Note: Methodology, explanation of analysis and biological background on Fawn Lake studies are contained within the Manitowish Waters Chain of Lakes-wide Management Plan document.

8.5 Fawn Lake

An Introduction to Fawn Lake

Fawn Lake, Vilas County, is a shallow, lowland drainage lake with a maximum depth of 16 feet, a mean depth of 7 feet, and a surface area of approximately 73 acres. The lake is fed via Clear Lake to the north and empties into Stone Lake to the south. The lake is considered to be mesotrophic and its watershed encompasses approximately 3,440 acres. In 2013, 43 native aquatic plant species were found in the lake, of which fern pondweed (*Potamogeton robbinsii*) was the most common. No aquatic invasive plant species were observed growing in or along the shorelines of Fawn Lake in 2013.

Field Survey Notes

Much aquatic plant growth within lake during summer surveys. Shoreline is largely undeveloped and a fair amount of coarse woody structure observed (see right).

Flow under the bridge that connects Clear Lake to Fawn Lake was able to keep open water during winter sampling visit.

Photo 8.5. Coarse Woody Habitat on Fawn Lake, Vilas County

Lake at a Glance* – Fawn Lake

Morphology	
Acreage	73
Maximum Depth (ft)	16
Mean Depth (ft)	7
Volume (acre-feet)	508
Shoreline Complexity	5.7
Vegetation	
Curly-leaf Survey Date	June 25, 2013
Comprehensive Survey Date	July 31, 2013
Number of Native Species	43
Threatened/Special Concern Species	Vasey's pondweed (*Potamogeton vaseyi*)
Exotic Plant Species	-
Simpson's Diversity	0.90
Average Conservatism	6.8
Water Quality	
Wisconsin Lake Classification	Shallow, Lowland Drainage
Trophic State	Mesotrophic
Limiting Nutrient	Phosphorus
Watershed to Lake Area Ratio	46:1

**These parameters/surveys are discussed within the Chain-wide portion of the management plan.*

8.5.1 Fawn Lake Water Quality

Water quality data was collected from Fawn Lake on six occasions in 2013/2014. Onterra staff sampled the lake for a variety of 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 surface samples. In addition to sampling efforts completed in 2013/2014, any historical data was researched and are included within this report as available.

Unfortunately, very limited data exists for two water quality parameters of interest – total phosphorus and chlorophyll-*a* concentrations. In 2013, average summer phosphorus concentrations (19.2 µg/L) were less than the median value (33.0 µg/L) for other shallow, lowland drainage lakes in the state (Figure 8.5.1-1). This value is also lower than the value for other lakes within the Northern Lakes and Forests ecoregion. A weighted value from all available data ranks as *Excellent* for a shallow, lowland drainage lake.

Total phosphorus surface values from 2013 are compared with bottom-lake samples collected during this same time frame in Figure 8.5.1-2. As displayed in this figure, on several occasions surface and bottom total phosphorus concentrations were similar. However, on some occasions, namely during August of 2013 and February of 2014, the bottom phosphorus concentrations were much greater than the relatively low surface concentrations. During these periods, anoxic conditions were recorded near the bottom of the lake through measurement of dissolved oxygen (refer to Figure 8.5.1-6 and associated text). This is an indication of hypolimnetic nutrient recycling, or internal nutrient loading, which is a natural process discussed further in the Manitowish Waters Chain of Lakes-wide document. While this process may be contributing some phosphorus to Fawn Lake's water column, this occurs primarily during the winter months and the impacts of nutrient loading are not apparent in the lake's overall water quality. As previously mentioned, Fawn Lake's surface water total phosphorus values are slightly lower than the median value for comparable lakes in Wisconsin, and rank as *Excellent* overall.

Similar to what has been observed with the total phosphorus dataset, summer average chlorophyll-*a* concentrations (6.7 µg/L) were slightly lower than the median value (7.0 µg/L) for other lakes of this type (Figure 8.5.1-3), as well as lower than the median for all lakes in the ecoregion. Both of these parameters, total phosphorus and chlorophyll-*a*, rank within a TSI category of *Excellent*, indicating the lake has enough nutrients for production of aquatic plants, algae, and other organisms but not so much that a water quality issue is present. During 2013 visits to the lake, Onterra ecologists recorded field notes describing very good water conditions.

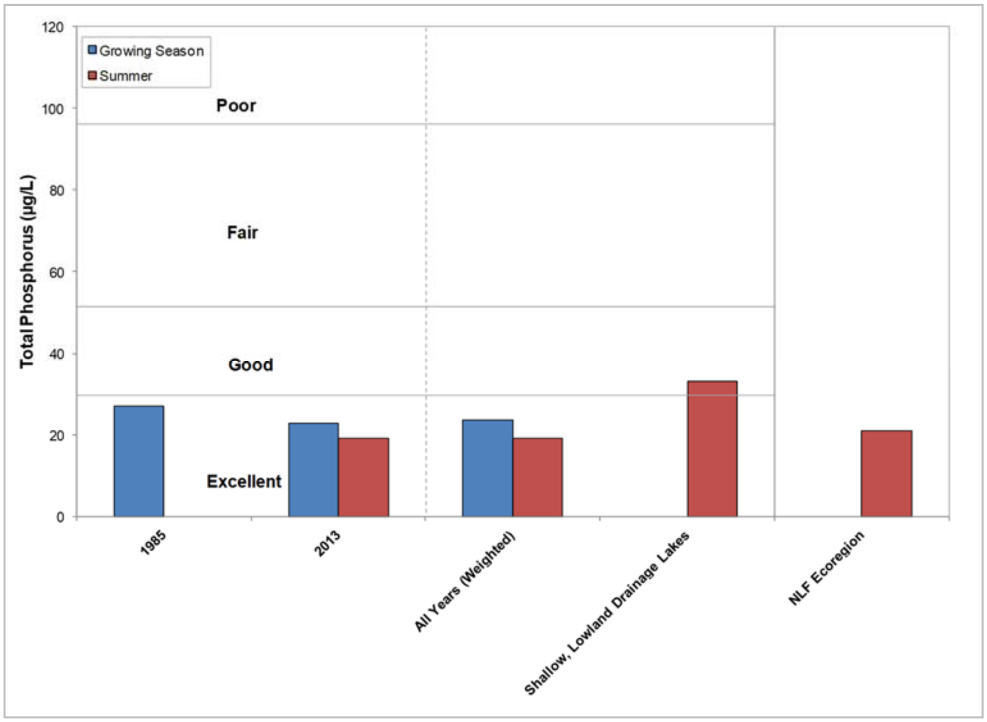


Figure 8.5.1-1. Fawn Lake, state-wide shallow, lowland drainage lakes, and regional total phosphorus concentrations. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

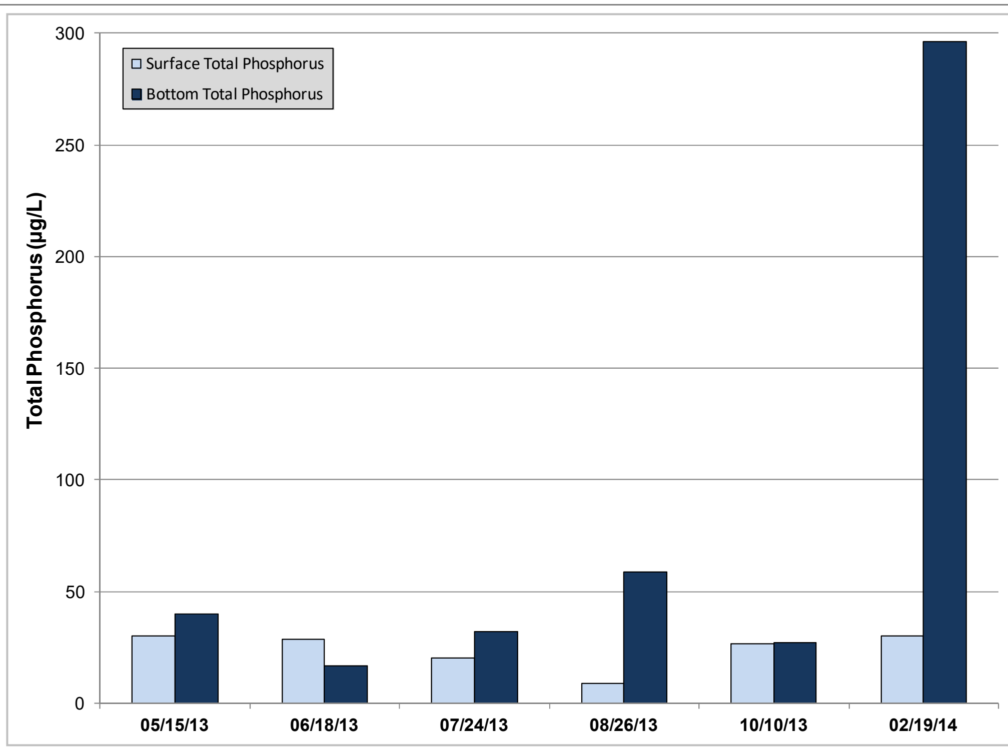


Figure 8.5.1-2. Fawn Lake surface and bottom total phosphorus values, 2013-2014. Anoxia was observed in the hypolimnion of the lake during August and February sampling visits.

