyll-*a* data are available from White Birch Lake from 1984, 1998-1999, and 2018 (Figure 8.6.1-2). Average summer chlorophyll-*a* concentrations ranged from 2.6 µg/L in 2018 to 5.0 µg/L in 1984; however, only one chlorophyll-*a* measurement was taken in 1984 and may not be representative of the summer average. White Birch Lake's weighted summer average chlorophyll-*a* concentration is 3.6 µg/L and falls into the *excellent* category for deep lowland drainage lakes in Wisconsin. White Birch Lake's summer average chlorophyll-*a* concentrations are lower than the median value for deep lowland drainage lakes in the state and lower than the median value for all lake types in the NLF ecoregion.

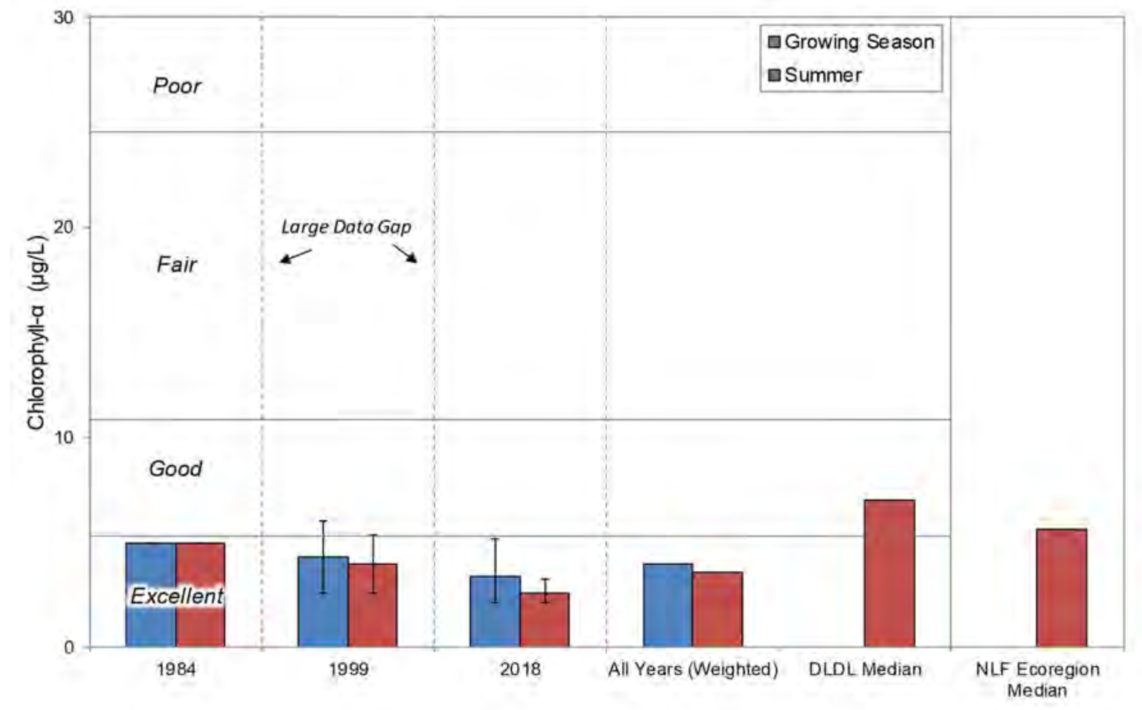


Figure 8.6.1-2. White Birch Lake, statewide deep lowland drainage lakes, and regional chlorophyll-*a* concentrations. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

Secchi disk transparency data are available from White Birch Lake from 1984, 1998-2000, 2015, and 2017-2018 (Figure 8.6.1-3). The weighted summer average Secchi disk depth is 14 feet and falls into the *excellent* category for deep lowland drainage lakes in Wisconsin. White Birch Lake's weighted summer average Secchi disk depth is approximately 5.5 feet deeper than the median value for deep lowland drainage lakes in the state and is approximately 5.1 feet deeper than the median value for all lake types in the NLF ecoregion. Secchi disk depths are also available from 1927-1930 from Birge and Juday (Splitt 2001). The average Secchi disk depth from this period was 7.3 feet. A Secchi disk depth measurement of 10.0 feet was also collected in 1960 (Black et al. 1960). These values were slightly lower than measurements made more recently.

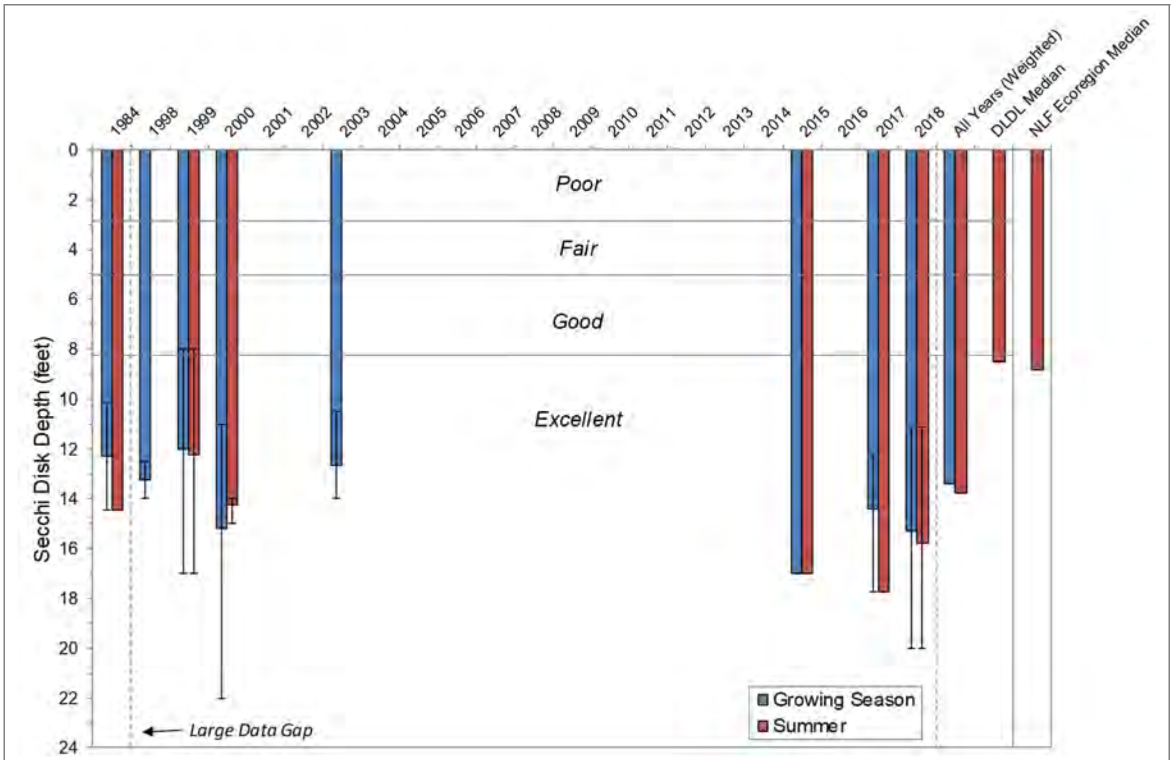


Figure 8.6.1-3. White Birch Lake, statewide deep lowland drainage lakes, and regional Secchi disk clarity values. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

Limiting Plant Nutrient of White Birch Lake

Using midsummer nitrogen and phosphorus concentrations from White Birch Lake, a nitrogen:phosphorus ratio of 44:1 was calculated. This finding indicates that White Birch Lake is indeed phosphorus limited as are the vast majority of Wisconsin lakes. In general, this means that cutting phosphorus inputs may limit plant growth within the lake.

White Birch Lake Trophic State

Figure 8.6.1-4 contains the Trophic State Index (TSI) values for White Birch Lake. These TSI values are calculated using summer near-surface total phosphorus, chlorophyll-*a*, and Secchi disk transparency data collected as part of this project along with available historical data. In general, the best values to use in assessing a lake's trophic state are chlorophyll-*a* and total phosphorus, as water clarity can be influenced by other factors other than phytoplankton such as dissolved organic compounds. The closer the calculated TSI values are for these three parameters are to one another indicates a higher degree of correlation.

The weighted TSI values for total phosphorus and chlorophyll-*a* (and Secchi disk transparency) in White Birch Lake indicate the lake is at present in an oligo-mesotrophic state. White Birch Lake's productivity is slightly lower when compared to other deep lowland drainage lakes in Wisconsin and all lake types within the NLF ecoregion.

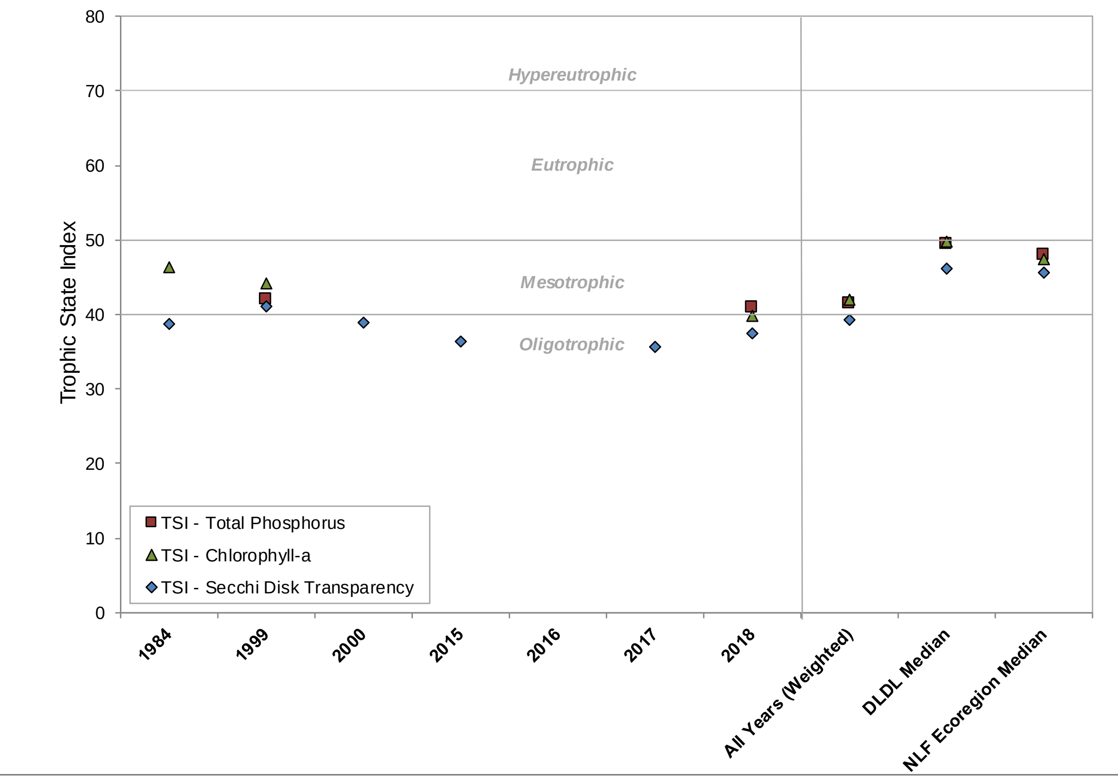


Figure 8.6.1-4. White Birch Lake, statewide deep lowland drainage lakes, and regional Trophic State Index values. Values calculated with summer month surface sample data using WDNR PUB-WT-193.

Dissolved Oxygen and Temperature in White Birch Lake

Dissolved oxygen and temperature were measured during water quality sampling visits to White Birch Lake by Onterra staff. Profiles depicting these data are displayed in Figure 8.6.1-5.

White Birch Lake is *dimictic*, meaning the lake remains stratified during the summer (and winter) and completely mixes, or turns over, once in spring and once in fall. During the summer, the surface of the lake warms and becomes less dense than the cold layer below, and the lake thermally stratifies. Given White Birch Lake's deeper nature, wind and water movement are not sufficient during the summer to mix these layers together, only the warmer upper layer will mix. The stratification in White Birch Lake results in an unusual profile on June 27, 2018 when the highest oxygen concentrations occurred in the deepest waters of the lake. This is because cooler water is able to have higher dissolved oxygen concentrations. Because of the excellent water quality conditions of the lake, oxygen depletion rates in the deep water are slow, allowing oxygen to be retained in the deep waters for a few months after the lake stratifies. By late July enough oxygen had been consumed so that the highest oxygen levels no longer occurred in the deepest waters, even though some oxygen was present. By late August, the very bottom waters had become anoxic.

In fall, as surface temperatures cool, the entire water column is again able to mix, which re-oxygenates the hypolimnion. During the winter, the coldest temperatures are found just under the overlying ice, while oxygen gradually declines once again towards the bottom of the lake. In February of 2019, oxygen concentrations remained above 2.0 mg/L throughout the majority of the water column, indicating that fishkills as a result of winter anoxia are likely not a concern in White Birch Lake.

