*Please note that study methods and explanations of analyses for Found Lake can be found within the Town of St. Germain Town-wide Management Plan document.*

## 8.5 Found Lake

### *An Introduction to Found Lake*

Found Lake, Vilas County, is a 339-acre, meso-eutrophic shallow lowland drainage lake with a maximum depth of 21 feet (Found Lake – Map 1). The lake's watershed encompasses approximately 3,279 acres in Vilas County and is comprised primarily of intact upland forests and wetlands. Water from Found Lake drains to downstream Lost Lake, Big Saint Germain Lake, Fawn Lake, and into the Rainbow Flowage/Wisconsin River, consecutively. Following the discovery of the non-native aquatic plant Eurasian watermilfoil (*Myriophyllum spicatum*) in 2018, the Wisconsin Department of Natural Resources completed a whole-lake aquatic plant point-intercept survey that same year. Because of this, a point-intercept survey was not completed in 2019. In 2018, 31 native aquatic plant species were located, of which fern-leaf pondweed (*Potamogeton robbinsii*) was the most common. No Eurasian watermilfoil was observed in Found Lake in 2019.

**Lake at a Glance - Found Lake**

| Morphology | |
|---|---|
| LakeType | Shallow Lowland Drainage Lake |
| Surface Area (Acres) | 339 |
| Max Depth (feet) | 21 |
| Mean Depth (feet) | 10 |
| Perimeter (Miles) | 4.0 |
| Shoreline Complexity | 2.4 |
| Watershed Area (Acres) | 3,279 |
| Watershed to Lake Area Ratio | 9:1 |
| **Water Quality** | |
| Trophic State | Meso-eutrophic |
| Limiting Nutrient | Phosphorus |
| Avg Summer P (μg/L) | 22.0 |
| Avg Summer Chl-α (μg/L) | 9.9 |
| Avg Summer Secchi Depth (ft) | 7.4 |
| Summer pH | 7.5 |
| Alkalinity (mg/L as $CaCO_3$) | 23.0 |
| **Vegetation (2018/19)** | |
| Number of Native Species | 31 |
| NHI-Listed Species | None |
| Exotic Species | Eurasian watermilfoil (*Myriophyllum spicatum*) |
| Average Conservatism | 7.0 |
| Floristic Quality | 33.6 |
| Simpson's Diversity (1-D) | 0.89 |

*Descriptions of these parameters can be found within the town-wide portion of themanagement plan*

## 8.5.1 Found Lake Water Quality

It is often difficult to determine the status of a lake's water quality purely through observation. Anecdotal accounts of a lake "getting better" or "getting worse" can be difficult to judge because a) a lake's water quality may fluctuate from year to year based upon environmental conditions such as precipitation, and b) differences in observation and perception of water quality can differ greatly from person to person. It is best to analyze the water quality of a lake through scientific data as this gives a concrete indication as to the health of the lake, and whether its health has deteriorated or improved. Further, by looking at data for similar lakes regionally and statewide, the status of a lake's water quality can be made by comparison.

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

Near-surface total phosphorus data from Found Lake are limited and available from 2007, 2010, and 2019 (Figure 8.5.1-1). Average summer total phosphorus concentrations ranged from 17.7 µg/L in 2010 to 25.0 µg/L in 2019. The weighted summer average total phosphorus concentration is 22.0 µg/L and falls into the *excellent* category for shallow lowland drainage lakes in Wisconsin. Found Lake's summer average total phosphorus concentrations are lower than the median values for shallow lowland drainage lakes in the state and comparable to the median concentration for all lake types in the Northern Lakes and Forests (NLF) ecoregion.

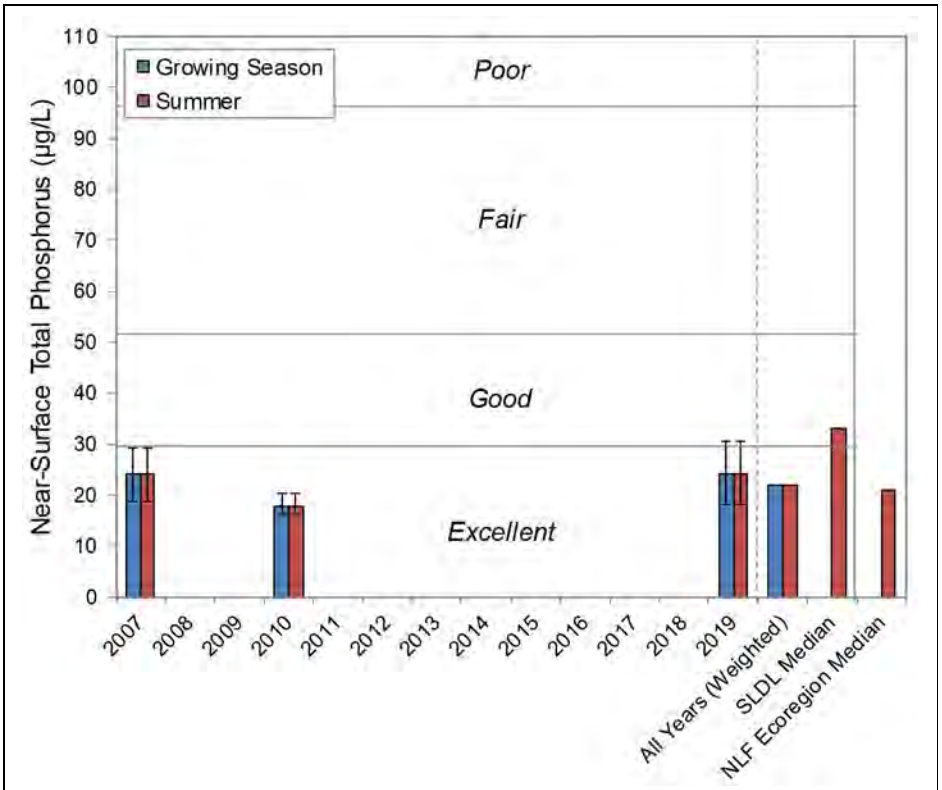



**Figure 8.5.1-1. Found Lake average annual near-surface total phosphorus concentrations and median near-surface total phosphorus concentrations for state-wide shallow lowland drainage lakes (SHDL) and Northern Lakes and Forests (NLF) ecoregion lakes.** Water Quality Index values adapted from WDNR PUB WT-913. Error bars represent maximum and minimum values.

As is discussed in the subsequent Found Lake Watershed Assessment Section (Section 8.5.2), measured phosphorus concentrations in Found Lake are over 20% higher than predicted by Wisconsin Lakes Modeling Suite (WiLMS) watershed modeling. This discrepancy between measured and predicted concentrations indicates that phosphorus is originating from a source(s) that was not accounted for in the model. It is believed that this additional phosphorus is likely originating from a process known as internal phosphorus loading.

Internal nutrient loading involves the release of phosphorus (and other nutrients) from lake bottom sediments into the overlying water. In general, lakes tend to act as phosphorus sinks, meaning they accumulate phosphorus over time within lake sediments. In most lakes, there is a net movement of phosphorus from the water to bottom sediments where it accumulates. The retention of this phosphorus within bottom sediments depends on a number of physical, chemical, and biological factors (Wetzel 2001). If this phosphorus remains bound within bottom sediments, it is largely unavailable for biological use. However, under certain conditions, this phosphorus can be released from bottom sediments into the overlying water where it may become biologically available.

When water at the sediment-water interface contains oxygen, phosphorus largely remains bound to ferric iron within the sediment. When the water at the sediment-water interface becomes anoxic, or devoid of oxygen, ferric iron is reduced to ferrous iron and the bond between iron and phosphorus is broken. Under these conditions, iron and phosphorus are now soluble in water and are released from the sediments into the overlying water (Pettersson 1998).

Anoxia at the sediment-water interface typically first develops following thermal stratification, or the formation of distinct layers of water based on temperature and density. As surface waters warm in late-spring/early summer, they become less dense and float atop a colder, denser layer of water below. The large density gradient between the upper, warm layer of water (epilimnion) and lower, cold layer of water (hypolimnion) prevents these layers from mixing together and eliminates atmospheric diffusion of oxygen into bottom waters. If there is a high rate of biological decomposition of organic matter in the bottom sediments, anoxic conditions within the hypolimnion can develop as oxygen is consumed and is not replaced through mixing. The loss of oxygen then results in the release of phosphorus from bottom sediments into the water of the hypolimnion.

The development of an anoxic hypolimnion and subsequent release of phosphorus from bottom sediments occurs in many lakes in Wisconsin. However, in deeper lakes which remain stratified during the summer, internal nutrient loading is often not problematic as the majority of the phosphorus released from bottom sediments is confined within the hypolimnion where it is largely inaccessible to phytoplankton. These deep lakes remain stratified throughout the summer (and winter) and experience only two complete mixing events (turnover) per year, one in spring and one in fall (dimictic lakes). In deep lakes, phosphorus released from bottom sediments into the hypolimnion during stratification only becomes available to phytoplankton in surface waters during the spring and fall mixing events. While these spring and fall mixing events can stimulate diatom and golden-brown phytoplankton blooms, these mixing events generally to not stimulate nuisance algal blooms because water temperatures are cooler.

Internal nutrient loading can become problematic in lakes when sediment-released phosphorus becomes accessible to phytoplankton during the summer months when surface temperatures are at their warmest. Sediment-released phosphorus can be mobilized to surface waters during the summer in shallow, polymictic lakes, or moderately shallow lakes which have the capacity to experience multiple stratification and mixing events over the course of the growing season. Some polymictic lakes tend to straddle the boundary between deep and shallow lakes and have the capacity to break stratification in summer when sufficient wind energy is generated. Consequently, phosphorus which has accumulated in the anoxic hypolimnion during periods of stratification is mobilized to the surface during partial or full mixing events where it then can spur nuisance phytoplankton blooms.

While phosphorus can be mobilized to the surface from anoxic bottom waters during a complete mixing event, phosphorus can also be mobilized to the surface in polymictic places through entrainment, or the continual deepening of the epilimnion and erosion of the metalimnion (transition zone or thermocline) and hypolimnion (Wetzel 2001). Wind-driven water generates turbulence across the thermal barrier between the epilimnion and the metalimnion and the metalimnion is eroded, mixing sediment-released nutrients into the epilimnion above. Entrainment acts as a “nutrient pump”, delivering sediment-released nutrients in bottom waters to surface waters (Orihel et al. 2015). Entrainment is believed to be the primary mechanism of phosphorus mobilization from bottom to surface waters in Found and Big Saint Germain lakes, occurring primarily later in the summer when warmer surface waters are driven down into the cooler, phosphorus-rich waters below.

Found Lake is classified as a shallow, polymictic system, meaning it has the capacity to mix or turnover during the growing season. Temperature and dissolved oxygen data from 2019 indicate that Found Lake was thermally stratified in June, and had already developed anoxia in the hypolimnion. Anoxic conditions began at a depth of approximately 12 feet and extended to the bottom. Like in Big Saint Germain Lake, near-surface phosphorus concentrations in Found Lake are on average higher in August when compared to June and July. This indicates that phosphorus is likely being mobilized to surface waters later in the summer as the epilimnion is driven deeper into the anoxic hypolimnion.

Like total phosphorus, chlorophyll-*a* data from Found Lake are limited and available from 2007, 2010, and 2019 (Figure 8.5.1-2). Average summer chlorophyll-*a* concentrations ranged from 5.3 µg/L in 2010 to 14.5 µg/L in 2019. Found Lake’s summer average chlorophyll-*a* concentration is 9.9 µg/L, falling on the line between *excellent* and *good* for Wisconsin’s shallow lowland drainage lakes. Found Lake’s summer average chlorophyll-*a* concentration is similar to the median values for shallow lowland

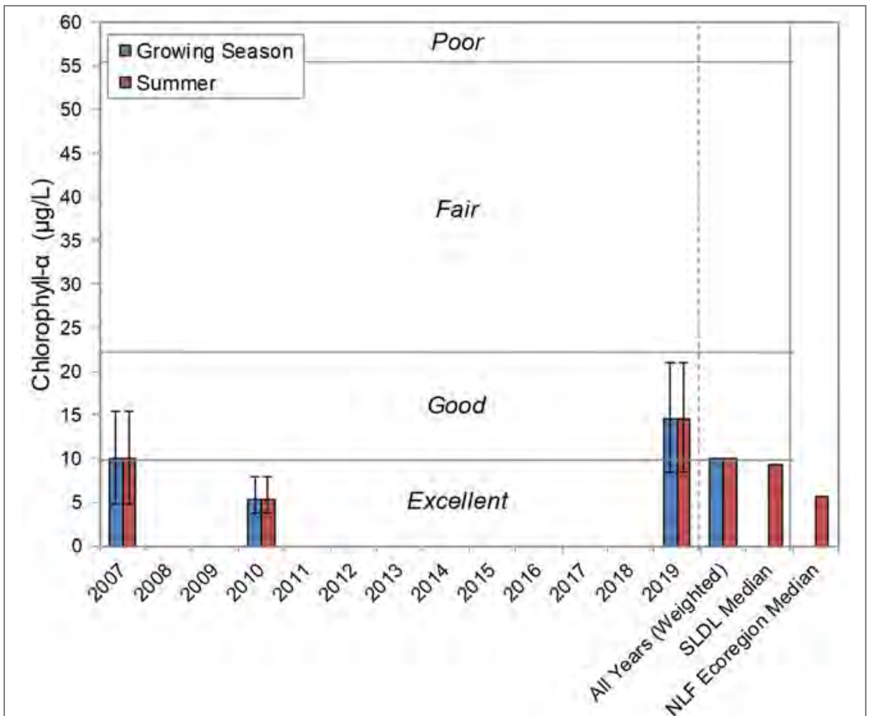



**Figure 8.5.1-2. Found Lake average annual chlorophyll-α concentrations and median chlorophyll-α concentrations for state-wide shallow lowland drainage lakes (SHDL) and Northern Lakes and Forests (NLF) ecoregion lakes.** Water Quality Index values adapted from WDNR PUB WT-913. Error bars represent maximum and minimum values.

drainage lakes in the state and approximately two times higher than the median concentration for all lake types in the NLF ecoregion.

Secchi disk data are available from 1979, 1990, 1993-2004, 2010, and 2016-2019 (Figure 8.5.1-3). Average summer Secchi disk depths ranged from 4.1 feet in 2019 to 9.7 feet in 2002. The weighted summer average Secchi disk depth is 7.4 feet and falls into the *excellent* category for shallow lowland drainage lakes in Wisconsin. Found Lake's weighted summer average Secchi disk depth is deeper than the median value for shallow lowland drainage lakes in the state but less than the median value for all lake types in the NLF ecoregion. Water clarity in Found Lake in recent years has been below average. The average summer Secchi disk depth from 2017-2019 was 4.6 feet compared to 8.0 feet from 1993-2010. This decline in water clarity has been observed on other area drainage lakes in northern Wisconsin, and is believed to be the result of increases in precipitation in recent years.