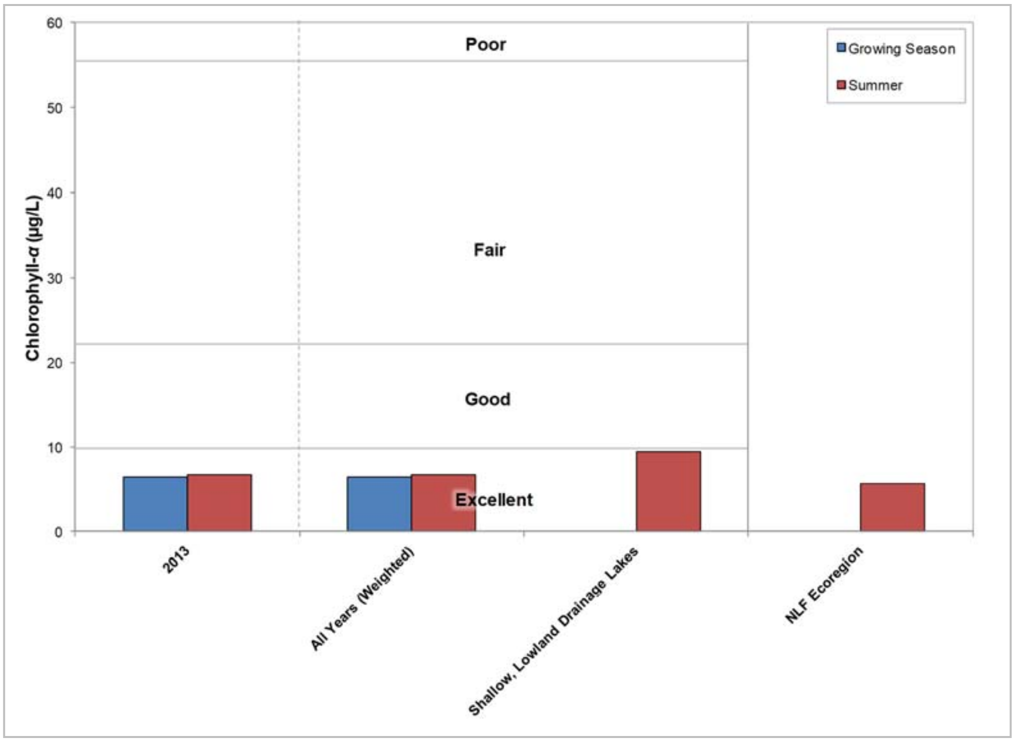


Figure 8.5.1-3. Fawn Lake, state-wide shallow, lowland drainage lakes, and regional chlorophyll-*a* concentrations. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

The clarity of Fawn Lake's water can be described as *Excellent* during the summer months in which data has been collected (Figure 8.5.1-4). A weighted average over this timeframe is greater than the median value for other shallow, lowland drainage lakes in the state and is also larger than the regional median. Secchi disk clarity is influenced by many factors, including plankton production and suspended sediments, which themselves vary due to several environmental conditions such as precipitation, sunlight, and nutrient availability. In Fawn Lake as well as the other lakes in the Manitowish Waters Chain of Lakes, a natural staining of the water plays a role in light penetration, and thus water clarity, as well. The waters of Fawn Lake contain naturally occurring organic acids that are washed into the lake from nearby wetlands. The acids are not harmful to humans or aquatic species; they are by-products of decomposing terrestrial and wetland plant species. This natural staining may reduce light penetration into the water column, which reduces visibility and also reduces the growing depth of aquatic vegetation within the lake. Because of its smaller watershed relative to the other Manitowish Waters Chain of Lakes, Fawn Lake's water may be less stained.

"True color" measures the dissolved organic materials in water. Water samples collected in May and July of 2015 were measured for this parameter, and were found to be 15 Platinum-cobalt units (Pt-co units, or PCU). Lillie and Mason (1983) categorized lakes with 0-40 PCU as having "low" color, 40-100 PCU as "medium" color, and >100 PCU as high color.

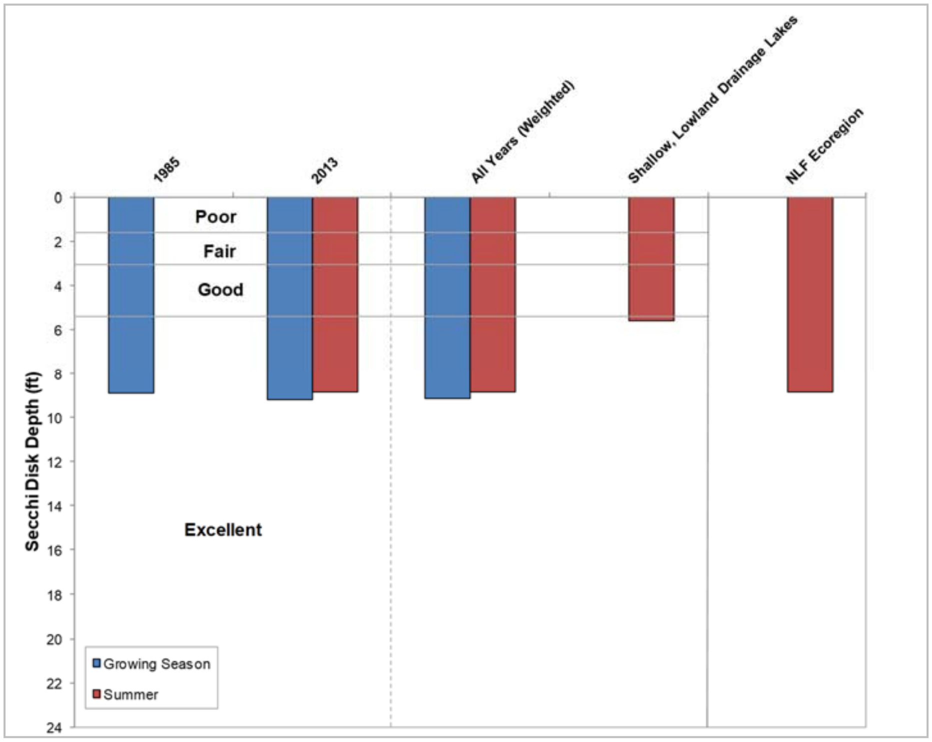


Figure 8.5.1-4. Fawn Lake, state-wide shallow, lowland drainage lakes, and regional Secchi disk clarity values. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

Fawn Lake Trophic State

The TSI values calculated with Secchi disk, chlorophyll-*a*, and total phosphorus values range in values spanning from lower mesotrophic to eutrophic (Figure 8.5.1-5). In general, the best values to use in judging a lake's trophic state are the biological parameters; therefore, relying primarily on total phosphorus and chlorophyll-*a* TSI values, it can be concluded that Fawn Lake is in a mesotrophic state.

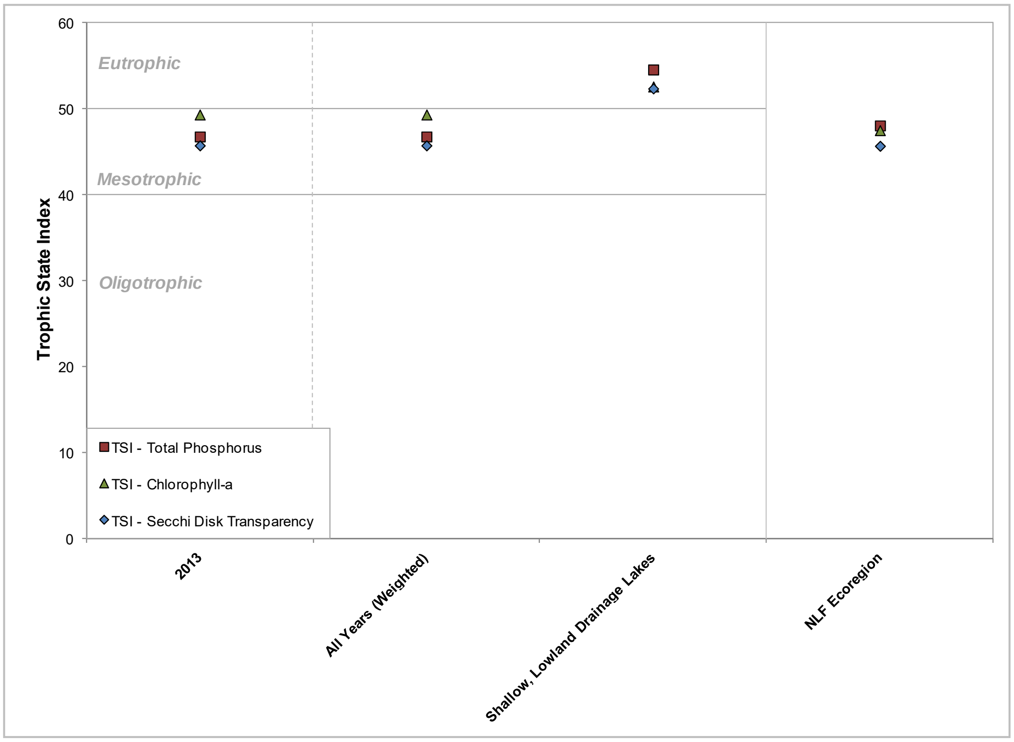


Figure 8.5.1-5. Fawn Lake, state-wide shallow, lowland drainage lakes, and regional Trophic State Index values. Values calculated with summer month surface sample data using WDNR PUB-WT-193.

