

Lauderdale Lakes Aquatic Plant Management Plan Update



Prepared for:
Lauderdale Lake Management District

Prepared by:
Mark Kordus, Associate

James Scharl, Staff Scientist

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1.0 INTRODUCTION / SUMMARY

Lauderdale Lakes is a chain of three lakes – Green, Middle, and Mill – that compromise 841 total surface acres in Walworth County. These waterbodies are locally important to many year-round residents and, with their proximity to larger metropolitan areas of Milwaukee, Madison, Chicago and northern Illinois, they support a wide array of heavy recreational use year round. Increasing lakeshore development, introduction of aquatic invasive species (AIS), and high recreational use have been cause for concern to protect the lakes for continued use while also maintaining existing quality.

To achieve this, multiple interest groups led by the Lauderdale Lake Management District (LLMD) have collaborated to manage the resources to ensure their use for future generations. Lake management activities have been focused on aquatic plant control as outlined under the current aquatic plant management plan (APMP) completed by the Southeastern Wisconsin Regional Planning Commission (SEWRPC). Currently, the plan was created and approved in 2010 with recommendations for aquatic plant management to focus on mechanical harvesting. Harvesting has replaced herbicide use within the chain, having been in place since 2002 and permitted for 200 acres across all three lakes.

Harvesting permits are issued for 5-year periods and the current permit expired after the 2014 season and was based on data collected in 2008 as part of the 2010 APMP. Continuation of harvesting to alleviate aquatic plant navigation issues is desired by the LLMD. In order to obtain a new permit, updated aquatic plant surveys were requested by WDNR to form an updated harvesting amendment to the current APMP to reflect current conditions. This document will serve as an update of the aforementioned plan.

1.1 LAUDERDALE LAKES MORPHOLOGY

The Lauderdale Lakes are located in the Towns of LaGrange and Sugar Creek, Walworth County, Wisconsin. A small impoundment at the outlet of Mill Lake on Honey Creek connects three, naturally occurring basins, allowing for unassisted navigation between all three lakes. All three lakes feature relatively deep basins with depths over 40', the deepest being Green Lake at 55 feet. Steep dropping shorelines limit habitat suitable for aquatic plant growth in many portions of the lakes. However, both Middle and Mill Lake have extensive areas under 10 feet deep. Much of this area in Middle Lake is protected under a WDNR designated environmentally sensitive areas due to its aquatic ecosystem diversity, limiting management to common navigational channels. Morphological characteristics of all lakes are found in Table 1 below. For further information relating to water quality, watershed and fisheries, please see: An Aquatic Plant Management Plan for the Lauderdale Lakes, SEWRPC, 2010.

Table 1: Lauderdale Lakes Morphology, Walworth County, Wisconsin

| | Entire System | Green Lake | Middle Lake | Mill Lake |
|-----------------------|---------------|------------|-------------|-----------|
| Surface Area (ac) | 841 | 311 | 259 | 271 |
| Lakes Volume | 12591 | --- | --- | --- |
| Shoreline Length (mi) | 14.7 | --- | --- | --- |
| Maximum Depth (ft) | 55 | 55 | 42 | 44 |
| Mean Depth (ft) | 14.3 | --- | --- | --- |

1.2 AQUATIC PLANTS

Aquatic plants are vital to the health of a water body. Unfortunately, they are often negatively referred to as “weeds”. The misconceptions this type of attitude brings must be overcome in order to properly manage a lake ecosystem. Rooted aquatic plants are extremely important for the well-being of a lake community and possess many positive attributes. Despite their importance, they sometimes grow to nuisance levels that hamper recreational activities and are common in degraded ecosystems. The introduction of AIS, such as EWM, often can increase nuisance conditions, particularly when they successfully out-compete native vegetation and occupy large portions of a lake.

To assess the state of the current plant communities, full point-intercept surveys were completed by Stantec, Inc. (Stantec) on July 29-30 for Green and Mill Lakes and by WDNR on Middle Lake from August 11 - 13. All surveys followed WDNR survey protocol and included sampling pre-determined locations to document the following at each site:

- Individual species present and their density
- Water depth
- Bottom substrate

Each location was assigned coordinates and loaded into a GPS unit, which was used to navigate to each point. Data collected at each point was then entered into a DNR spreadsheet, which outputs various aquatic plant community indexes and data, allowing for a comparison to past data to monitor changes over time. Information on methods and all referenced tables, figures or charts is included in Appendices A-D.

Past management plans for Lauderdale Lakes also included aquatic plant surveys, providing historical background to document potential changes in the communities over time. Surveys were completed in 1969, 1999, and most recently in 2008 for the current APMP. The 1969 survey was a presence/absence inventory that did not generate statistics. Both the 1999 and 2008 sets of surveys were completed as line-transects surveys. These surveys focused on near-shore areas in limited locations throughout the lake.

To better document aquatic communities, the WDNR adopted the point-intercept survey method above. This method allows for repetition of past surveys by reusing pre-established sample locations. Because of the difference in techniques between the 2014 surveys and those used prior, direct comparison is difficult, limiting it to presence/absence between surveys only, including use of Floristic Quality Index (FQI).

To compare changes in the plant community over time within Lauderdale Lakes and to similar lakes in Wisconsin, the FQI can be used. FQI provides the ability to compare aquatic plant communities based on species presence. This value varies throughout Wisconsin, ranging from 3.0 to 44.6 with a statewide average of 22.2. To achieve this, each plant species, except for AIS, is assigned a coefficient of conservatism value (C values). A plant's C value relates to a plant species' ability to tolerate disturbance. Low C values (0-3) indicate that a species is very tolerant of disturbance, while high C values (7-10) indicate species with a low tolerance of disturbance. Intermediate C values (4-6) indicate plant species that can tolerate moderate disturbance.

Not only does this track changes over time within the Lauderdale Lakes, but allows for comparison of the Lakes to lakes with similar environmental conditions within a delineated area, called an eco-region, to be compared.

Lauderdale Lakes are located in the southern portion of the Southeastern Till Plains eco-region. Lake within the Southeastern Till Plains are typically natural lakes that, due to higher population density in this area of the State, have developed shoreline. Increased development around the lake and overall use of these lakes leads to more disturbance from an undisturbed, natural condition, which leads to lower plant community metrics like FQI and coefficient of conservatism.

1.3 2014 POINT-INTERCEPT SURVEYS

In 2014, the aquatic plant surveys identified a moderately diverse community in Green and Mill Lakes with a very diverse community in Middle Lake. Total species identified within the lakes ranged from 13 (Green) to 28 (Middle) with two AIS – Eurasian water-milfoil (*Myriophyllum spicatum*- EWM) and curly-leaf pondweed (*Potamogeton crispus* - CLP), found in Middle and Mill Lakes and only EWM found in Green Lake (Table 2).

Species sampled in the Lakes were present in three categories: emergent, near shore species which are rooted below the water's surface, but their growth extends above the water (bur-reed - *Sparganium* sp.), submersed species which root on the lake bottom and remain below the water's surface (coontail – *Ceratophyllum demersum*), and floating-leaf species which root on the lake bottom with vegetation growing to and floating on the surface (white water lily – *Nymphaea odorata*). Raw data for all surveys is included in Appendix D.

The photic zone, depth to which sunlight reaches the bottom, allowing plants to grow, was similar for all lakes, with plant growth noted to 11.5-12 feet across the Chain. However, amount of photic zone vegetated varied between the lakes, with the lowest amount (62.5%) in Green Lake, limited to many areas of steep dropping shoreline that, though shallow enough for light to penetrate to the bottom, did not provide ideal growing conditions. Native species richness exhibited good diversity per sample point and remained nearly stable throughout the chain with a moderately good spread throughout the system, as exhibited by a Simpson Diversity Index (SDI) varying only slightly from 0.80 – 0.84 throughout. A SDI value closer to 1.0 indicates a healthier, more evenly spread plant community (Table 3).

1.3.1 Green Lake

The aquatic plant community of Green Lake was sampled on July 29, 2014 by Stantec. A full point-intercept survey was completed and included sampling at 695 locations. Because of the steep-dropping bottom in many areas, vegetation within Green Lake was limited to a sand hard-bottom flat that, though within the photic zone, does not provide ideal growing conditions due to nutrient limitation with sandy sediments.

The aquatic macrophyte community of the Lake included 13 floating-leaf, emergent, and submerged aquatic plant species during 2014 (Table 4). Figures 1.1 – 1.4 illustrate the locations of each AIS found and any species identified with a relative frequency of occurrence of 5% or greater.

Plants were found growing to a maximum depth of 12 feet, with only 317 of the 695 locations shallower than this and 62.5% of locations within the photic zone vegetated. Muskgrass (*Chara* sp.), a macro-algae, was the most dominant species sampled in 2014, found at 25.9% of photic-zone locations. This species prefers sandy areas, often times creating a carpet in shallow locations. Much of the Lauderdale Lakes provide excellent habitat for muskgrass, making it the most prevalent species within all three lakes. Wild celery (*Vallisneria americana*) and sago pondweed (*Stuckenia pectinata*), both native plants valuable for near-shore sediment stabilization and important food sources for waterfowl, were the next most common species sampled (Table 4).

Only one AIS was found; Eurasian water-milfoil. This species can grow rapidly and dense, reaching the surface and forming a canopy that shades out native species and hampers recreational use and spreads through fragmentation. Mechanical harvesting cuts growing plants. If all cut portions are not removed from the water it can provide an ideal mechanism for EWM to spread throughout a system. Even with an intensive harvesting program in place on Lauderdale Lakes, EWM growth does not appear to increase by harvesting. Though spread throughout many portions of Green Lake, there were no locations of dense EWM growth noted.

Past surveys on Green Lake are comparable to the current one with both identifying more species than found in 2014 – 18 in 1999 and 20 in 2008. Three species identified in 2014 were new compared to historical records; common bladderwort, arum-leaved arrowhead, and alpine pondweed, though all were likely present during past surveys. Bladderwort was present, but not identified to species level in 2008 (Table 5).

Conversely, three species sampled in both 1999 and 2008 were not sampled in 2014; northern-water-milfoil, Illinois pondweed, and flat-stem pondweed. Northern water-milfoil can readily hybridize with its invasive cousin EWM, creating a plant that has characteristics of both species, but most often resembles EWM. With EWM first identified in 1990 in Lauderdale Lakes, it is likely the EWM within Green Lake and the entire chain is actually a hybrid. However, genetic analysis is required to determine hybridity. The local WDNR lake manager can assist with genetic analyses, which is highly recommended.

Though individual members of the aquatic plant community have changed over time, the FQI has remained stable with average coefficient increasing over all three surveys. FQI across all surveys averaged 20.64, most recently being calculated at 20.2 in 2014. Though lower than that found in 2008, the average coefficient rose considerably to 6.09, over one full point higher than 1999. This shows an increasingly stable plant community comprised of plants less tolerant of disturbance and higher quality. This is especially notable in the presence of active mechanical harvesting, invasive species, and high recreational use, all three which contribute to disturbance, further showing a stable and healthy plant community in Green Lake (Table 6).

1.3.2 Middle Lake

The aquatic plant community of Middle Lake was sampled on August 11 - 13, 2014 by WDNR staff. A full point-intercept survey was completed and included sampling at 588 locations. Middle Lake has a deep basin, but also a large, shallow soft-sediment area that creates ideal growing conditions for aquatic vegetation. This area is a high-value habitat area and, as such, is designated as an environmentally sensitive area by the WDNR to protect it from management and use on the Lake. Because of this, the community within Middle Lake is typically the most diverse of the entire Lauderdale Lakes system.

The aquatic macrophyte community of the Lake included 28 floating-leaf, emergent, and submerged aquatic plant species during 2014 (Table 7). Figures 2.1 – 2.4 illustrate the locations of each AIS found and any species identified with a relative frequency of occurrence of 5% or greater.

In Middle Lake, the photic zone extended to a maximum depth of 12 feet, with 401 of the 588 locations shallower than this. Much of the photic zone was vegetated, due to better habitat, with 85.9% of locations within the photic zone vegetated. Muskgrass was the most dominant species, sampled in at 68.3% of photic-zone locations. Spiny naiad (*Najas mariana*) was the next most common species at 25.9% of photic locations. Though not native to Wisconsin, this species is not considered invasive and does not become a nuisance, simply blending in with the lake's ecosystem. Spiny naiad provides good food and habitat for fish and can be an important food source for ducks. Similar to Green Lake, sago pondweed was the next most common species sampled (Table 7).

Both EWM and CLP were found within Middle Lake, though neither of them was reported as dense. The life cycle of curly-leaf pondweed is different from all other aquatic plants in Wisconsin such that it dies back during mid to late summer, typically in July. Because of this, early-season surveys typically completed in May are required to accurately document distribution of CLP within a lake. It is likely that CLP is under represented by all surveys completed on Lauderdale Lakes due to this.

Middle Lake has historically contained the most diverse plant community of the Lauderdale Chain. Past surveys are comparable to the current one, though diversity increased greatly from 2008 to 2014 by 8 species. Diversity in Middle Lake is greatly enhanced by the protection provided by the large, WDNR sensitive area. This designation limits management within it, creating a near-natural condition. Many high quality species are present only in this location on the whole Chain. Bladderwort species are unique family of aquatic plants with the ability to be "carnivorous" to obtain some of their nutrients, often being successful in low-nutrient conditions where other species struggle. They get their name from small bladders located on the plant that trap tiny zooplankton, which the plant feeds on. Many of the species are high quality and uncommon in Wisconsin and three are present in Middle Lake: common bladderwort (*Utricularia vulgaris*), twin-stemmed bladderwort (*Utricularia geminiscapa*), and creeping bladderwort (*Utricularia gibba*).

Three individual species identified in 2014 were new compared to historical records; whorled water-milfoil – a high-quality native milfoil rarely found in southern Wisconsin, and both twin-stem and creeping bladderwort. Though new, both bladderworts were possibly present in past surveys as only bladderwort species were recorded. No species present in both 1999 and 2008 surveys were absent in 2014 (Table 8).

With a high diversity, FQI is exceptionally high in Middle Lake. It has increased from past surveys after remaining stable from 1999 to 2008. Average coefficient, though down slightly from 2008, is also still high and relatively stable at 5.74. The large WDNR sensitive area provides valuable protection for many of these species, creating a high-quality and stable plant community by protecting them from disturbance in Middle Lake (Table 9).