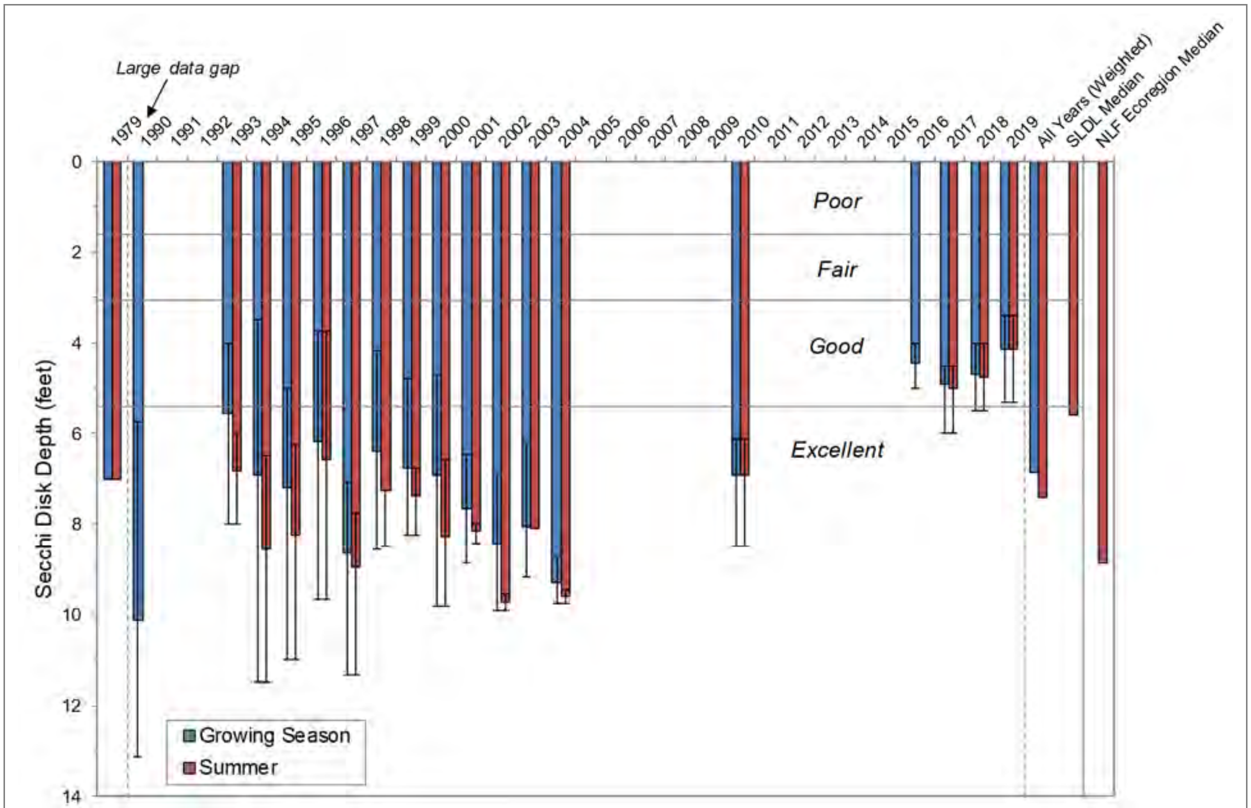



**Figure 8.5.1-3. Found Lake average annual Secchi disk depths and median Secchi disk depths for state-wide shallow lowland drainage lakes (SHDL) and Northern Lakes and Forests (NLF) ecoregion lakes.** Water Quality Index values adapted from WDNR PUB WT-913. Error bars represent maximum and minimum values.

The increase in precipitation has resulted in increased runoff of phosphorus which leads to higher levels of algal production. The higher rates of precipitation are also believed to have resulted in increased runoff of dissolved humic substances, particularly in lakes like Found Lake which have large, forested wetland complexes within their watersheds. These humic substances originate from decaying vegetation within wetlands and forests and give the water a brown or tea-like color. A measure of water clarity once all of the suspended material (i.e. phytoplankton and sediments) have been removed, is termed *true color*, and measures how the clarity of the water is influenced by dissolved components.

True color was measured at 50 SU (standard units) in Found Lake in 2019, indicating the lake's water was *tea-colored*. Found Lake had the highest true color value measured of the Town of Saint Germain project lakes. This higher true color value indicates that in addition to algae, dissolved humic compounds have a significant influence on Found Lake's water clarity. As is discussed in the Found Lake Aquatic Vegetation Section (8.5.3), the significant decline in the lake's water clarity between 2010 and 2019 has resulted in significant changes in the lake's aquatic plant community. It is important to note that the tea-colored water in Found Lake is natural and common in drainage lakes in northern Wisconsin, and it is not an indication of degraded or degrading conditions. The concentration of these humic substances and resulting water clarity will likely fluctuate in the future with changes in precipitation.

### Limiting Plant Nutrient of Found Lake

Using midsummer nitrogen and phosphorus concentrations from Found Lake, a nitrogen:phosphorus ratio of 24:1 was calculated. This finding indicates that Found Lake is indeed phosphorus limited as are the vast majority of Wisconsin lakes. In general, this means that phosphorus is the primary nutrient regulating algal production.

### Found Lake Trophic State

Figure 8.5.1-4 contains the Trophic State Index (TSI) values for Found Lake. These TSI values are calculated using summer near-surface total phosphorus, chlorophyll-*a*, and Secchi disk depth 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.

In Found Lake, particularly in 2019, the TSI value for chlorophyll-*a* is higher than the TSI value for total phosphorus. This indicates that there is a higher level of algal production than expected given the concentration of total phosphorus. The weighted TSI values for total phosphorus and chlorophyll-*a* in Found Lake indicate the lake is in an meso-eutrophic state. However as mentioned above, in recent years the lake's productivity appears to have increased and at the present time the lake is in the eutrophic state. Found Lake's productivity based upon the long-term average is lower than other shallow lowland drainage lakes in Wisconsin and higher than all lake types within the NLF ecoregion.

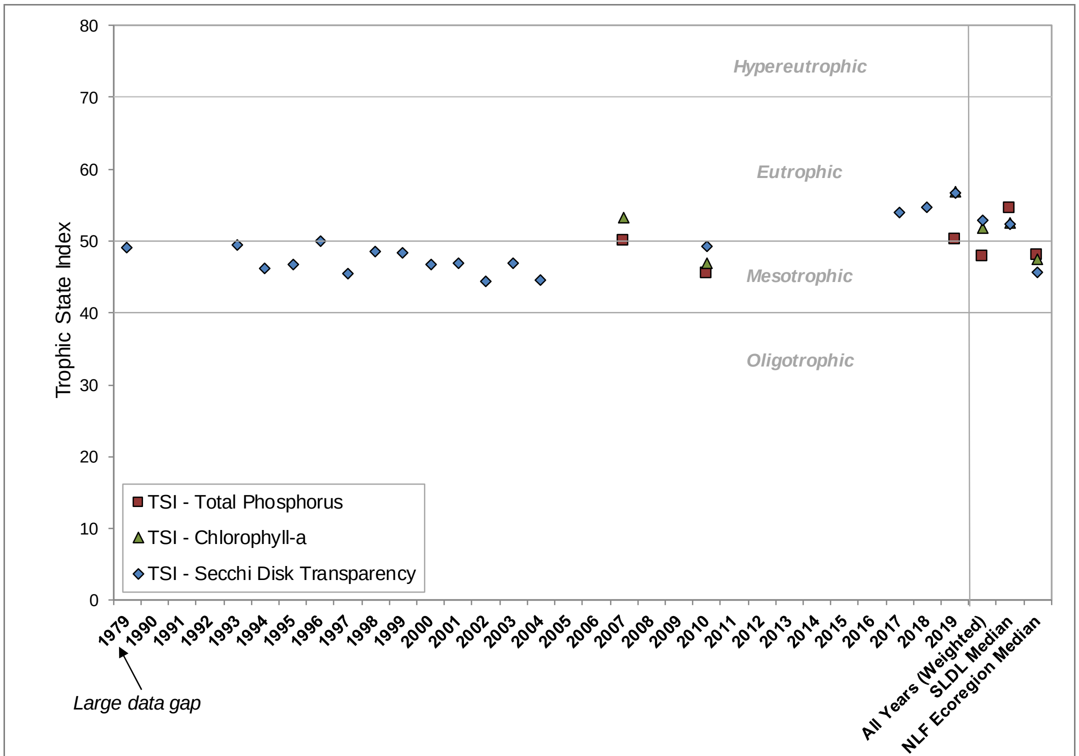



**Figure 8.5.1-4. Found Lake, statewide shallow lowland drainage lakes, and regional Trophic State Index values.** Values calculated with summer month surface sample data using WDNR PUB-WT-193.

## Dissolved Oxygen and Temperature in Found Lake

Dissolved oxygen and temperature were measured in Found Lake on three occasions by Onterra staff in 2019. Profiles depicting these data are displayed in Figure 8.5.1-5. Except for the June sample which was collected at the deep hole, profiles were collected at the site where citizen lake volunteers have been collecting samples for the trophic parameters. This site is not at the deepest location in the lake. The June sample was taken where the water depth was 23 feet while the water depth at the July and August profiles was 12-13 feet. The change in sampling location provides different information.

Found Lake is *polymictic*, meaning the lake has the capacity to mix periodically during the growing season. In June at the deep hole sampling location, the lake was stratified with the bottom waters being anoxic. The July and August profiles were collected in shallower waters where the lake was not stratified. Unfortunately, temperature and dissolved oxygen profiles were not collected from the deep hole sampling location in July and August to determine if Found Lake remained stratified or mixed during the summer of 2019.

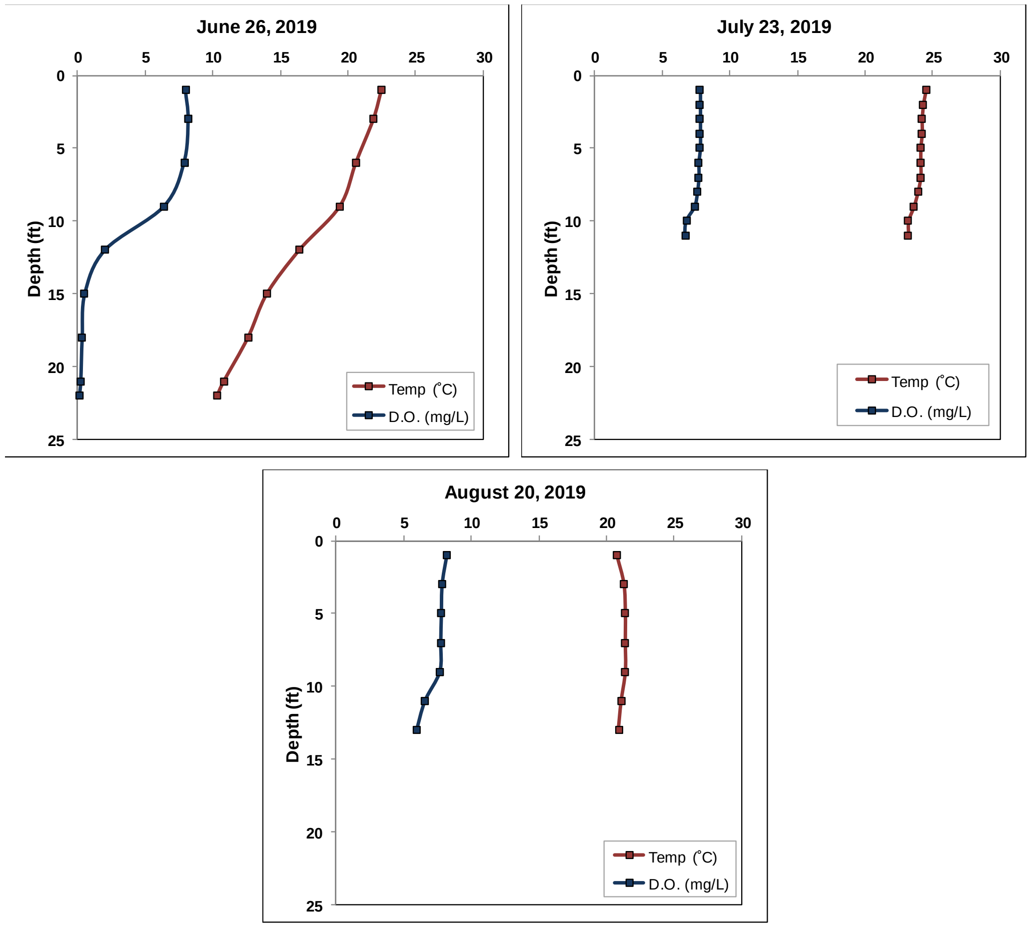



**Figure 8.5.1-5. Found Lake 2019 dissolved oxygen and temperature profiles.**

## Additional Water Quality Data Collected at Found Lake

The water quality section is centered on lake eutrophication. However, parameters other than water clarity, nutrients, and chlorophyll-*a* were collected as part of the project. These other parameters were collected to increase the understanding of Found Lake's water quality and are recommended as a part of the WDNR long-term lake trends monitoring protocol. These parameters include pH, alkalinity, and calcium.

The pH scale ranges from 0 to 14 and indicates the concentration of hydrogen ions ($H^+$) within the lake's water and is an index of the lake's acidity. Water with a pH value of 7 has equal amounts of hydrogen ions and hydroxide ions ($OH^-$) and is considered to be neutral. Water with a pH of less than 7 has higher concentrations of hydrogen ions and is considered to be acidic, while values greater than 7 have lower hydrogen ion concentrations and are considered basic or alkaline. The pH scale is logarithmic; meaning that for every 1.0 pH unit the hydrogen ion concentration changes tenfold. The normal range for lake water pH in Wisconsin is about 5.2 to 8.4, though values lower than 5.2 can be observed in some acid bog lakes and higher than 8.4 in some marl lakes. In lakes with a pH of 6.5 and lower, the spawning of certain fish species such as walleye becomes inhibited (Shaw and Nimphius 1985). The mid-summer pH of the water in Found Lake was found to be alkaline with a value of 7.5 and falls within the normal range for Wisconsin Lakes.

Alkalinity is a lake's capacity to resist fluctuations in pH by neutralizing or buffering against inputs such as acid rain. The main compounds that contribute to a lake's alkalinity in Wisconsin are bicarbonate ($HCO_3^-$) and carbonate ($CO_3^-$), which neutralize hydrogen ions from acidic inputs. These compounds are present in a lake if the groundwater entering it comes into contact with minerals such as calcite ($CaCO_3$) and/or dolomite ($CaMgCO_3$). A lake's pH is primarily determined by the amount of alkalinity. Rainwater in northern Wisconsin is slightly acidic naturally due to dissolved carbon dioxide from the atmosphere with a pH of around 5.0. Consequently, lakes with low alkalinity have lower pH due to their inability to buffer against acid inputs. The alkalinity in Found Lake was 23.0 mg/L (mg/L as $CaCO_3$), indicating that the lake has a low sensitivity to lower pH values from acid rain.