Dissolved Oxygen and Temperature in Fawn Lake

Dissolved oxygen and temperature profiles were created during each water quality sampling trip made to Fawn Lake by Onterra staff. Graphs of those data are displayed in Figure 8.5.1-6 for all sampling events.

Fawn Lake mixes thoroughly during the spring and fall, when changing air temperatures and gusty winds help to mix the water column. During the summer months, the shallow lake likely mixes often as well. The bottom of the lake was found to become void of oxygen (anoxic) several times during the year. This occurrence is not uncommon in Wisconsin lakes, as bacteria break down organic matter that has collected at the bottom of the lake and in doing so utilize any available oxygen. If the lake mixes completely, oxygen will be reintroduced to the lower levels of the water column.

The lake mixes completely again in the fall, re-oxygenating the water in the lower part of the water column. During the winter months, the coldest temperatures are found just under the overlying ice, while oxygen gradually diminishes once again towards the bottom of the lake. In February of 2013, oxygen levels remained sufficient throughout most of the water column to support most aquatic life in northern Wisconsin lakes.

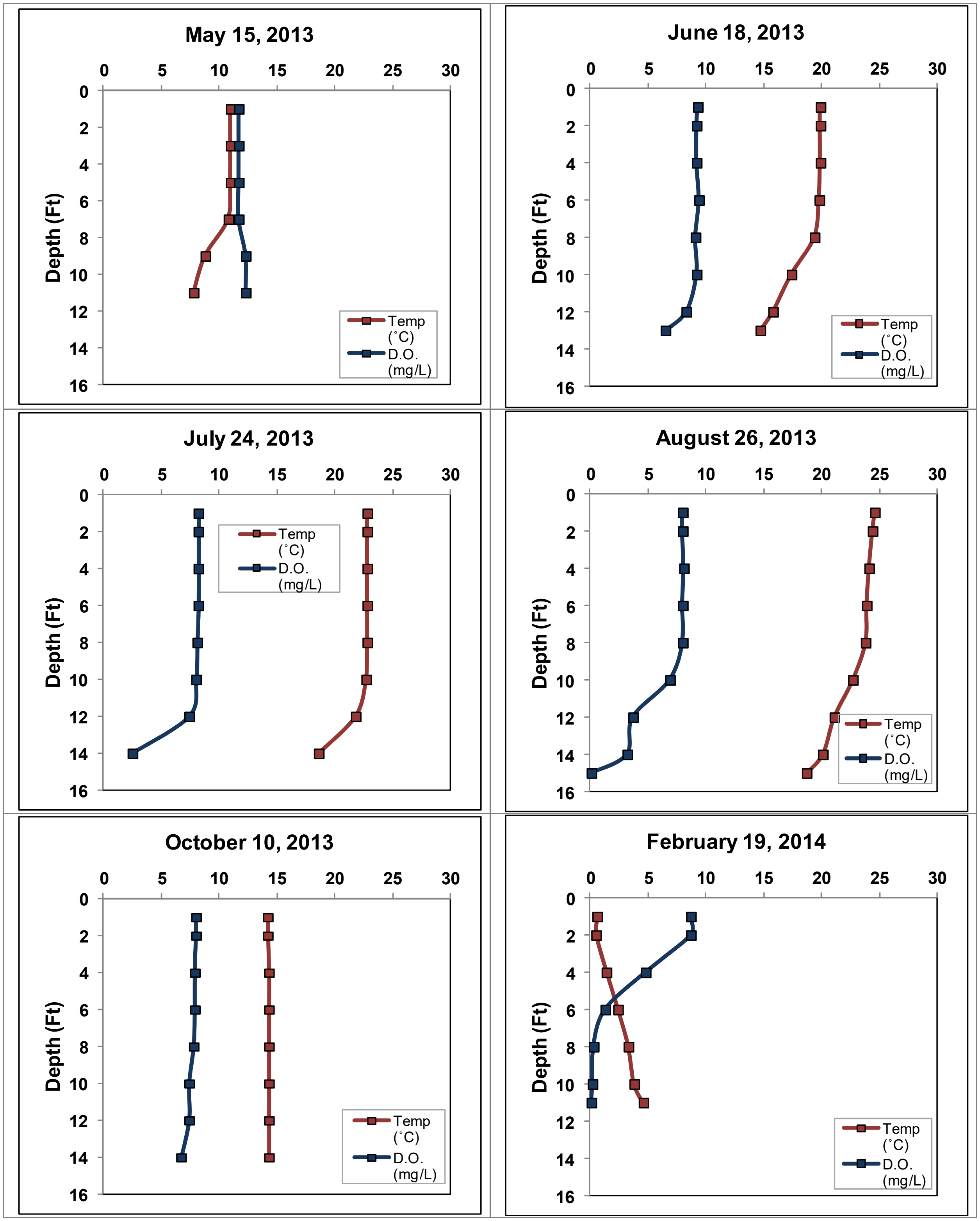


Figure 8.5.1-6. Fawn Lake dissolved oxygen and temperature profiles.

Additional Water Quality Data Collected at Fawn 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 Fawn 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.

As the Chain-wide Water Quality Section explains, the pH scale ranges from 0 to 14 and indicates the concentration of hydrogen ions (H^+) within the lake's water and is thus an index of the lake's acidity. Fawn Lake's surface water pH was measured at roughly 7.7 during May and 8.0 during July of 2013. These values are slightly above neutral and fall within the normal range for Wisconsin lakes. Fluctuations in pH with respect to seasonality is common; in-lake processes such as photosynthesis by plants act to reduce acidity by carbon dioxide removal while decomposition of organic matter add carbon dioxide to water, thereby increasing acidity.

A lake's pH is primarily determined by the amount of alkalinity that is held within the water. Alkalinity is a lake's capacity to resist fluctuations in pH by neutralizing or buffering against inputs such as acid rain. Lakes with low alkalinity have higher amounts of the bicarbonate compound (HCO_3^-) while lakes with a higher alkalinity have more of the carbonate compound of alkalinity ($CO_3^=$). The carbonate form is better at buffering acidity, so lakes with higher alkalinity are less sensitive to acid rain than those with lower alkalinity. The alkalinity in Fawn Lake was measured at 35.8 and 39.2 mg/L as $CaCO_3$ in May and July of 2013, respectively. This indicates that the lake has a substantial capacity to resist fluctuations in pH and has a low sensitivity to acid rain.

Samples of calcium were also collected from Fawn Lake during 2013. Calcium is commonly examined because invasive and native mussels use the element for shell building and in reproduction. Invasive mussels typically require higher calcium concentrations than native mussels. The commonly accepted pH range for zebra mussels is 7.0 to 9.0, so Fawn Lake's pH of 7.7 – 8.0 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 Fawn Lake was found to be 11.0 mg/L in July of 2013, which is below the optimal range for zebra mussels. Plankton tows were completed by Onterra staff during the summer of 2013 and these samples were processed by the WDNR for larval zebra mussels. No veligers (larval stage of zebra mussels) were observed within these samples.

8.5.2 Fawn Lake Watershed Assessment

Fawn Lake's watershed is 3,440 acres in size. Compared to Fawn Lake's size of 73 acres, this makes for a large watershed to lake area ratio of 46:1. Similar to most lakes that are downstream of other lakes, the large majority of the lake's watershed consists of the lake immediately upstream. For Fawn Lake this means that 3,046 acres (89%) of Fawn Lake's watershed is the Clear Lake subwatershed. The direct watershed of Fawn Lake is a small part of the lake's total watershed (Figure 8.5.2-1). The part of the lake's watershed that is forest is 196 ac (6%) while wetlands comprise 110 acres (3%). Wisconsin Lakes Modeling Suite (WiLMS) modeling indicates that Fawn Lake's residence time is approximately 44 days, or that the water within the lake is completely replaced 8.1 times per year.