1.3.3 Mill Lake

The aquatic plant community of Mill Lake was sampled on July 30, 2014 by Stantec. A full point-intercept survey was completed and included sampling at 457 locations. Much of Mill Lake is shallow, especially the southern half, and as such is conducive to aquatic vegetation. Because of this, Mill Lake can see the densest plant growth out of all three lakes and requires the most harvesting management. Mill Lake also has the largest infestation of EWM.

The aquatic macrophyte community of Mill Lake included 17 floating-leaf, emergent, and submerged aquatic plant species during 2014 (Table 10). Figures 3.1 – 3.4 illustrate the locations of each AIS found and any species identified with a relative frequency of occurrence of 5% or greater.

Similar to the other lakes, plants were found growing to a maximum depth of 11.5 feet, with 296 of the 457 locations shallower than this and 77.9% of these vegetated. Also like the remainder of the system, muskgrass was the most dominant species sampled found at 37.1% of photic-zone locations. Wild celery was the next most common species sampled (Table 11).

Unlike the Green and Middle Lake, Mill Lake has a sizable infestation of EWM as the third-most abundant species sampled in 2014. EWM was spread throughout much of the lake at 28.7% of the photic zone and especially common in the southern portion and the small, boat landing bay. Though abundant, populations of EWM were not dense, with no density over 1.00 recorded, likely due to active harvesting keeping it from becoming a nuisance. Curly-leaf pondweed was also sampled, but at only two locations and is likely under represented due to its life cycle.

Even with the most intensive levels of harvesting and largest spread of AIS within the system, the community of Mill Lake remained diverse. Twenty-one species were found in both previous surveys and dipped slightly to 17 found in 2014. Vegetated sites within Mill Lake had the highest average number of species per location (2.01) on the whole system and highest presence of wild celery, which is important for near-shore stabilization of lake sediments, even more so on heavily recreated lakes that have high amounts of boat wake. Three species found in both previous surveys were not present in 2014; northern water-milfoil, large-leaf pondweed, and leafy pondweed (Table 11).

As a continued theme for Mill Lake, even with high mechanical management and AIS presence, FQI and coefficients within were reasonably high and stable. Though FQI dropped, average coefficient remained stable from 2008, which increased from 1999. Increased management regime in Mill Lake is evident through its average C, which is the lowest of the lakes and is dominated mainly by plants moderately tolerant of disturbance, fewer with a C of 7 or above (Table 12).

1.3.4 All Lakes – 2014 Comparison

Though each lake is its own somewhat unique ecosystem, being a connected chain of waterbodies creates a stable system throughout. All Lauderdale Lakes are subject to the same atmospheric, use, and management conditions. Across each lake, the most common species present by lake, though varying slightly, was comprised of largely the same species. Muskgrass was the most common in all lakes while sago pondweed and spiny naiad were within

the five most common in each lake with EWM and wild celery the most prevalent in two out of three (Table 13).

Use of FQI and average C can also be extrapolated out to lakes in similar eco-regions of Wisconsin to compare communities. The Lauderdale Lakes lie within the Southeastern Till Plains eco-region and are typically more developed with higher recreational use. This impacts the plant communities and is shown by lakes in this eco-region typically having FQI and average C values below those found throughout the State. However, the lakes of the Lauderdale Chain have elevated C values, due to their diverse communities, and are near or exceed the upper quartile for all lakes in the eco-region while also comparing favorably to the mean C for the entire State. In conjunction, the FQI found on all lakes meet and exceed the mean FQI for the Southeastern Till Plains. Middle Lake's FQI surpasses even the upper quartile of eco-region and Wisconsin lakes, indicating a very healthy community comparative that to an undisturbed, natural condition (Table 14).

2.0 MANAGEMENT RECOMMENDATIONS

Management of aquatic plants can take many facets, depending on each lakes unique condition and desire by the community. To be successful, a management option must be accepted by its users. Though herbicide use has been done in the past within Lauderdale Lakes, its use has declined significantly since 2002. Herbicides for aquatic plant management can have negative connotations and be misunderstood by some users, making it potentially controversial. However, the combinations of periodic large scale whole lake type treatments for AIS have shown to reduce the need and frequency of harvesting for several years after treatment. These include periodic triggers based on frequency of occurrence of the AIS, which may be a hybrid, and is a management option that should be further explored by the District.

Currently, mechanical harvesting is practiced on all Lauderdale Lakes and is an accepted approach by riparian owners and lake users. Typically, this entails a high up-front cost to start with the purchase of harvesting equipment. Once started, however, cost can be minimized for upkeep and operation, though plant disposal can be an issue. With the general acceptance of this practice and overall minimal effect on the plant communities of Lauderdale Lakes, continuation of mechanical harvesting is recommended for all lakes. The following guidance for harvester operation and mechanical harvesting recommendations are based on historical aquatic plant management approaches and incorporate needs by lake users (Section 3.0).

Since harvesting can spread infestations of EWM by not removing all fragments cut, a multi-faceted approach should be considered. For Green and Mill Lakes, if EWM populations exceed 30% frequency of occurrence during a full point-intercept aquatic plant survey, whole-lake herbicide management should be considered to reduce infestation, opening up habitat for native species. This will reduce presence and spread of AIS and reduce harvesting cost and need after a large infestation becomes present. However, due to the large WDNR Sensitive Area on Middle Lake, this approach should NOT be used, only applied to Green and Mill Lakes. If any herbicide management is desired, pre and post-treatment aquatic plant surveys should be completed to document results.

All actions should follow Table 15 below based on strain of EWM present. Waiting to apply after formation of a thermocline has shown to reduce cost and amount of herbicide required to achieve target rates. Herbicide applied does not mix below an established thermocline. Currently, neither Green Lake (8.8%) nor Mill Lake (28.7%) exceeds the 30% frequency of occurrence threshold.

| EWM Littoral Zone | | Management Action(s) | |
|-------------------------------|---|---|--|
| Frequency | Task | Action | Timing |
| < 30.0% | 1 | Follow harvesting guidance | As needed throughout the year |
| | 1 | Pre-treatment aquatic plant survey | Mid-late April |
| | Whole-lake Herbicide Application | | |
| | 2 | Green Lake - 8055 ac/feet or 3353 ac/ft with 15' thermocline** Mill Lake - 2705 ac/feet or 1700 ac/ft with 15' thermocline** | May, prior to 65 degree water temperature |
| | 3 | Post-treatment aquatic plant survey | July/August |
| >30.0% | 4 | Follow harvesting guidance | Beginning 30 days after herbicide application and continuing as needed throughout the year |
| | Whole-lake Herbicide Application Information by EWM Strain | | |
| | Pure-strain Eurasian water-milfoil | | 2,4-D whole-lake at 0.25-0.350 PPM |
| Hybrid Eurasian water-milfoil | | 2,4-D / endothall mixture at 0.3 / 0.6 PPM | |
| | | Fluridone at 4-6 PPB maintained for 90+ days | |

** - Whole-lake and 15' thermocline volumes based on 2014 aquatic plant survey data

3.0 GENERAL GUIDANCE FOR HARVESTER OPERATION

- EXCEPT FOR NAVIGATIONAL ACCESS LANES, ONLY CUT IN DEPTHS MORE THAN THREE FEET
- PRIORITIZE HARVESTING AREAS TO FOCUS ON GREATEST NEED – Highest priority should be on maintaining navigation access lanes to/from boat landings and common navigational lanes. In these areas, you must leave 12 inches of plant on the lake bottom. Individual areas by priority are included in the table below.
- TOP CUT IN AREAS FOR EWM MANAGEMENT – These areas are of moderate priority. Restrict cutting up to a depth of 4’, leaving a minimum of 12 inches of plant growth on the lake bottom in areas shallower than 5 feet.
- RECREATIONAL HARVESTING AREAS – These areas of low priority and are to alleviate nuisance, surface-matting growth for riparian owners. Restrict harvesting from the end of pier heads to open water. Harvesting from pier-heads to shore should be done manually only.
- WILD CELERY – Removal of water celery shall be limited to areas that reach “nuisance” conditions – when water celery is closer than 2 feet from the water’s surface
- Harvesting of native pondweeds and/or muskgrass is prohibited.
- MINIMIZE IMPACTS TO WDNR ENVIRONMENTALLY SENSITIVE AREAS – Restrict harvesting to navigation channels only within these areas and to a depth of 2 feet, leaving 12 inches of plant growth on the lake bottom. Harvesting to occur after June 30th only.
- SURFACE SKIMMING ALLOWED IN ALL LOCATIONS EXCEPT FOR WDNR SENSITIVE AREAS – Outside of mapped areas, harvester may surface skim free-floating vegetation that has been previously cut or uprooted, but not collected, to a depth of 1 ft. **Use of the cutter head is not permitted for this action.**
- ALL CUT MATERIAL SHOULD BE INSPECTED FOR FISH AND ANIMALS. ANY ORGANISMS FOUND SHOULD BE IMMEDIATELY RETURNED TO THE WATER.
- ALL CUT MATERIALS SHOULD BE COLLECTED AND DEPOSITED AT THE DESIGNATED DISPOSAL SITE – Mr. Donald West’s property at W5865.
- Maps of all harvesting location and disposal site are included in Appendix E.

| Area | Description | Instructions |
|--------------------------------|-------------------------------|--|
| HIGH PRIORITY AREAS | | |
| A ₁ | Common access navigation lane | Cut a lane 50' wide to the 5' contour - must leave 12" of plant growth on the bottom* |
| A ₂ | Boating access lane | Cut a lane 15' wide to the 5' contour - must leave 12" of plant growth on the bottom* |
| MODERATE PRIORITY AREAS | | |
| B ₁ | EWM management areas | EWM Management Areas: Top cut to a depth of 4' to control surface matting of EWM growth and promote native species growth. Must leave 12" of plant growth on the bottom. |
| B ₂ | Riparian access | Top cut 2' from pier heads to open water for riparian access |
| LOW PRIORITY AREAS | | |
| C | Recreational areas | Surface cut only from pier heads to open water (variable widths). Manual harvest ONLY from shore to pier heads |

* - In Middle Lake, cutting depth limited to 2 feet, beginning after June 30th ONLY

APPENDICES

Appendix A

Supporting Aquatic Plant Survey Methods and Documentation

The point intercept method was used to evaluate the existing emergent, submergent, floating-leaf, and free-floating aquatic plants. If a species was not collected at a specific point, the space on the datasheet was left blank. For the survey, the data for each sample point was entered into the WDNR "Worksheets" (i.e., a data-processing spreadsheet) to calculate the following statistics:

Taxonomic richness (the total number of taxa detected)

- **Maximum depth of plant growth**
- **Community frequency of occurrence** (number of intercept points where aquatic plants were detected divided by the number of intercept points shallower than the maximum depth of plant growth)
- **Mean intercept point taxonomic richness** (the average number of taxa per intercept point)
- **Mean intercept point native taxonomic richness** (the average number of native taxa per intercept point)
- **Taxonomic frequency of occurrence within vegetated areas** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points where vegetation was present)
- **Taxonomic frequency of occurrence at sites within the photic zone** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points which are equal to or shallower than the maximum depth of plant growth)
- **Relative taxonomic frequency of occurrence** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the sum of all species' occurrences)
- **Mean density** (the sum of the density values for a particular species divided by the number of sampling sites)
- **Simpson Diversity Index (SDI)** is an indicator of aquatic plant community diversity. SDI is calculated by taking one minus the sum of the relative frequencies squared for each species present. Based upon the index of community diversity, the closer the SDI is to one, the greater the diversity within the population.

Floristic Quality Index (FQI) (This method uses a predetermined Coefficient of Conservatism (C), that has been assigned to each native plant species in Wisconsin, based on that species' tolerance for disturbance. Non-native plants are not assigned conservatism coefficients. The aggregate conservatism of all the plants inhabiting a site determines its floristic quality. The mean C value for a given lake is the arithmetic mean of the coefficients of all native vascular plant species occurring on the entire site, without regard to dominance or frequency. The FQI value is the mean C times the square root of the total number of native species. This formula combines the conservatism of the species present with a measure of the species richness of the site.

Appendix B

Tables

2. Taxa Detected During 2014 Aquatic Plant Surveys, Lauderdale Lakes, Walworth County, WI
3. 2014 Aquatic Plant Community Statistics, Lauderdale Lakes, Walworth County, WI
4. 2014 Aquatic Plant Taxa – Specific Statistics, Green Lake, Walworth County, WI
5. Taxa Detected During Aquatic Plant Surveys, Green Lake, Walworth County, WI
6. 2014 Floristic Quality Indices, Green Lake, Walworth County, WI
7. 2014 Aquatic Plant Taxa – Specific Statistics, Middle Lake, Walworth County, WI
8. Taxa Detected During Aquatic Plant Surveys, Middle Lake, Walworth County, WI
9. Floristic Quality Indices, Middle Lake, Walworth County, WI
10. 2014 Aquatic Plant Taxa – Specific Statistics, Mill Lake, Walworth County, WI
11. Taxa Detected During Aquatic Plant Surveys, Mill Lake, Walworth County, WI
12. Floristic Quality Indices, Mill Lake, Walworth County, WI
13. Aquatic Plant Community Statistics, Lauderdale Lakes, Walworth County, WI
14. FQI and Average Coefficient of Lauderdale Lakes Compared to Wisconsin and Southeastern Till Plain Lakes