Like associated pH and alkalinity, the concentration of calcium within a lake's water depends on the geology of the lake's watershed. Recently, the combination of calcium concentration and pH has been used to determine what lakes can support zebra mussel populations if they are introduced. The commonly accepted pH range for zebra mussels is 7.0 to 9.0, so Found Lake's pH of 7.5 falls within this range. Lakes with calcium concentrations of less than 12 mg/L are considered to have very low susceptibility to zebra mussel establishment. The calcium concentration of Found Lake was found to be 6.3 mg/L, meaning it is unlikely to support the growth of zebra mussels.

## 8.5.2 Found Lake Watershed Assessment

Two aspects of a lake's watershed are the key factors in determining the amount of phosphorus the watershed exports to the lake: 1) the land cover (land use) within the watershed and 2) the size of the watershed. The type of land cover and the amount of that land cover that exists in the watershed is largely going to determine the amount of phosphorus (and sediment) that runs off the land and eventually makes its way to the lake. The actual amount of pollutants (nutrients, sediment, toxins, etc.) depends greatly on how the land within the watershed is used. Areas within a lake's watershed that are naturally vegetated (e.g., forests, grasslands, and wetlands) strongly influence the way water behaves on the land surface after it falls as precipitation or is released by the melting of snow (Silk and Ciruna 2005).

Runoff is slowed down in areas with denser vegetation and increases the time it takes for precipitation from a storm event to reach the lake. This allows more water to soak into the soil and reduces the potential for flooding. Intact wetlands within a lake's watershed have been likened to the "kidneys of the landscape" as they filter out nutrients, sediments, and other pollutants from water which passes through them (Silk and Ciruna 2005). The water quality within a lake is largely a reflection of the health of its watershed, and maintaining natural land cover within a lake's watershed is essential for maintaining good water quality.

Among the largest threats to a lake's water quality is the conversion of natural areas to agriculture and urban development. Conversion of natural areas to agriculture disrupts the hydrologic regime and increases surface runoff due to increased soil compaction and reduced water infiltration. Wetlands which were drained and converted to farmland were shown to increase runoff by 200-400% (Silk and Ciruna 2005). Agriculture accounts for 60% of the pollutants in lakes and rivers in the United States due to increased runoff in combination with the application of fertilizers, pesticides, and manure.

Similar to agriculture, urban development can significantly alter the hydrologic regime within a watershed, primarily through the installation of impervious surfaces (e.g., roads, driveways, roof-tops) which decrease water infiltration and increase runoff. As impervious surface cover increases, the time it takes water from a storm event to reach the lake decreases. With the increase in water velocity and volume entering the water body, nutrient and sediment input also increase, degrading water quality. Nutrient input can also increase from urban areas as the result of fertilizer application, wastewater treatment facilities, and other industrial activities.

As is discussed further in this section, Found Lake's watershed is largely comprised of intact upland forests and wetlands with some smaller areas of rural and urban development. In the forested watersheds of northern Wisconsin where soils and climate are not as conducive for farming, apart from shoreland development (discussed in the next section) forestry or timber harvest likely represents the largest man-made disturbance occurring in these watersheds. While timber harvest has the potential to increase sediment erosion through the removal of vegetation and construction of access roads and bridges, the impacts of timber harvest to a lake's water quality are going to be highly dependent upon harvest rates and methods, vegetation management, and the location and size of these activities within the watershed (Silk and Ciruna 2005).

Wisconsin is required by federal law to develop and implement a program of best management practices (BMPs) to reduce nonpoint source pollution, including from timber harvesting activities

(WDNR PUB FR-093 2010). In summary, any forestry activities that occur within Found Lake's watershed must be implemented under this framework and should not impart significant impacts to the lake's water quality.

In addition to land cover within the watershed, the size of the watershed relative to the water volume within the lake also influences water quality. The watershed to lake area ratio (WS:LA) defines how many acres of watershed drain to each surface-acre of the lake. Larger ratios result in the watershed having a greater role in the lake's annual water budget and phosphorus load. In systems with lower WS:LA ratios, land cover type plays a very important role in how much phosphorus is loaded to the lake from the watershed. In these systems, the occurrence of agriculture or urban development in even a small percentage of the watershed (less than 10%) can unnaturally elevate phosphorus inputs to the lake. If these land cover types are converted to a cover that does not export as much phosphorus, such as converting row crop areas to grasslands or forested areas, the phosphorus load and its impacts to the lake may be decreased. In fact, if the phosphorus load is reduced greatly, changes in lake water quality may be noticeable, (e.g., reduced algal abundance and better water clarity) and may even be enough to cause a shift in the lake's trophic state.

In systems with high WS:LA ratios, like those 10-15:1 or higher, the impact of land cover may be tempered by the sheer amount of land draining to the lake. Situations actually occur where lakes with completely forested watersheds have sufficient phosphorus loads to support high rates of primary production. In other systems with high ratios, the conversion of vast areas of row crops to vegetated areas (grasslands, meadows, forests, etc.) may not reduce phosphorus loads sufficiently to see measurable changes in primary production. Both of these situations occur frequently in impoundments.

Regardless of the size of the watershed or the makeup of its land cover, it must be remembered that every lake is different and other factors, such as flushing rate, lake volume, sediment type, and many others, also influence how the lake will react to what is flowing into it. For instance, a deeper lake with a greater volume can dilute more phosphorus within its waters than a less voluminous lake and as a result, the production of a lake is kept low. However, in that same lake, because of its low flushing rate (a residence time of years), there may be a buildup of phosphorus in the sediments that may reach sufficient levels over time and lead to a problem such as internal nutrient loading. On the contrary, a lake with a higher flushing rate (low residence time of days or weeks) may be more productive early on, but the constant flushing of its waters may prevent a buildup of phosphorus and internal nutrient loading may never reach significant levels.

## *Watershed Modeling*

A reliable and cost-efficient method of creating a general picture of a watershed's effect on a lake can be obtained through modeling. The WDNR created a useful suite of modeling tools called the Wisconsin Lake Modeling Suite (WiLMS). Certain morphological attributes of a lake and its watershed are entered into WiLMS along with the acreages of different types of land cover within the watershed to produce useful information about the lake ecosystem. This information includes an estimate of annual phosphorus load and the partitioning of those loads between the watershed's different land cover types and atmospheric fallout entering through the lake's water surface.

WiLMS also calculates the lake's flushing rate and residence times using county-specific average precipitation/evaporation values or values entered by the user. Predictive models are also included within WiLMS that are valuable in validating modeled phosphorus loads to the lake in question and modeling alternate land cover scenarios within the watershed. Finally, if specific information is available, WiLMS will also estimate the significance of internal nutrient loading within a lake and the impact of shoreland septic systems.

A lake's **flushing rate** is simply a determination of the time required for the lake's water volume to be completely exchanged. **Residence time** describes how long a volume of water remains in the lake and is expressed in days, months, or years. The parameters are related and both determined by the volume of the lake and the amount of water entering the lake from its watershed. Greater flushing rates equal shorter residence times.

## *Found Lake Watershed Assessment*

Found Lake's watershed encompasses approximately 3,279 acres, yielding a watershed to lake area ratio of 9:1 (Figure 8.5.2-1 and Found Lake – Map 2). In other words, approximately 9.0 acres of land drain to every one acre of Found Lake's surface area. WiLMS modeling estimates that Found Lake's water residence time is approximately one year, meaning the water within the lake is completely replaced (flushing rate) on average once every year.

Approximately 69% (2,277 acres) of Found Lake's watershed is comprised of upland forests, 18% (578 acres) is comprised of wetlands, 10% (3339 acres) is comprised the lake's surface itself, 2% (54 acres) is comprised of rural open space, and 1% (32 acres) is comprised of rural residential areas (Figure 8.5.2-2).

Using the land cover types and their acreages within Found Lake's watershed, WiLMS was utilized to estimate the annual potential phosphorus load delivered to the lake. In addition, data obtained from a stakeholder survey sent to Found Lake riparian property owners in 2019 was also used to estimate the potential phosphorus loading to the lake from riparian septic systems. The model estimated that approximately 324 pounds of phosphorus are loaded to Found Lake from its watershed on an annual basis (Figure 8.5.2-2).

Using the estimated annual potential phosphorus load of 324 pounds, WiLMS predicted an in-lake growing season average total phosphorus concentration of 18 µg/L, which is approximately 22% lower than the measured growing season mean concentration of 22 µg/L. This is an indication that there is a source of phosphorus being delivered to Found Lake that was not accounted for in the model. As discussed in the previous Found Lake Water Quality Section (Section 8.3.1), this additional phosphorus is believed to be from the internal loading of phosphorus from anoxic bottom sediments. WiLMS estimated that an additional 79 pounds, or a total of 403 pounds of phosphorus needs to be loaded to Found Lake on annual basis to achieve the measured growing season concentration of 22 µg/L.

Of the estimated 403 pounds of phosphorus that are loaded to Found Lake annually, approximately 183 pounds (45%) originate from upland forests, 53 pounds (13%) from direct atmospheric deposition onto the lake's surface, 51 pounds (13%) from wetlands, 15 pounds (4%) from rural open space, 10 pounds (2%) from developed shoreland properties, 9 pounds (2%) from riparian septic systems, 2 pounds (1%) from rural residential areas, and 79 pounds (20%) from internal phosphorus loading (Figure 8.5.2-2).

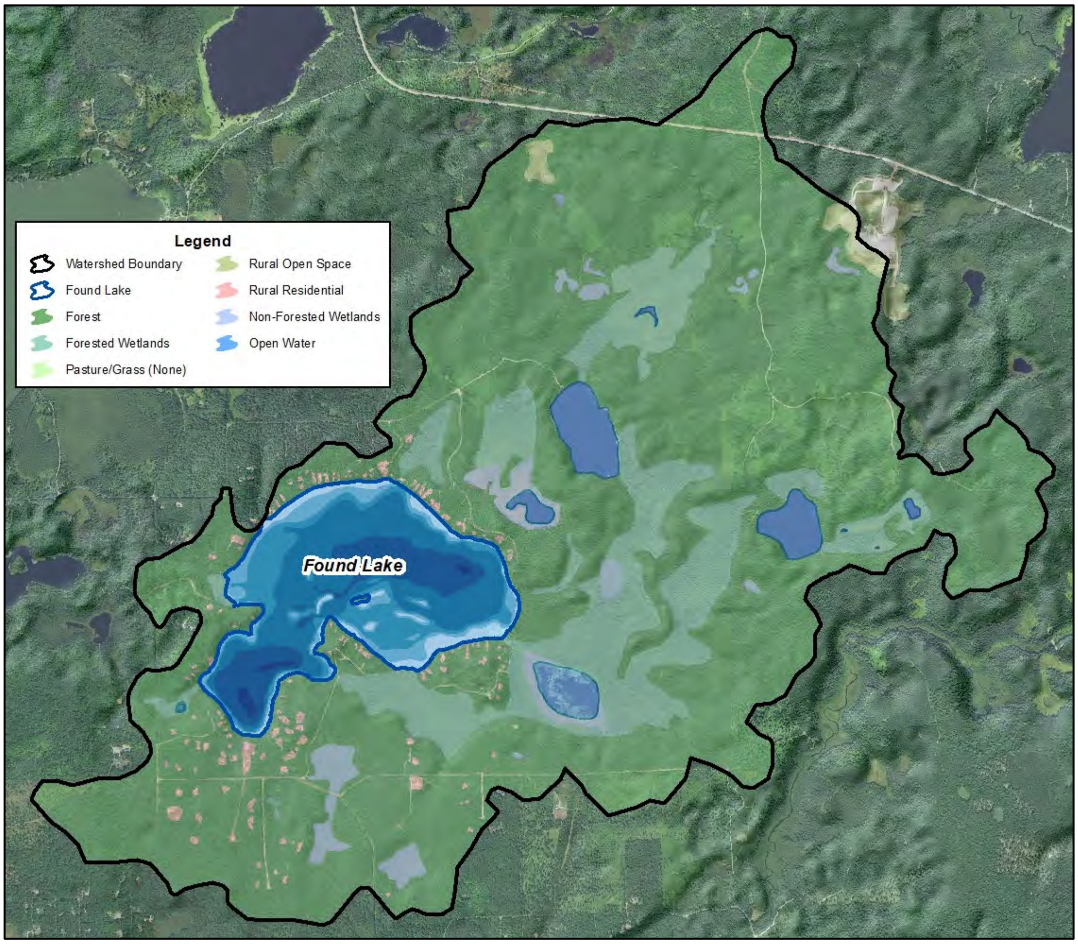



**Figure 8.5.2-1. Found Lake watershed boundaries and land cover types.** Based upon National Land Cover Database (NLCD – Fry et. al 2011).

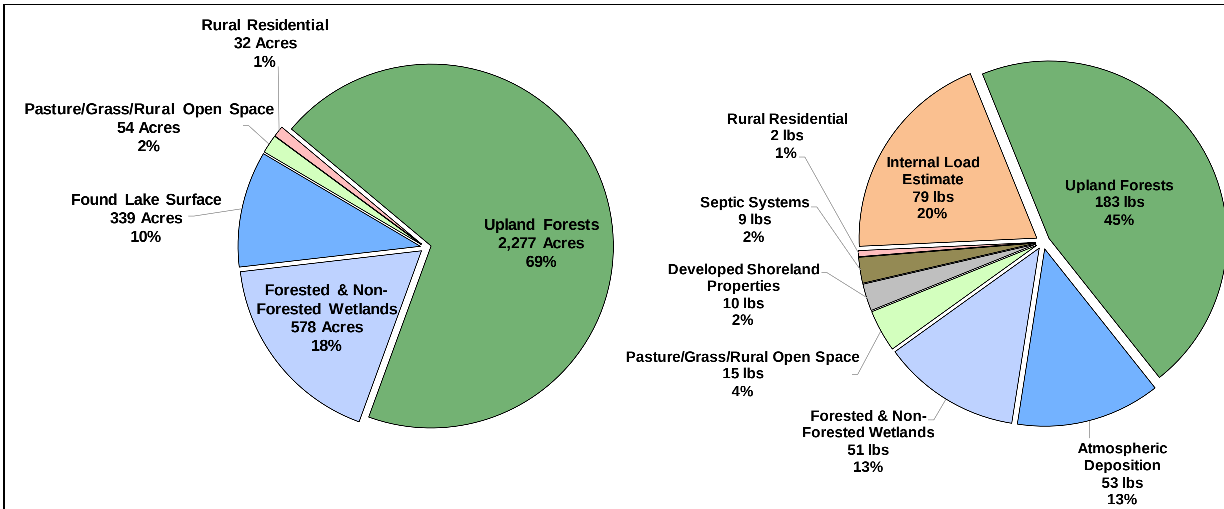



**Figure 8.5.2-2. Found Lake watershed land cover types (left) and estimated annual watershed phosphorus loading (right).** Based upon National Land Cover Database (NLCD – Fry et. al 2011).