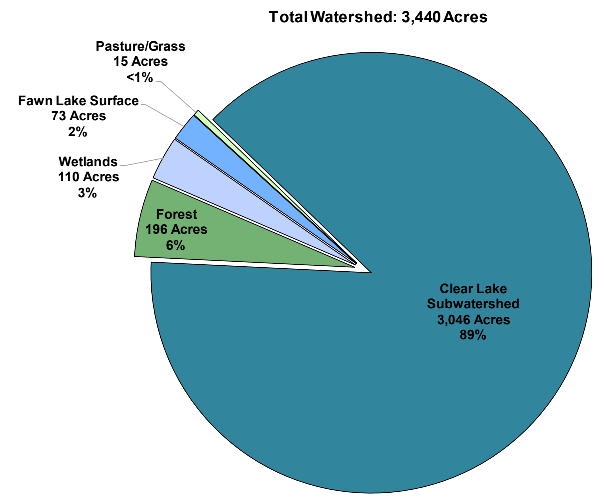


Figure 8.5.2-1. Fawn Lake watershed boundary (red line) and proportion of land cover types. Based upon National Land Cover Database (NLCD – Fry et. al 2011).

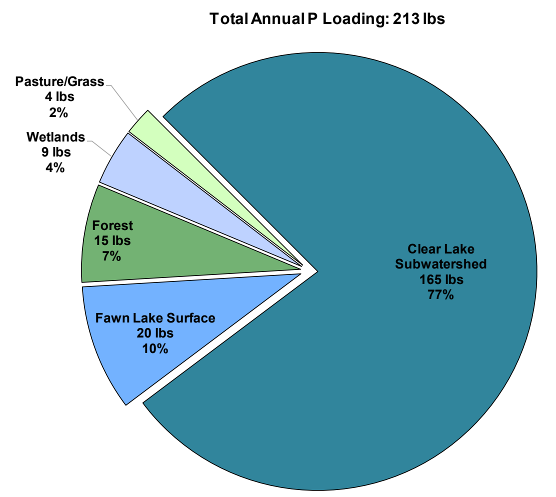


Figure 8.5.2-2. Fawn Lake estimated potential annual phosphorus loading. Based upon Wisconsin Lake Modeling Suite (WiLMS) estimates.

Of the estimated 213 pounds of phosphorus being delivered to Fawn Lake on an annual basis, approximately 168 pounds (77%) originates from Clear Lake which is the lake immediately upstream of Fawn Lake (Figure 8.5.2-2). The remaining phosphorus comes from approximately 20 pounds (10%) through direct atmospheric deposition onto the lake, 15 pounds (7%) from forests, 9 pounds (4%) from wetlands, and 4 pounds (2%) from areas of pasture/grass/rural open space. Using the estimated annual potential phosphorus load, WiLMS predicted an in-lake growing season average total phosphorus concentration of 18 μg/L, which is the slightly less than measured growing season phosphorus concentration of 24 μg/L. This means the model works reasonably well for Fawn Lake.

Because the large majority of the phosphorus that enters Fawn Lake comes from the upstream Clear Lake, efforts to reduce phosphorus levels in Fawn Lake should concentrate on reducing phosphorus inputs to Clear Lake.

8.5.3 Fawn Lake Shoreland Condition

Shoreland Development

As mentioned previously in the Chain-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 late summer of 2013, Fawn Lake's immediate shoreline was assessed in terms of its development. Fawn Lake has stretches of shoreland that fit all of the five shoreland assessment categories. In all, 2.6 miles of natural/undeveloped and developed-natural shoreline were observed during the survey (Figure 8.5.3-1). This constitutes about 93% of Fawn 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, 0.2 miles of urbanized and developed–unnatural shoreline (4%) was observed. If restoration of the Fawn 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. Fawn Lake Map 1 displays the location of these shoreline lengths around the entire lake.

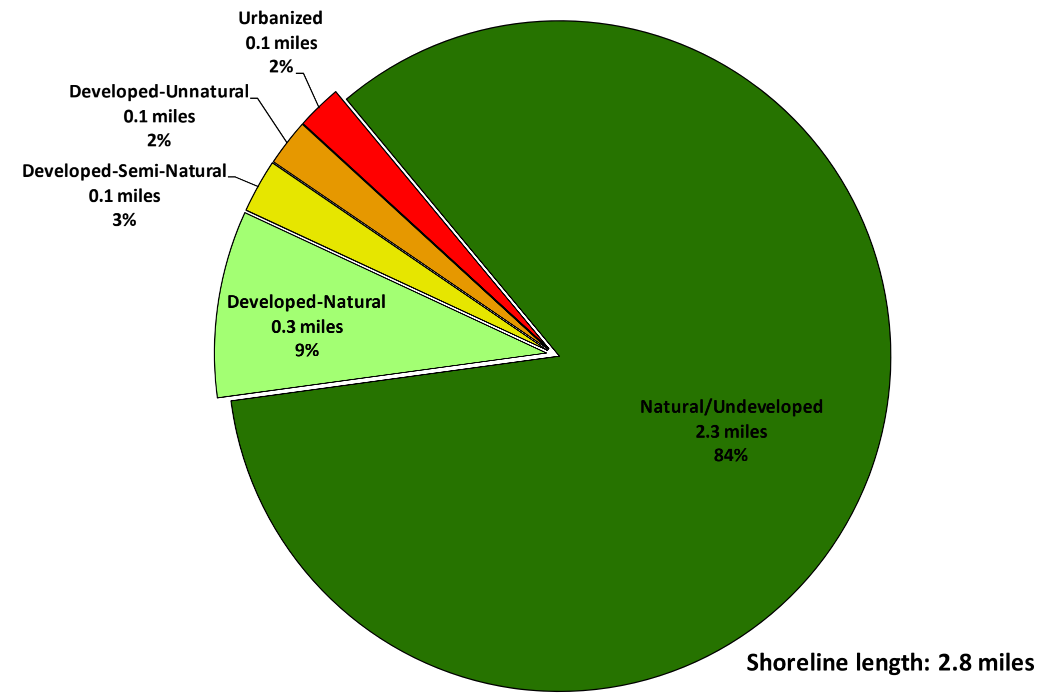


Figure 8.5.3-1. Fawn Lake shoreland categories and total lengths. Based upon a late summer 2013 survey. Locations of these categorized shorelands can be found on Fawn Lake Map 1.

Coarse Woody Habitat

As part of the shoreland condition assessment, Fawn Lake was also surveyed to determine the extent of its coarse woody habitat. Coarse woody habitat was identified and classified in three size categories (2-8 inches in diameter, 8+ inches in diameter, or clusters 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, 113 total pieces of coarse woody habitat were observed along 2.8 miles of shoreline (Fawn Lake Map 2), which gives Fawn Lake a coarse woody habitat to shoreline mile ratio of 40:1 (Figure 8.5.3-2). Only instances where emergent coarse woody habitat extended from shore into the water were recorded during the survey. Ninety-one pieces of 2-8 inches in diameter pieces of coarse woody habitat were found, fifteen pieces of 8+ inches in diameter pieces of coarse woody habitat were found, and seven 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 Fawn 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 Fawn Lake falls above the 75th percentile of these 98 lakes (Figure 8.5.3-2).