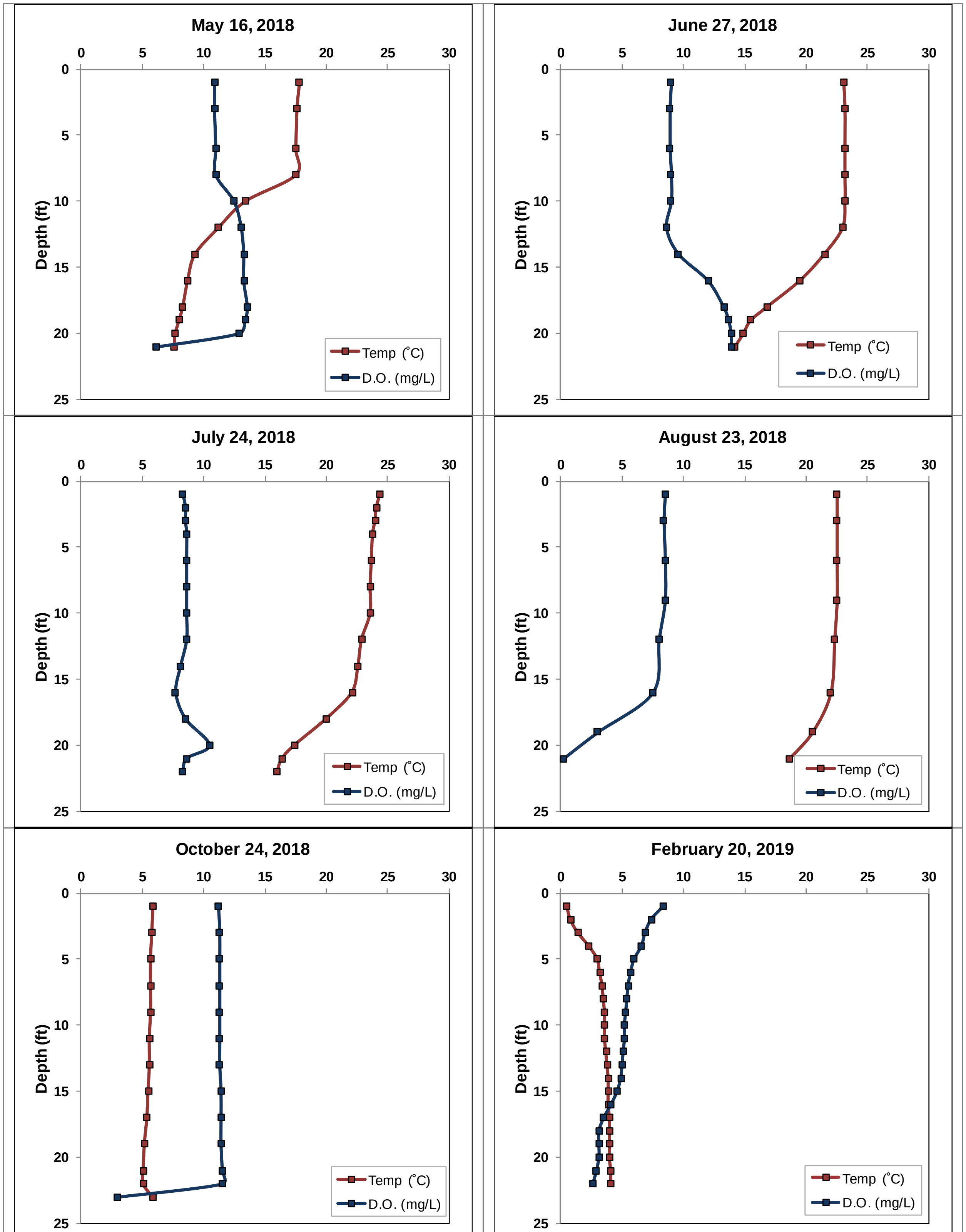


Figure 8.6.1-5. White Birch Lake 2018 dissolved oxygen and temperature profiles.

8.6.2 White Birch Lake Watershed Assessment

White Birch Lake's watershed encompasses an area of approximately 2,683 acres, yielding a watershed to lake area ratio of 22:1 (Figure 8.5.2-1, White Birch Lake – Map 2). According to WiLMS modeling, the lake's water residence time is 0.6 years, meaning the lake water is replaced approximately 1.7 times per year (flushing rate).

The largest part of the lake's watershed is the Ballard Lake watershed which is immediately upstream of White Birch Lake. Of the remaining part of the watershed, 5% is forest, 4% is the lake's surface, 2% is wetlands, 1% is pasture/grass, and <1% is shoreland development (Figure 8.6.2-1).

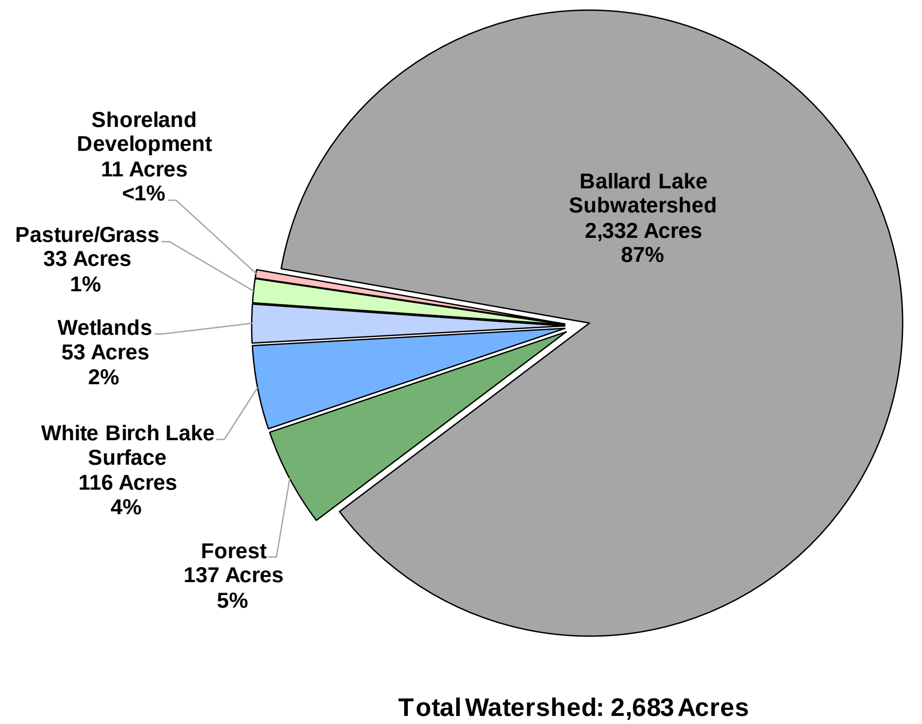


Figure 8.6.2-1. White Birch Lake watershed land cover types in acres. Based upon National Land Cover Database (NLCD – Fry et. al 2011).

Using the land cover data described above, WiLMS was utilized to estimate the annual potential phosphorus load from White Birch Lake's watershed. It was estimated that approximately 147 pounds of phosphorus is delivered to White Birch Lake from its watershed on an annual basis (Figure 8.6.2-2).

Of the estimated 147 pounds of phosphorus being delivered annually to White Birch Lake, the largest contributor is the upstream Ballard Lake watershed at 82 pounds (55%). The means that the most effective way to reduce phosphorus loading to White Birch Lake would be to address issues in the Ballard Lake watershed. Of the remaining portion of the White Birch Lake watershed, 31 pounds (21%) is estimated to originate from direct atmospheric deposition onto the lake, 11 pounds (8%) from forest, 9 pounds (9%) from pasture/grass, 6 pounds (4%) from riparian septic systems, 5 pounds (3%) from wetlands, and 4 pounds (3%) from shoreland development (Figure 8.6.2-2).

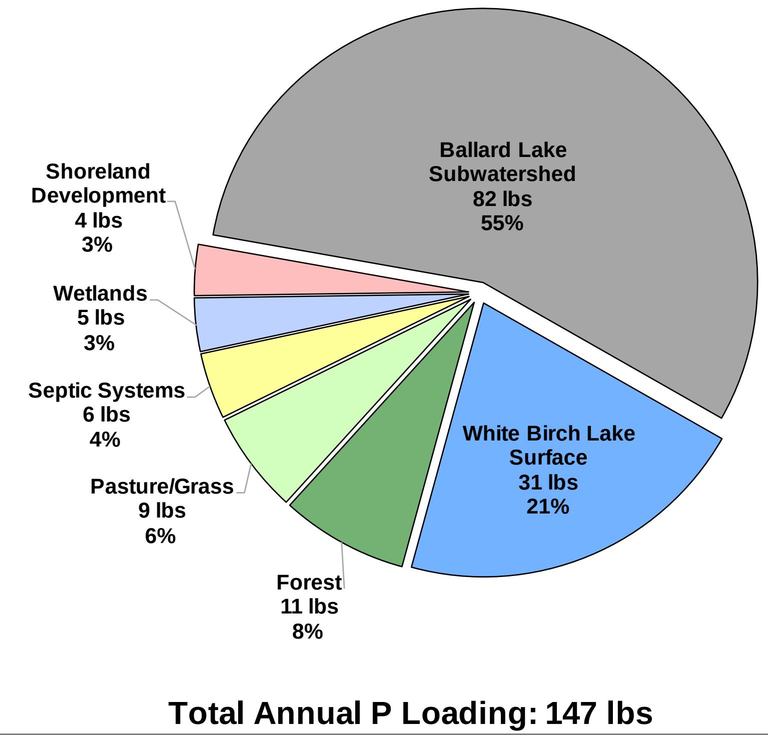


Figure 8.6.2-2. White Birch Lake watershed phosphorus loading in pounds. Based upon Wisconsin Lake Modeling Suite (WiLMS) estimates.

Using predictive equations, WiLMS estimated that based on the 147 pounds of phosphorus which are loaded to White Birch Lake annually, the lake should have an in-lake growing season mean (GSM) total phosphorus concentration of approximately 15 µg/L. This predicted GSM total phosphorus concentration almost the same as the measured mean of 13 µg/L. This indicates the model accurately predicts the phosphorus loading to the lake.

8.6.3 White Birch Lake Shoreland Condition

Shoreland Development

As mentioned previously in the Town-wide Shoreland Condition Section, one of the most sensitive areas of the watershed is the immediate shoreland area. This area of land is the last source of protection for a lake against surface water runoff, and is also a critical area for wildlife habitat. In the fall of 2018, White Birch Lake's immediate shoreline was assessed in terms of its development. White Birch Lake has stretches of shoreland that fit all of the five shoreland assessment categories. In all, 2.4 miles of natural/undeveloped and developed-natural shoreline were observed during the survey (Figure 8.6.3-1). This constitutes about 89% of White Birch Lake's shoreline. These shoreland types provide the most benefit to the lake and should be left in their natural state if at all possible. During the survey, <0.1 miles of urbanized and developed–unnatural shoreline (5%) was observed. If restoration of the White Birch Lake shoreline is to occur, primary focus should be placed on these shoreland areas as they currently provide little benefit to, and actually may harm, the lake ecosystem. White Birch Lake - Map 3 displays the location of these shoreline lengths around the entire lake.

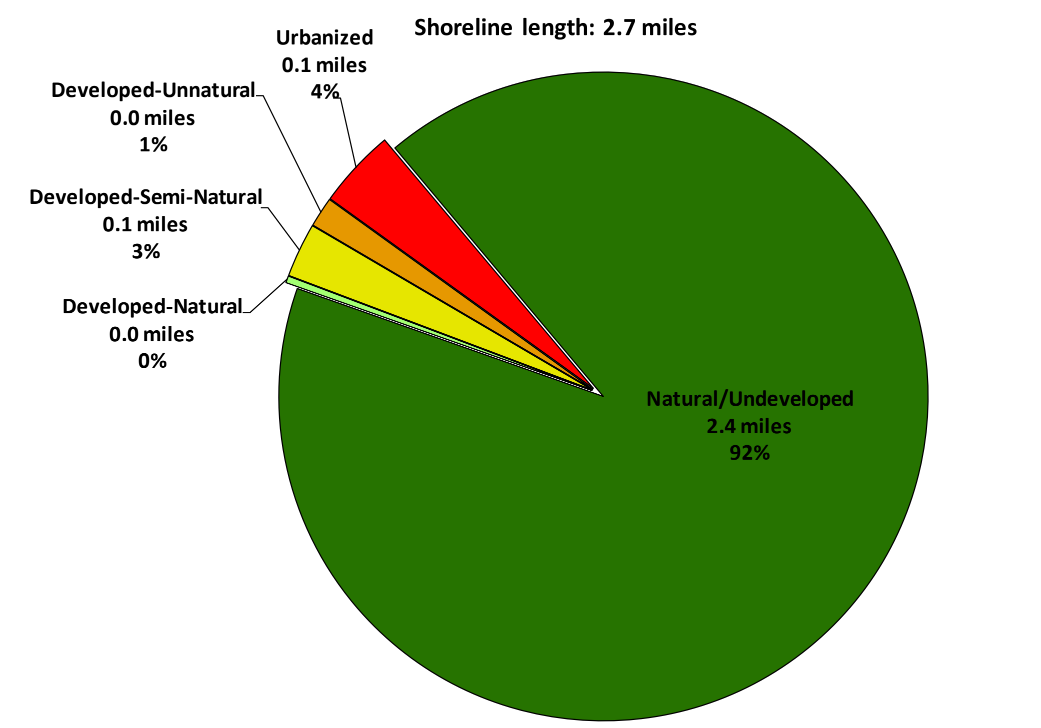


Figure 8.6.3-1. White Birch Lake shoreland categories and total lengths. Based upon a fall 2018 survey. Locations of these categorized shorelands can be found on White Birch Lake - Map 3.

Coarse Woody Habitat

A survey for coarse woody habitat was conducted in conjunction with the shoreland assessment (development) survey. Coarse woody habitat was identified, and classified in three size categories (2-8 inches in diameter, >8 inches in diameter, and cluster of pieces) as well as four branching categories: no branches, minimal branches, moderate branches, and full canopy. As discussed earlier, research indicates that fish species prefer some branching as opposed to no branching on coarse woody habitat, and increasing complexity is positively correlated with higher fish species richness, diversity and abundance (Newbrey et al. 2005).

During this survey, 206 total pieces of coarse woody habitat were observed along 2.7 miles of shoreline (White Birch Lake - Map 4), which gives White Birch Lake a coarse woody habitat to shoreline mile ratio of 78:1 (Figure 8.6.3-2). Only instances where emergent coarse woody habitat extended from shore into the water were recorded during the survey. Of the 206 total pieces of coarse woody habitat observed during the survey, 169 pieces were 2-8 inches in diameters, 37 were 8 inches in diameter or greater, and no clusters of pieces of coarse woody habitat were found.