## 8.5.3 Found Lake Shoreland Condition

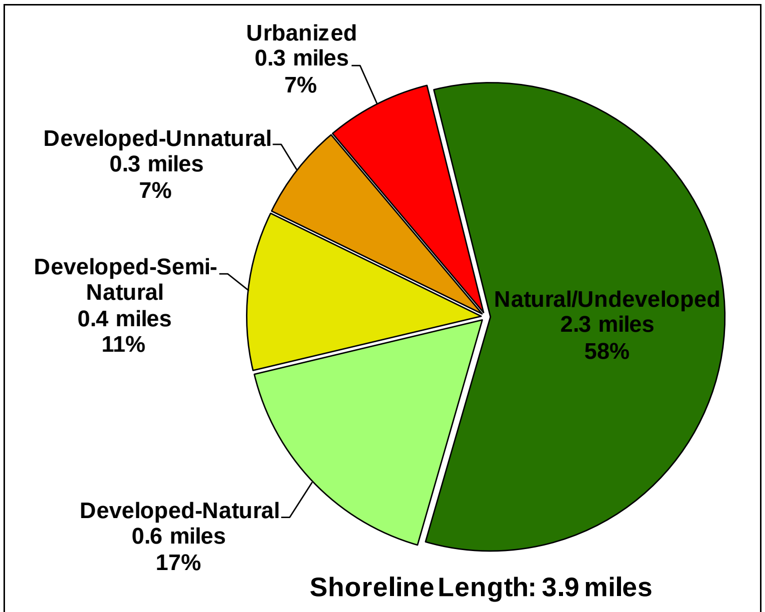



**Figure 8.5.3-1. Found Lake shoreland categories and total lengths.** Based upon a fall 2019 survey. Locations of these categorized shorelands can be found on Found Lake Map – 3.

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 fall of 2019, Found Lake's immediate shoreline was assessed in terms of its level of development.

Found Lake has stretches of shoreland that fit all of the five shoreland assessment categories (Figure 8.5.3-1). Approximately 41% (2.9 miles) of the lake's shoreline contains little to no development, categorized as natural/undeveloped or developed-natural. 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, 14% (0.6 miles) of shoreline with a higher degree of development was observed, categorized as either urbanized or developed-unnatural. If restoration of the Found 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.

### Coarse Woody Habitat

As part of the shoreland condition assessment, Found Lake was also surveyed to determine the extent of its coarse woody habitat. Coarse woody habitat was identified, and classified in three size categories (cluster of pieces, 2-8 inches in diameter, and 8+ inches in diameter) as well as four branching categories: no branches, minimal branches, moderate branches, and full canopy. Pictures descriptions of these categories can be found in the Town-Wide Section 3.4. 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, 131 total pieces of coarse woody habitat were observed along 3.9 miles of shoreline (Found Lake Map – 4), which yields a coarse woody habitat to shoreline mile ratio of 34:1 (Figure 8.5.3-2). Only instances where emergent coarse woody habitat extended from shore into the water were recorded during the survey. Seventy-five pieces of 2-8 inches in diameter pieces of coarse woody habitat were found, 56 pieces of 8+ inches in diameter pieces of coarse woody habitat were found, and zero instances of clusters 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 Found 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 111 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 Found Lake falls in the 66th percentile of these 111 lakes.

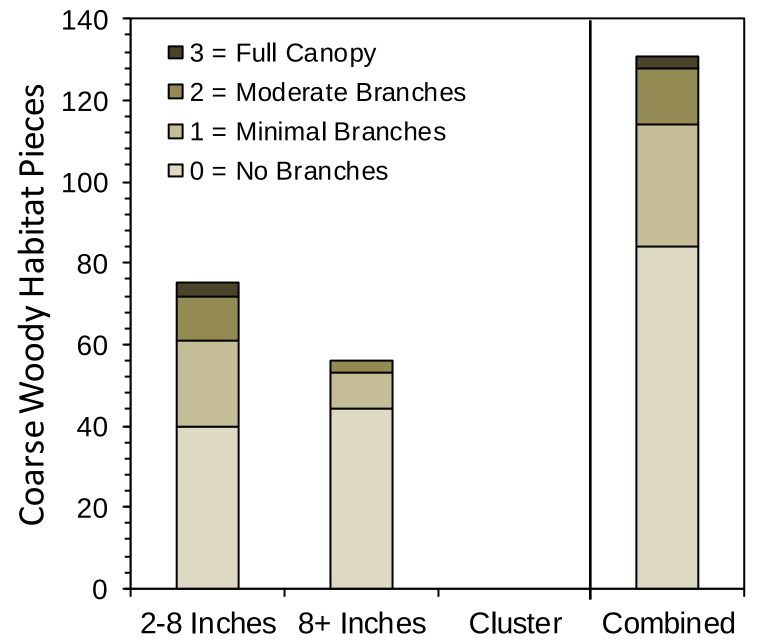



**Figure 8.5.3-2. Found Lake coarse woody habitat survey results.** Based upon a Fall of 2019 survey. Locations of the Found Lake coarse woody habitat can be found on Found Lake – Map 4.

## 8.5.4 Found Lake Aquatic Vegetation

An Early-Season Aquatic Invasive Species (ESAIS) Survey was conducted by Onterra ecologists on Found Lake on June 20, 2019. While the intent of this survey is to locate any potential non-native species within the lake, the primary focus is to locate occurrences of the non-native curly-leaf pondweed, which should be at or near its peak growth at this time. In addition to locating potential occurrences of curly-leaf pondweed, Onterra ecologists also attempted to locate occurrences of Eurasian watermilfoil which had been discovered in Found Lake in 2018. As is discussed in the subsequent Non-Native Aquatic Plants Section, no Eurasian watermilfoil or any other non-native aquatic or wetland plants were located in Found Lake in 2019.

The whole-lake aquatic plant point-intercept survey was conducted on Found Lake by the Wisconsin DNR on July 5 and 6, 2018 following the reported discovery of Eurasian watermilfoil. The emergent and floating-leaf plant community mapping survey was conducted by Onterra ecologists on August 19, 2019. During these surveys, a total of 33 native aquatic plant species were located (Table 8.5.4-1). One native aquatic plant species present in Found Lake, Vasey's Pondweed, is listed by the Wisconsin Natural Heritage Inventory Program as a species of special concern because it is rare in Wisconsin, and there is uncertainty regarding its abundance and distribution within the state. Onterra also completed a whole-lake point-intercept survey on Found Lake in 2010, and the species located during that survey are also included in Table 8.5.4-1.

Lakes in Wisconsin vary in their morphometry, water chemistry, water clarity, substrate composition, management, and recreational use, all factors which influence aquatic plant community composition. Like terrestrial plants, different aquatic plant species are adapted to grow in certain substrate types; some species are only found growing in soft substrates, others only in sandy/rocky areas, and some can be found growing in either. The combination of both soft sediments and areas of harder substrates creates different habitat types for aquatic plants, and generally leads to a higher number of aquatic plant species within the lake.

During the 2018 point-intercept survey, information regarding substrate type was collected at locations sampled with a pole-mounted rake (less than 15 feet). These data indicate that 63% of the point-intercept locations in 15 feet of water or less contained soft organic sediments, 33% contained sand, and 4% contained rock (Figure 8.5.4-1). Sampling locations with sand and/or rock were primarily located in shallower, near-shore areas, while the majority of sampling locations with organic sediments were located in deeper areas. The combination of both soft and hard substrates in Found Lake creates habitat types which support different aquatic plant community assemblages.

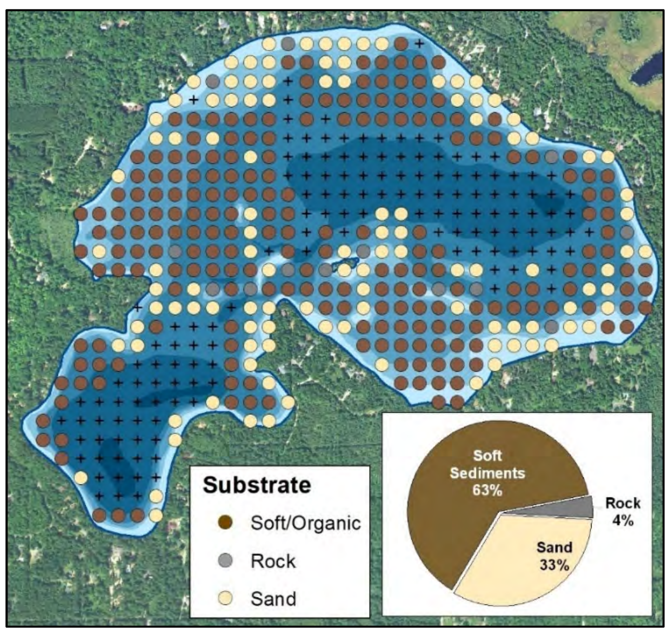



**Figure 8.5.4-1. Found Lake substrate types as determined from the 2018 point-intercept survey.** Please note substrate types can only be determined at sampling locations in 15 feet of water or less.

**Table 8.5.4-1. Aquatic plant species located in Found Lake during 2010 and 2018 aquatic plant surveys.**

| Growth Form | Scientific Name | Common Name | Status in Wisconsin | Coefficient of Conservatism | 2010 | 2018 |
|---|---|---|---|---|---|---|
| Emergent | *Calla palustris* | Water arum | Native | 9 | | I |
| | *Carex gynandra* | Nodding sedge | Native | 6 | | I |
| | *Carex lasiocarpa* | Narrow-leaved woolly sedge | Native | 9 | I | |
| | *Carex utriculata* | Common yellow lake sedge | Native | 7 | | I |
| | *Carex vesicaria* | Blister sedge | Native | 7 | X | |
| | *Dulichium arundinaceum* | Three-way sedge | Native | 9 | I | |
| | *Eleocharis palustris* | Creeping spikerush | Native | 6 | X | X |
| | *Equisetum fluviatile* | Water horsetail | Native | 7 | I | |
| | *Lythrum salicaria* | Purple loosestrife | Non-Native - Invasive | N/A | I | |
| | *Pontederia cordata* | Pickerelweed | Native | 9 | X | I |
| | *Sagittaria latifolia* | Common arrowhead | Native | 3 | | I |
| | *Schoenoplectus tabernaemontani* | Softstem bulrush | Native | 4 | I | I |
| | *Sparganium americanum* | American bur-reed | Native | 8 | | I |
| | *Typha latifolia* | Broad-leaved cattail | Native | 1 | | I |
| FL | *Brasenia schreberi* | Watershield | Native | 7 | X | X |
| | *Nuphar variegata* | Spatterdock | Native | 6 | X | X |
| | *Nymphaea odorata* | White water lily | Native | 6 | X | X |
| | *Sparganium angustifolium* | Narrow-leaf bur-reed | Native | 9 | | X |
| | *Sparganium fluctuans* | Floating-leaf bur-reed | Native | 10 | I | X |
| Submergent | *Ceratophyllum demersum* | Coontail | Native | 3 | X | X |
| | *Chara* spp. | Muskgrasses | Native | 7 | X | X |
| | *Elatine minima* | Waterwort | Native | 9 | X | |
| | *Elodea canadensis* | Common waterweed | Native | 3 | X | X |
| | *Elodea nuttallii* | Slender waterweed | Native | 7 | | X |
| | *Isoetes spp.* | Quillwort spp. | Native | 8 | X | X |
| | *Lobelia dortmanna* | Water lobelia | Native | 10 | X | X |
| | *Myriophyllum sibiricum* | Northern watermilfoil | Native | 7 | X | |
| | *Myriophyllum spicatum* | Eurasian watermilfoil | Non-Native - Invasive | N/A | | I |
| | *Myriophyllum tenellum* | Dwarf watermilfoil | Native | 10 | X | X |
| | *Najas flexilis* | Slender naiad | Native | 6 | X | X |
| | *Nitella* spp. | Stoneworts | Native | 7 | X | |
| | *Potamogeton amplifolius* | Large-leaf pondweed | Native | 7 | X | X |
| | *Potamogeton amplifolius* x *P. praelongus* | Large-leaf x White-stem pondweed hybrid | Native | N/A | X | |
| | *Potamogeton gramineus* | Variable-leaf pondweed | Native | 7 | X | X |
| | *Potamogeton illinoensis* | Illinois pondweed | Native | 6 | X | |
| | *Potamogeton natans* | Floating-leaf pondweed | Native | 5 | I | |
| | *Potamogeton praelongus* | White-stem pondweed | Native | 8 | X | X |
| | *Potamogeton pusillus* | Small pondweed | Native | 7 | X | X |
| | *Potamogeton richardsonii* | Clasping-leaf pondweed | Native | 5 | X | |
| | *Potamogeton robbinsii* | Fern-leaf pondweed | Native | 8 | X | X |
| | *Potamogeton vaseyi* | Vasey's pondweed | Native - Special Concern | 10 | X | |
| | *Potamogeton zosteriformis* | Flat-stem pondweed | Native | 6 | X | |
| | *Ranunculus aquatilis* | White water crowfoot | Native | 8 | X | |
| | *Utricularia vulgaris* | Common bladderwort | Native | 7 | X | X |
| | *Vallisneria americana* | Wild celery | Native | 6 | X | X |
| SE | *Eleocharis acicularis* | Needle spikerush | Native | 5 | X | X |
| | *Juncus pelocarpus* | Brown-fruited rush | Native | 8 | X | X |

*X = Located on rake during point-intercept survey; I = Incidentally located; not located on rake during point-intercept survey*
*FL = Floating-leaf; SE = Submergent and/or Emergent*

The 2010 and 2018 point-intercept data show that overall aquatic plant occurrence in Found Lake has declined markedly between these two surveys. The littoral frequency of occurrence of vegetation in Found Lake in 2010 was 67% compared to 44% in 2018, representing a statistically valid reduction in occurrence of 34% over this period (Figure 8.5.4-2). Total rake fullness (TRF) ratings recorded in 2018 indicated the overall biomass of aquatic plants in Found Lake also decreased when compared to 2010. In 2010, 52% of sampling locations that contained aquatic vegetation had TRF ratings of 2 or 3 indicating higher biomass, while 15% of sampling locations that contained vegetation in 2018 had TRF ratings of 2 or 3.