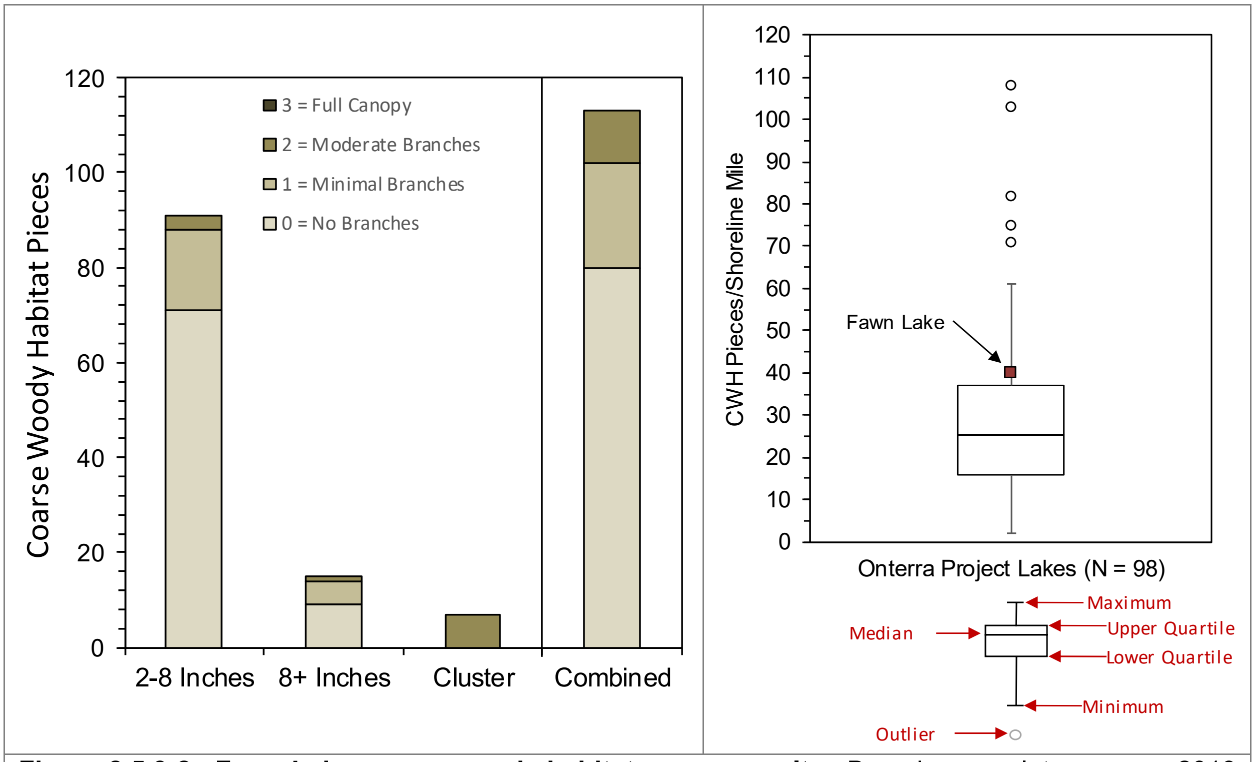


Figure 8.5.3-2. Fawn Lake coarse woody habitat survey results. Based upon a late summer 2013 survey. Locations of the Fawn Lake coarse woody habitat can be found on Fawn Lake Map 2.

8.5.4 Fawn Lake Aquatic Vegetation

An early season aquatic invasive species survey was conducted on Fawn Lake on June 25, 2013. 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 curly-leaf pondweed which should be at or near its peak growth at this time. During this meander-based survey of the littoral zone, Onterra ecologists did not locate any occurrences of curly-leaf pondweed or any other submersed non-native aquatic plant species.

The aquatic plant point-intercept survey was conducted on Fawn Lake on July 31, 2013 by Onterra. The floating-leaf and emergent plant community mapping survey was completed on that same day to map these community types. During all surveys, 43 species of native aquatic plants were located in Fawn Lake (Table 8.5.4-1). 32 of these species were sampled directly during the point-intercept survey and are used in the analysis that follows, while 11 species were observed incidentally during visits to Fawn Lake.

Aquatic plants were found growing to a depth of 18 feet. As discussed later on within this section, many of the plants found in this survey indicate that the overall community is healthy, diverse and in one species case somewhat rare. Of the 200 point-intercept locations sampled within the littoral zone, roughly 98% contained aquatic vegetation. Fawn Lake Map 3 indicates that most of the point-intercept locations that contained aquatic vegetation are located in shallow bays that are more likely to hold organic substrates. Approximately 13% of the point-intercept sampling locations where sediment data was collected at were sand, 87% consisted of a fine, organic substrate (muck) and 0% were determined to be rocky (Chain-wide Fisheries Section, Table 3.5-5).

Table 8.5.4-1. Aquatic plant species located in Fawn Lake during 2013 plant surveys.

Growth Form	Scientific Name	Common Name	Coefficient of Conservatism (c)	2013 (Onterra)
Emergent	*Carex comosa*	Bristly sedge	5	*I*
	Carex gynandra	Nodding sedge	6	*I*
	Carex crawfordii	Crawford's sedge	5	*I*
	Carex pseudocyperus	Cypress-like sedge	8	*I*
	Dulichium arundinaceum	Three-way sedge	9	*X*
	Eleocharis palustris	Creeping spikerush	6	*I*
	Iris versicolor	Northern blue flag	5	*I*
	Scirpus cyperinus	Wool grass	4	*I*
	Schoenoplectus tabernaemontani	Softstem bulrush	4	*I*
	Sagittaria latifolia	Common arrowhead	3	*I*
	Sagittaria rigida	Stiff arrowhead	8	*X*
	Typha spp.	Cattail spp.	1	*X*
	Zizania sp.	Wild rice Species	8	*X*
FL	*Brasenia schreberi*	Watershield	7	*X*
	Nuphar variegata	Spatterdock	6	*X*
	Nymphaea odorata	White water lily	6	*X*
	Polygonum amphibium	Water smartweed	5	*I*
Submergent	*Bidens beckii*	Water marigold	8	*X*
	Callitriche sp.	Starwort sp.	N/A	*I*
	Chara spp.	Muskgrasses	7	*X*
	Ceratophyllum demersum	Coontail	3	*X*
	Elodea canadensis	Common waterweed	3	*X*
	Heteranthera dubia	Water stargrass	6	*X*
	Myriophyllum sibiricum	Northern watermilfoil	7	*X*
	Najas flexilis	Slender naiad	6	*X*
	Potamogeton epihydrus	Ribbon-leaf pondweed	8	*X*
	Potamogeton foliosus	Leafy pondweed	6	*X*
	Potamogeton spirillus	Spiral-fruited pondweed	8	*X*
	Potamogeton vaseyi	Vasey's pondweed	10	*X*
	Potamogeton strictifolius	Stiff pondweed	8	*X*
	Potamogeton friesii	Fries' pondweed	8	*X*
	Potamogeton berchtoldii	Small pondweed	7	*X*
	Potamogeton gramineus	Variable pondweed	7	*X*
	Potamogeton pusillus	Small pondweed	7	*X*
	Potamogeton amplifolius	Large-leaf pondweed	7	*X*
	Potamogeton richardsonii	Clasping-leaf pondweed	5	*X*
	Potamogeton praelongus	White-stem pondweed	8	*X*
	Potamogeton zosteriformis	Flat-stem pondweed	6	*X*
	Potamogeton robbinsii	Fern pondweed	8	*X*
	Sagitaria sp. (rosette)	Arrowhead rosette	N/A	*X*
	Utricularia intermedia	Flat-leaf bladderwort	9	*X*
	Utricularia vulgaris	Common bladderwort	7	*X*
	Vallisneria americana	Wild celery	6	*X*

FL = Floating Leaf
X = Located on rake during point-intercept survey; I = Incidental Species

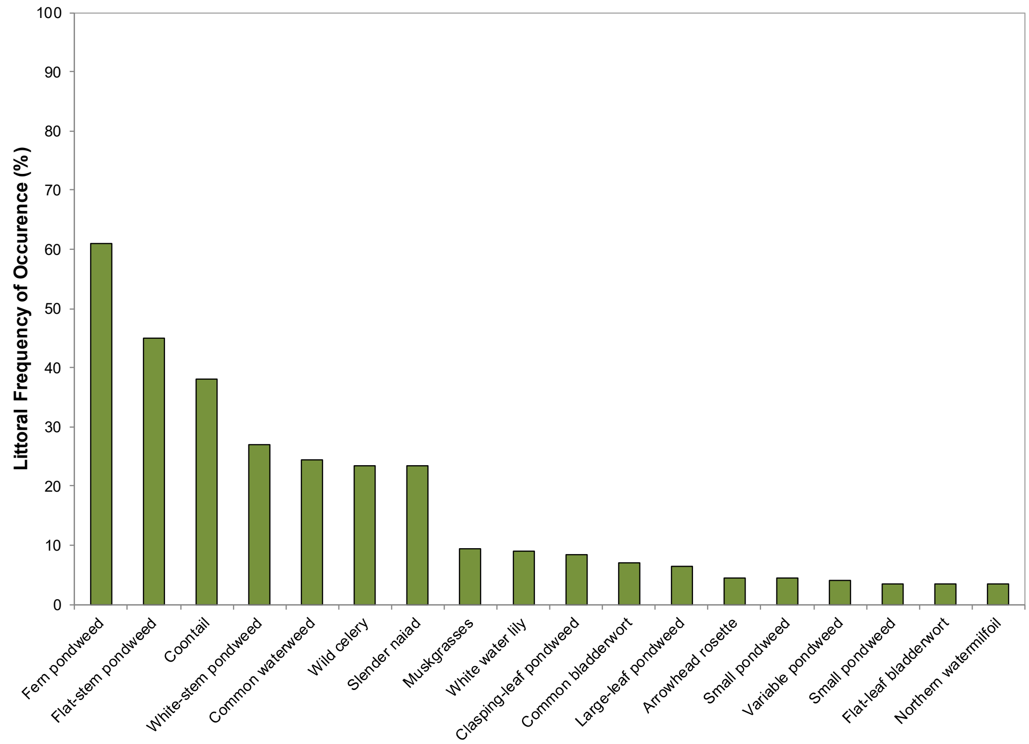


Figure 8.5.4-1. Fawn Lake aquatic plant littoral frequency of occurrence analysis. Created using data from a 2013 point-intercept survey. Please note that only species with a frequency of occurrence greater than 3% are depicted.