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Table 2: Taxa Detected During 2014 Aquatic Plant Surveys, Lauderdale Lakes, Walworth County, WI

| Genus | Species | Common Name | Category | Present in Lake | | |
|-----------------------|----------------------|--------------------------|---------------|-----------------|-------------|-----------|
| | | | | Green Lake | Middle Lake | Mill Lake |
| <i>Myriophyllum</i> | <i>spicatum</i> | Eurasian water-milfoil | Invasive | X | X | X |
| <i>Potamogeton</i> | <i>crispus</i> | Curly-leaf pondweed | Invasive | | X | X |
| <i>Ceratophyllum</i> | <i>demersum</i> | Coontail | Submersed | | X | X |
| <i>Chara</i> | <i>sp.</i> | Muskgrass | Submersed | X | X | X |
| <i>Elodea</i> | <i>canadensis</i> | Common waterweed | Submersed | X | X | X |
| <i>Heteranthera</i> | <i>dubia</i> | Water stargrass | Submersed | X | X | X |
| <i>Myriophyllum</i> | <i>verticillatum</i> | Whorled water-milfoil | Submersed | | X | |
| <i>Najas</i> | <i>flexilis</i> | Slender naiad | Submersed | X | X | X |
| <i>Najas</i> | <i>mariana</i> | Spiny naiad | Submersed | X | X | X |
| <i>Nuphar</i> | <i>variegata</i> | Spatterdock | Floating-leaf | X | X | |
| <i>Nymphaea</i> | <i>odorata</i> | White water lily | Floating-leaf | | X | X |
| <i>Potamogeton</i> | <i>alpinus</i> | Alpine pondweed | Submersed | X | | X |
| <i>Potamogeton</i> | <i>foliosus</i> | Leafy pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>gramineus</i> | Variable pondweed | Submersed | X | X | |
| <i>Potamogeton</i> | <i>illinoensis</i> | Illinois pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>natans</i> | Floating-leaf pondweed | Submersed | | X | X |
| <i>Potamogeton</i> | <i>richardsonii</i> | Clasping-leaf pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>zosteriformis</i> | Flat-stem pondweed | Submersed | | X | X |
| <i>Sagittaria</i> | <i>cuneata</i> | Arum-leaved arrowhead | Emergent | X | | X |
| <i>Sagittaria</i> | <i>latifolia</i> | Common arrowhead | Emergent | | X | |
| <i>Sagittaria</i> | <i>sp.</i> | Arrowhead species | Emergent | | X | |
| <i>Schoenoplectus</i> | <i>acutus</i> | Hardstem bulrush | Emergent | | X | |
| <i>Sparganium</i> | <i>sp.</i> | Bur-reed species | Emergent | | X | |
| <i>Stuckenia</i> | <i>pectinata</i> | Sago pondweed | Submersed | X | X | X |
| <i>Typha</i> | <i>sp.</i> | Cattail | Emergent | | X | |
| <i>Utricularia</i> | <i>geminiscapa</i> | Twin-stemmed bladderwort | Submersed | | X | |
| <i>Utricularia</i> | <i>gibba</i> | Creeping bladderwort | Submersed | | X | |
| <i>Utricularia</i> | <i>vulgaris</i> | Common bladderwort | Submersed | X | X | X |
| <i>Vallisneria</i> | <i>americana</i> | Wild celery | Submersed | X | X | X |
| <i>Zizania</i> | <i>aquatica</i> | Southern wild rice | Submersed | | X | |

Table 3: 2014 Aquatic Plant Community Statistics, Lauderdale Lakes, Walworth County, WI.

| | Green Lake | Middle Lake* | Mill Lake |
|---|------------|---------------|-----------|
| Date Sampled | 7/29/2014 | 08/11-13/2014 | 7/3/2014 |
| Points Sampled | 695 | 588 | 457 |
| Points with vegetation | 198 | 401 | 296 |
| Points shallower than maximum depth of plants | 317 | 467 | 380 |
| Frequency of occurrence | 62.46% | 85.87% | 77.89% |
| Simpson Diversity Index | 0.82 | 0.8 | 0.84 |
| Maximum depth of plants (ft) | 12 | 12 | 11.5 |
| Average number of species per site (shallower than max depth) | 1.04 | 1.71 | 1.56 |
| Average number of species per site (veg. sites only) | 1.66 | 1.99 | 2.01 |
| Average number of native species per site (shallower than max depth) | 0.82 | 1.37 | 1.11 |
| Average number of native species per site (veg. sites only) | 1.53 | 1.66 | 1.64 |
| Species Richness | 13 | 28 | 17 |

* - survey completed by WDNR staff

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Table 4: 2014 Aquatic Plant Taxa-Specific Statistics, Green Lake, Walworth County, WI

| Common Name | Percent Frequency of Occurrence within vegetated areas | Percent Frequency of Occurrence at sites shallower than max depth of plants | Percent Relative Frequency of Occurrence | Number of Intercept Points Where Detected | Average Density |
|-------------------------------|--|---|--|---|-----------------|
| Eurasian water-milfoil | 14.14 | 8.83 | 8.5 | 28 | 1.00 |
| Muskgrass | 41.41 | 25.87 | 24.9 | 82 | 1.18 |
| Common waterweed | 1.01 | 0.63 | 0.6 | 2 | 1.00 |
| Water stargrass | 2.02 | 1.26 | 1.2 | 4 | 1.25 |
| Slender naiad | 8.08 | 5.05 | 4.9 | 16 | 1.06 |
| Spiny naiad | 21.21 | 13.25 | 12.8 | 42 | 1.00 |
| Spatterdock | 0.51 | 0.32 | 0.3 | 1 | 1.00 |
| Alpine pondweed | 1.01 | 0.32 | 0.3 | 2 | 1.00 |
| Variable pondweed | 0.51 | 0.32 | 0.3 | 1 | 1.00 |
| Arum-leaved arrowhead | 1.01 | 0.32 | 0.3 | 2 | 1.00 |
| Sago pondweed | 33.33 | 20.82 | 20.1 | 66 | 1.00 |
| Common bladderwort | 3.54 | 2.21 | 2.1 | 7 | 1.00 |
| Wild celery | 38.38 | 23.97 | 23.1 | 76 | 1.01 |

* - Species recorded visually only, not data calculated

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Table 5: Taxa Detected During Aquatic Plant Surveys, Green Lake, Walworth County, WI

| Genus | Species | Common Name | Category | Present in Lake | | |
|----------------------|----------------------|------------------------|---------------|-----------------|------|------|
| | | | | 1999 | 2008 | 2014 |
| <i>Myriophyllum</i> | <i>spicatum</i> | Eurasian water-milfoil | Invasive | X | X | X |
| <i>Potamogeton</i> | <i>crispus</i> | Curly-leaf pondweed | Invasive | X | X | |
| <i>Ceratophyllum</i> | <i>demersum</i> | Coontail | Submersed | X | X | |
| <i>Chara</i> | <i>sp.</i> | Muskgrass | Submersed | X | X | X |
| <i>Elodea</i> | <i>canadensis</i> | Common waterweed | Submersed | X | | X |
| <i>Heteranthera</i> | <i>dubia</i> | Water stargrass | Submersed | X | X | X |
| <i>Myriophyllum</i> | <i>sibiricum</i> | Northern water-milfoil | Submersed | X | X | |
| <i>Najas</i> | <i>flexilis</i> | Slender naiad | Submersed | X | X | X |
| <i>Najas</i> | <i>mariana</i> | Spiny naiad | Submersed | X | X | X |
| <i>Nuphar</i> | <i>variegata</i> | Spatterdock | Floating-leaf | X | X | X |
| <i>Nymphaea</i> | <i>odorata</i> | White water lily | Floating-leaf | X | X | |
| <i>Potamogeton</i> | <i>alpinus</i> | Alpine pondweed | Submersed | | | X |
| <i>Potamogeton</i> | <i>foliosus</i> | Leafy pondweed | Submersed | X | X | |
| <i>Potamogeton</i> | <i>gramineus</i> | Variable pondweed | Submersed | | X | X |
| <i>Potamogeton</i> | <i>illinoensis</i> | Illinois pondweed | Submersed | X | X | |
| <i>Potamogeton</i> | <i>natans</i> | Floating-leaf pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>pusillus</i> | Small pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>richardsonii</i> | Clasping-leaf pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>sp.</i> | Pondweed species | Submersed | X | | |
| <i>Potamogeton</i> | <i>zosteriformis</i> | Flat-stem pondweed | Submersed | X | X | |
| <i>Sagittaria</i> | <i>cuneata</i> | Arum-leaved arrowhead | Emergent | | | X |
| <i>Stuckenia</i> | <i>pectinata</i> | Sago pondweed | Submersed | X | X | X |
| <i>Typha</i> | <i>sp.</i> | Cattail | Emergent | X | | |
| <i>Utricularia</i> | <i>sp.</i> | Bladderwort species | Submersed | | X | |
| <i>Utricularia</i> | <i>vulgaris</i> | Common bladderwort | Submersed | | | X |
| <i>Vallisneria</i> | <i>americana</i> | Wild celery | Submersed | X | X | X |

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| Common Name | 1999 | 2008 | 2014 |
|---|--------------|--------------|--------------|
| Coontail | 3 | 3 | --- |
| Muskgrass | 7 | 7 | 7 |
| Common waterweed | 3 | --- | 3 |
| Water stargrass | 6 | 6 | 6 |
| Northern water-milfoil | 6 | 6 | --- |
| Slender naiad | 6 | 6 | 6 |
| Spatterdock | 6 | 6 | 6 |
| White water lily | 6 | 6 | --- |
| Alpine pondweed | --- | --- | 9 |
| Leafy pondweed | 6 | 6 | --- |
| Variable pondweed | --- | 7 | 7 |
| Illinois pondweed | 6 | 6 | --- |
| Floating-leaf pondweed | --- | 5 | --- |
| Small pondweed | --- | 7 | --- |
| Clasping-leaf pondweed | --- | 5 | --- |
| Flat-stem pondweed | 6 | 6 | --- |
| Arum-leaved arrowhead | --- | --- | 7 |
| Sago pondweed | 3 | 3 | 3 |
| Cattail | 1 | --- | --- |
| Common bladderwort | --- | --- | 7 |
| Wild celery | 6 | 6 | 6 |
| Total Species | 14 | 16 | 11 |
| Mean C | 5.07 | 5.69 | 6.09 |
| Floristic Quality Index (FQI) | 18.98 | 22.75 | 20.20 |
| Please note: There is no Coefficient of Conservatism for exotic species such as Eurasian Water-Milfoil or plants not identified to the species level (<i>Sagittaria sp.</i>). | | | |
| Coefficient of Conservatism C | | | |
| 0-3 taxa found in wide variety of plant communities and very tolerant of disturbance. | | | |
| 4-6 taxa associated with specific plant communities and tolerates moderate disturbance. | | | |
| 7-8 taxa found in narrow range of plant communities and tolerate minor disturbance. | | | |
| 9-10 taxa restricted to a narrow range of conditions with low tolerance of disturbance. | | | |

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Table 7: 2014 Aquatic Plant Taxa-Specific Statistics, Middle Lake, Walworth County, WI

| Common Name | Percent Frequency of Occurrence within vegetated areas | Percent Frequency of Occurrence at sites shallower than max depth of plants | Percent Relative Frequency of Occurrence | Number of Intercept Points Where Detected | Average Density |
|-------------------------------|--|---|--|---|-----------------|
| Eurasian water-milfoil | 8.48 | 7.28 | 4.3 | 34 | 1.00 |
| Curly-leaf pondweed | 0.25 | 0.21 | 0.1 | 1 | 1.00 |
| Coontail | 0.75 | 0.61 | 0.4 | 3 | 1.00 |
| Muskgrass | 79.55 | 68.31 | 40 | 319 | 1.21 |
| Common waterweed | 1 | 0.86 | 0.5 | 4 | 1.00 |
| Water stargrass | 0.25 | 0.21 | 0.1 | 1 | 1.00 |
| Whorled water-milfoil | 5.49 | 4.71 | 2.8 | 22 | 1.00 |
| Slender naiad | 7.73 | 6.64 | 3.9 | 31 | 1.03 |
| Spiny naiad | 30.17 | 25.91 | 15.2 | 121 | 1.02 |
| Spatterdock | 3.24 | 2.78 | 1.6 | 13 | 1.00 |
| White water lily | 5.74 | 4.93 | 2.9 | 23 | 1.00 |
| Leafy pondweed* | --- | --- | --- | 1 | --- |
| Variable pondweed | 1.75 | 1.5 | 0.9 | 7 | 1.00 |
| Illinois pondweed | 0.25 | 0.21 | 0.1 | 1 | 1.00 |
| Floating-leaf pondweed | 0.75 | 0.64 | 0.4 | 3 | 1.00 |
| Clasping-leaf pondweed* | --- | --- | --- | 1 | --- |
| Flat-stem pondweed | 1 | 0.86 | 0.5 | 4 | 1.00 |
| Common arrowhead* | --- | --- | --- | 1 | --- |
| Arrowhead species | 12.47 | 10.71 | 6.3 | 50 | 1.02 |
| Hardstem bulrush | 2 | 1.71 | 1 | 8 | 1.13 |
| Bur-reed species | 2 | 1.71 | 1 | 8 | 1.00 |
| Sago pondweed | 17.46 | 14.99 | 8.8 | 70 | 1.00 |
| Cattail* | --- | --- | --- | 2 | --- |
| Twin-stemmed bladderwort | 1 | 0.86 | 0.5 | 4 | 1.00 |
| Creeping bladderwort | 2.99 | 2.57 | 1.5 | 12 | 1.00 |
| Common bladderwort | 6.73 | 5.78 | 3.4 | 27 | 1.00 |
| Wild celery | 7.73 | 6.64 | 3.9 | 31 | 1.00 |
| Southern wild rice | 0.25 | 0.21 | 0.1 | 1 | 1.00 |