To put this into perspective, Wisconsin researchers have found that in completely undeveloped lakes, an average of 345 coarse woody habitat structures may be found per mile (Christensen et al. 1996). Please note the methodologies between the surveys done on White Birch Lake and those cited in this literature comparison are much different, but still provide a valuable insight into what undisturbed shorelines may have in terms of coarse woody habitat.

Onterra has completed coarse woody habitat surveys on 98 lakes throughout Wisconsin since 2012, with the majority occurring in the NLF ecoregion on lakes with public access. The number of coarse woody habitat pieces per shoreline mile in White Birch Lake fell well above the 75th percentile of these 98 lakes (Figure 8.6.3-2).

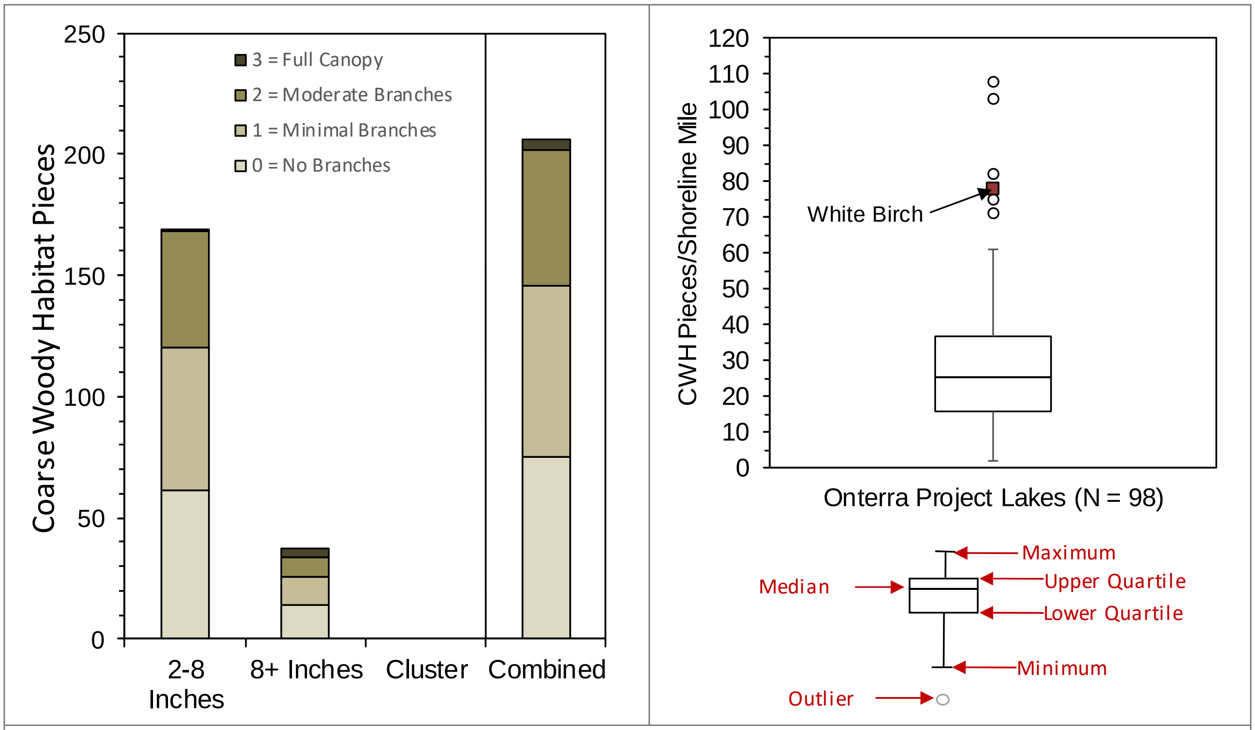
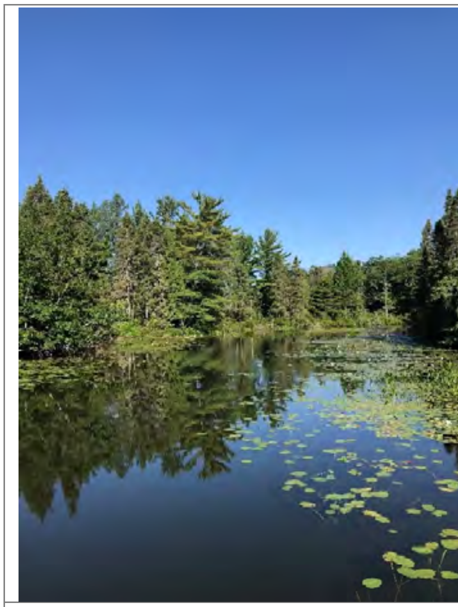


Figure 8.6.3-2. White Birch Lake coarse woody habitat survey results. Based upon a fall 2018 survey. Locations of White Birch Lake coarse woody habitat can be found on White Birch Lake - Map 4.

8.6.4 White Birch Lake Aquatic Vegetation

An Early-Season Aquatic Invasive Species (ESAIS) Survey was conducted by Onterra ecologists on White Birch Lake on June 27, 2018. While the intent of this survey is to locate any potential non-native species within the lake, the primary focus is to locate potential occurrences of the non-native curly-leaf pondweed, which should be at or near its peak growth at this time. No aquatic invasive species were located on White Birch Lake during this survey.



Photograph 8.5.4-1. White Birch Lake.

The whole-lake aquatic plant point-intercept survey and emergent and floating-leaf aquatic plant community mapping survey were conducted on White Birch by Onterra ecologists on July 24-25, 2018. During these surveys, a total of 37 native aquatic plant species were located (Table 8.6.4-1). One native aquatic plant species present in White Birch Lake, Northeastern bladderwort, is listed by the Wisconsin Natural Heritage Inventory Program as a species of 'special concern' because it is rare or uncommon in Wisconsin and there is uncertainty regarding its abundance and distribution within the state.

As discussed in the primer section, sediment data were collected at each sampling location within the littoral zone during the point-intercept survey. Approximately 74% of the point-intercept locations within littoral areas contained fine, organic sediments (muck), 23% contained sand, and 3% contained rock (Figure 8.6.4-1; White Birch Lake - Map 5). Like terrestrial plants, different aquatic plant species are adapted to grow in certain substrate types; some species are only found growing in mucky substrates, others only in sandy areas, and some can be found growing in either. Lakes that have varying substrate types generally support a higher number of plant species because the different habitat types that are available.

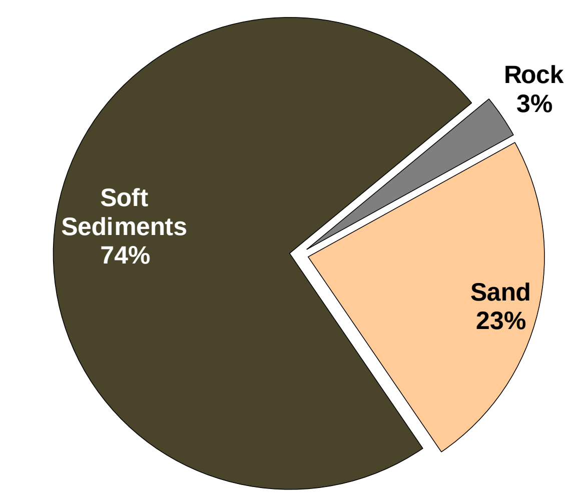


Figure 8.6.4-1. White Birch Lake 2018 proportion of substrate types. Created from data collected during the 2018 whole-lake point-intercept survey (N = 272).

Table 8.6.4-1. List of aquatic plant species located in White Birch Lake during Onterra 2018 aquatic plant surveys.

Growth Form	Scientific Name	Common Name	Coefficient of Conservatism (C)	2018 (Onterra)
Emergent	*Calla palustris*	Water arum	9	I
	Carex comosa	Bristly sedge	5	I
	Carex sp. (sterile)	Sedge sp. (sterile)	N/A	I
	Dulichium arundinaceum	Three-way sedge	9	I
	Pontederia cordata	Pickerelweed	9	I
	Sparganium americanum	American bur-reed	8	I
	Sagittaria latifolia	Common arrowhead	3	I
	Scirpus cyperinus	Wool grass	4	I
	Sparganium sp. (sterile)	Bur-reed sp. (sterile)	N/A	I
	Typha spp.	Cattail spp.	1	I
FL	*Brasenia schreberi*	Watershield	7	X
	Nuphar variegata	Spatterdock	6	X
	Nymphaea odorata	White water lily	6	X
	Sparganium angustifolium	Narrow-leaf bur-reed	9	I
Submergent	*Chara spp.*	Muskgrasses	7	X
	Elodea canadensis	Common waterweed	3	X
	Isoetes spp.	Quillwort spp.	8	X
	Lobelia dortmanna	Water lobelia	10	I
	Myriophyllum sibiricum	Northern watermilfoil	7	X
	Myriophyllum tenellum	Dwarf watermilfoil	10	X
	Najas flexilis	Slender naiad	6	X
	Najas guadalupensis	Southern naiad	7	X
	Potamogeton amplifolius	Large-leaf pondweed	7	X
	Potamogeton gramineus	Variable-leaf pondweed	7	X
	Potamogeton illinoensis	Illinois pondweed	6	X
	Potamogeton natans	Floating-leaf pondweed	5	X
	Potamogeton praelongus	White-stem pondweed	8	X
	Potamogeton pusillus	Small pondweed	7	X
	Potamogeton robbinsii	Fern-leaf pondweed	8	X
	Potamogeton zosteriformis	Flat-stem pondweed	6	X
	Ranunculus flammula	Creeping spearwort	9	X
	Sagittaria sp. (rosette)	Arrowhead sp. (rosette)	N/A	X
	*Utricularia resupinata**	Northeastern bladderwort	9	X
	Vallisneria americana	Wild celery	6	X
S/E	*Comarum palustre*	Marsh cinquefoil	N/A	I
	Eleocharis acicularis	Needle spikerush	5	X
	Sagittaria graminea	Grass-leaved arrowhead	9	X

FL = Floating Leaf; FL/E = Floating Leaf and Emergent; S/E = Submergent and Emergent; FF = Free Floating
X = Located on rake during point-intercept survey; I = Incidental Species
** = Species listed as special concern by WI Natural Heritage Inventory*

Of the 340 point-intercept sampling locations that fell at or below the maximum depth of plant growth in 2018, approximately 83% contained aquatic vegetation. White Birch Lake – Map 6 displays the point-intercept locations that contained aquatic vegetation in 2018, and the total rake fullness ratings at those locations. Thirty-five percent of the point-intercept locations had a total rake fullness (TRF) rating of 1, 33% had a total rake fullness rating of 2, and 15% had the highest total rake fullness rating of 3 (Figure 8.6.4-2). Seventeen percent of the littoral zone had no vegetation.

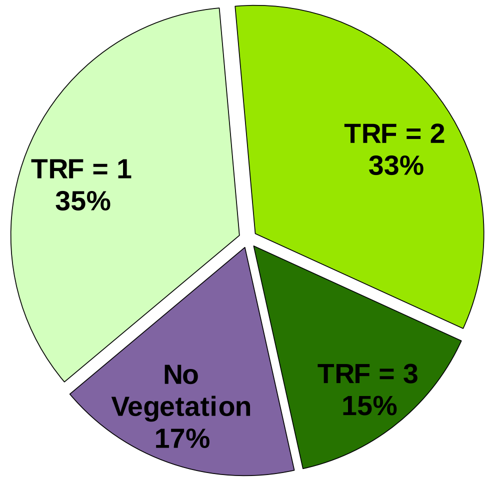


Figure 8.6.4-2. White Birch Lake 2018 aquatic vegetation total rake fullness ratings (TRF). Created from data collected during the 2018 whole-lake point-intercept survey (N = 340).

Of the 37 native aquatic plant species located in White Birch Lake in 2018, 24 were encountered directly on the rake during the whole-lake point-intercept survey (Figure 8.6.4-3). The remaining 13 plants were located incidentally, meaning they were observed by Onterra ecologists while on the lake but they were not directly sampled on the rake at any of the point-intercept sampling locations. Incidental species typically include emergent and floating-leaf species that are often found growing on the fringes of the lake and submersed species that are relatively rare within the plant community. Of the 24 species directly sampled with the rake during the point-intercept survey, fern-leaf pondweed, southern naiad, common waterweed, and variable-leaf pondweed were the four-most frequently encountered plants, respectively (Figure 8.6.4-3).

Fern-leaf pondweed was the most abundant plant in White Birch Lake in 2018 with a littoral occurrence of 52% (Figure 8.6.4-3). As its name suggests, it has the appearance of a fern's leaf and is a common pondweed found in lakes in northern Wisconsin. This plant generally grows in dense beds which creep along the bottom of the lake, where they provide excellent structural habitat for aquatic invertebrates and fish.

Southern naiad was the second most abundant aquatic plant in White Birch Lake in 2018 with a littoral occurrence of just under 21% (Figure 8.6.4-3). Southern naiad can dislodge and form surface mats that interfere with navigation, recreation, and aesthetics. Often the plants are not growing in place, but rather have uprooted and aggregated on taller vegetation.

Common waterweed was the third most abundant aquatic plant encountered in White Birch Lake in 2018, with a littoral occurrence of approximately 9% (Figure 8.6.4-3). Common waterweed is found throughout lakes in Wisconsin and North America and is often dominant in areas with soft sediments. Its dense foliage provides valuable aquatic habitat while its ability to derive nutrients directly from the water aid in improving water quality.