Figure 8.5.4-1 (above) shows that fern pondweed, flat-stem pondweed and coontail were the most frequently encountered plants within Fawn Lake. Fern pondweed is a low-growing plant that was likely named after its palm-frond or fern-like appearance. This plant is known to provide habitat for smaller aquatic animals that are used as food by larger, predatory fishes. Flat-stem pondweed, as its name implies, is a freely branched plant with strongly flattened stems and long, stiff leaves. Flat-stem pondweed lacks floating leaves, a feature many plants in the *Potamogeton* genus have. This plant can be a locally important food source to many aquatic and terrestrial organisms. Coontail is largely un-rooted (although do sometimes possess structures that function similar to roots or become partially buried in the sediment) and its locations can be largely a product of water movement.

One species discovered during 2013 studies, Vasey's pondweed (*Potamogeton vaseyi*), is listed by the Wisconsin Natural Heritage Inventory as a species of special concern in Wisconsin due to uncertainty regarding its distribution and abundance in Wisconsin. Vasey's pondweed is typically found in bays of large soft-water lakes as well as in rivers and ponds.

During aquatic plant inventories, 43 species of native aquatic plants (including incidentals) were found in Fawn Lake. Because of this, one may assume that the system would also have a high diversity. As discussed earlier, how evenly the species are distributed throughout the system also influence the diversity. The diversity index for Fawn Lake's plant community (0.90) lies above the Northern Lakes and Forest Lakes ecoregion value (0.86), indicating the lake holds exceptional diversity.

As explained earlier in the Manitowish Waters Chain of Lakes-wide document, the littoral frequency of occurrence analysis allows for an understanding of how often each of the plants is located during the point-intercept survey. 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 pondweed was found at 61% of the sampling locations, its relative frequency of occurrence is 19%. Explained another way, if 100 plants were randomly sampled from Fawn Lake, 19 of them would be fern pondweed. This distribution can be observed in Figure 8.5.4-2, where together 7 native (and one non-native) species account for 75% of the aquatic plant population within Fawn Lake, while the other 25 species account for the remaining 25%. 11 additional native species were found incidentally from the lake but not from of the point-intercept survey, and are indicated in Table 8.5.4-1 as incidentals.

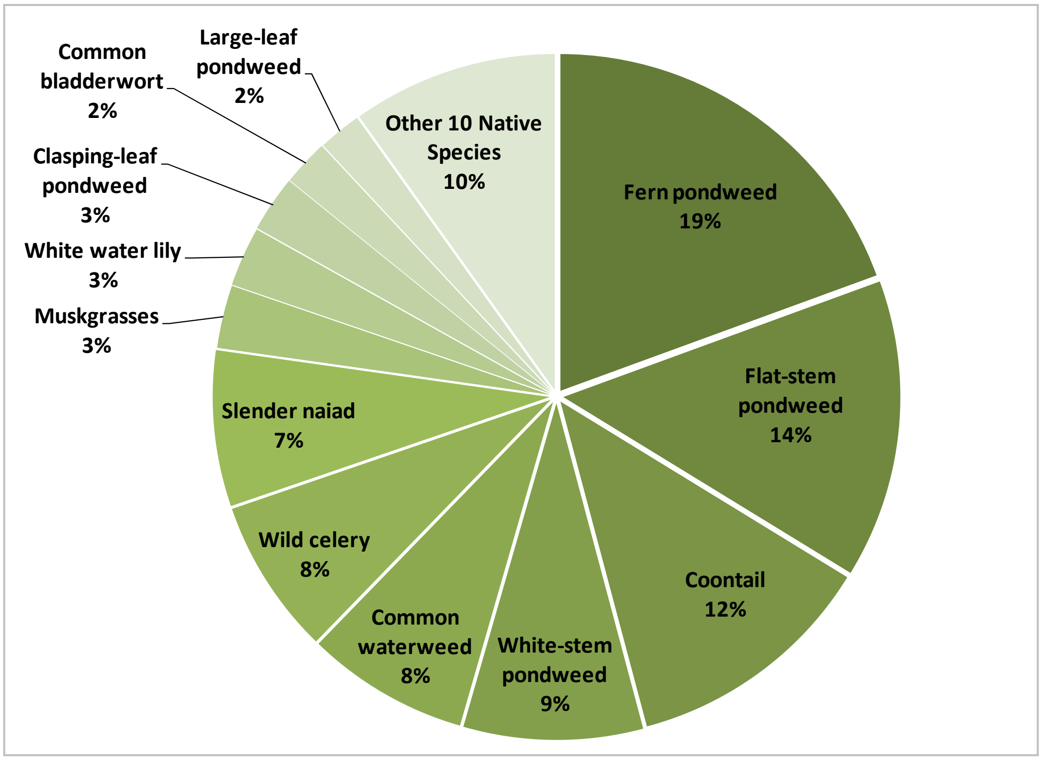


Figure 8.5.4-2. Fawn Lake aquatic plant relative frequency of occurrence analysis. Created using data from 2013 point-intercept survey.

Fawn Lake's average conservatism value (6.8) is higher than the state (6.0) and the Northern Lakes and Forests ecoregion median (6.7). This indicates that the plant community of Fawn Lake is indicative of a mostly undisturbed system. Combining Fawn Lake's species richness and average conservatism values to produce its Floristic Quality Index (FQI) results in a value of 38.3 which is above the median values of the ecoregion and state.

The quality of Fawn Lake is also indicated by the high incidence of emergent and floating-leaf plant communities that occur in many areas. The 2013 community map indicates that approximately 13.5 acres of the lake contains these types of plant communities (Fawn Lake Map 4, Table 8.5.4-2). Seventeen floating-leaf and emergent species were located on Fawn Lake (Table 8.5.4-1), all of which provide valuable wildlife habitat.

Table 8.5.4-2. Fawn Lake acres of emergent and floating-leaf plant communities from the 2013 community mapping survey.

Plant Community	Acres
Emergent	2.1
Floating-leaf	11.4
Mixed Floating-leaf and Emergent	-
Total	13.5

The community map represents a 'snapshot' of the emergent and floating-leaf plant communities, replications of this survey through time will provide a valuable understanding of the dynamics of these communities within Fawn Lake. This is important, because these communities are often negatively affected by recreational use and shoreland development. Radomski and Goeman (2001) found a 66% reduction in vegetation coverage on developed shorelines when compared to undeveloped shorelines in Minnesota Lakes. Furthermore, they also found a significant reduction in abundance and size of northern pike (*Esox lucius*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*Lepomis gibbosus*) associated with these developed shorelines.

Non-Native Aquatic Plants in Fawn Lake

Curly-leaf Pondweed

Curly-leaf pondweed (*Potamogeton crispus*) is discussed in detail at the end of the Aquatic Plant Section 3.4. Monitoring results, control actions, and a description of the plant's lifecycle are contained in that section.

Curly-leaf pondweed was first discovered in Fawn Lake during 2018. Through 2019, the infrequent occurrences of this exotic were managed through volunteer and professional hand-harvesting. As a part of the Manitowish Waters Comprehensive Management Plan, Fawn Lake's curly-leaf pondweed population will be monitored by volunteers and professionals with control actions being implemented as appropriate.