* - Species recorded visually only, not data calculated

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Table 8: Taxa Detected During Aquatic Plant Surveys, Middle Lake, Walworth County, WI

| Genus | Species | Common Name | Category | Present in Lake | | |
|-----------------------|----------------------|--------------------------|---------------|-----------------|------|------|
| | | | | 1999 | 2008 | 2014 |
| <i>Myriophyllum</i> | <i>spicatum</i> | Eurasian water-milfoil | Invasive | X | X | X |
| <i>Potamogeton</i> | <i>crispus</i> | Curly-leaf pondweed | Invasive | X | X | X |
| <i>Ceratophyllum</i> | <i>demersum</i> | Coontail | Submersed | X | X | X |
| <i>Chara</i> | <i>sp.</i> | Muskgrass | Submersed | X | X | X |
| <i>Decodon</i> | <i>verticillatus</i> | Swamp loosestrife | Emergent | X | | |
| <i>Elodea</i> | <i>canadensis</i> | Common waterweed | Submersed | X | X | X |
| <i>Heteranthera</i> | <i>dubia</i> | Water stargrass | Submersed | X | | X |
| <i>Lemna</i> | <i>minor</i> | Small duckweed | Free-floating | X | | |
| <i>Myriophyllum</i> | <i>sibiricum</i> | Northern water-milfoil | Submersed | X | X | |
| <i>Myriophyllum</i> | <i>verticillatum</i> | Whorled water-milfoil | Submersed | | | X |
| <i>Najas</i> | <i>flexilis</i> | Slender naiad | Submersed | X | X | X |
| <i>Najas</i> | <i>mariana</i> | Spiny naiad | Submersed | X | X | X |
| <i>Nuphar</i> | <i>variegata</i> | Spatterdock | Floating-leaf | X | X | X |
| <i>Nymphaea</i> | <i>odorata</i> | White water lily | Floating-leaf | X | X | X |
| <i>Potamogeton</i> | <i>foliosus</i> | Leafy pondweed | Submersed | | X | X |
| <i>Potamogeton</i> | <i>gramineus</i> | Variable pondweed | Submersed | | X | X |
| <i>Potamogeton</i> | <i>illinoensis</i> | Illinois pondweed | Submersed | X | X | X |
| <i>Potamogeton</i> | <i>natans</i> | Floating-leaf pondweed | Submersed | X | | X |
| <i>Potamogeton</i> | <i>nodosus</i> | Long-leaf pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>richardsonii</i> | Clasping-leaf pondweed | Submersed | | | X |
| <i>Potamogeton</i> | <i>sp.</i> | Pondweed species | Submersed | X | | |
| <i>Potamogeton</i> | <i>zosteriformis</i> | Flat-stem pondweed | Submersed | X | X | X |
| <i>Sagittaria</i> | <i>latifolia</i> | Common arrowhead | Emergent | X | | X |
| <i>Sagittaria</i> | <i>sp.</i> | Arrowhead species | Emergent | | | X |
| <i>Schoenoplectus</i> | <i>acutus</i> | Hardstem bulrush | Emergent | X | X | X |
| <i>Schoenoplectus</i> | <i>subterminalis</i> | Water bulrush | Submersed | X | | |
| <i>Sparganium</i> | <i>natans</i> | Small bur-reed | Emergent | | X | |
| <i>Sparganium</i> | <i>sp.</i> | Bur-reed species | Emergent | | | X |
| <i>Stuckenia</i> | <i>pectinata</i> | Sago pondweed | Submersed | X | X | X |
| <i>Typha</i> | <i>sp.</i> | Cattail | Emergent | X | | X |
| <i>Utricularia</i> | <i>geminiscapa</i> | Twin-stemmed bladderwort | Submersed | | | |
| <i>Utricularia</i> | <i>gibba</i> | Creeping bladderwort | Submersed | | | X |
| <i>Utricularia</i> | <i>sp.</i> | Bladderwort species | Submersed | X | X | |
| <i>Utricularia</i> | <i>vulgaris</i> | Common bladderwort | Submersed | | | X |
| <i>Vallisneria</i> | <i>americana</i> | Wild celery | Submersed | X | X | X |
| <i>Zizania</i> | <i>aquatica</i> | Southern wild rice | Submersed | X | | X |

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| Common Name | 1999 | 2008 | 2014 |
|---|--------------|--------------|--------------|
| Coontail | 3 | 3 | 3 |
| Muskgrass | 7 | 7 | 7 |
| Swamp loosestrife | 7 | --- | --- |
| Common waterweed | 3 | 3 | 3 |
| Water stargrass | 6 | --- | 6 |
| Small duckweed | 4 | --- | --- |
| Northern water-milfoil | 6 | 6 | --- |
| Whorled water-milfoil | --- | --- | 8 |
| Slender naiad | 6 | 6 | 6 |
| Spatterdock | 6 | 6 | 6 |
| White water lily | 6 | 6 | 6 |
| Leafy pondweed | --- | 6 | 6 |
| Variable pondweed | --- | 7 | 7 |
| Illinois pondweed | 6 | 6 | 6 |
| Floating-leaf pondweed | 5 | --- | 5 |
| Long-leaf pondweed | --- | 7 | --- |
| Clasping-leaf pondweed | -- | --- | 5 |
| Flat-stem pondweed | 6 | 6 | 6 |
| Common arrowhead | 3 | --- | 3 |
| Hardstem bulrush | 6 | 6 | 6 |
| Water bulrush | 9 | --- | --- |
| Small bur-reed | --- | 9 | --- |
| Sago pondweed | 3 | 3 | 3 |
| Cattail | 1 | --- | 1 |
| Twin-stemmed bladderwort | --- | --- | 9 |
| Creeping bladderwort | --- | --- | 9 |
| Common bladderwort | --- | --- | 7 |
| Wild celery | 6 | 6 | 6 |
| Southern wild rice | 8 | --- | 8 |
| Total Species | 20 | 16 | 23 |
| Mean C | 5.35 | 5.81 | 5.74 |
| Floristic Quality Index (FQI) | 23.93 | 23.25 | 27.52 |
| Please note: There is no Coefficient of Conservatism for exotic species such as Eurasian Water-Milfoil or plants not identified to the species level (<i>Sagittaria sp.</i>). | | | |
| Coefficient of Conservatism C | | | |
| 0-3 taxa found in wide variety of plant communities and very tolerant of disturbance. | | | |
| 4-6 taxa associated with specific plant communities and tolerates moderate disturbance. | | | |
| 7-8 taxa found in narrow range of plant communities and tolerate minor disturbance. | | | |
| 9-10 taxa restricted to a narrow range of conditions with low tolerance of disturbance. | | | |

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Table 10: 2014 Aquatic Plant Taxa-Specific Statistics, Mill Lake, Walworth County, WI

| Common Name | Percent Frequency of Occurrence within vegetated areas | Percent Frequency of Occurrence at sites shallower than max depth of plants | Percent Relative Frequency of Occurrence | Number of Intercept Points Where Detected | Average Density |
|-------------------------------|--|---|--|---|-----------------|
| Eurasian water-milfoil | 36.82 | 28.67 | 18.4 | 109 | 1 |
| Curly-leaf pondweed | 0.68 | 0.53 | 0.3 | 2 | 1 |
| Coontail | 5.07 | 3.95 | 2.5 | 15 | 1.07 |
| Muskgrass | 47.64 | 37.11 | 23.7 | 141 | 1.14 |
| Common waterweed | 4.39 | 3.42 | 2.2 | 13 | 1 |
| Water stargrass | 1.01 | 0.79 | 5 | 3 | 1 |
| Slender naiad | 6.76 | 5.26 | 3.4 | 20 | 1 |
| Spiny naiad | 20.27 | 15.79 | 10.1 | 60 | 1.03 |
| Spatterdock | 0.68 | 0.53 | 0.3 | 2 | 1 |
| White water lily | 1.01 | 0.79 | 0.5 | 3 | 1 |
| Alpine pondweed | 6.08 | 4.47 | 3 | 18 | 1 |
| Floating-leaf pondweed | 1.01 | 0.79 | 0.5 | 3 | 1 |
| Flat-stem pondweed | 0.34 | 0.26 | 0.2 | 1 | 1 |
| Arum-leaved arrowhead | 1.35 | 1.05 | 0.7 | 4 | 1 |
| Sago pondweed | 10.47 | 8.16 | 5.2 | 31 | 1 |
| Common bladderwort | 10.47 | 8.16 | 5.2 | 31 | 1 |
| Wild celery | 46.62 | 36.32 | 23.2 | 138 | 1.01 |

* - Species recorded visually only, not data calculated

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Table 11: Taxa Detected During Aquatic Plant Surveys, Mill Lake, Walworth County, WI

| Genus | Species | Common Name | Category | Present in Lake | | |
|----------------------|----------------------|------------------------|---------------|-----------------|------|------|
| | | | | 1999 | 2008 | 2014 |
| <i>Myriophyllum</i> | <i>spicatum</i> | Eurasian water-milfoil | Invasive | X | X | X |
| <i>Potamogeton</i> | <i>crispus</i> | Curly-leaf pondweed | Invasive | X | X | X |
| <i>Ceratophyllum</i> | <i>demersum</i> | Coontail | Submersed | X | X | X |
| <i>Chara</i> | <i>sp.</i> | Muskgrass | Submersed | X | X | X |
| <i>Decodon</i> | <i>verticillatus</i> | Swamp loosestrife | Emergent | X | | |
| <i>Elodea</i> | <i>canadensis</i> | Common waterweed | Submersed | X | X | X |
| <i>Heteranthera</i> | <i>dubia</i> | Water stargrass | Submersed | X | X | X |
| <i>Lemna</i> | <i>sp.</i> | Duckweed species | Free-floating | | X | |
| <i>Myriophyllum</i> | <i>sibiricum</i> | Northern water-milfoil | Submersed | X | X | |
| <i>Najas</i> | <i>flexilis</i> | Slender naiad | Submersed | X | X | X |
| <i>Najas</i> | <i>mariana</i> | Spiny naiad | Submersed | X | X | X |
| <i>Nuphar</i> | <i>variegata</i> | Spatterdock | Floating-leaf | X | X | X |
| <i>Nymphaea</i> | <i>odorata</i> | White water lily | Floating-leaf | X | X | X |
| <i>Potamogeton</i> | <i>alpinus</i> | Alpine pondweed | Submersed | | | X |
| <i>Potamogeton</i> | <i>amplifolius</i> | Large-leaf pondweed | Submersed | X | X | |
| <i>Potamogeton</i> | <i>foliosus</i> | Leafy pondweed | Submersed | X | X | |
| <i>Potamogeton</i> | <i>gramineus</i> | Variable pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>illinoensis</i> | Illinois pondweed | Submersed | X | | |
| <i>Potamogeton</i> | <i>natans</i> | Floating-leaf pondweed | Submersed | X | | X |
| <i>Potamogeton</i> | <i>nodosus</i> | Long-leaf pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>pusillus</i> | Small pondweed | Submersed | | X | |
| <i>Potamogeton</i> | <i>sp.</i> | Pondweed species | Submersed | X | | |
| <i>Potamogeton</i> | <i>zosteriformis</i> | Flat-stem pondweed | Submersed | X | X | X |
| <i>Sagittaria</i> | <i>cuneata</i> | Arum-leaved arrowhead | Emergent | | | X |
| <i>Stuckenia</i> | <i>pectinata</i> | Sago pondweed | Submersed | X | X | X |
| <i>Typha</i> | <i>sp.</i> | Cattail | Emergent | X | | |
| <i>Utricularia</i> | <i>sp.</i> | Bladderwort species | Submersed | X | X | |
| <i>Utricularia</i> | <i>vulgaris</i> | Common bladderwort | Submersed | | | X |
| <i>Vallisneria</i> | <i>americana</i> | Wild celery | Submersed | | X | X |

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| Common Name | 1999 | 2008 | 2014 |
|--------------------------------------|--------------|--------------|--------------|
| Coontail | 3 | 3 | 3 |
| Muskgrass | 7 | 7 | 7 |
| Swamp loosestrife | 7 | --- | --- |
| Common waterweed | 3 | 3 | 3 |
| Water stargrass | 6 | 6 | 6 |
| Northern water-milfoil | 6 | 6 | --- |
| Slender naiad | 6 | 6 | 6 |
| Spatterdock | 6 | 6 | 6 |
| White water lily | 6 | 6 | 6 |
| Alpine pondweed | --- | --- | 9 |
| Large-leaf pondweed | 7 | 7 | --- |
| Leafy pondweed | 6 | 6 | --- |
| Variable pondweed | --- | 7 | --- |
| Illinois pondweed | 6 | --- | --- |
| Floating-leaf pondweed | 5 | --- | 5 |
| Long-leaf pondweed | --- | 7 | --- |
| Small pondweed | --- | 7 | --- |
| Flat-stem pondweed | 6 | 6 | 6 |
| Arum-leaved arrowhead | --- | --- | 7 |
| Sago pondweed | 3 | 3 | 3 |
| Cattail | 1 | --- | --- |
| Common bladderwort | --- | --- | 7 |
| Wild celery | --- | 6 | 6 |
| Total Species | 16 | 16 | 14 |
| Mean C | 5.25 | 5.75 | 5.71 |
| Floristic Quality Index (FQI) | 21.00 | 23.00 | 21.38 |

Please note: There is no Coefficient of Conservatism for exotic species such as Eurasian Water-Milfoil or plants not identified to the species level (*Sagittaria sp.*).

Coefficient of Conservatism C

- 0-3 taxa found in wide variety of plant communities and very tolerant of disturbance.
- 4-6 taxa associated with specific plant communities and tolerates moderate disturbance.
- 7-8 taxa found in narrow range of plant communities and tolerate minor disturbance.
- 9-10 taxa restricted to a narrow range of conditions with low tolerance of disturbance.