Variable-leaf pondweed was the fourth most abundant aquatic plant in White Birch Lake in 2018, with a littoral frequency of occurrence of 9% (Figure 8.6.4-3). Variable-leaf pondweed produces long, slender stems with alternating lance-shaped leaves. As its name indicates, this plant can look very different from lake to lake, with some populations having larger leaves and others possessing smaller leaves.

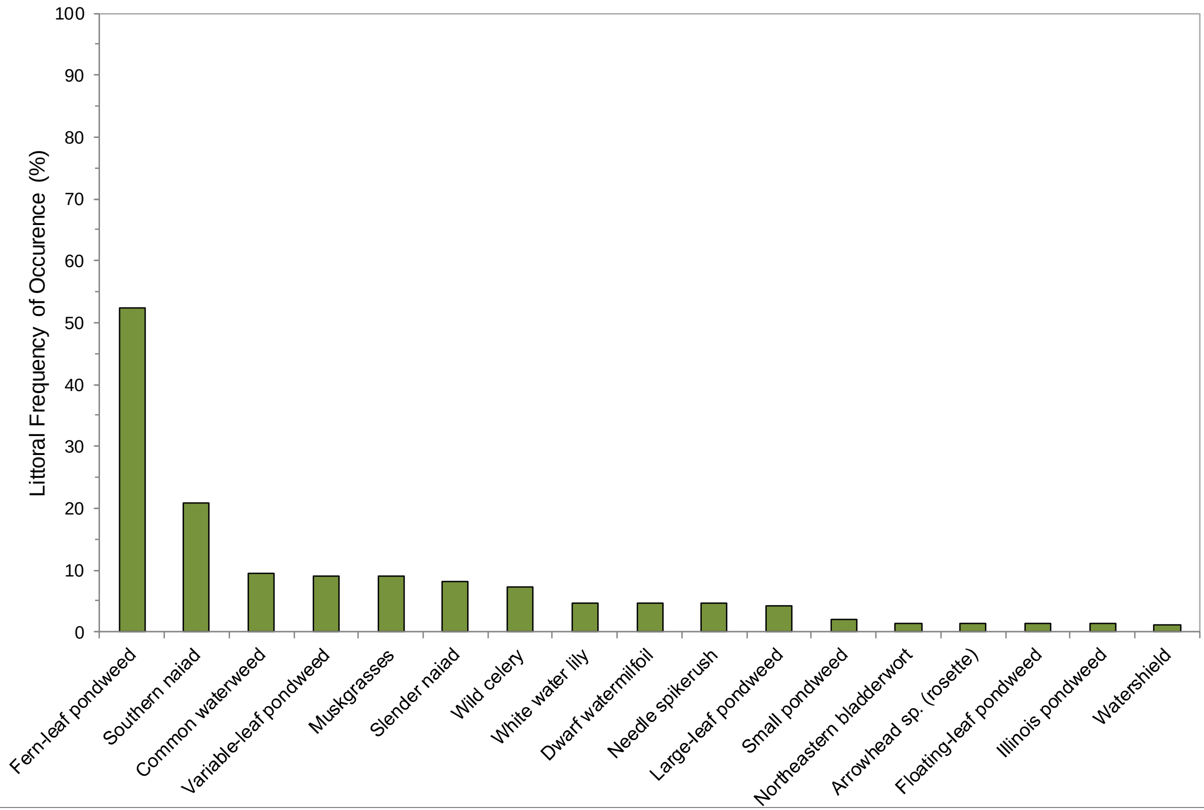


Figure 8.6.4-3. White Birch Lake 2018 littoral frequency of occurrence of aquatic plant species. Created using data from 2018 whole-lake point-intercept survey.

As discussed in the Town-wide section, the calculations used to create the Floristic Quality Index (FQI) for a lake's aquatic plant community are based on the aquatic plant species that were encountered on the rake during the point-intercept survey and do not include incidental species. The native species encountered on the rake during the 2018 point-intercept survey and their conservatism values were used to calculate the FQI of West Plum's aquatic plant community (equation shown below).

$$FQI = \text{Average Coefficient of Conservatism} * \sqrt{\text{Number of Native Species}}$$

Figure 8.6.4-4 compares 2018 FQI components of White Birch Lake to median values of lakes within the Northern Lakes and Forests (NLF) ecoregion and lakes throughout Wisconsin. The number of native aquatic plant species encountered on the rake, or native species richness, was 24 for the 2018 survey. White Birch Lake's species richness is above the median value for lakes within the ecoregion and the state.

White Birch Lake's average conservatism in 2018 was 6.9 (Figure 8.6.4-4). White Birch Lake's average conservatism is just slightly above the median values for lakes in the ecoregion and for lakes throughout Wisconsin, which indicates White Birch Lake's aquatic plant community contains a similar, but slightly higher number of aquatic plants that are considered to be sensitive to environmental degradation and require high-quality habitats. Given White Birch Lake's higher native species richness and average conservatism values from 2018, White Birch Lake has a higher Floristic Quality Index value of 33.9. This FQI value is above the median values for lakes in the ecoregion and the state, and indicates that White Birch Lake's aquatic plant community is of higher quality than the majority of lakes throughout Wisconsin.

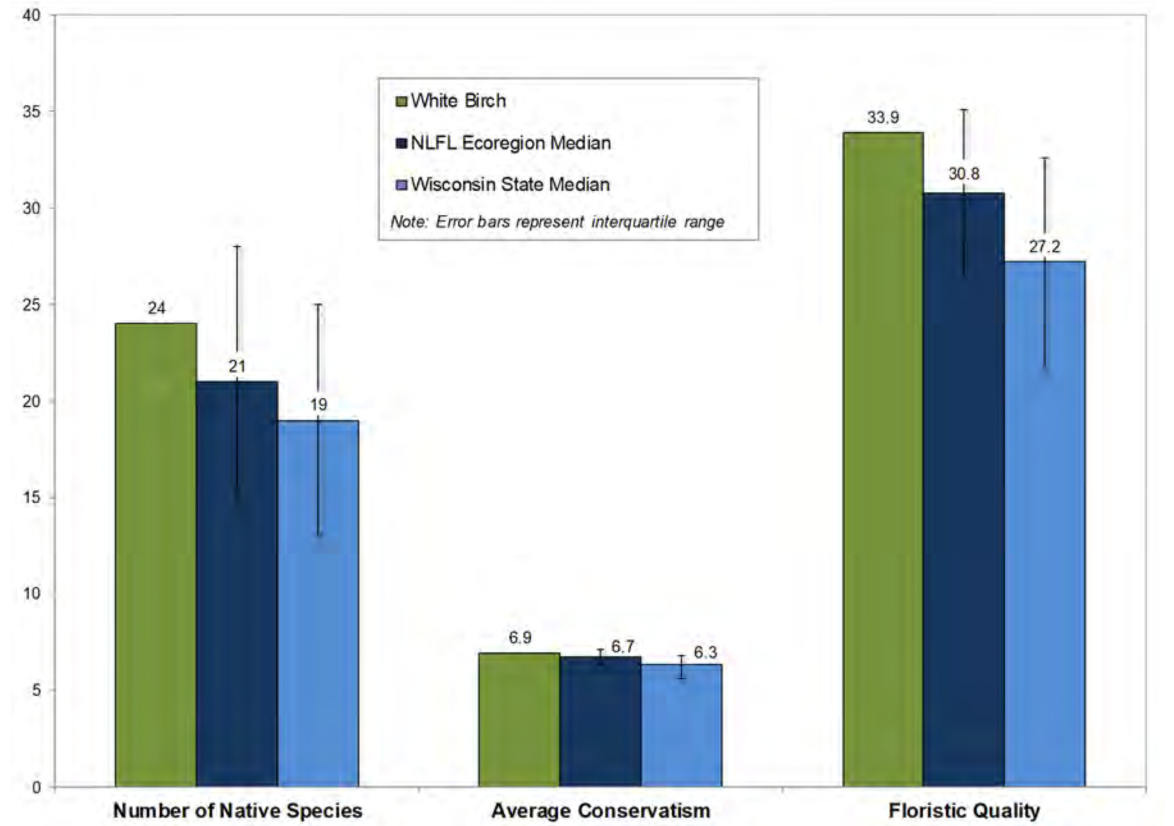


Figure 8.6.4-4. White Birch Lake Floristic Quality Assessment. Created using data from Onterra 2018 whole-lake point-intercept survey. Analysis follows Nichols (1999).

As explained in the Town-wide section, lakes with diverse aquatic plant communities have higher resilience to environmental disturbances and greater resistance to invasion by non-native plants. In addition, a plant community with a mosaic of species with differing morphological attributes provides zooplankton, macroinvertebrates, fish, and other wildlife with diverse structural habitat and various sources of food. Because White Birch Lake contains a higher number of native aquatic plant species, one may assume the aquatic plant community has high species diversity. However, species diversity is also influenced by how evenly the plant species are distributed within the community.

While a method for characterizing diversity values of fair, poor, etc. does not exist, lakes within the same ecoregion may be compared to provide an idea of how White Birch Lake's diversity value ranks. Using data collected by Onterra and WDNR Science Services, quartiles were calculated for 212 lakes within the NLF ecoregion (Figure 8.6.4-5). Using the data collected from the 2018 point-intercept survey, White Birch Lake's aquatic plant community is shown to have average species diversity with a Simpson's Diversity Index value of 0.83. In other words, if two individual aquatic plants were randomly sampled from White Birch Lake in 2018, there would be an 83% probability that they would be different species. This diversity value falls just slightly below the ecoregion median and the median for lakes throughout the state.

One way to visualize White Birch Lake's species diversity is to look at the relative occurrence of aquatic plant species. Figure 8.6.4-6 displays the relative frequency of occurrence of aquatic plant species created from the 2018 whole-lake point-intercept survey and illustrates the distribution of aquatic plant species within the community. A plant community that is dominated by just one or a few species yields lower species diversity. Because each sampling location may contain numerous plant species, relative frequency of occurrence is one tool to evaluate how often each plant species is found in relation to all other species found (composition of population). For instance, while fern-leaf pondweed was found at 52% of the littoral sampling locations in White Birch Lake in 2018, its relative frequency of occurrence is 36%. Explained another way, if 100 plants were randomly sampled from White Birch Lake in 2018, 36 of them would be fern-leaf pondweed.

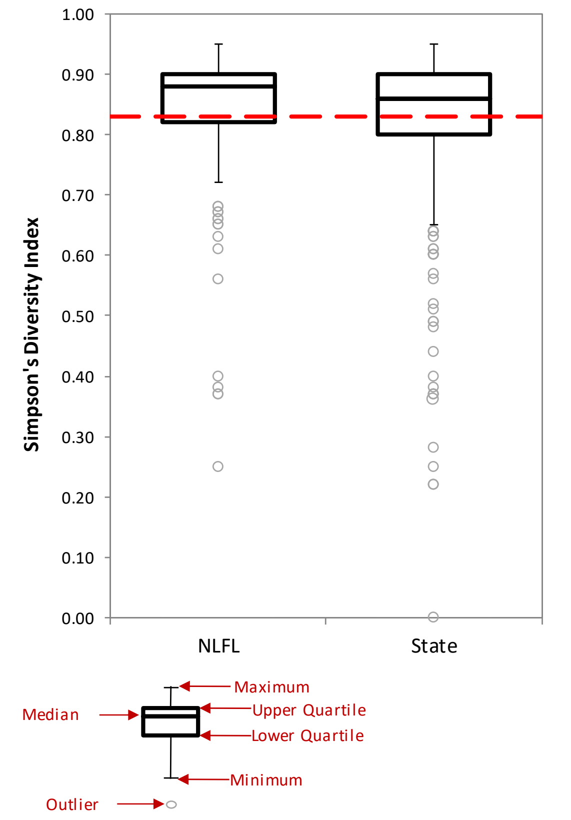


Figure 8.6.4-5. White Birch Lake species diversity index. Created using data from the Onterra 2017 point-intercept survey.

In 2018, Onterra ecologists also conducted a survey aimed at mapping emergent and floating-leaf aquatic plant communities in White Birch Lake. This survey revealed White Birch Lake contains approximately 16.6 acres of these communities comprised of 13 different aquatic plant species (White Birch Lake – Map 7 and Table 8.6.4-2). These native emergent and floating-leaf plant communities provide valuable fish and wildlife habitat that is important to the ecosystem of the lake. These areas are particularly important during times of fluctuating water levels, since structural habitat of fallen trees and other forms of course-woody habitat can be quite sparse along the shores of receding water lines.

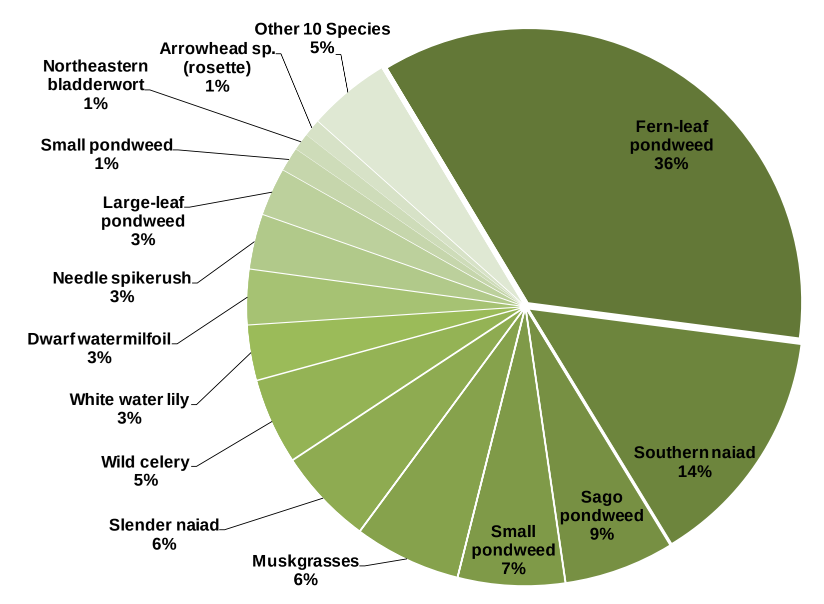


Figure 8.6.4-6. White Birch Lake 2018 relative frequency of occurrence of aquatic plant species. Created using data from 2018 point-intercept survey.