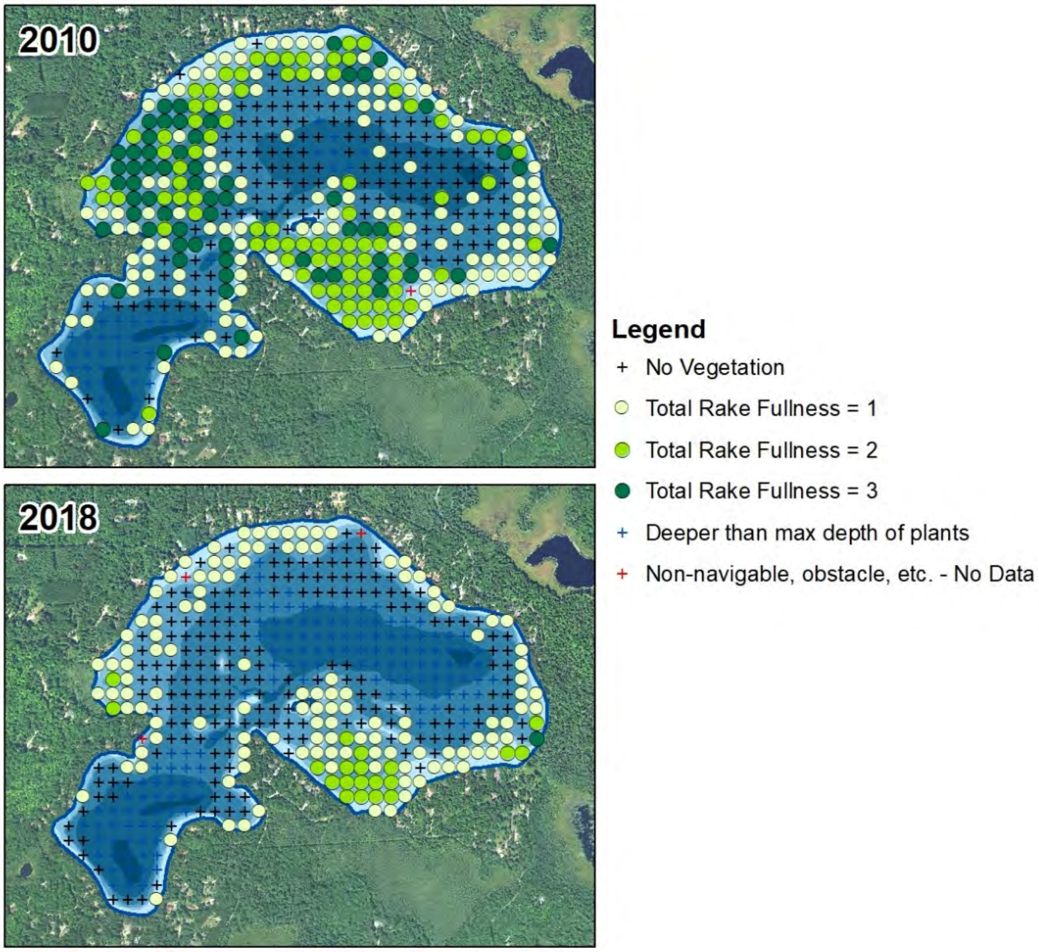



**Figure 8.5.4-2. Distribution of aquatic vegetation in Found Lake in 2010 and 2018 illustrating reduction in lake-wide vegetation occurrence.** Littoral frequency of occurrence of vegetation in 2010 was 67% (n = 430) and 44% in 2018 (n = 327), representing a 34% reduction in occurrence. Created using data from Onterra 2010 and WDNR 2018 point-intercept surveys.

The maximum depth of aquatic plant growth in Found Lake also declined from 21 feet in 2010 to 16 feet in 2018. The maximum depth of plant growth is largely going to be determined by water clarity. In general, aquatic plants grow to a depth of two to three times the average Secchi disk depth. As is discussed in the Found Lake Water Quality Section (8.5.1), Found Lake has seen significant declines in water clarity in recent years. The mean summer Secchi disk depth from 1993-2010 was 8.0 feet compared to an average of 4.6 feet from 2017-2019. In fact, 2018 and 2019 had the lowest mean summer Secchi disk depths on record for the lake. This reduction in water clarity in recent years is believed to be the result of increased concentrations of dissolved organic matter (DOM) entering the lake which give the water a tea-like color. DOM originates from decaying vegetation in wetlands and forests within the watershed. The increased concentrations of DOM are due to above average precipitation which both increases the runoff of DOM and saturates soils which facilitates a higher production of DOM.

The increased DOM in Found Lake in recent years has resulted in reduced light availability for plants to photosynthesize, particularly in deeper areas of Found Lake's littoral zone. In 2010, 80-100% of the sampling points between 1-15 feet of water contained aquatic vegetation before declining in occurrence out to a maximum depth of 21 feet (Figure 8.5.4-3). In 2018, 80-100% of the sampling locations between 1-8 feet contained aquatic vegetation, and the occurrence of vegetation declined rapidly beyond 8 feet to a maximum depth of 16 feet. The loss of vegetation in Found Lake between 2010 and 2018 occurred primarily in deeper areas of the littoral zone where light availability was reduced to the greatest extent.

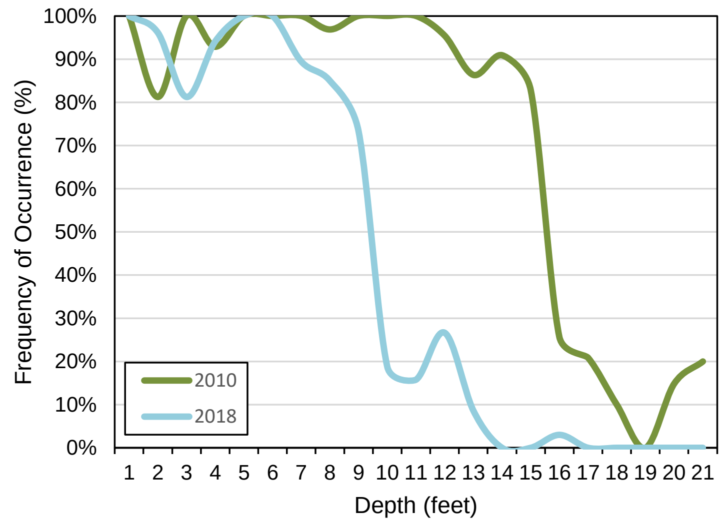



**Figure 8.5.4-3. Found Lake occurrence of vegetation across littoral depths in 2010 and 2018.** There was a significant reduction in the occurrence of aquatic plants between 2010 and 2018, most notably in deeper areas of Found Lake's littoral zone.

The data from the two point-intercept surveys completed on Found Lake can be used to compare how the occurrence of individual species have changed between the 2010 and 2018 surveys. The littoral frequencies of occurrence of aquatic plant species which had a littoral occurrence of at least 5% in one of the four point-intercept surveys are displayed in Figure 8.5.4-3.

In 2010, common waterweed was the most frequently-encountered species in Found Lake with a littoral frequency of occurrence of 43% (Figure 8.5.4-4). In 2018, its littoral frequency of occurrence had declined to 0.3%, representing a statistically valid reduction in occurrence of 99.3%. Similarly, the occurrence of coontail declined by 77.3%, large-leaf pondweed declined in occurrence by 96.6%, small pondweed by 94.2%, and variable-leaf pondweed by 60.6%. Stoneworts and flat-stem pondweed which had littoral frequencies of 20.9% and 19.3% respectively in 2010 were not observed in 2018, representing a 100% decline in occurrence. Two species, fern-leaf pondweed and wild celery exhibited statistically valid increases in abundance between the two surveys. Fern-leaf pondweed increased by 77.7% and wild celery by 99.4%. The occurrences of white-stem pondweed, muskgrasses and slender naiad were not statistically different between the two surveys.

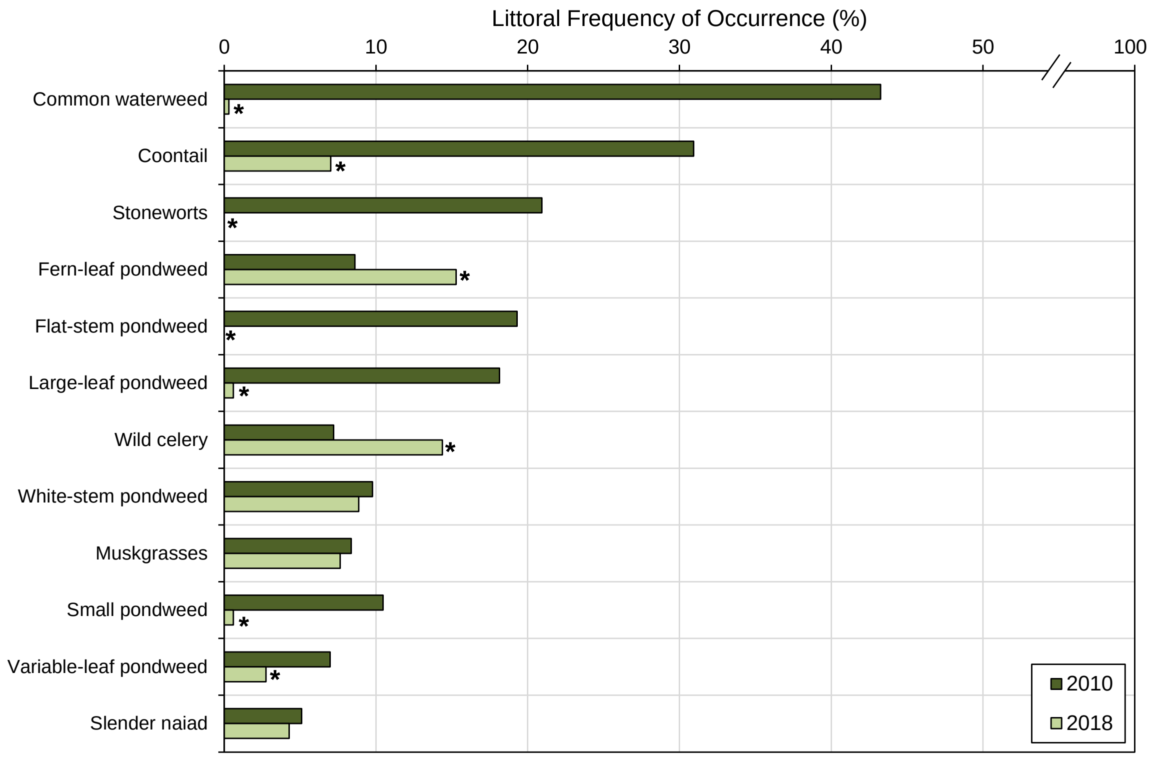



**Figure 8.5.4-4. Littoral frequency of occurrence of select aquatic plant species in Found Lake from 2010 and 2018 point-intercept surveys.** Species with a littoral frequency of occurrence of at least 5% in one of the two surveys are displayed. Created using data from Onterra 2010 and WDNR 2018 point-intercept surveys.

The data that continues to be collected from Wisconsin lake's is revealing that aquatic plant communities are highly dynamic, and populations of individual species have the capacity to fluctuate, sometimes greatly, in their occurrence from year to year and over longer periods of time. These fluctuations are driven by a combination of interacting natural factors including variations in water levels, temperature, ice and snow cover (winter light availability), nutrient availability, changes in water flow, water clarity, length of the growing season, herbivory, disease, and competition (Lacoul and Freedman 2006). In Found Lake, the primary driver of the changes observed is believed to the reduction in water clarity as the result of increased DOM. It is anticipated that Found Lake's water clarity will increase during periods of lower precipitation, and aquatic plant abundance will likely increase in response.

Lakes with diverse aquatic plant communities are believed to 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. One may assume that because a lake has a high number of aquatic plant species that it also has high species diversity. However, species diversity is influenced by both the number of species and how evenly they a 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 Found Lake's diversity values rank. Using data collected by Onterra and WDNR Science Services, quartiles were calculated for 212 lakes within the NLFL Ecoregion. The Simpson's Diversity Index values were calculated for Found Lake using the 2010 and 2018 point-intercept survey data. Found Lake's species diversity has remained similar at a value of 0.90 in 2010 and 0.89 in 2018 (Figure 8.5.4-5). The values for both years rise above the ecoregion median (0.88) indicating a more diverse plant community than in similar lakes.

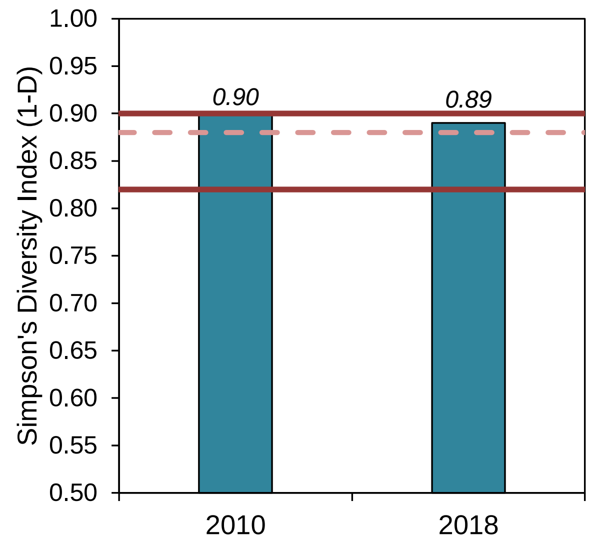



**Figure 8.5.4-5. Found Lake Simpson's Diversity Index.** Red solid lines represent NLFL upper and lower quartiles; light red dashed line represents NLFL median. Regional and state values calculated with Onterra & WDNR data.

In other words, if two plants were randomly sampled from two locations in Found Lake in 2010, there would have been an 90% probability that the plants would be two different species. In 2018, this probability would be 89%. The reduction in overall plant occurrence yet similar species diversity in Found Lake between 2010 and 2018 may seem contradictory. However, since 2010, Found Lake has seen large reductions in the occurrence of the most dominant and widespread species within the lake, resulting in more evenness in their relative abundance when compared to other species.

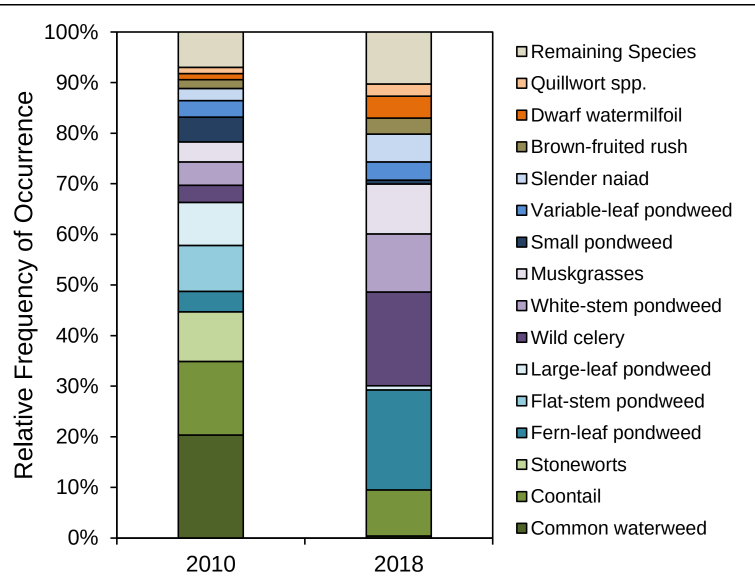



**Figure 8.5.4-6. Found Lake aquatic plant relative frequency of occurrence.** Created using data from Onterra 2010 and 2018 point-intercept surveys.

One way to visualize the diversity of Found Lake's plant community is to examine the relative frequency of occurrence of aquatic plant species. Relative frequency of occurrence is used to evaluate how often each plant species is encountered in relation to all the other species found. For example, common waterweed was found at 43% of the littoral sampling locations in 2010 (littoral occurrence), the relative frequency of occurrence was 20% (Figure 8.5.4-6).