LAUDERDALE LAKES AQUATIC PLANT MANAGEMENT PLAN UPDATE

December 11, 2015

Table 13: Aquatic Plant Community Statistics, Lauderdale Lakes, Walworth County, WI

| | Green Lake | Middle Lake | Mill Lake |
|--|------------------------|------------------------|-------------------------------------|
| F.o.o. at sites shallower than maximum depth of plants | 62.46% | 85.87% | 77.89% |
| Simpson Diversity Index | 0.82 | 0.8 | 0.84 |
| Most Dominant Species | Muskgrass | Muskgrass | Muskgrass |
| | Wild celery | Spiny naiad | Wild celery |
| | Sago pondweed | Sago pondweed | Eurasian water-milfoil |
| | Spiny naiad | Arrowhead sp. | Spiny naiad |
| | Eurasian water-milfoil | Eurasian water-milfoil | Sago pondweed / Common bladderworth |
| Species Richness | 13 | 28 | 17 |
| Community FQI | 20.2 | 27.52 | 21.38 |
| Average Coefficient of Conservatism | 6.09 | 5.74 | 5.71 |

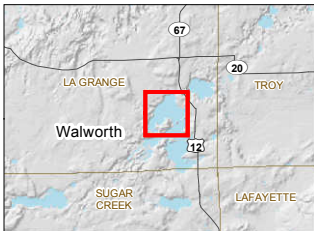
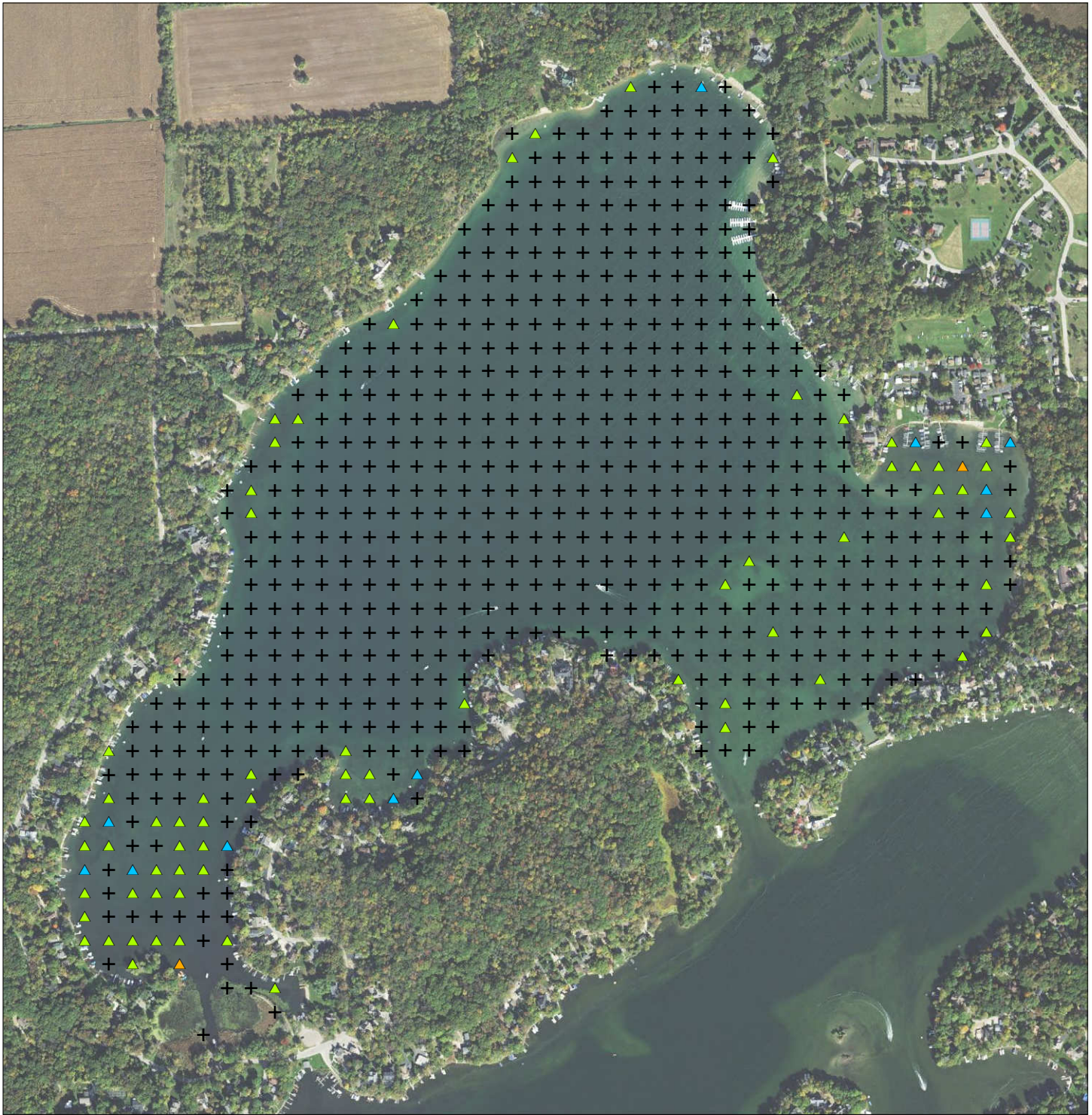
Table 14: FQI and Average Coefficient of Lauderdale Lakes Compared to Wisconsin and Southeastern Till Plain lakes.

| Quartile* | Average Coefficient of Conservatism | | | Floristic Quality | | |
|--------------------------|-------------------------------------|------|-------|-------------------|------|-------|
| | Lower | Mean | Upper | Lower | Mean | Upper |
| Wisconsin Lakes | 5.5 | 6 | 6.9 | 16.9 | 22.2 | 27.5 |
| Southeastern Till Plains | 5.2 | 5.6 | 5.8 | 17 | 20.9 | 24.4 |
| Green Lake - 2014 | 6.09 | | | 20.2 | | |
| Middle Lake - 2014 | 5.74 | | | 27.52 | | |
| Mill Lake - 2014 | 5.71 | | | 21.38 | | |

* - Values indicate highest value of the lowest quartile, mean, and lowest value of the upper quartile

Appendix C

Figures



- Notes**
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
 3. Orthophotography: 2015 NAIP

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Legend

- ✚ GPS Sample Points*
- ▲ Fullness Rating 1
- ▲ Fullness Rating 2
- ▲ Fullness Rating 3

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover lines. |
| 3 | | The rake is completely covered and lines are not visible. |

*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

Figure No.

1.1

Title

**2014 PI Survey - Green Lake
Muskgrass (*Chara sp.*)**

Client/Project

Lauderdale Lakes
Management District

Project Location

T. of Elkhorn,
Walworth Co., WI

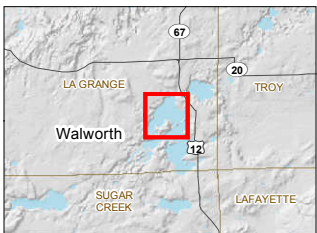
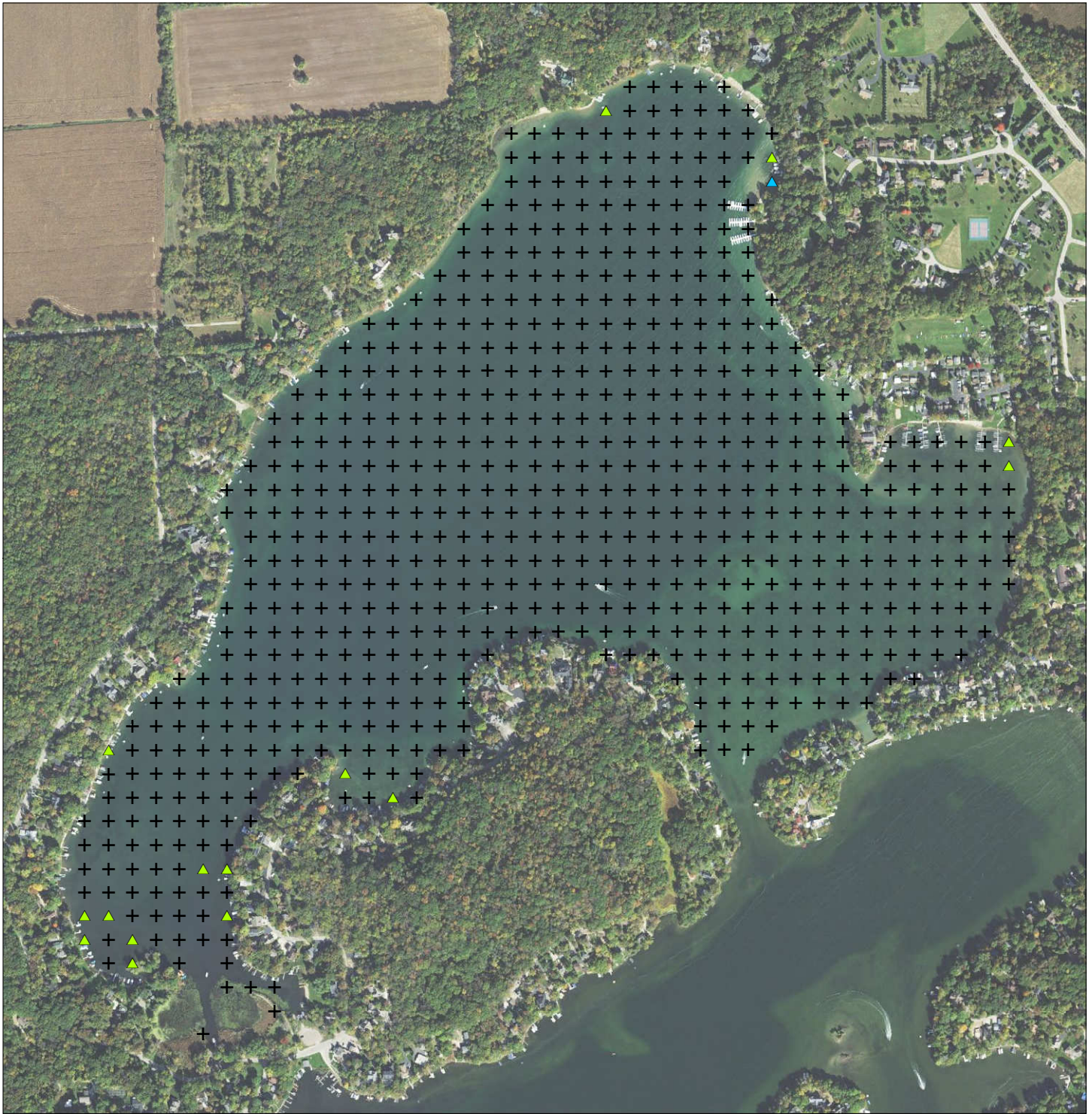
193703101

Prepared by KAS on 2014-09-25

Technical Review by AB on 2014-09-25

Independent Review by JS on 2015-02-05





- Notes**
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
 3. Orthophotography: 2015 NAIP

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Legend

- ✦ GPS Sample Points*
- ▲ Fullness Rating 1
- ▲ Fullness Rating 2

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover lines. |
| 3 | | The rake is completely covered and lines are not visible. |

*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

Figure No.

1.3

Title

**2014 PI Survey - Green Lake
Slender Naiad (*Najas flexilis*)**

Client/Project

Lauderdale Lakes
Management District

Project Location

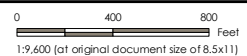
T. of Ekhorn,
Walworth Co., WI

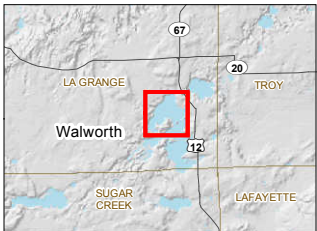
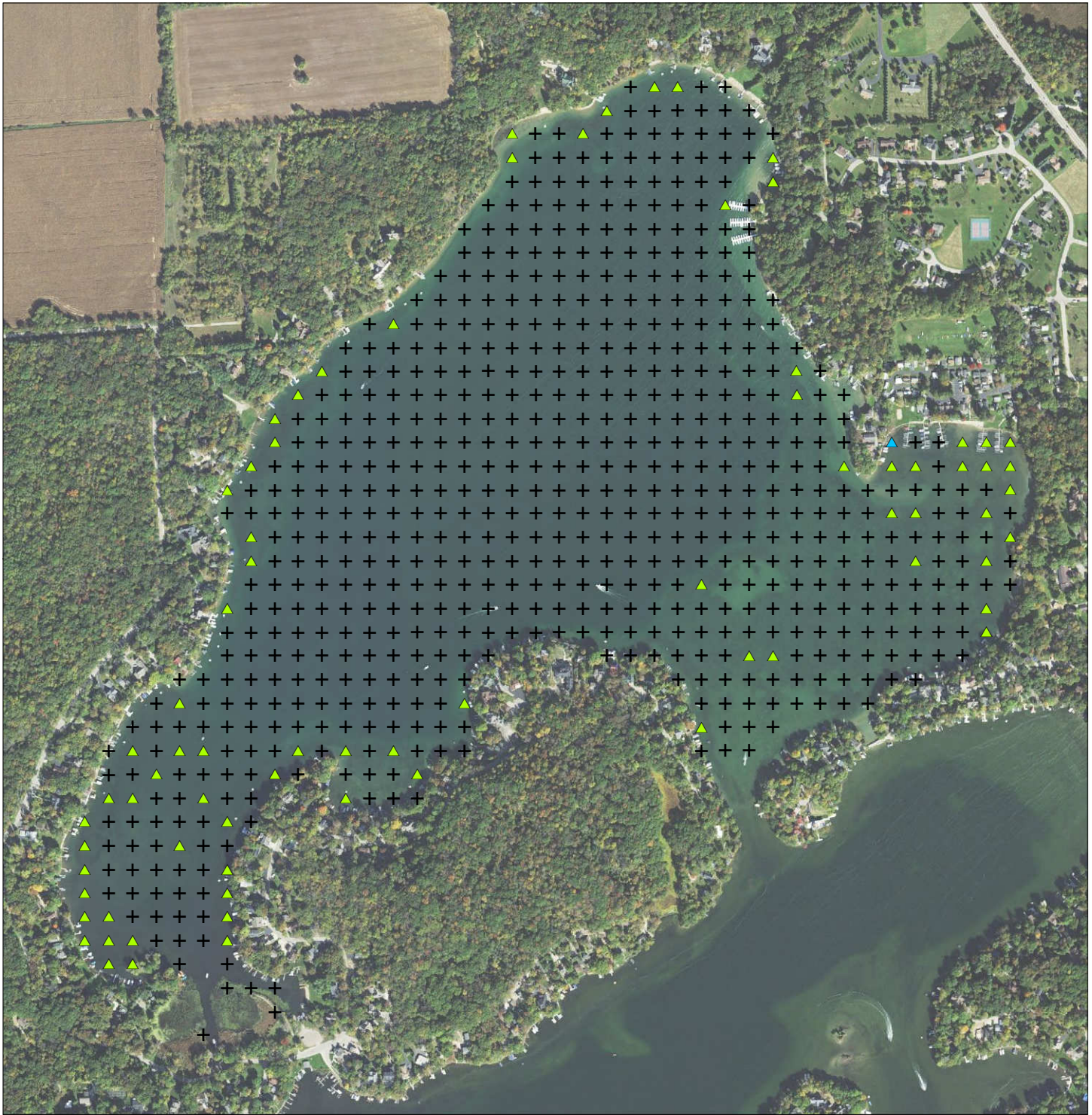
193703101

Prepared by KAS on 2014-09-25

Technical Review by AB on 2014-09-25

Independent Review by JS on 2015-02-05





Notes
 1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
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Legend

- ✚ GPS Sample Points*
- ▲ Fullness Rating 1
- ▲ Fullness Rating 2

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover fines. |
| 3 | | The rake is completely covered and fines are not visible. |

*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

Figure No.