The community map represents a 'snapshot' of the important emergent and floating-leaf plant communities, and a replication of this survey in the future will provide a valuable understanding of the dynamics of these communities within

White Birch Lake. This is important, because these communities are often negatively affected by recreational use and shoreland development.

Table 8.6.4-2. White Birch Lake 2018 acres of emergent and floating-leaf aquatic plant communities. Created using data from 2018 aquatic plant community mapping survey.

Plant Community	Acres
Emergent	0.4
Floating-leaf	13.9
Mixed Emergent & Floating-leaf	2.4
Total	**16.6**

8.6.5 Aquatic Invasive Species in White Birch Lake

As is discussed in section 2.0 Stakeholder Participation, the lake stakeholders were asked about aquatic invasive species (AIS) and their presence in White Birch Lake within the anonymous stakeholder survey. Onterra and the WDNR have confirmed that there are currently no AIS present in White Birch Lake.

More information on invasive species or any other AIS can be found at the following links:

- http://dnr.wi.gov/topic/invasives/
- https://nas.er.usgs.gov/default.aspx
- https://www.epa.gov/greatlakes/invasive-species

8.6.6 White Birch Lake Fisheries Data Integration

Fishery management is an important aspect in the comprehensive management of a lake ecosystem; therefore, a brief summary of available data is included here as a reference. The following section is not intended to be a comprehensive plan for the lake's fishery, as those aspects are currently being conducted by the fisheries biologists overseeing White Birch Lake. The goal of this section is to provide an overview of some of the data that exists. Although current fish data were not collected as a part of this project, the following information was compiled based upon data available from the Wisconsin Department of Natural Resources (WDNR) the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) and personal communications with DNR Fisheries Biologist Steve Gilbert (WDNR 2019 & GLIFWC 2018).

White Birch Lake Fishery

Energy Flow of a Fishery

When examining the fishery of a lake, it is important to remember what drives that fishery, or what is responsible for determining its mass and composition. The gamefish in White Birch Lake are supported by an underlying food chain. At the bottom of this food chain are the elements that fuel algae and plant growth – nutrients such as phosphorus and nitrogen, and sunlight. The next tier in the food chain belongs to zooplankton, which are tiny crustaceans that feed upon algae and plants, and insects. Smaller fish called planktivores feed upon zooplankton and insects, and in turn become food for larger fish species. The species at the top of the food chain are called piscivores and are the larger gamefish that are often sought after by anglers, such as bass and walleye.

A concept called energy flow describes how the biomass of piscivores is determined within a lake. Because algae and plant matter are generally small in energy content, it takes an incredible amount of this food type to support a sufficient biomass of zooplankton and insects. In turn, it takes a large biomass of zooplankton and insects to support planktivorous fish species. And finally, there must be a large planktivorous fish community to support a modest piscivorous fish community. Studies have shown that in natural ecosystems, it is largely the amount of primary productivity (algae and plant matter) that drives the rest of the producers and consumers in the aquatic food chain. This relationship is illustrated in Figure 8.6.6-1.

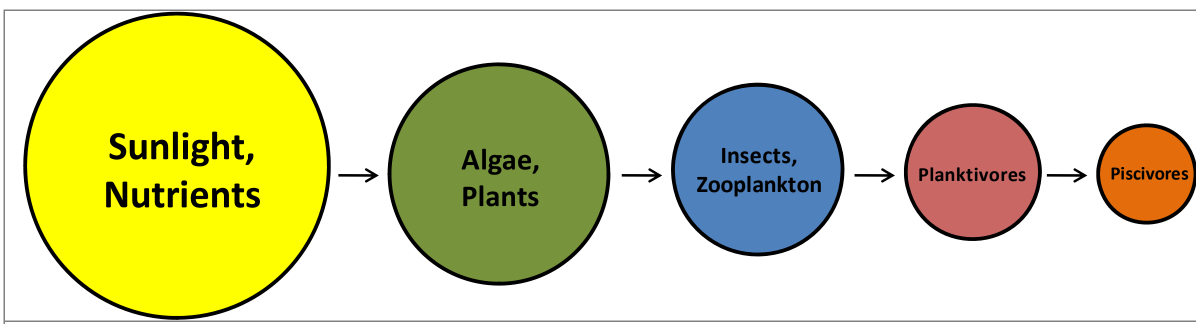


Figure 8.6.6-1. Aquatic food chain. Adapted from Carpenter et. al 1985.

As discussed in the Water Quality section, White Birch Lake is a oligo-mesotrophic system, meaning it has a moderate to high amount of nutrients and thus a moderate amount of primary productivity. This is relative to an oligotrophic system, which contains fewer nutrients (less productive) and a eutrophic system, which contains more nutrients (more productive). Simply put, this means White Birch Lake should be able to support an appropriately sized population of predatory fish (piscivores) when compared to a eutrophic system. Table 8.6.6-1 shows the popular game fish present in the system.

Table 8.6.6-1. Gamefish present in White Birch Lake with corresponding biological information (Becker, 1983).

Common Name (*Scientific Name*)	Max Age (yrs)	Spawning Period	Spawning Habitat Requirements	Food Source
Black Crappie (*Pomoxis nigromaculatus*)	7	May - June	Near *Chara* or other vegetation, over sand or fine gravel	Fish, cladocera, insect larvae, other invertebrates
Bluegill (*Lepomis macrochirus*)	11	Late May - Early August	Shallow water with sand or gravel bottom	Fish, crayfish, aquatic insects and other invertebrates
Largemouth Bass (*Micropterus salmoides*)	13	Late April - Early July	Shallow, quiet bays with emergent vegetation	Fish, amphipods, algae, crayfish and other invertebrates
Muskellunge (*Esox masquinongy*)	30	Mid April - Mid May	Shallow bays over muck bottom with dead vegetation, 6 - 30 in.	Fish including other muskies, small mammals, shore birds, frogs
Northern Pike (*Esox lucius*)	25	Late March - Early April	Shallow, flooded marshes with emergent vegetation with fine leaves	Fish including other pike, crayfish, small mammals, water fowl, frogs
Pumpkinseed (*Lepomis gibbosus*)	12	Early May - August	Shallow warm bays 0.3 - 0.8 m, with sand or gravel bottom	Crustaceans, rotifers, mollusks, flatworms, insect larvae (terrestrial and aquatic)
Rock Bass (*Ambloplites rupestris*)	13	Late May - Early June	Bottom of course sand or gravel, 1 cm - 1 m deep	Crustaceans, insect larvae, and other invertebrates
Smallmouth Bass (*Micropterus dolomieu*)	13	Mid May - June	Nests more common on north and west shorelines over gravel	Small fish including other bass, crayfish, insects (aquatic and terrestrial)
Walleye (*Sander vitreus*)	18	Mid April - Early May	Rocky, wavewashed shallows, inlet streams on gravel bottoms	Fish, fly and other insect larvae, crayfish
Yellow Perch (*Perca flavescens*)	13	April - Early May	Sheltered areas, emergent and submergent veg	Small fish, aquatic invertebrates

Photograph 8.6.6-1. Fyke net positioned in the littoral zone of a Wisconsin Lake (left) and an electroshocking boat (right).

Fish Stocking

To assist in meeting fisheries management goals, the WDNR may permit the stocking of fry, fingerling or adult fish in a waterbody that were raised in permitted hatcheries (Photograph 8.6.6-2). Stocking of a lake may be done to assist the population of a species due to a lack of natural reproduction in the system, or to otherwise enhance angling opportunities. White Birch Lake has been stocked from 1972 to 2018 with muskellunge and walleye (Table 8.6.6-2).

Photograph 8.6.6-2. Fingerling Muskellunge.

Table 8.6.6-2. Stocking data available for White Birch Lake (1972-2018).

Year	Species	Strain (Stock)	Age Class	# Fish Stocked	Avg Fish Length (in)
1972	Muskellunge	Unspecified	Fingerling	200	13
1976	Muskellunge	Unspecified	Fingerling	200	13
1996	Muskellunge	Unspecified	Fry	50,000	0.5
1998	Muskellunge	Unspecified	Large Fingerling	115	10.8
2013	Muskellunge	Upper Wisconsin River	Large Fingerling	29	9.7
2014	Muskellunge	Upper Wisconsin River	Large Fingerling	30	11.3
2015	Muskellunge	Upper Wisconsin River	Large Fingerling	14	11.7
2016	Muskellunge	Upper Wisconsin River	Large Fingerling	29	11.24
2017	Muskellunge	Upper Wisconsin River	Large Fingerling	18	10.8
2018	Muskellunge	Upper Wisconsin River	Large Fingerling	29	11.6
1973	Walleye	Unspecified	Fingerling	400	9
1974	Walleye	Unspecified	Fingerling	7000	3
1975	Walleye	Unspecified	Fingerling	3500	3
1976	Walleye	Unspecified	Fingerling	3500	3
1977	Walleye	Unspecified	Fingerling	3500	3
1978	Walleye	Unspecified	Fingerling	3500	2
1981	Walleye	Unspecified	Fingerling	6210	4
1986	Walleye	Unspecified	Fingerling	5670	2
1987	Walleye	Unspecified	Fingerling	33840	2
1988	Walleye	Unspecified	Fingerling	8680	4
1996	Walleye	Unspecified	Fingerling	6050	1.7
1996	Walleye	Unspecified	Fry	150000	0.3
1998	Walleye	Unspecified	Small Fingerling	11815	1.5
2000	Walleye	Unspecified	Small Fingerling	11760	1.8
2003	Walleye	Mississippi Headwaters	Small Fingerling	5984	1.8
2007	Walleye	Mississippi Headwaters	Small Fingerling	3855	2.8
2009	Walleye	Mississippi Headwaters	Small Fingerling	4091	1.7
2011	Walleye	Mississippi Headwaters	Small Fingerling	4000	1.8
2013	Walleye	Mississippi Headwaters	Small Fingerling	3995	2

Fishing Activity

Based on data collected from the stakeholder survey (Appendix B), fishing (open water) was the first most important reason for owning property on or near Ballard, Irving and White Birch Lakes (Question #18). Figure 8.6.6-2 displays the fish that Ballard, Irving and White Birch Lakes stakeholders enjoy catching the most, with muskellunge and walleye being the most popular. Approximately 78% of these same respondents believed that the quality of fishing on the lake was either good or fair (Figure 8.6.6-3). Approximately 69% of respondents who fish Ballard Lake believe the quality of fishing has remained the same or is somewhat worse since they first started fishing the lake (Figure 8.6.6-4).

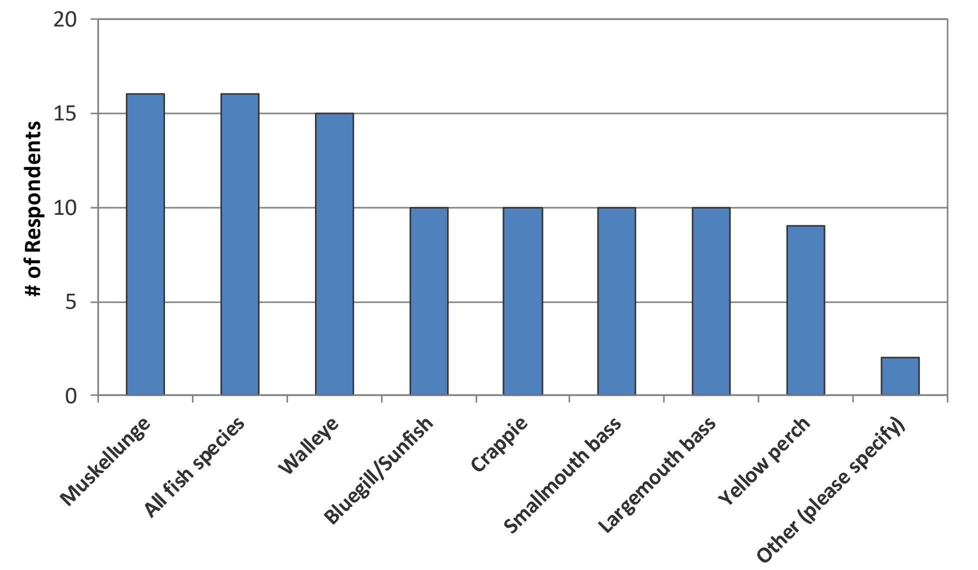


Figure 8.6.6-2. Stakeholder survey response Question #12. *What species of fish do you like to catch on your lake?*

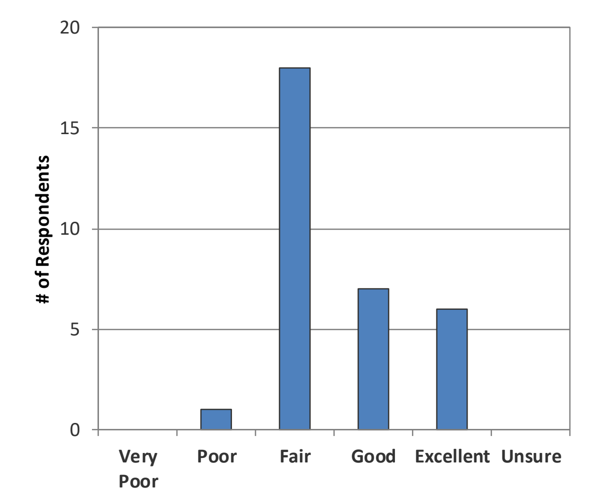


Figure 8.6.6-3. Stakeholder survey response Question #13. *How would you describe the current quality of fishing on your lake?*

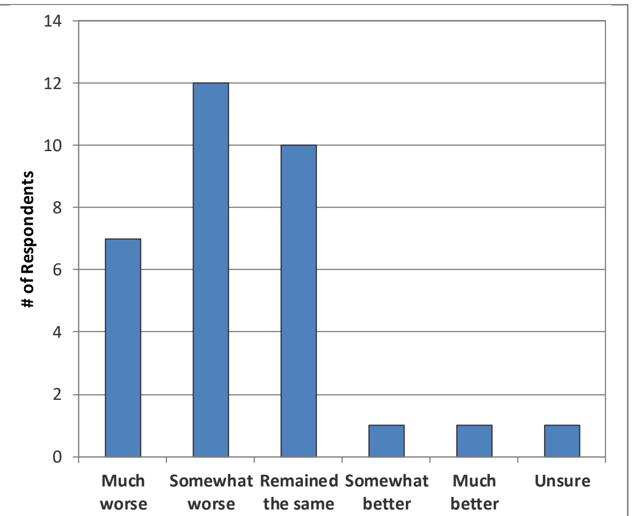


Figure 8.6.6-4. Stakeholder survey response Question #14. *How has the quality of fishing changed on your lake since you started fishing the lake?*

White Birch Lake Spear Harvest Records

Approximately 22,400 square miles of northern Wisconsin was ceded to the United States by the Lake Superior Chippewa tribes in 1837 and 1842 (Figure 8.6.6-5). White Birch Lake falls within the ceded territory based on the Treaty of 1842. This allows for a regulated open water spear fishery by Native Americans on lakes located within the Ceded Territory.