Explained another way, if 100 plants were randomly sampled from Found Lake in 2010, 20 of them would have been common waterweed, 15 coontail, etc. In 2010, Found Lake's plant community was primarily dominated by common waterweed, coontail, and stoneworts. In 2019, the occurrence of these three dominant species declined significantly, and Found Lake's plant community was largely comprised of fern-leaf pondweed, wild celery, and white-stem pondweed. While the abundance and composition of Found Lake's plant community has changed between these two surveys, species diversity remains high. This illustrates the importance of having a diverse aquatic plant community; in years when conditions are unfavorable for some species, there are other species present that can grow and compensate for these reductions.

Submersed aquatic plants can be grouped into one of two general categories based upon their morphological growth form and habitat preferences. These two groups include species of the *isoetid* growth form and those of the *elodeid* growth form. Plants of the isoetid growth form are small, slow-growing, inconspicuous submerged plants (Figure 8.5.4-7). These species often have evergreen, succulent-like leaves and are usually found growing in sandy/rocky soils within near-shore areas of a lake (Boston and Adams 1987) (Vestergaard and Sand-Jensen 2000).

In contrast, aquatic plant species of the elodeid growth form have leaves on tall, erect stems which grow up into the water column, and are the plants that lake users are likely more familiar with (Figure 8.5.4-6). It is important to note that the definition of these two groups is based solely on morphology and physiology and not on species' relationships. For example, dwarf watermilfoil (*Myriophyllum tenellum*) is classified as an isoetid, while all of the other milfoil species in Wisconsin such as northern watermilfoil (*Myriophyllum sibiricum*) are classified as elodeids.

Alkalinity, as it relates to the amount of bicarbonate within the water, is the primary water chemistry factor for determining a lake's aquatic plant community composition in terms of isoetid versus elodeid growth forms (Vestergaard and Sand-Jensen 2000). Most aquatic plant species of the elodeid growth form cannot inhabit lakes with little or no alkalinity because their carbon demand for photosynthesis cannot be met solely from the dissolved carbon dioxide within the water and must be supplemented from dissolved bicarbonate.

**Figure 8.5.4-7. Lake quillwort (Isoetes lacustris) of the isoetid growth form (left) and large-leaf pondweed (Potamogeton amplifolius) of the elodeid growth form (right).** Photo credit: Onterra.

On the other hand, aquatic plant species of the isoetid growth form can thrive in lakes with little or no alkalinity because they have the ability to derive carbon dioxide directly from the sediment, and many also have a modified form of photosynthesis to maximize their carbon storage (Madsen 2002). While isoetids are able to grow in lakes with higher alkalinity, their short stature makes them poor competitors for space and light against the taller elodeid species. Thus, isoetids are most prevalent in lakes like Alma and Moon that have little to no alkalinity where they can avoid competition from elodeids.

In Found Lake and the other Town of Saint Germain lakes which have more moderate alkalinity levels, isoetids are generally restricted to shallower, wave-swept areas where elodeids are unable to grow, or scattered amongst less dense elodeid communities where light can penetrate to the bottom. Isoetid communities are vulnerable to sedimentation and eutrophication (Smolders, Lucassen and Roelofs 2002), and a number are listed as special concern or threatened in Wisconsin due to their rarity and susceptibility to environmental degradation. Found lake has large areas of both soft sediment and shallow sand bars which make is capable of supporting both types of plant growth. Several isoetid species were observed in both the 2010 and 2018 surveys of the lake.

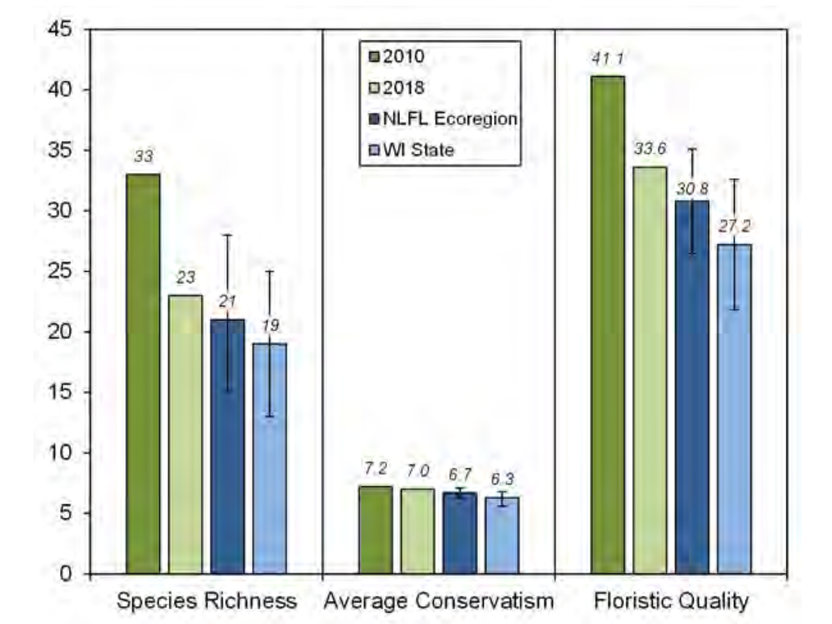



**Figure 8.5.4-8. Found Lake Floristic Quality Assessment.** Error bars represent interquartile range. Created using data from Onterra 2010 and 2018 point-intercept surveys. Regional and state medians calculated with Onterra and WDNR data. Analysis follows Nichols 1999.

Using the aquatic plant species recorded on the rake during the point-intercept surveys completed on Found Lake, the Floristic Quality Index (FQI) was also calculated for each survey (Figure 8.5.4-8). Native plant species richness, or the number of native species recorded on the rake was 33 in 2010 and 23 in 2018. Average species conservatism was 7.2 in 2010 and 7.0 in 2018, while the FQI was 41.1 in 2010 and 33.6 in 2018. Found Lake's species richness in 2010 was well above the median values for lakes in the NLFL ecoregion (21) and the state (19) but in 2018 had decreased to a value similar to the medians. Found Lake's average conservatism values are higher than the median values for both the ecoregion (6.7) and the state (6.3), indicating the lake supports a higher number of environmentally-sensitive species than similar lakes. Found Lake's FQI values also exceed both the median values for ecoregion lakes (30.8) and the state (27.2) but experienced a decline between surveys.

Overall, this analysis shows that Found Lake's aquatic plant community is of similar quality when compared to the majority of lakes in the ecoregion and the state. The reduction in Found Lake's FQI value between 2010 and 2018 is likely due to the overall reduction in aquatic plant abundance due to reduced water clarity, and it is not an indication of degrading conditions.

One native aquatic plant species, Vasey's pondweed (*Potamogeton vaseyi*; Photograph 8.5.4-1), that is listed as special concern in Wisconsin was located in Found Lake in 2010 but not observed in the 2018 survey. Vasey's pondweed produces very thin and pointed leaves that alternate along a long fine stem. In instances when it is able to reach the surface it frequently produces small oval to oblong floating leaves no larger than a human thumbnail. When floating leaves are produced, they often support a small cluster of flowers on a stalk which are held above the water's surface. In Wisconsin, Vasey's pondweed is generally found in lakes in the northern and central regions of the state. Species are listed as special concern by the WDNR's Natural Heritage Conservation Program when a problem with abundance or distribution is suspected by not yet proven, and this designation is to focus attention on these species before they become threatened or endangered. During the 2010 survey, the littoral frequency of occurrence of Vasey's pondweed was 1.6%.

**Photograph 8.5.4-1. Vasey's pondweed (Potamogeton vaseyi), with floating leaves and flowering present.** *P. vaseyi* is an uncommon native aquatic plant listed as special concern found in Found Lake. Photo credit: Onterra.

In 2019, Onterra ecologists also re-mapped emergent and floating-leaf aquatic plant communities in Found Lake (Found Lake – Map 5). Figure 8.5.4-9 illustrates that the size of these communities has remained relatively consistent since they were first mapped by NES Ecological Services in 2004. The acreage of these communities was 11.1 acres in 2004, 10.9 acres in 2010, and 11.6 acres in 2019. These communities often respond to changes in water levels, often expanding in size during periods of lower water levels and contracting again when water levels increase. The relatively small changes in Found Lake's emergent and floating-leaf aquatic plant communities compared to some of the other project lakes is likely due to the fact that the lake has maintained relatively stable water levels over this period. The full list of species found in these communities can be found in Table 8.5.4-1.

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.

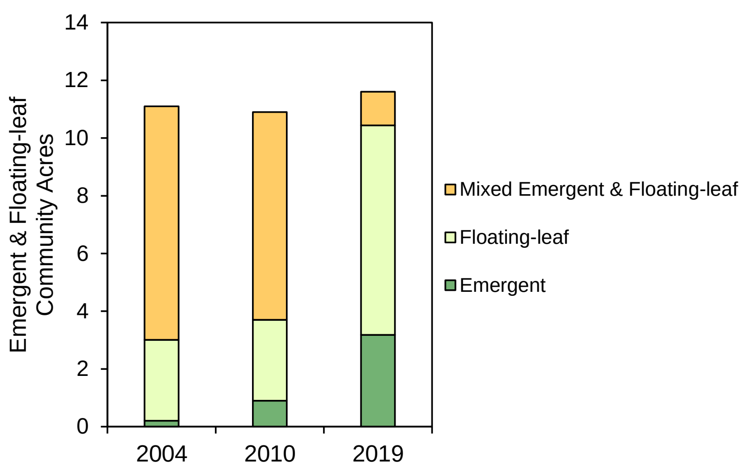



**Figure 8.5.4-9. Found Lake emergent and floating-leaf community acres from 2004, 2010, and 2019.** Change in acreage likely due to fluctuations in water levels over this period.

While Found Lake has seen a reduction in the occurrence of aquatic vegetation in 2018 when compared to 2010, the lake still maintains a high-quality native aquatic plant community comprised of a number of environmentally-sensitive species. The decline in water clarity is likely the primary driver of the changes observed in Found Lake's plant community. Riparian property owners should be educated on the importance of Found Lake's aquatic plant community and the role it plays in the lake's overall ecology, and conservation of this plant community should be a priority.

## Aquatic Invasive Species in Found Lake

### Eurasian watermilfoil (Myriophyllum spicatum)

Eurasian watermilfoil (EWM; Photograph 8.5.4-2) is a non-native, invasive aquatic plant from Eurasia. To date, populations of EWM have been found in Little Saint Germain Lake (2003), Lost Lake (2013), and Found Lake (2018). Discussions surrounding the occurrence and management of EWM in Little Saint Germain and Lost Lakes can be found in their respective individual lake management plans.

**Photograph 8.5.4-2. Eurasian watermilfoil, a non-native invasive aquatic plant located in Found Lake.** Photo credit: Onterra.

Eurasian watermilfoil was recently located in Found Lake during a June 2018 early-season aquatic invasive species survey being completed by Onterra. A few single plants were located in the bay on the west side of lake in approximately 6.0 feet of water (Figure 8.5.4-10). Following discussions between the Found Lake Property Owners Association (FLPOA), Onterra, and the WDNR, a hand-harvesting firm was contracted to remove the newly-discovered EWM population as well as to conduct scuba-based reconnaissance in the area around the public boat launch.

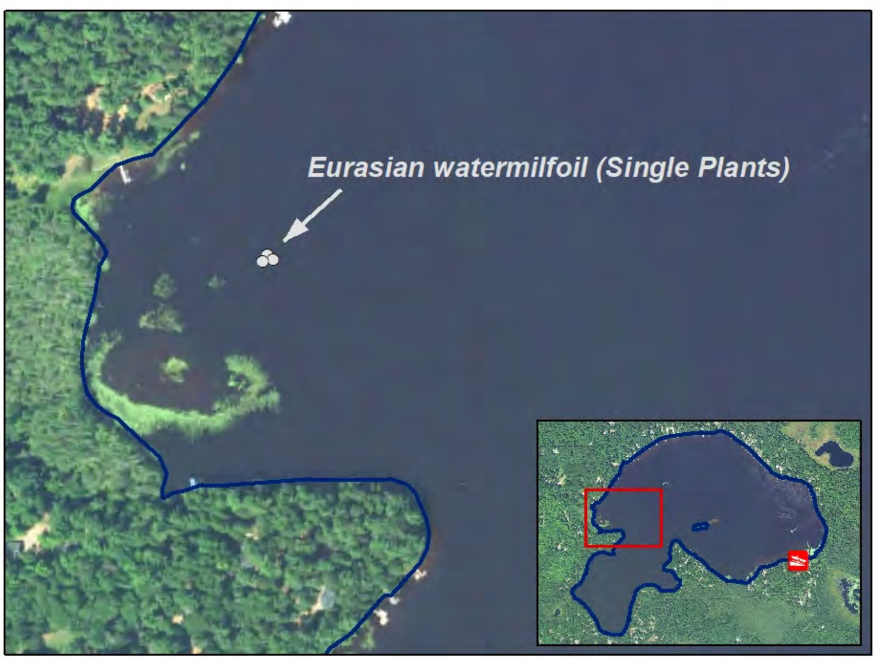



**Figure 8.5.4-10. Found Lake June 2018 Eurasian watermilfoil locations.** Extent of large map shown in red.

The FLPOA successfully received a WDNR AIS-Early Detection and Response (EDR) grant to aid in funding EWM monitoring and hand-harvesting from 2018-2020. Aquatic Plant

Management, LLC (APM) conducted hand-harvesting of EWM on Found Lake on July 6, 2018. They spend six hours on the lake and removed approximately 0.25 cubic feet of EWM. The divers noted smaller (< 6 inches) EWM plants growing in the immediate area near the mapped occurrences. No EWM was located near the public boat launch.