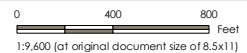
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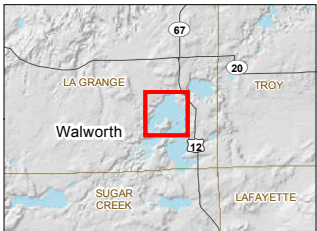
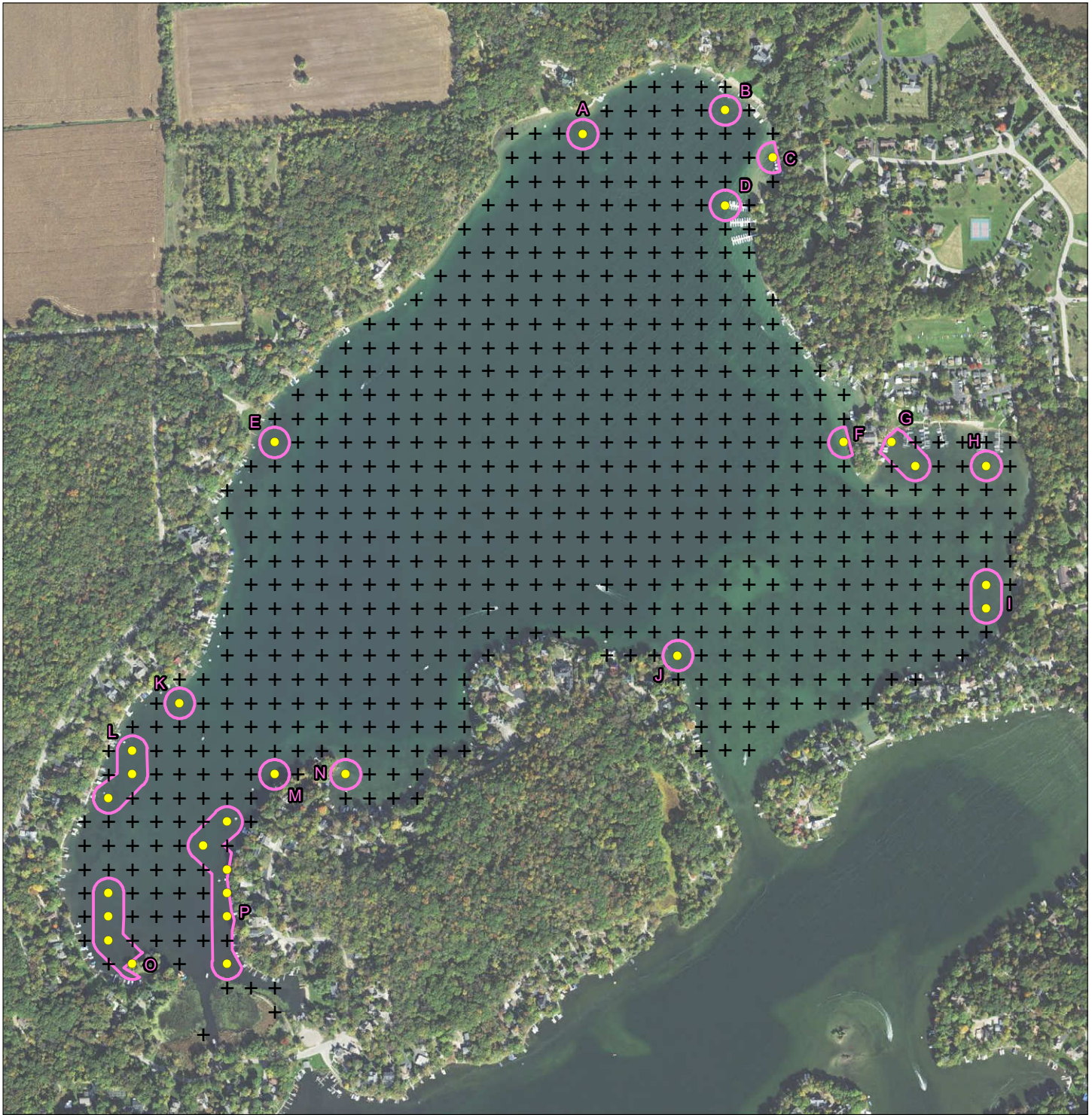
Title

**2014 PI Survey - Green Lake
 Wild Celery (*Vallisneria americana*)**

Client/Project
 Lauderdale Lakes
 Management District

Project Location 193703101
 T. of Ekhorn, Prepared by KAS on 2014-09-25
 Walworth Co., WI Technical Review by AB on 2014-09-25
 Independent Review by JS on 2015-02-05





- Notes**
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
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 3. Orthophotography: 2015 NAIP

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Legend

- + GPS Sample Points*
- Fullness Rating 1
- Aquatic Invasive Plant Area

| Eurasian Water-Milfoil (acreage) | | | |
|----------------------------------|------|---|------|
| A | 0.50 | I | 1.00 |
| B | 0.50 | J | 0.50 |
| C | 0.35 | K | 0.50 |
| D | 0.50 | L | 1.67 |
| E | 0.50 | M | 0.50 |
| F | 0.35 | N | 0.50 |
| G | 1.06 | O | 1.98 |
| H | 0.50 | P | 3.03 |
| Total = 13.95 | | | |

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover lines. |
| 3 | | The rake is completely covered and lines are not visible. |

*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

Figure No.

1.6

Title
2014 PI Survey - Green Lake
Eurasian Water-Milfoil

Client/Project
 Lauderdale Lakes
 Management District

Project Location 193703101
 T. of Elkhorn, Prepared by KAS on 2014-09-25
 Walworth Co., WI Technical Review by AB on 2014-09-25
 Independent Review by JS on 2015-02-05



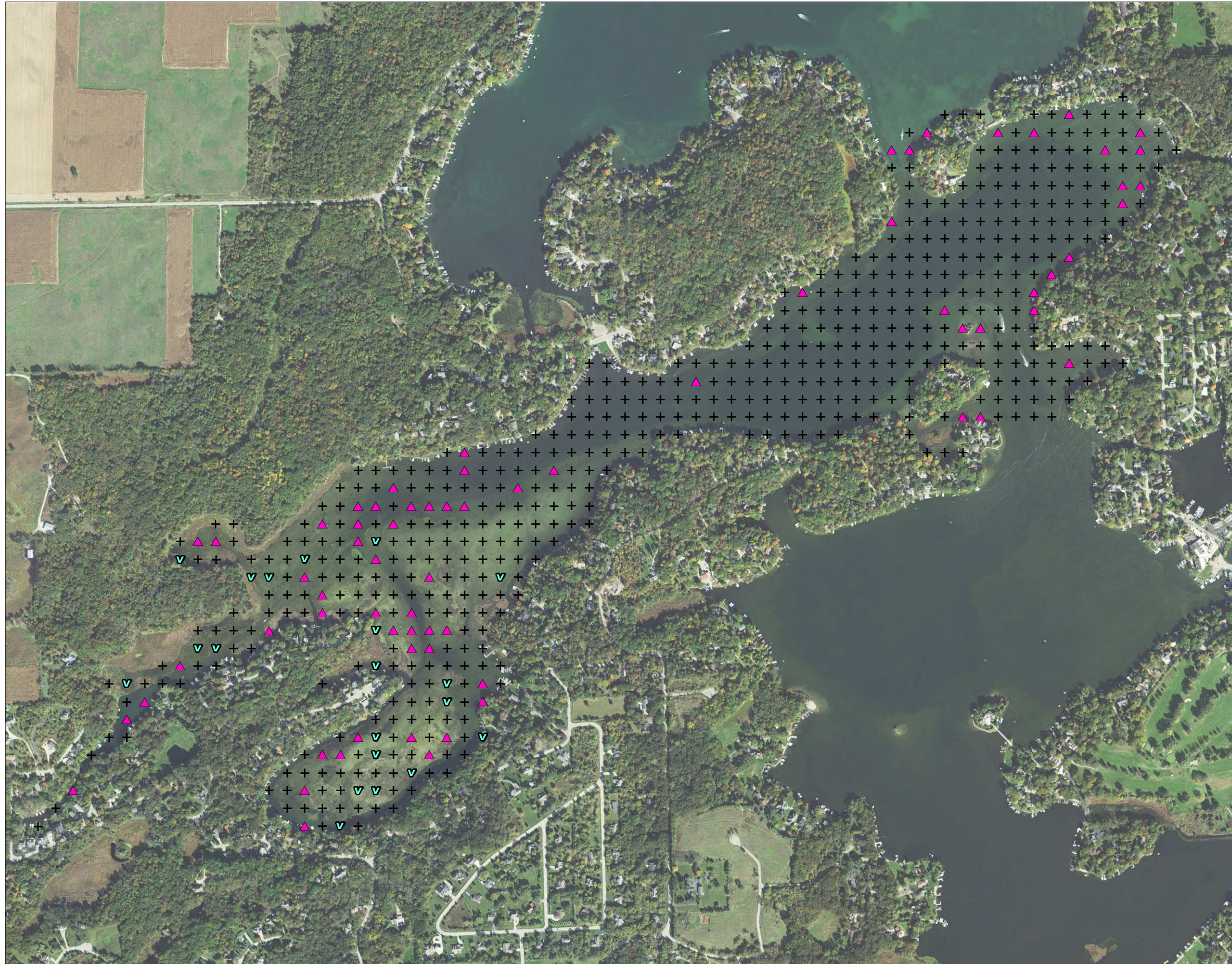
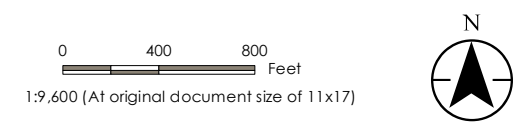


Figure No. **2.1**
 Title
2014 PI Survey - Middle Lake
Sago Pondweed (*Stuckenia pectinata*)

Client/Project
 Lauderdale Lakes
 Management District

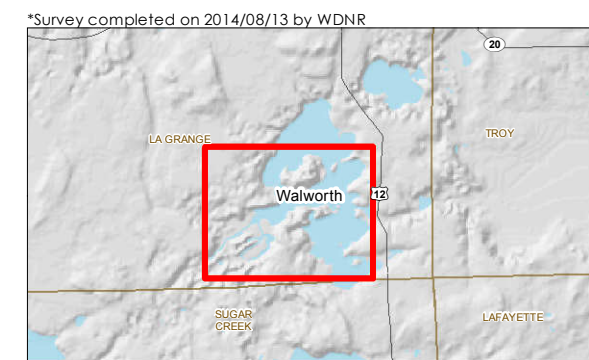
Project Location
 T. of Elkhorn,
 Walworth Co., WI

193703101
 Prepared by KAS on 2015-01-13
 Technical Review by JD on 2015-01-13
 Independent Review by JS on 2015-02-03



- Legend**
- + GPS Sample Points
 - ▲ Fullness Rating 1
 - ▼ Visual Only

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines. |
| 3 | | The rake is completely covered and tines are not visible. |



- Notes**
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
 3. Orthophotography: 2015 NAIP



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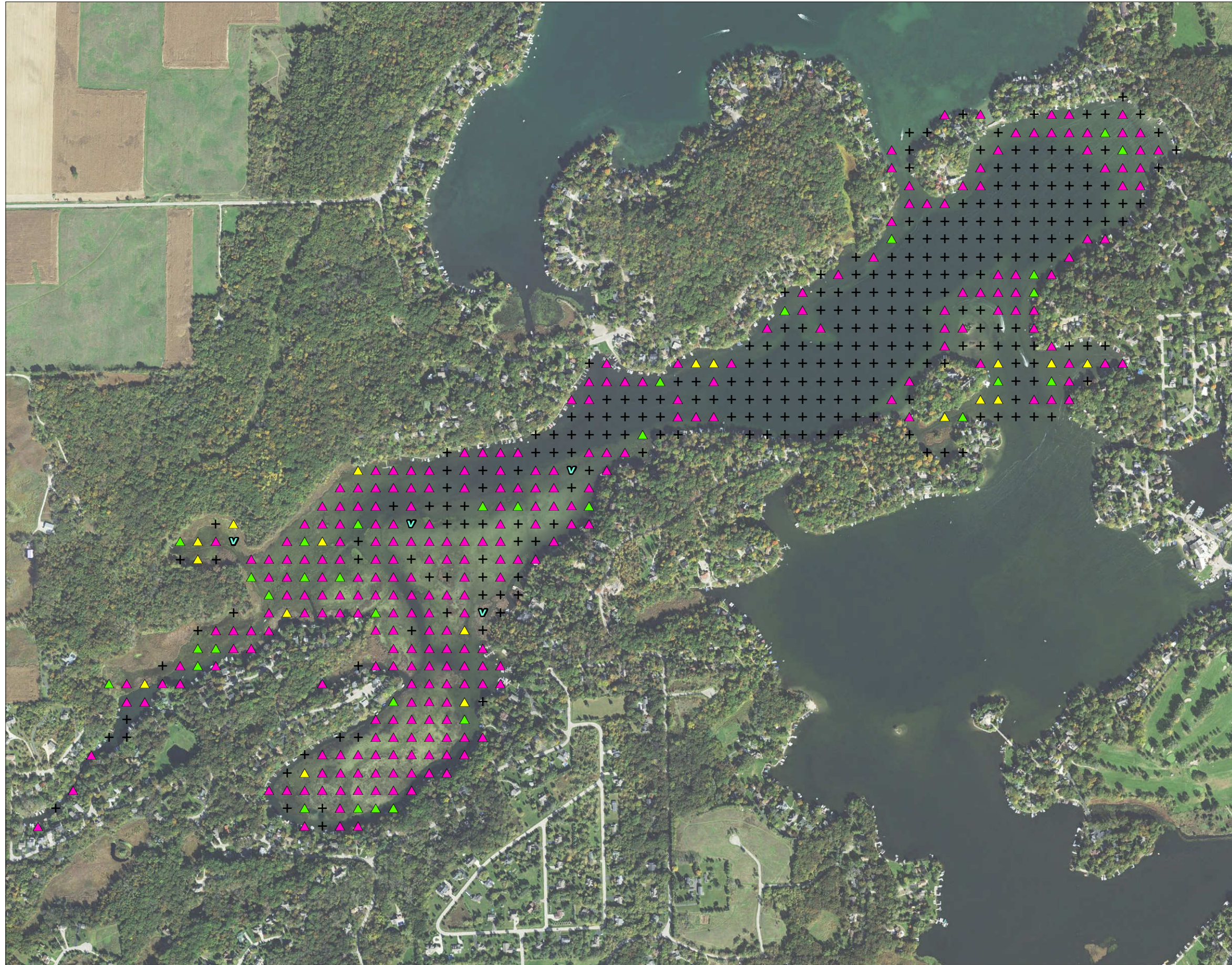
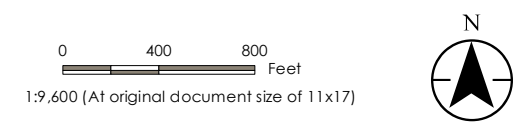