Figure 8.6.6-5. Location of White Birch Lake within the Native American Ceded Territory (GLIFWC 2017). This map was digitized by Onterra; therefore, it is a representation and not legally binding.

While within the ceded territory, White Birch Lake has not experienced a spearfishing harvest. A small quota for walleye harvest has been listed for White Birch Lake in recent years; however, no spearing efforts have been undertaken.

It is possible that spearing efforts have been concentrated on other larger lakes in the region, which would potentially have a higher estimated safe harvest for both walleye and muskellunge.

White Birch Lake Fish Habitat

Substrate Composition

Just as forest wildlife require proper trees and understory growth to flourish, fish require certain substrates and habitat types to nest, spawn, escape predators, and search for prey. Lakes with primarily a silty/soft substrate, many aquatic plants, and coarse woody debris may produce a completely different fishery than lakes that are largely sandy/rocky, and contain few aquatic plant species or coarse woody habitat.

Substrate and habitat are critical to fish species that do not provide parental care to their eggs. Northern pike is one species that does not provide parental care to its eggs (Becker 1983). Northern pike broadcast their eggs over woody debris and detritus, which can be found above sand or muck. This organic material suspends the eggs above the substrate, so the eggs are not buried in sediment and suffocate as a result. Walleye are another species that does not provide parental care to its eggs. Walleye preferentially spawn in areas with gravel or rock in places with moving water or wave action, which oxygenates the eggs and prevents them from getting buried in sediment. Fish that provide parental care are less selective of spawning substrates. Species such as bluegill tend to prefer a harder substrate such as rock, gravel or sandy areas if available, but have been found to spawn and care for their eggs in muck as well.

According to the point-intercept survey conducted by Onterra in 2018, 74% of the substrate sampled in the littoral zone of White Birch Lake were soft sediments, 23% composed of sand and 3% composed of rock sediments.

Woody Habitat

As discussed in the Shoreland Condition Section, the presence of coarse woody habitat is important for many stages of a fish's life cycle, including nesting or spawning, escaping predation as a juvenile, and hunting insects or smaller fish as an adult. Unfortunately, as development has increased on Wisconsin lake shorelines in the past century, this beneficial habitat has often been the first to be removed from the natural shoreland zone. Leaving these shoreland zones barren of coarse woody habitat can lead to decreased abundances and slower growth rates in fish (Sass 2009). A fall 2017 survey documented 206 pieces of coarse woody along the shores of White Birch Lake, resulting in a ratio of approximately 78 pieces per mile of shoreline.

Fish Habitat Structures

Some fisheries managers may look to incorporate fish habitat structures on the lakebed or littoral areas extending to shore for the purpose of improving fish habitats. These projects are typically conducted on lakes lacking significant coarse woody habitat in the shoreland zone. The "Fish sticks" program, outlined in the WDNR best practices manual, adds trees to the shoreland zone restoring fish habitat to critical near shore areas. Typically, every site has 3 – 5 trees which are partially or fully submerged in the water and anchored to shore (Photograph 8.6.6-3). The WDNR recommends placement of the fish sticks during the winter on ice when possible to prevent adverse impacts on fish spawning or egg incubation periods. The program requires a WDNR permit and can be funded through many different sources including the WDNR, County Land & Water Conservation Departments or partner contributions.


Photograph 8.6.6-3. Examples of fish sticks (left) and half-log habitat structures. (Photos by WDNR)

Fish cribs are a fish habitat structure that is placed on the lakebed. Installing fish cribs may be cheaper than fish sticks; however some concern exists that fish cribs can concentrate fish, which in turn leads to increased predation and angler pressure.

Half-logs are another form of fish spawning habitat placed on the bottom of the lakebed (Photograph 8.6.6-3). Smallmouth bass specifically have shown an affinity for overhead cover when creating spawning nests, which half-logs provide (Wills 2004). If the waterbody is exempt from a permit or a permit has been received, information related to the construction, placement and maintenance of half-log structures are available online.

An additional form of fish habitat structure is spawning reefs. Spawning reefs typically consist of small rubble in a shallow area near the shoreline for mainly walleye habitat. Rock reefs are sometimes utilized by fisheries managers when attempting to enhance spawning habitats for some fish species. However, a 2004 WDNR study of rock habitat projects on 20 northern Wisconsin lakes offers little hope the addition of rock substrate will improve walleye reproduction (WDNR 2004).

Placement of a fish habitat structure in a lake does not require a permit if the project meets certain conditions outlined by the WDNR's checklists available online:

(https://dnr.wi.gov/topic/waterways/Permits/Exemptions.html)

If a project does not meet all of the conditions listed on the checklist, a permit application may be sent in to the WDNR and an exemption requested.

The TPL may work with the local WDNR fisheries biologist to determine if the installation of fish habitat structures should be considered in aiding fisheries management goals for White Birch Lake.

Regulations

Regulations for White Birch Lake gamefish species as of June 2019 are displayed in Table 8.6.6-3. For specific fishing regulations on all fish species, anglers should visit the WDNR website (*www.http://dnr.wi.gov/topic/fishing/regulations/hookline.html)* or visit their local bait and tackle shop to receive a free fishing pamphlet that contains this information.

Table 8.6.6-3. WDNR fishing regulations for White Birch Lake (As of June 2019).

Species	Daily bag limit	Length Restrictions	Season
Panfish (bluegill, pumpkinseed, sunfish, crappie and yellow perch)	25	None	Open All Year
Smallmouth bass (Early Season)	Catch and release only	None	May 4, 2019 to June 14, 2019
Largemouth and Smallmouth bass	5	14"	June 15, 2019 to March 1, 2020
Largemouth bass	5	14"	May 4, 2019 to June 14, 2019
Muskellunge and hybrids	1	40"	May 25, 2019 to November 30, 2019
Northern pike	5	None	May 4, 2019 to March 1, 2020
Walleye, sauger, and hybrids	3	The minimum length is 15", but walleye, sauger, and hybrids from 20" to 24" may not be kept, and only 1 fish over 24" is allowed.	May 4, 2019 to March 1, 2020
Bullheads	Unlimited	None	Open All Year

General Waterbody Restrictions: Motor Trolling is allowed with 1 hook, bait, or lure per angler, and 2 hooks, baits, or lures maximum

Mercury Contamination and Fish Consumption Advisories

Freshwater fish are amongst the healthiest of choices you can make for a home-cooked meal. Unfortunately, fish in some regions of Wisconsin are known to hold levels of contaminants that are harmful to human health when consumed in great abundance. The two most common contaminants are polychlorinated biphenyls (PCBs) and mercury. These contaminants may be found in very small amounts within a single fish, but their concentration may build up in your body over time if you consume many fish. Health concerns linked to these contaminants range from poor balance and problems with memory to more serious conditions such as diabetes or cancer. These contaminants, particularly mercury, may be found naturally to some degree. However, the majority of fish contamination has come from industrial practices such as coal-burning facilities, waste incinerators, paper industry effluent and others. Though environmental regulations have reduced emissions over the past few decades, these contaminants are greatly resistant to breakdown and may persist in the environment for a long time. Fortunately, the human body is able to eliminate contaminants that are consumed however this can take a long time depending upon the type of contaminant, rate of consumption, and overall diet. Therefore, guidelines are set upon the consumption of fish as a means of regulating how much contaminant could be consumed over time.

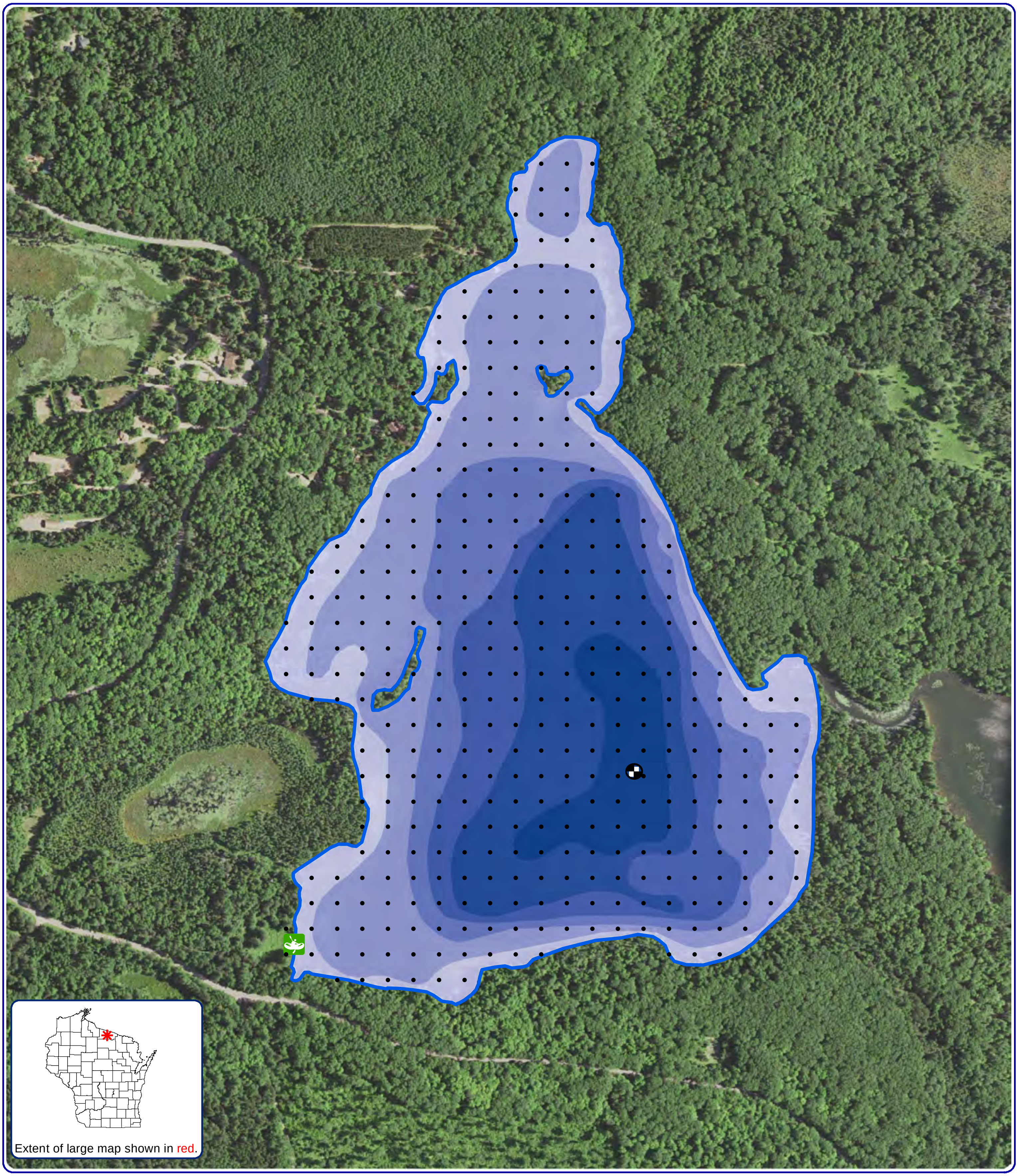
General fish consumption guidelines for Wisconsin inland waterways are presented in Figure 8.6.6-6. There is an elevated risk for children as they are in a stage of life where cognitive development is rapidly occurring. As mercury and PCB both locate to and impact the brain, there are greater restrictions on women who may have children or are nursing children, and also for children under 15.