Onterra LLC
Lake Management Planning

8.5.5 Fawn Lake Fisheries Data Integration

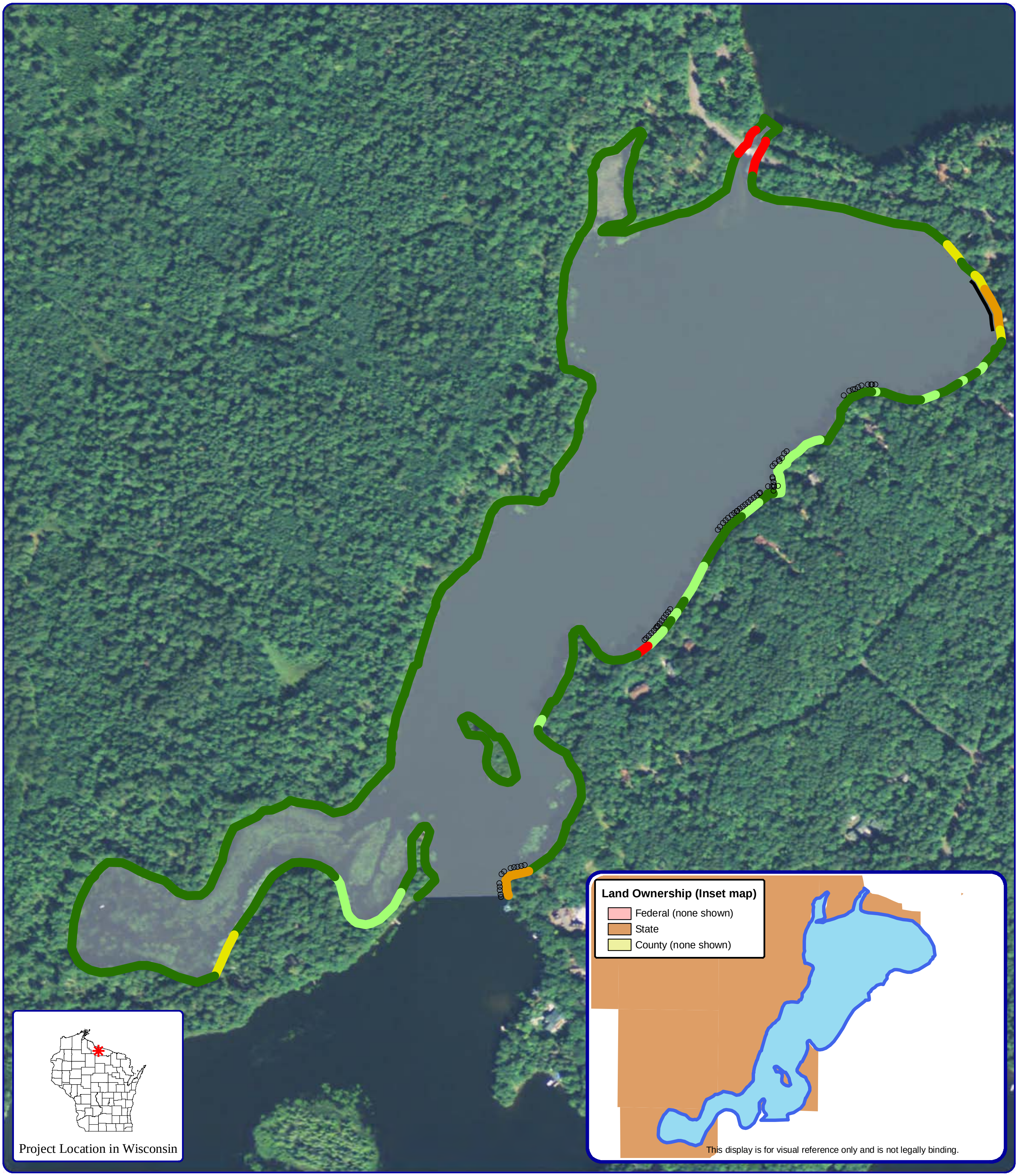
Fishery management is an important aspect in the comprehensive management of a lake ecosystem; therefore, a brief summary of available data is included here and within the chain wide report section as a reference. The following section is not intended to be a comprehensive plan for the lake's fishery, as those aspects are currently being conducted by the fisheries biologists overseeing Fawn 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 Hadley Boehm (WDNR 2018 & GLIFWC 2017).

Fish Stocking

To assist in meeting fisheries management goals, the WDNR may stock fry, fingerling or adult fish in a waterbody that were raised in nearby permitted hatcheries. 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. No known stocking has been conducted on Fawn Lake.

Fawn Lake Spear Harvest Records

Although Fawn Lake has been declared as a spear harvest lake, it has not historically seen a harvest. It is possible 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.



N W E S

500

Feet

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

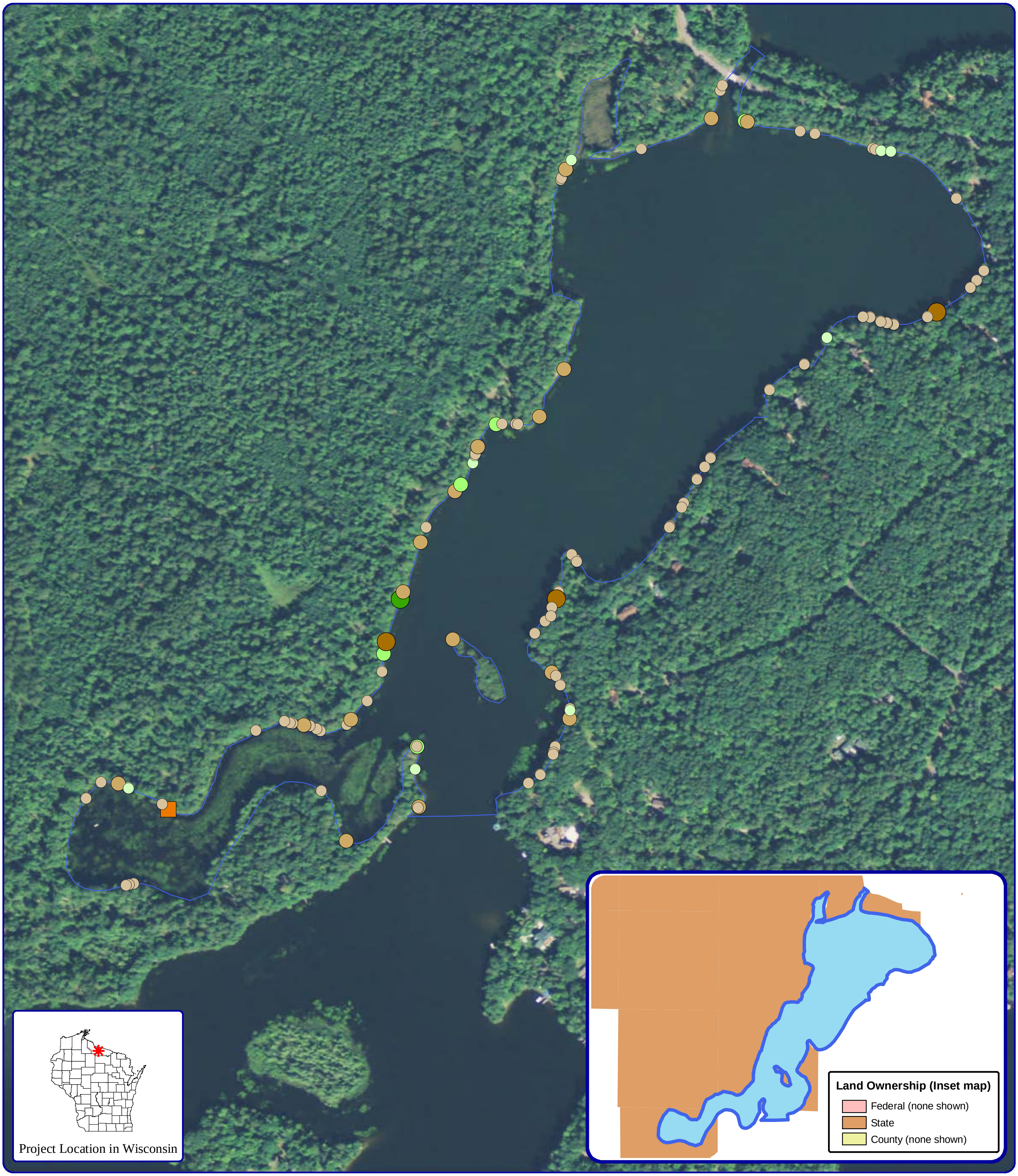
Sources:
Hydro, State Land and Roads: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plant Survey: Onterra, 2013
Map date: October 14, 2014
Filename: Fawn_ShorelandCondition_2014.mxd

Legend

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

Seawall
- Masonary/Metal/Wood
- Rip-Rap

Fawn Lake - Map 1
Manitowish Waters Chain of Lakes
Vilas County, Wisconsin
Shoreland Condition



500
Feet

Legend

2-8 Inch Pieces
- No Branches
- Minimal Branches
- Moderate Branches
- Full Canopy (none)

8+ Inch Pieces
- No Branches
- Minimal Branches
- Moderate Branches
- Full Canopy (none)

Cluster of Pieces
- No Branches (none)
- Minimal Branches (none)
- Moderate Branches
- Full Canopy (none)