Figure No. **2.2**
 Title
**2014 PI Survey - Middle Lake
 Muskgrass (*Chara sp.*)**

Client/Project
 Lauderdale Lakes
 Management District

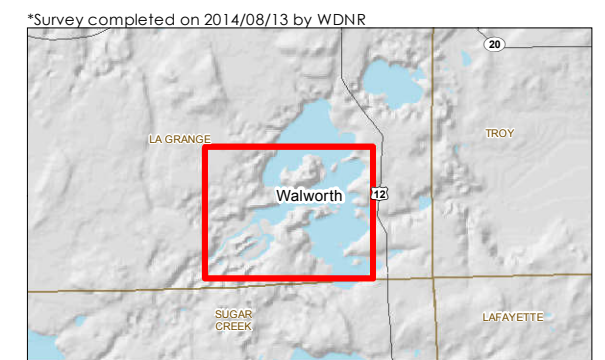
Project Location
 T. of Elkhorn,
 Walworth Co., WI

193703101
 Prepared by KAS on 2015-01-13
 Technical Review by JD on 2015-01-13
 Independent Review by JS on 2015-02-03



- Legend**
- + GPS Sample Points*
 - ▲ Fullness Rating 1
 - ▲ Fullness Rating 2
 - ▲ Fullness Rating 3
 - ✓ Visual Only

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines. |
| 3 | | The rake is completely covered and tines are not visible. |



- Notes**
- Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 - Data Sources Include: Stantec
 - Orthophotography: 2015 NAIP



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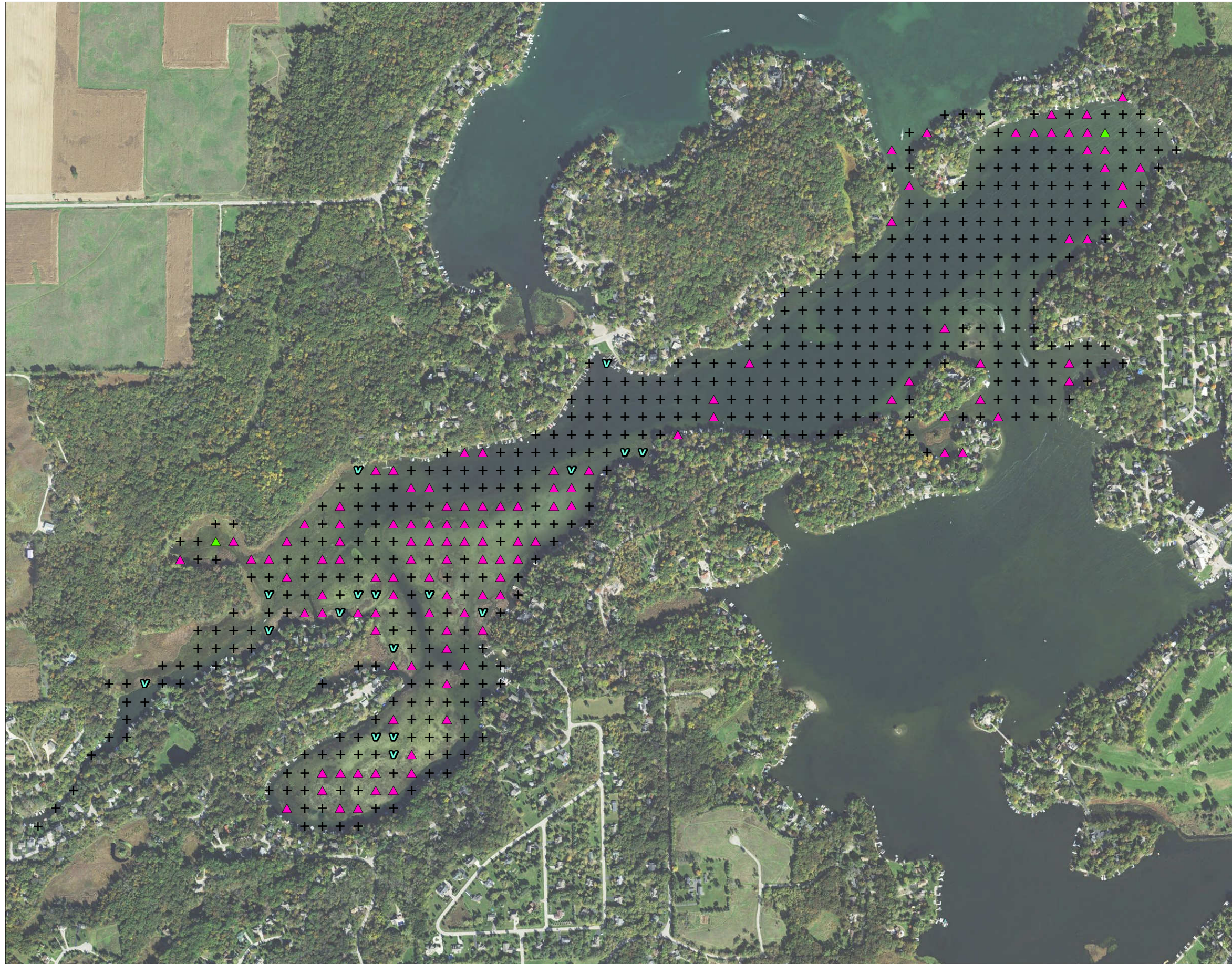
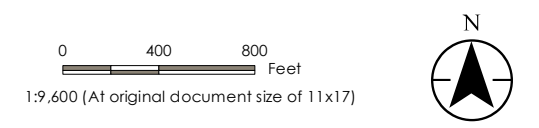


Figure No. **2.3**
 Title
2014 PI Survey - Middle Lake
Spiny Naiad (*Najas marina*)

Client/Project
 Lauderdale Lakes
 Management District

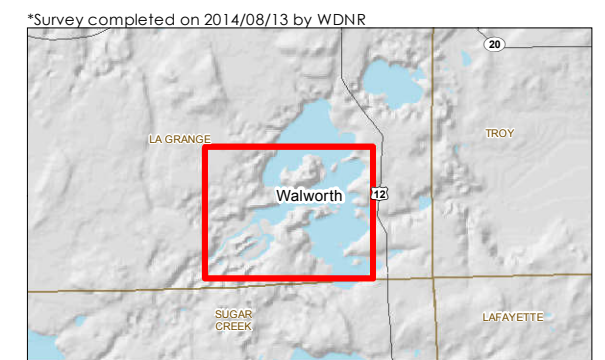
Project Location
 T. of Elkhorn,
 Walworth Co., WI

193703101
 Prepared by KAS on 2015-01-13
 Technical Review by JD on 2015-01-13
 Independent Review by JS on 2015-02-03



- Legend**
- + GPS Sample Points*
 - ▲ Fullness Rating 1
 - ▲ Fullness Rating 2
 - ▼ Visual Only

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines. |
| 3 | | The rake is completely covered and tines are not visible. |



- Notes**
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
 3. Orthophotography: 2015 NAIP



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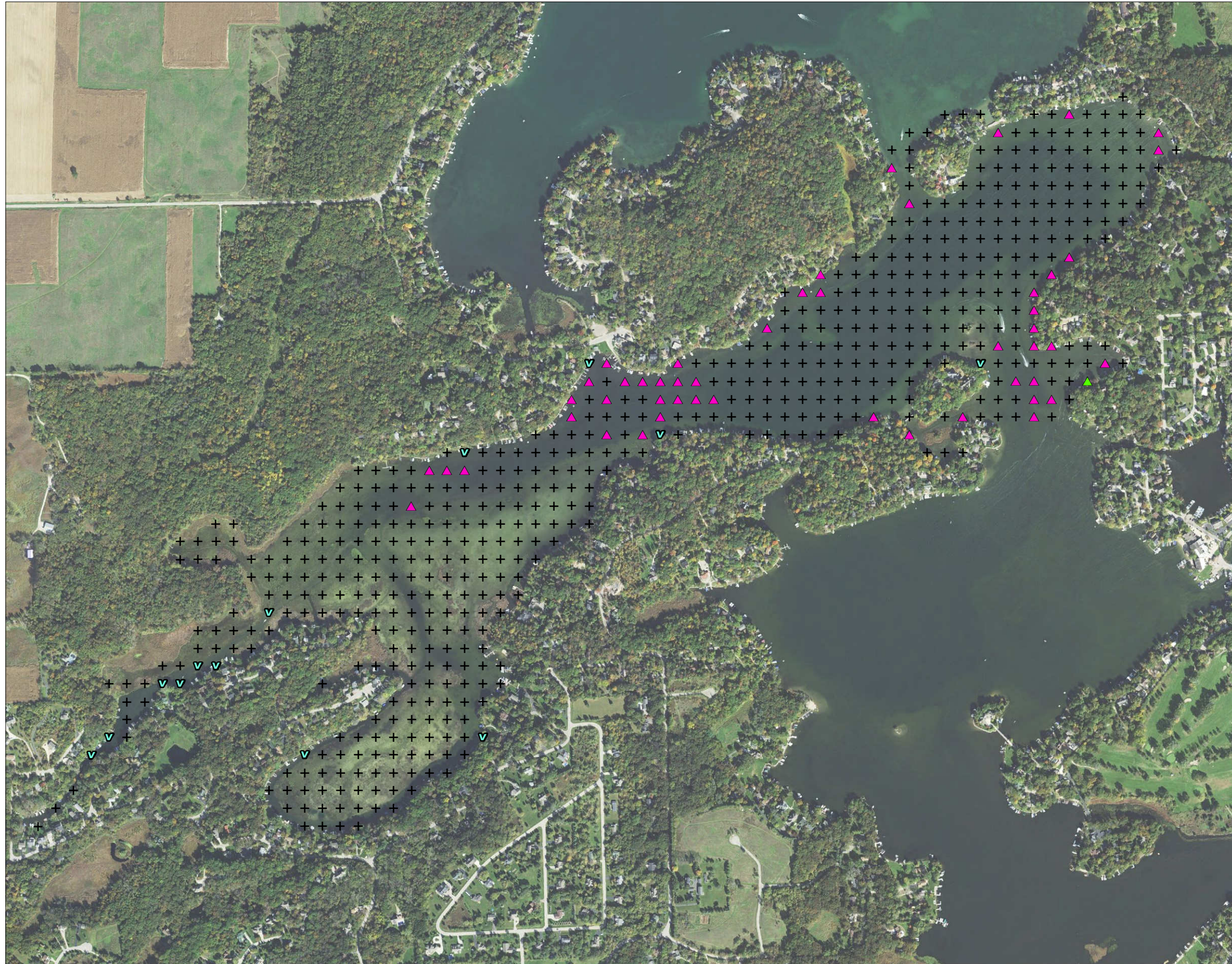


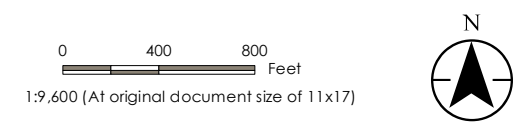
Figure No.
2.4

Title
2014 PI Survey - Middle Lake Arrowhead (Sagittaria sp.)

Client/Project
 Lauderdale Lakes Management District

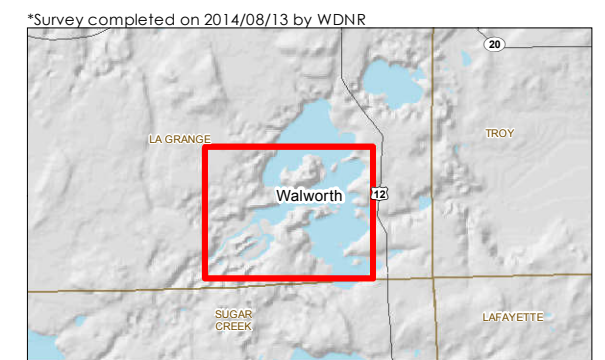
Project Location
 T. of Elkhorn, Walworth Co., WI

193703101
 Prepared by KAS on 2015-01-13
 Technical Review by JD on 2015-01-13
 Independent Review by JS on 2015-02-03



- Legend**
- + GPS Sample Points*
 - ▲ Fullness Rating 1
 - ▲ Fullness Rating 2
 - ▽ Visual Only

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines. |
| 3 | | The rake is completely covered and tines are not visible. |



- Notes**
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
 3. Orthophotography: 2015 NAIP



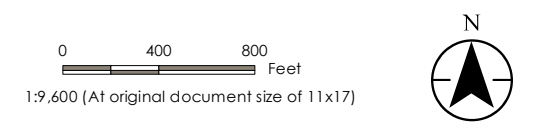
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Figure No. **2.5**
 Title
2014 PI Survey - Middle Lake Eurasian Water-Milfoil

Client/Project
 Lauderdale Lakes Management District

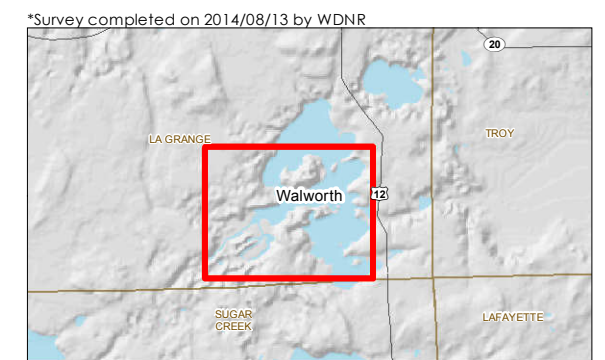
Project Location
 T. of Elkhorn, Walworth Co., WI