Fish Consumption Guidelines for Most Wisconsin Inland Waterways

	Women of childbearing age, nursing mothers and all children under 15	**Women beyond their childbearing years and men**
Unrestricted*	-	Bluegill, crappies, yellow perch, sunfish, bullhead and inland trout
1 meal per week	Bluegill, crappies, yellow perch, sunfish, bullhead and inland trout	Walleye, pike, bass, catfish and all other species
1 meal per month	Walleye, pike, bass, catfish and all other species	Muskellunge
Do not eat	Muskellunge	-

**Doctors suggest that eating 1-2 servings per week of low-contaminant fish or shellfish can benefit your health. Little additional benefit is obtained by consuming more than that amount, and you should rarely eat more than 4 servings of fish within a week.*

Figure 8.6.6-6. Wisconsin statewide safe fish consumption guidelines. Graphic displays consumption guidance for most Wisconsin waterways. Figure adapted from WDNR website graphic (http://dnr.wi.gov/topic/fishing/consumption/)



N W E S

500

Feet

White Birch Lake - Map 1

Town of Plum Lake

Vilas County, Wisconsin

Project Location & Lake Boundaries

Legend

White Birch Lake ~116 acres

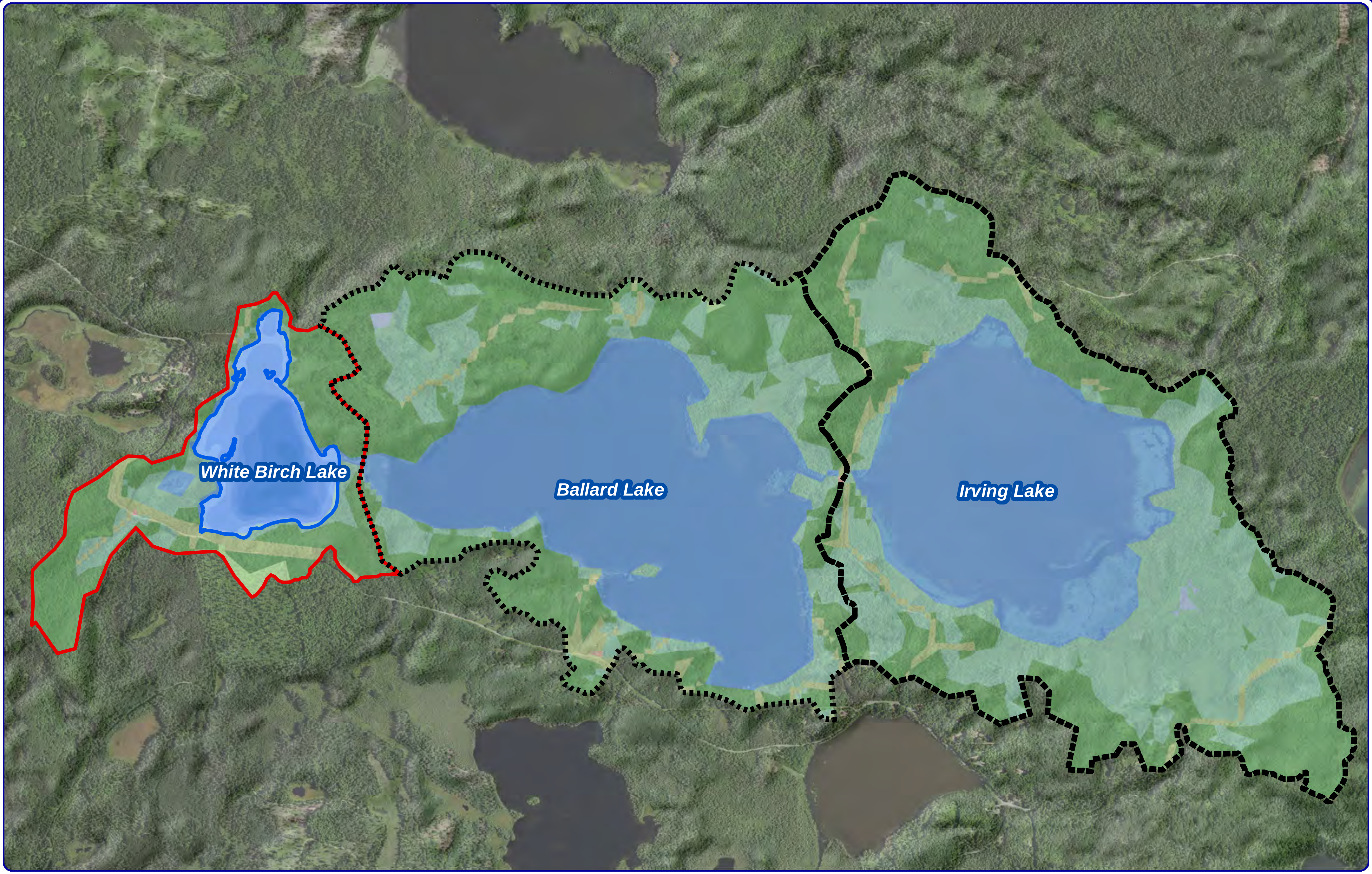
Public Access

Water Quality Sampling Location

Point-intercept Sample Location
34 meter points

Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources
Hydro: WDNR
Survey: Onterra, 2018
Orthophotography: NAIP, 2017
Map date: July 17, 2019 HAL
Filename: WhiteBirch_Location.mxd

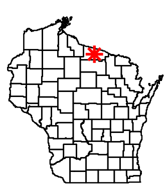


N
W E
S

2,100
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Orthophotography: NAIP 2015
Land Cover: NLCD 2011
Watershed Boundaries: Onterra 2019
Map Date: July 19, 2019 AMS
Filename: *WhiteBirch_WS_2019.mxd*



Project Location in Wisconsin

Legend

Land Cover Types

- Forest
- Forested Wetlands
- Wetlands
- Open Water
- Rural Open Space
- Pasture/Grass
- Rural Residential

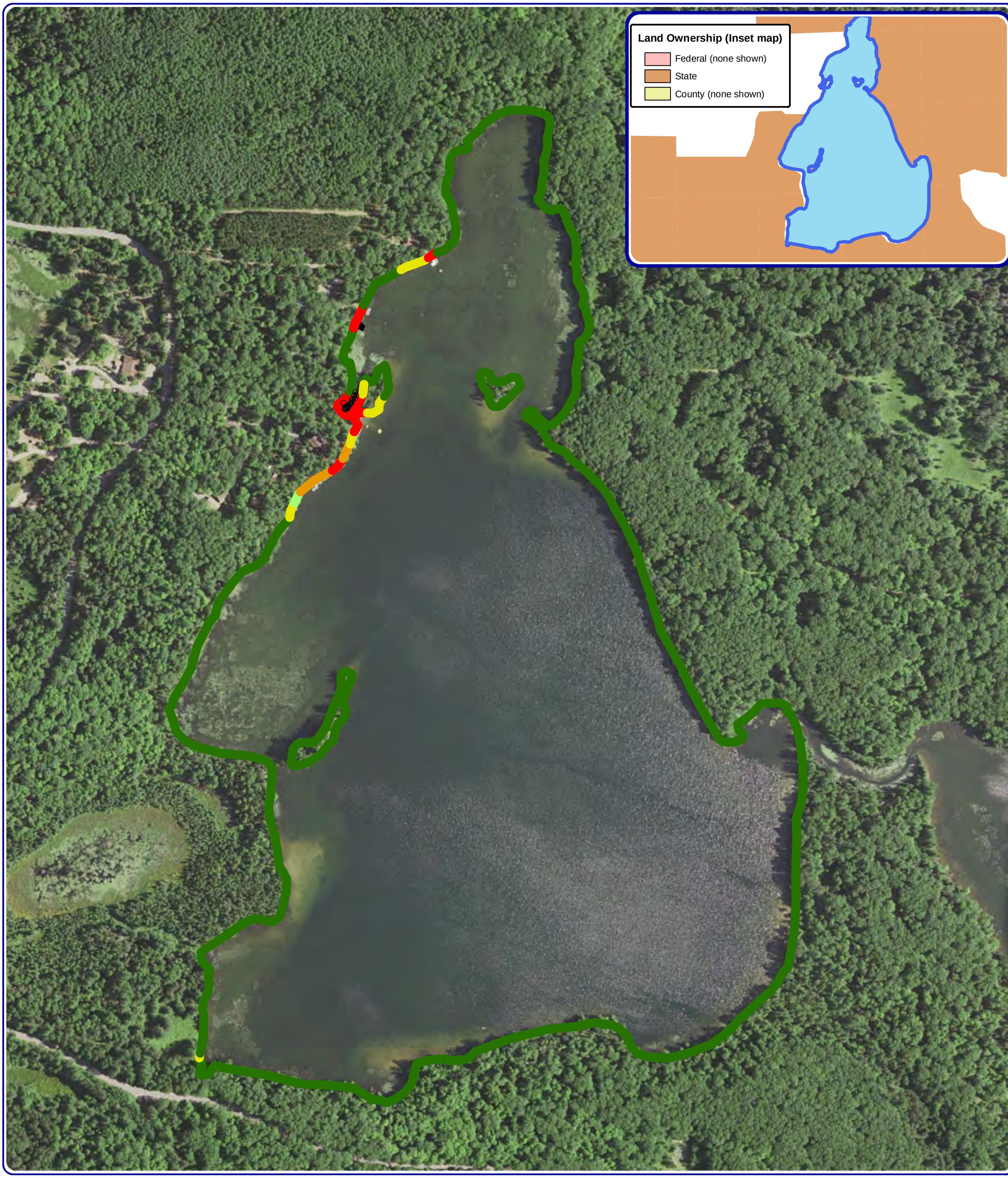
- White Birch Lake Direct Watershed Boundary
- Subwatershed Boundary

White Birch - Map 2

Town of Plum Lake

Vilas County, Wisconsin

Watershed Boundaries & Land Cover Types



480
Feet

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De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources
Hydro: WDNR
Shoreland Assessment: Onterra, 2018
Orthophotography: NAIP, 2017
Map date: April 3, 2019 AMS
Filename: WhiteBirch_SA_Oct18.mxd

Legend

- Natural/Undeveloped
- Developed-Natural
- Developed-Semi-Natural
- Developed-Unnatural
- Urbanized

Seawall Modifier

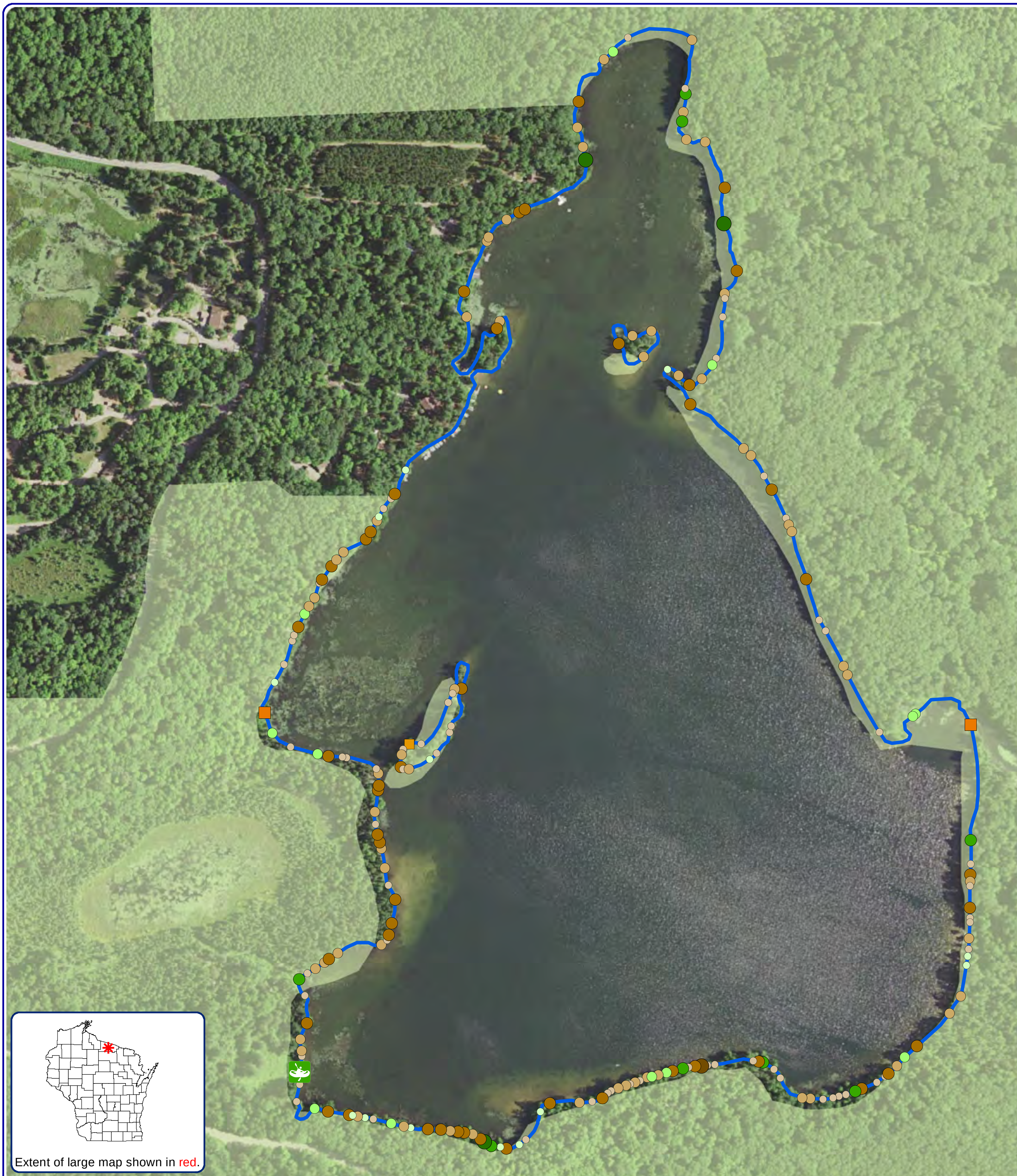
- Masonary/Wood Seawall
- Rip-Rap

White Birch Lake - Map 3

Town of Plum Lake

Vilas County, Wisconsin

2018 Shoreland Condition Assessment



500

Feet

Legend

2-8 Inch Pieces	8+ Inch Pieces	Cluster of Pieces
No Branches	No Branches	No Branches
Minimal Branches	Minimal Branches	Minimal Branches
Moderate Branches	Moderate Branches	Moderate Branches
Full Canopy	Full Canopy	Full Canopy