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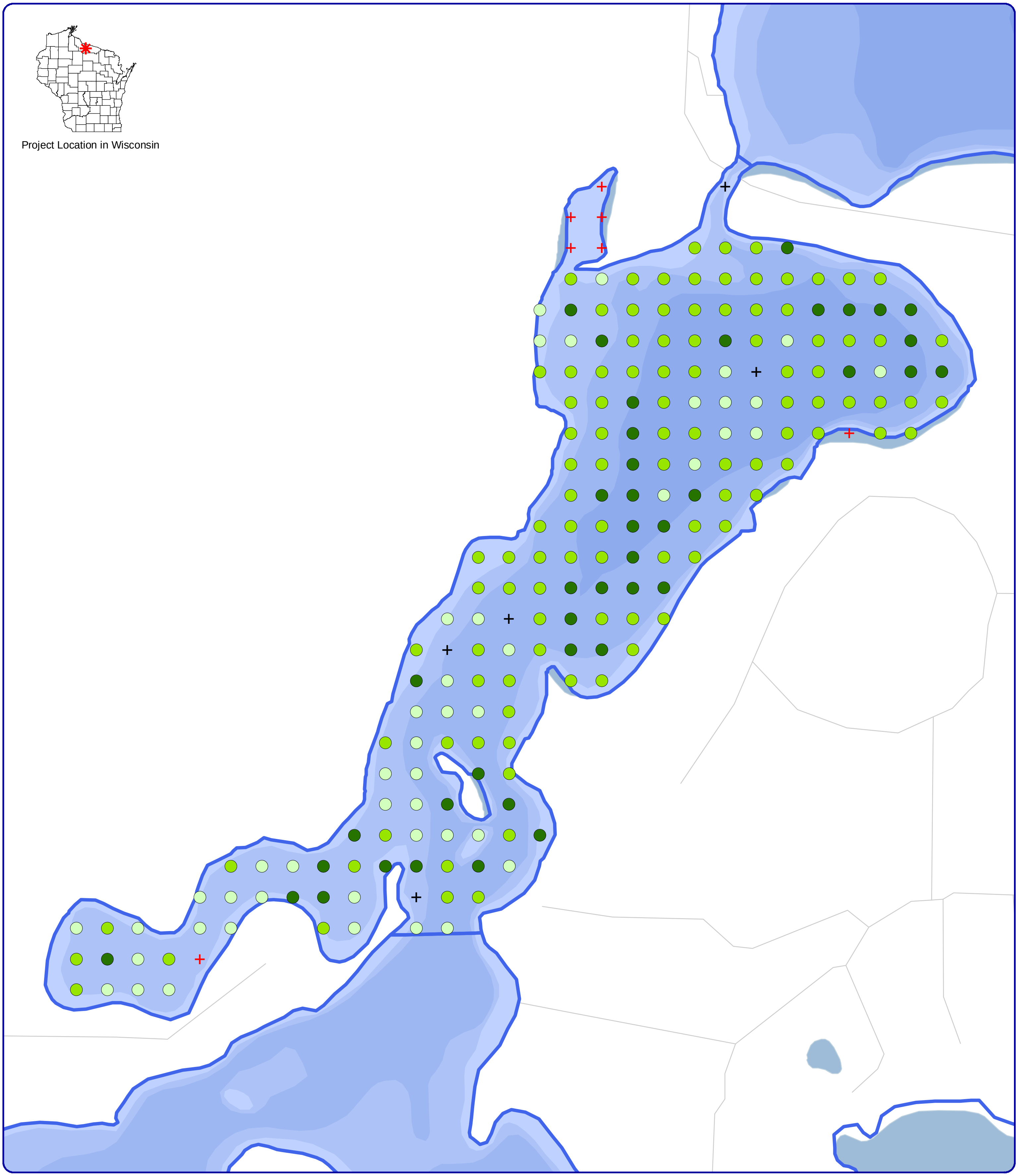
Sources:
Hydro: WDNR
Aquatic Plants: Onterra, 2013
Orthophotography: NAIP, 2013
Map date: October 6, 2014
Filename: Fawn_CWH_2014.mxd

Fawn Lake - Map 2
Manitowish Waters Chain of Lakes
Vilas County, Wisconsin
Coarse Woody Habitat



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

Sources:
Roads and Hydro: WDNR
Map Date: December 16, 2014
Filename: Fawn_TRFPI_2013.mxd

Legend

2013 Point-intercept Survey

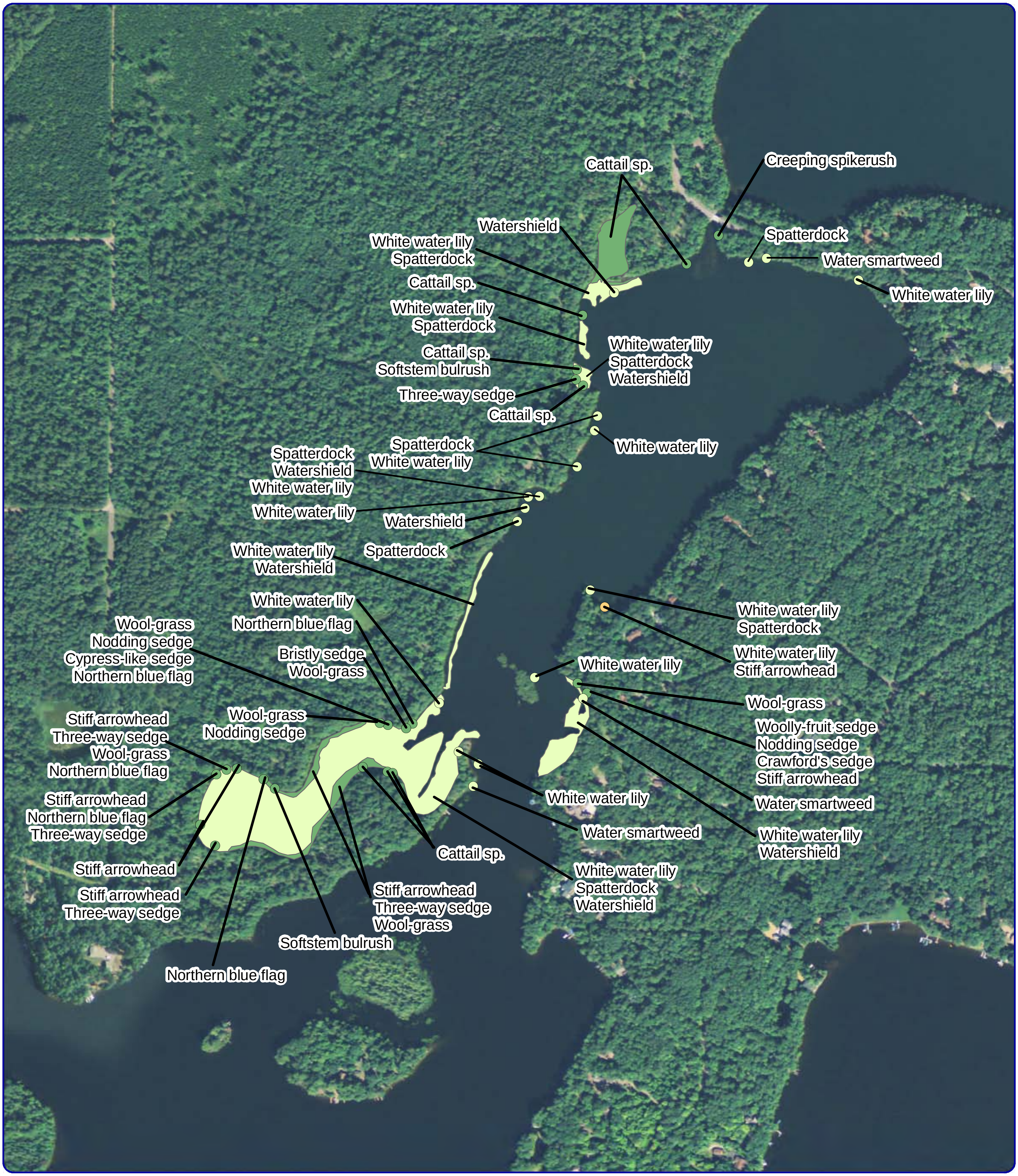
- Total Rake Fullness = 1
- Total Rake Fullness = 2
- Total Rake Fullness = 3
- No Vegetation
- Non-navigable
- Deep

Fawn Lake - Map 3

Manitowish Waters
Chain of Lakes

Vilas County, Wisconsin

Aquatic Plant Distribution



N
W E
S

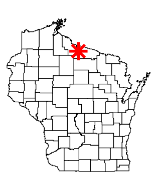
650

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, 2013
Orthophotography: NAIP, 2010
Map date: January 29, 2014
Filename: *Fawn_Comm_2013.mxd*



Project Location in Wisconsin

Legend

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

Map 4

Fawn Lake

Vilas County, Wisconsin

Aquatic Plant Communities