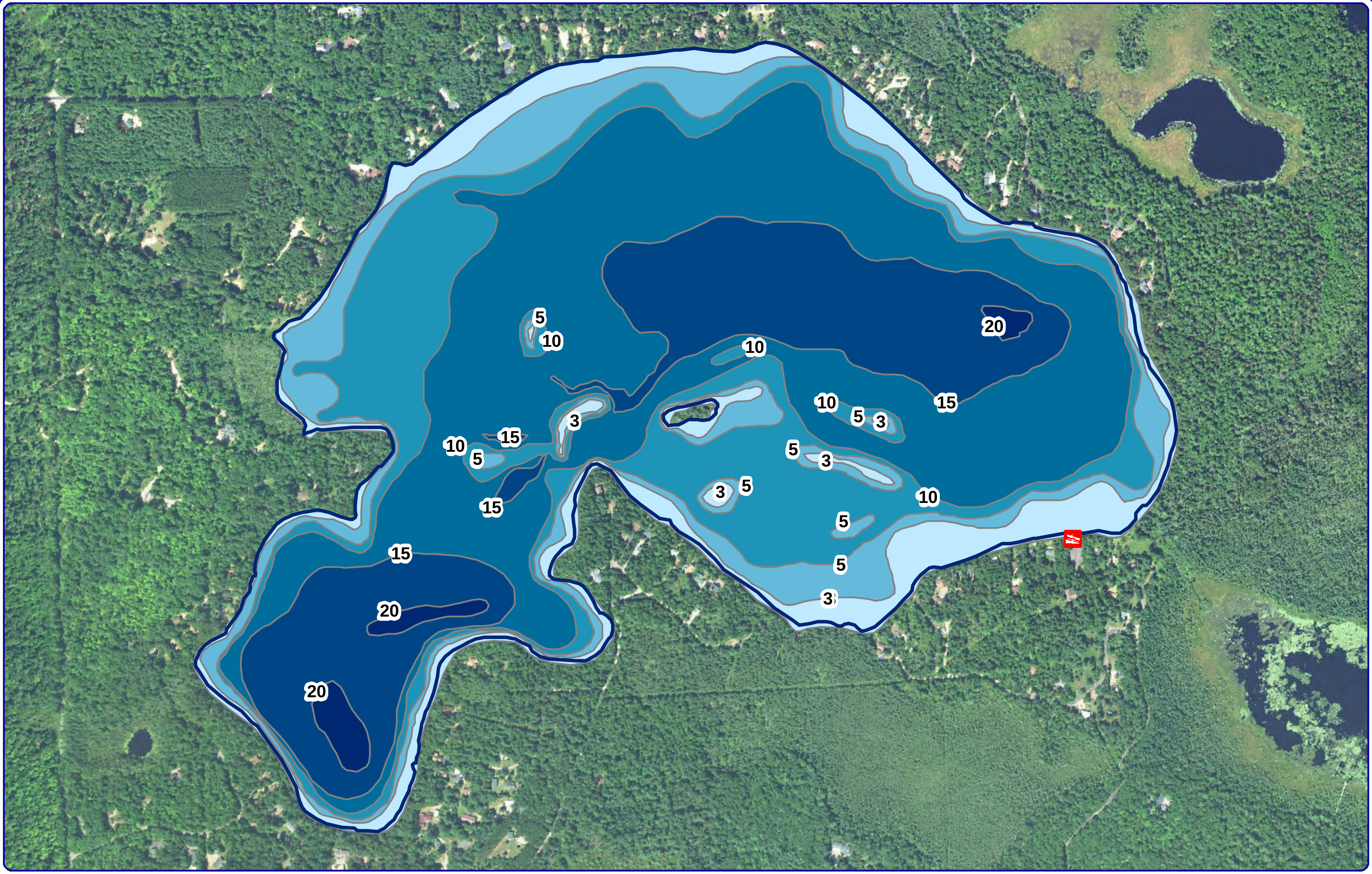
On June 20, 2019, Onterra ecologist completed another early-season AIS survey on Found Lake in an effort to located and map EWM and coordinate potential hand-harvesting efforts. The area where EWM had been located in 2018 was intensely surveyed from the surface and with a submersible camera and no EWM could be located in this area or anywhere else within the lake. Onterra ecologists returned to Found Lake on August 19, 2019 to conduct the late-season AIS survey. Again, no EWM could be located in the area previously mapped in 2018. Given no EWM was located in Found Lake in 2019, no hand-harvesting activities took place. An early-season AIS survey is scheduled for June of 2020 in an effort to locate any potential remaining EWM occurrences.

### *Purple loosestrife (Lythrum salicaria)*

Purple loosestrife is a perennial, herbaceous wetland plant native to Europe and was likely brought over to North America as a garden ornamental (Photograph 8.5.4-3). This plant escaped from its garden landscape into wetland environments where it is able to out-compete our native plants for space and resources. First detected in Wisconsin in the 1930's, it is now widespread across Wisconsin. Purple loosestrife largely spreads by seed but can also spread from root or stem fragments.

**Photograph 8.5.4-3. The non-native weltand plant purple loosestrife.** Photo credit: Onterra.

In 2010, a few purple loosestrife plants were located along the shoreline of Found Lake. Shortly thereafter, these plants were manually removed by the Vilas County AIS Coordinator and the current president of the FLPOA. During the 2019 community mapping surveys on the six Town of Saint Germain project lakes, no purple loosestrife was located. Continued monitoring for potential occurrences of purple loosestrife should continue by riparian property owners.




N
W E
S

740

Feet


**Legend**

Found Lake
*(336 acres - WDNR definition)*

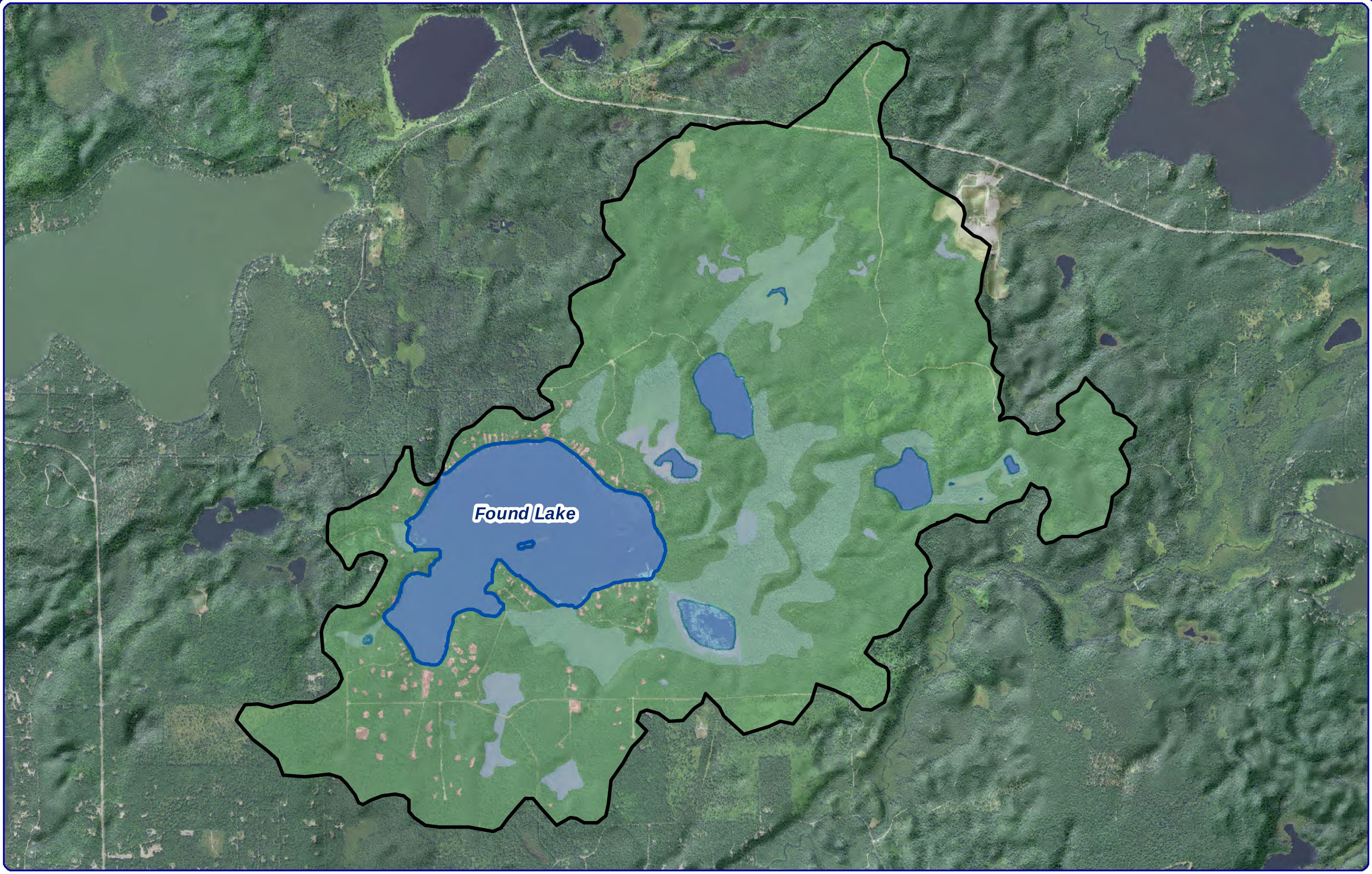
Public Boat Launch

Found Lake - Map 1
Town of Saint Germain
Vilas County, Wisconsin

**Project Location & Lake Boundaries**

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: 2018 NAIP
**Map Date:** March 3, 2020 BTB
**File Name** Map1_Found_Location.mxd




N
W E
S

2,600
Feet

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

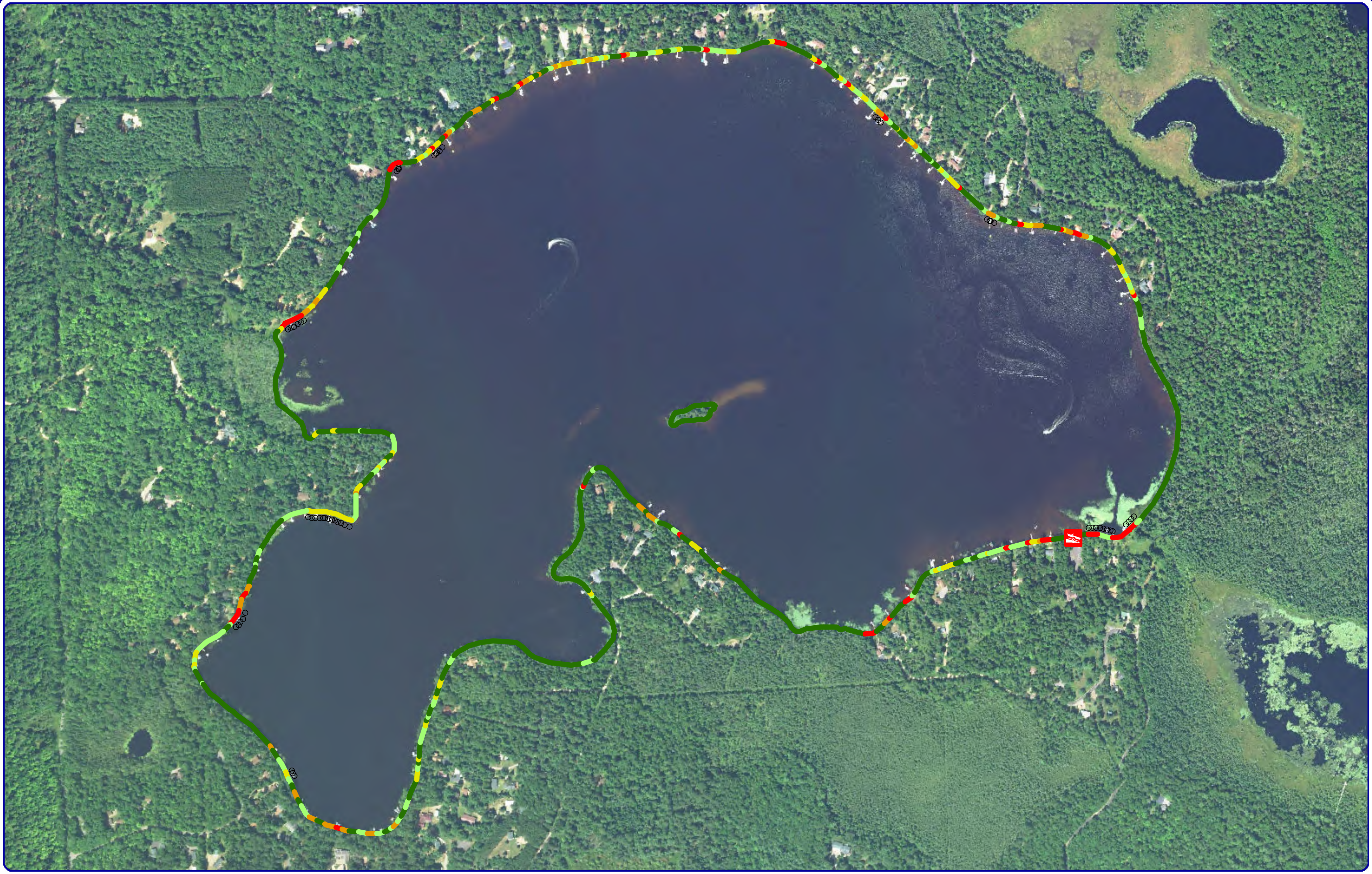
**Sources:**
Hydro: WDNR
Watershed: Onterra 2019
Orthophotography: 2018 NAIP
**Map Date:** March 3, 2020 BTB
**File Name** Map2_Found_WS.mxd

Project Location in Wisconsin

**Legend**

- Watershed Boundary
- Found Lake
- Forest
- Forested Wetlands
- Pasture/Grass (None)
- Rural Open Space
- Rural Residential
- Non-Forested Wetlands
- Open Water

# Found Lake - Map 2
## Town of Saint Germain
Vilas County, Wisconsin
# Watershed Boundaries & Land Cover Types



N
W E
S

740

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: 2018 NAIP
**Map Date:** March 3, 2020 BTB
**File Name** Map3_Found_SCA_2019.mxd