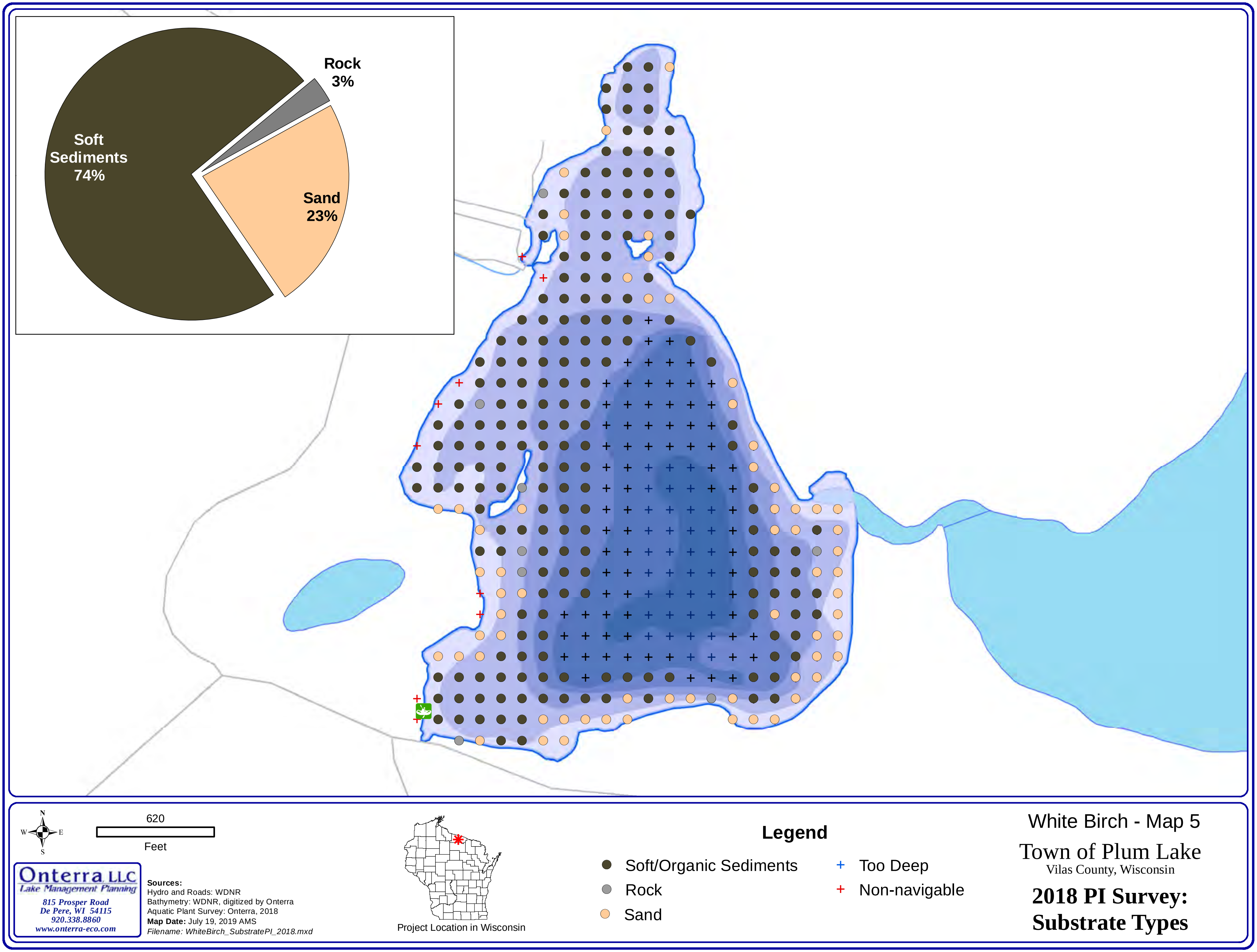
DNR Managed Land

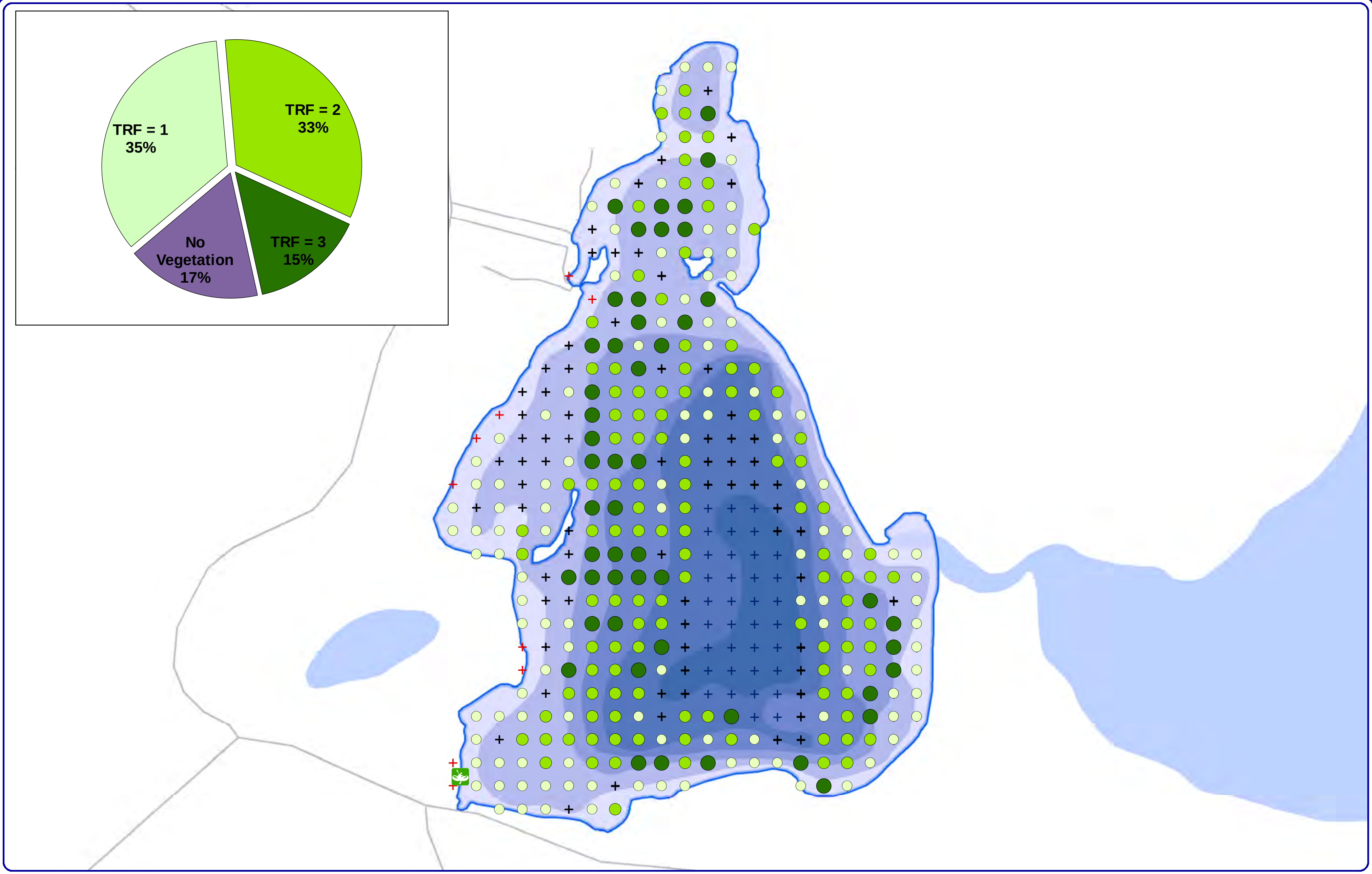
Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources
Hydro: WDNR
CWH Survey: Onterra, 2018
Orthophotography: NAIP, 2017
Map date: November 15, 2018 AMS
Filename: WhiteBirch_CWH_Oct18.mxd

White Birch Lake - Map 4
Town of Plum Lake
Vilas County, Wisconsin

Coarse Woody Habitat


Rock
3%
Soft
Sediments
74%
Sand
23%
N
W
E
S
620
Feet
Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com
Sources:
Hydro and Roads: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plant Survey: Onterra, 2018
Map Date: July 19, 2019 AMS
Filename: WhiteBirch_SubstratePI_2018.mxd
Project Location in Wisconsin
Legend
Soft/Organic Sediments
Rock
Sand
Too Deep
Non-navigable
White Birch - Map 5
Town of Plum Lake
Vilas County, Wisconsin
2018 PI Survey:
Substrate Types

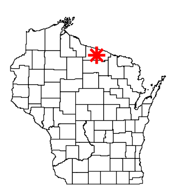


N
W E
S

620
Feet

Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Plant Survey: Onterra, 2017
Map Date: July 8, 2019
Filename: *WhiteBirch_TRFPI_2018.mxd*



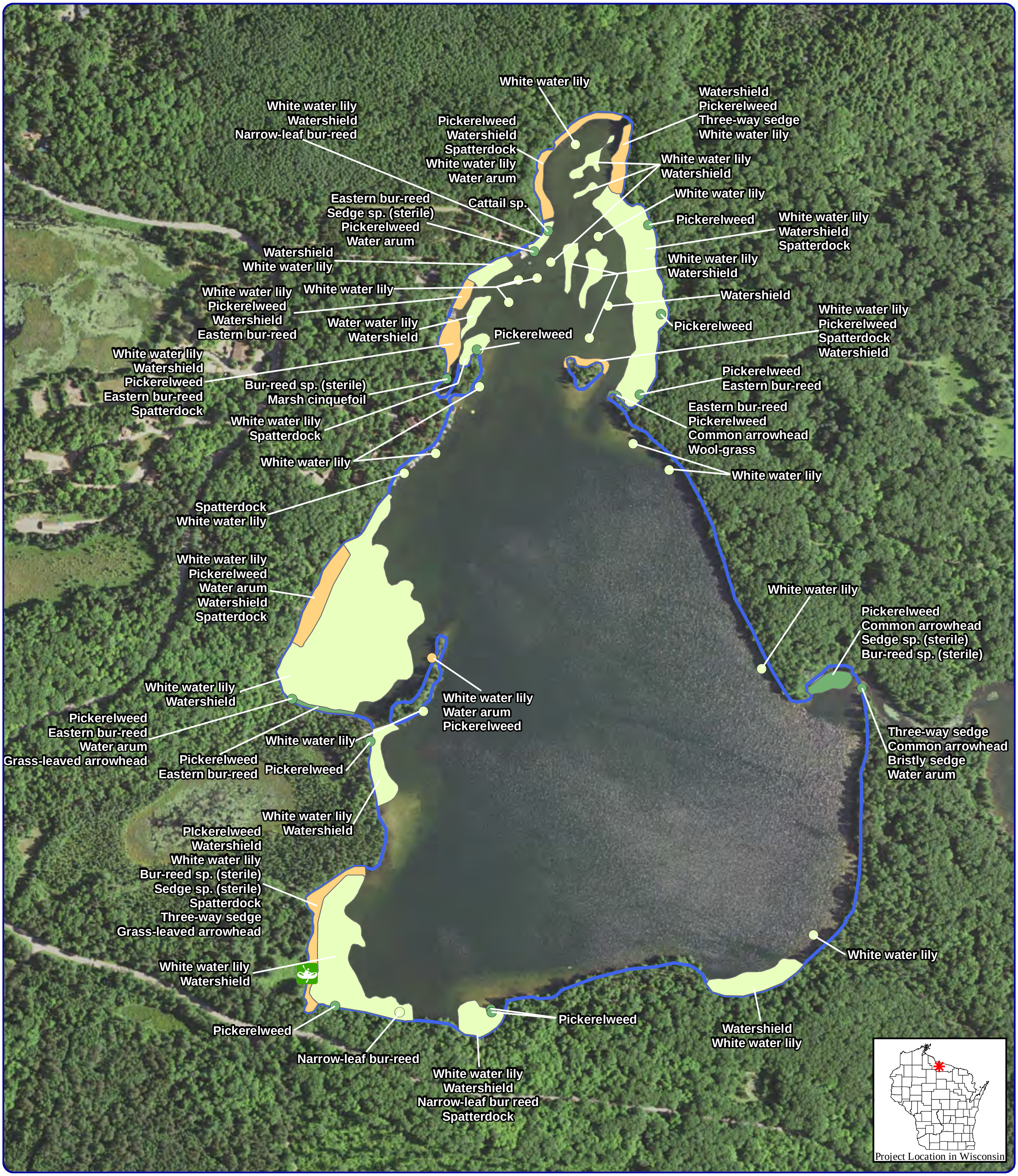
Project Location in Wisconsin

Legend

- Total Rake Fullness = 1
- Total Rake Fullness = 2
- Total Rake Fullness = 3
- No Vegetation
- Non-Navigable

White Birch Lake - Map 6
Town of Plum Lake
Vilas County, Wisconsin

2018 PI Survey: Aquatic Vegetation Distribution



N
W E
S

510

Feet

Legend

Small Plant Communities
- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent

Large Plant Communities
- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent

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Sources
Hydro: WDNR
Aquatic Plants: Onterra, 2018
Orthophotography: NAIP, 2017
Map date: December 21, 2018 AMS
Filename: WhiteBirch_Comm_2018.mxd

White Birch Lake - Map 7
Town of Plum Lake
Vilas County, Wisconsin

Emergent & Floating-leaf Aquatic Plant Communities