Project Location in Wisconsin

**Legend**

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

Seawall

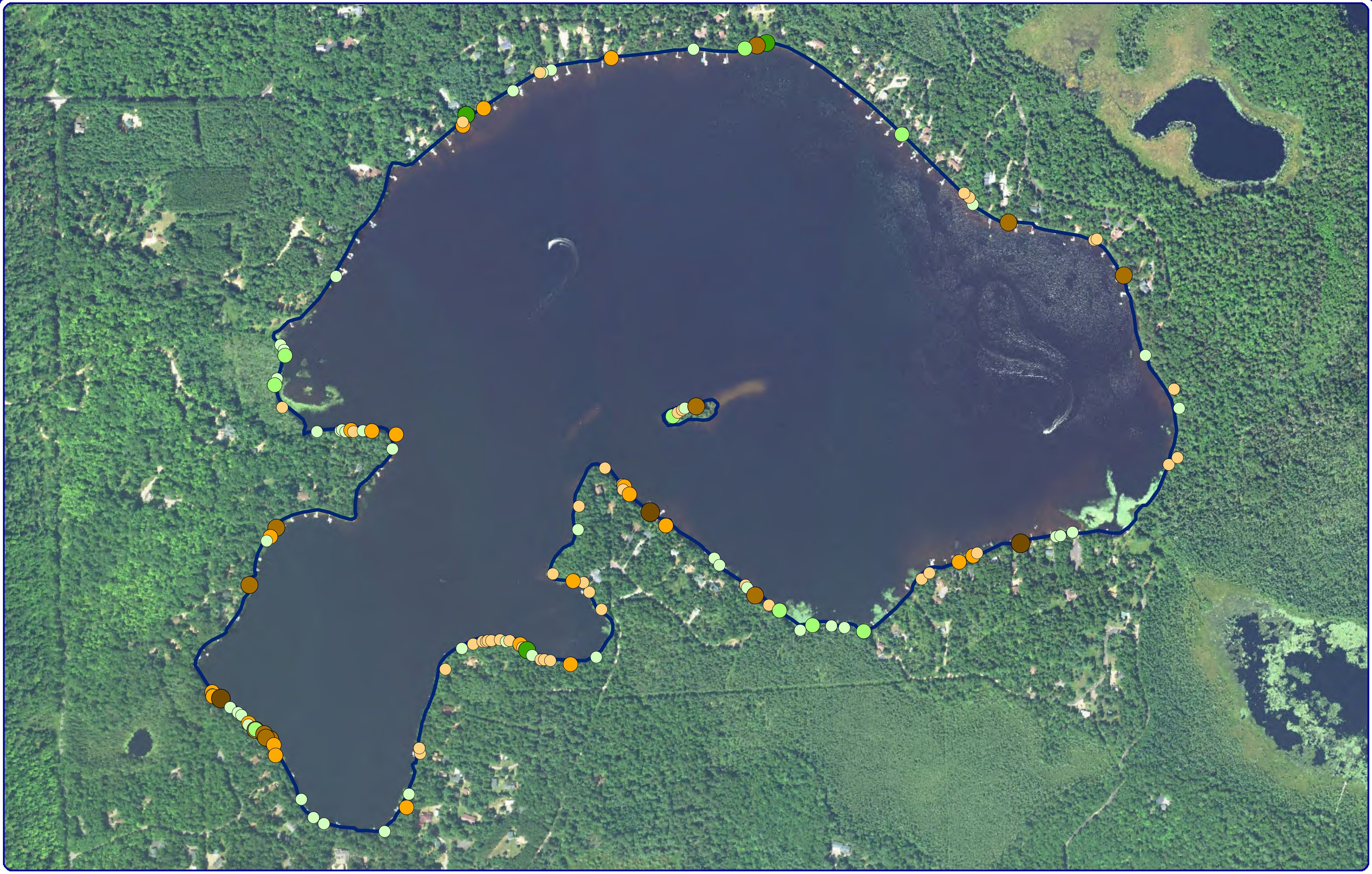
- Masonry/Wood/Metal
- Rip-Rap

Found Lake - Map 3

Town of Saint Germain

Vilas County, Wisconsin

**2019 Shoreland Condition Assessment**







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

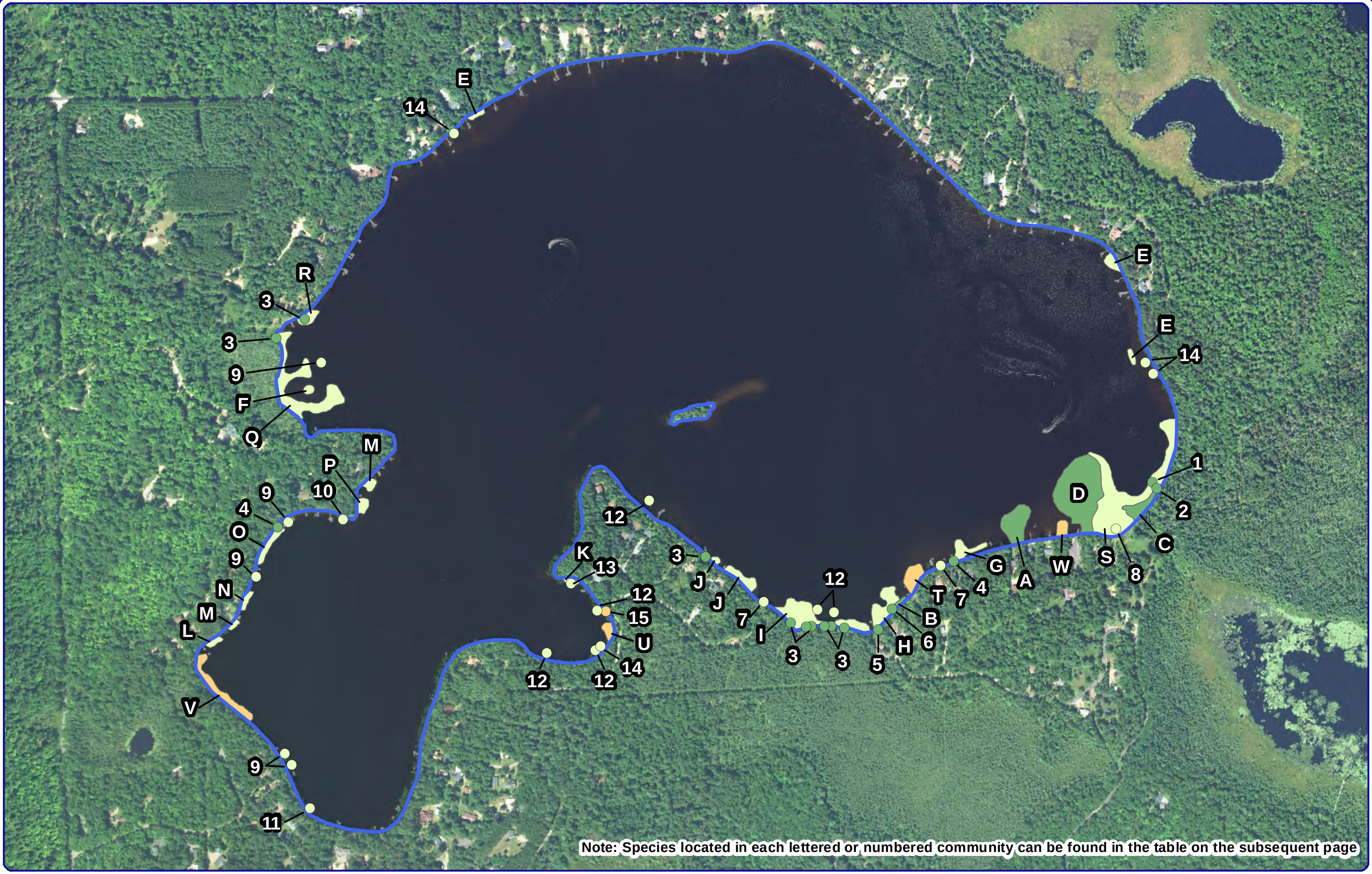
**Sources:**
Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Orthophotography: 2018 NAIP
**Map Date:** March 3, 2020 BTB
**File Name** Map4_Found_CWH_2019.mxd

**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 |

Found Lake - Map 4
Town of Saint Germain
Vilas County, Wisconsin

**2019 Course Woody Habitat Assessment**

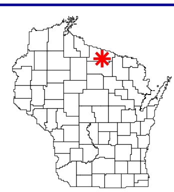



N
W E
S

770
Feet

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

**Sources**
Hydro: WDNR
Aquatic Plants: Onterra, 2019
Orthophotography: NAIP, 2017
**Map date:** December 17, 2019 AMS
*Filename: Map5_Found_Comm_2019.mxd*



Project Location in Wisconsin

**Large Plant Community**
- Native - Emergent
- Native - Floating-leaf
- Native - Mixed Floating-leaf & Emergent

**Small Plant Community**
- Native - Emergent
- Native - Floating-leaf
- Native - Mixed Floating-leaf & Emergent

# Found Lake - Map 5

## Town of Saint Germain

Vilas County, Wisconsin

## 2019 Emergent & Floating-leaf Aquatic Plant Communities

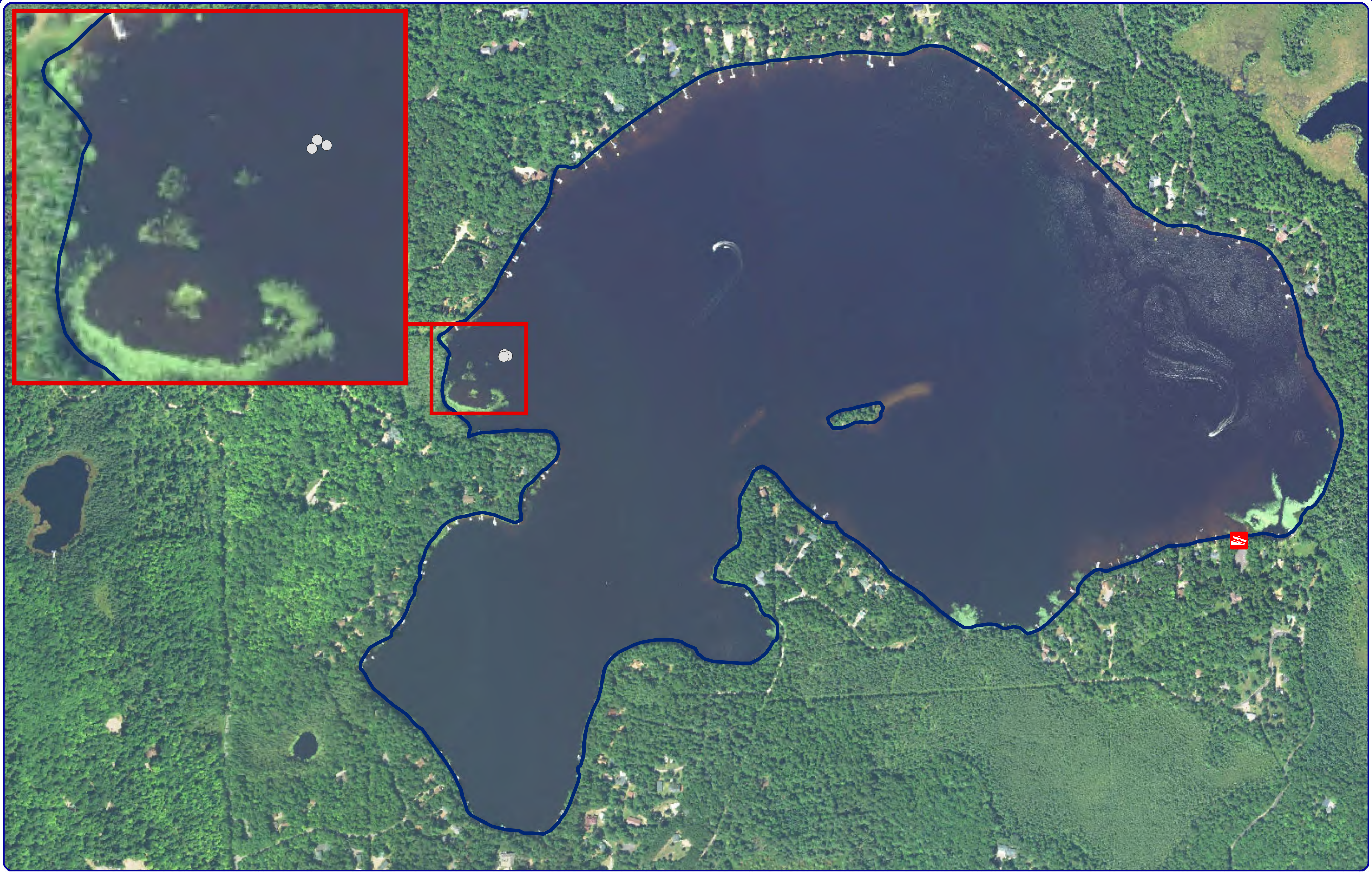
# Found Lake Emergent & Floating-Leaf Plant Species

**Corresponding Community Polygons and Points are displayed on Found Lake - Map 5**

| Large Plant Community (Polygons) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Emergent** | **Species 1** | **Species 2** | **Species 3** | **Species 4** | **Species 5** | **Species 6** | **Species 7** | **Species 8** | **Acres** |
| A | Creeping Spikerush | | | | | | | | 0.65 |
| B | American bur-reed | Common arrowhead | | | | | | | 0.06 |
| C | Pickerelweed | Common yellow lake sedge | Spikerush sp. | Nodding sedge | Softstem bulrush | water arum | Creeping spikerush | Broad-leaved cattail | 0.34 |
| D | Creeping spikerush | Pickerelweed | American bur-reed | Water arum | Common yellow lake sedge | | | | 2.14 |
| **Floating-leaf** | **Species 1** | **Species 2** | **Species 3** | **Species 4** | **Species 5** | **Species 6** | **Species 7** | **Species 8** | **Acres** |
| E | Narrow-leaf bur-reed | | | | | | | | 0.32 |
| F | Narrow-leaf bur-reed | White water lily | | | | | | | 0.07 |
| G | Narrow-leaf bur-reed | White water lily | | | | | | | 0.27 |
| H | White water lily | Spatterdock | Watershield | | | | | | 0.51 |
| I | Spatterdock | White water lily | Watershield | Narrow-leaf bur-reed | | | | | 1.02 |
| J | Narrow-leaf bur-reed | Spatterdock | | | | | | | 0.33 |
| K | White water lily | Spatterdock | Narrow-leaf bur-reed | | | | | | 0.09 |
| L | Spatterdock | White water lily | Watershield | | | | | | 0.10 |
| M | White water lily | | | | | | | | 0.16 |
| N | White water lily | Spatterdock | | | | | | | 0.11 |
| O | White water lily | Spatterdock | | | | | | | 0.26 |
| P | Spatterdock | | | | | | | | 0.14 |
| Q | White water lily | Spatterdock | Narrow-leaf bur-reed | Watershield | | | | | 1.37 |
| R | Watershield | Narrow-leaf bur-reed | Spatterdock | | | | | | 0.18 |
| S | Spatterdock | Watershield | White water lily | Narrow-leaf bur-reed | | | | | 2.33 |
| **Floating-leaf & Emergent** | **Species 1** | **Species 2** | **Species 3** | **Species 4** | **Species 5** | **Species 6** | **Species 7** | **Species 8** | **Acres** |
| T | Creeping spikerush | Spatterdock | American bur-reed | Pickerelweed | | | | | 0.32 |
| U | Spatterdock | American bur-reed | | | | | | | 0.15 |
| V | White water lily | Spatterdock | Watershield | | | | | | 0.55 |
| W | Narrow-leaf bur-reed | Pickerelweed | Creeping spikerush | Spatterdock | | | | | 0.14 |

| Small Plant Community (Points) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Emergent** | **Species 1** | **Species 2** | **Species 3** | **Species 4** | **Species 5** | **Species 6** | **Species 7** | **Species 8** |
| 1 | Pickerelweed | | | | | | | |
| 2 | Pickerelweed | Common arrowhead | | | | | | |
| 3 | American bur-reed | | | | | | | |
| 4 | Creeping spikerush | | | | | | | |
| 5 | American bur-reed | Common arrowhead | | | | | | |
| 6 | American bur-reed | Common arrowhead | | | | | | |
| **Floating-leaf** | **Species 1** | **Species 2** | **Species 3** | **Species 4** | **Species 5** | **Species 6** | **Species 7** | **Species 8** |
| 7 | Narrow-leaf bur-reed | Spatterdock | | | | | | |
| 8 | Floating-leaf bur-reed | | | | | | | |
| 9 | White water lily | | | | | | | |
| 10 | White water lily | Spatterdock | | | | | | |
| 11 | Spatterdock | Watershield | White water lily | | | | | |
| 12 | Spatterdock | | | | | | | |
| 13 | White water lily | Spatterdock | Narrow-leaf bur-reed | | | | | |
| 14 | Narrow-leaf bur-reed | | | | | | | |
| **Floating-leaf & Emergent** | **Species 1** | **Species 2** | **Species 3** | **Species 4** | **Species 5** | **Species 6** | **Species 7** | **Species 8** |
| 15 | Spatterdock | American bur-reed | | | | | | |

*Species are listed in order of dominance within the community; Scientifc names can be found in the species list in the Found Lake Aquatic Vegetation Section 8.5.4*




Found Lake - Map 6
Town of Saint Germain
Vilas County, Wisconsin

**June 2018**
**EWM Locations**

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: 2018 NAIP
**Map Date:** March 3, 2020 BTB
**File Name** Map6_Found_EWM_June18.mxd