193703101
 Prepared by KAS on 2015-01-13
 Technical Review by JD on 2015-01-13
 Independent Review by JS on 2015-02-03

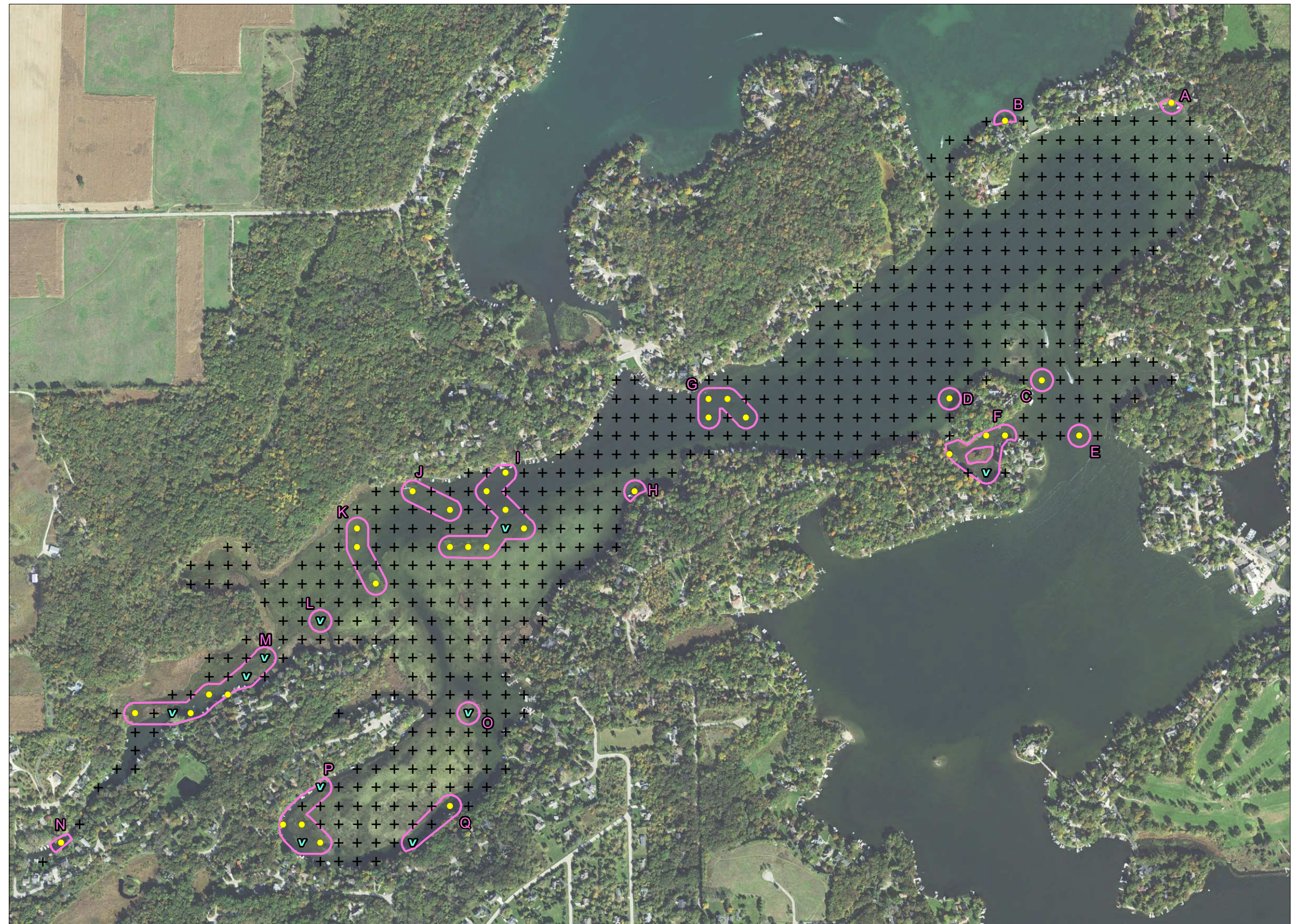


- Legend**
- + GPS Sample Points*
 - Fullness Rating 1
 - ∇ Visual Only
 - Aquatic Invasive Plant Area

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines. |
| 3 | | The rake is completely covered and tines are not visible. |



- Notes**
- Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 - Data Sources Include: Stantec
 - Orthophotography: 2015 NAIP



| Invasive Plant Area (ac) | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | TOTAL |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------------|
| | 0.27 | 0.30 | 0.50 | 0.50 | 0.50 | 2.51 | 2.29 | 0.39 | 4.82 | 1.70 | 2.22 | 0.50 | 4.47 | 0.27 | 0.50 | 3.08 | 1.74 | 26.58 |

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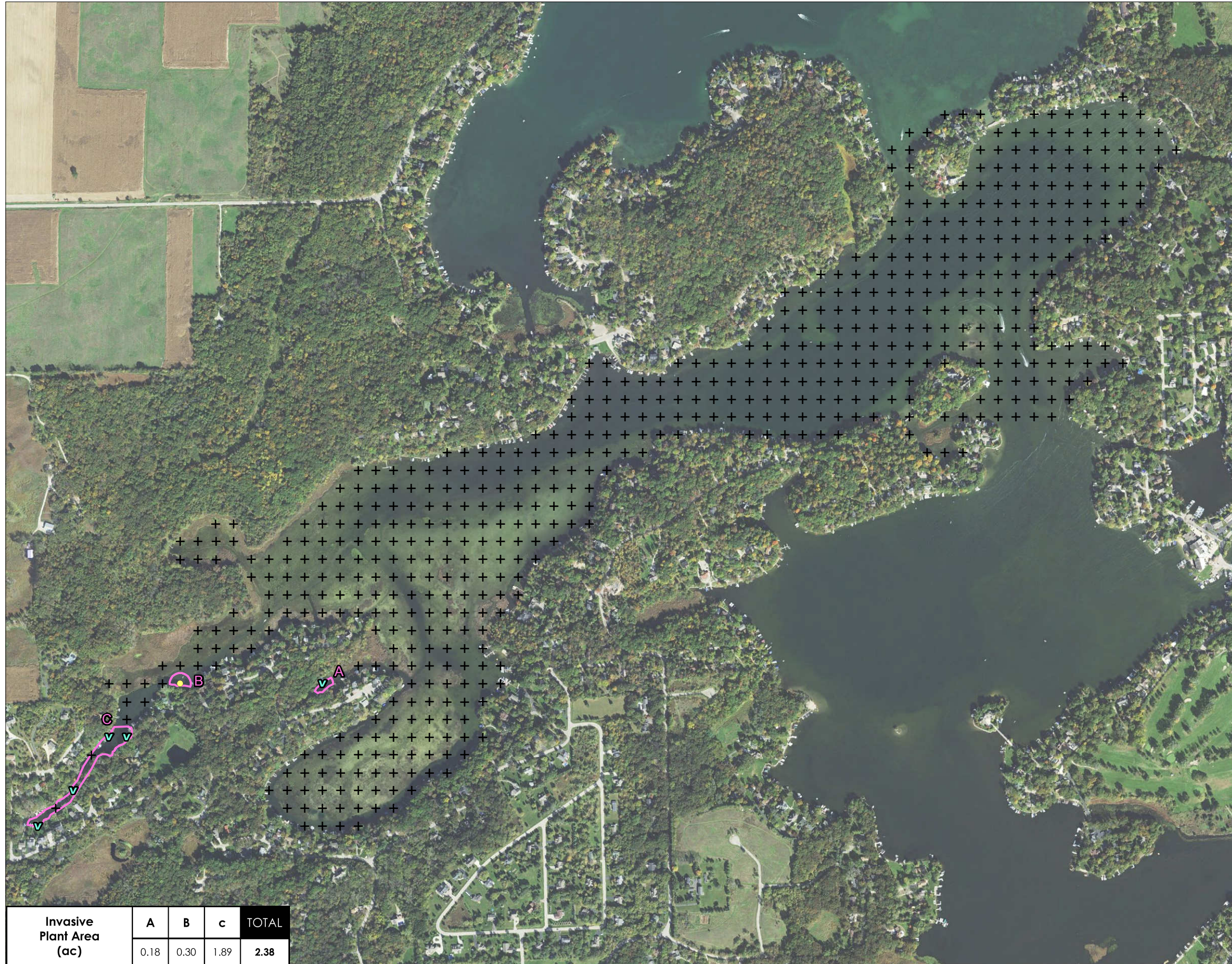
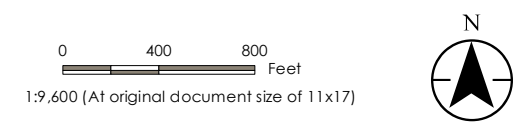


Figure No. **2.6**
 Title
**2014 PI Survey - Middle Lake
 Curly-leaf Pondweed**

Client/Project
 Lauderdale Lakes
 Management District

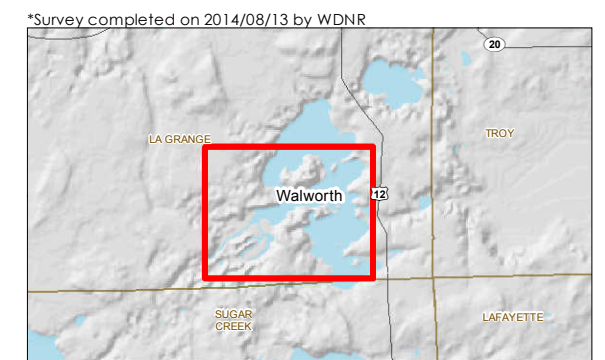
Project Location
 T. of Elkhorn,
 Walworth Co., WI

193703101
 Prepared by KAS on 2015-01-13
 Technical Review by JD on 2015-01-13
 Independent Review by JS on 2015-02-03



- Legend**
- + GPS Sample Points*
 - Fullness Rating 1
 - ∇ Visual Only
 - Aquatic Invasive Plant Area

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines. |
| 3 | | The rake is completely covered and tines are not visible. |

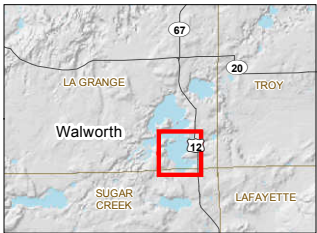
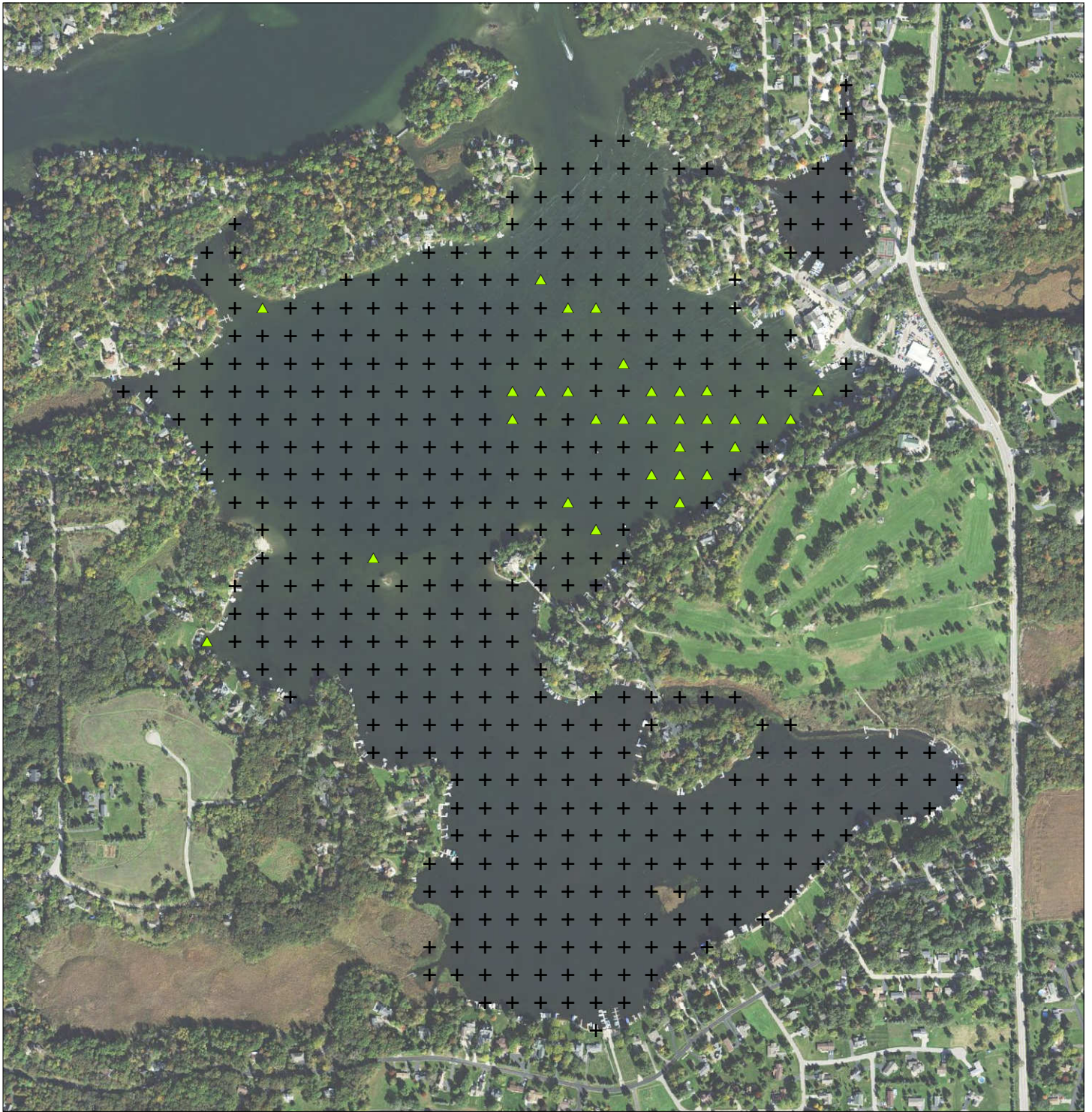


- Notes**
- Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 - Data Sources Include: Stantec
 - Orthophotography: 2015 NAIP

| Invasive Plant Area (ac) | A | B | c | TOTAL |
|--------------------------|------|------|------|-------------|
| | 0.18 | 0.30 | 1.89 | 2.38 |



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 Reviset: 2015-01-16 By: kscabou



Notes
 1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
 3. Orthophotography: 2015 NAIP

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Legend

- ✚ GPS Sample Points*
- ▲ Fullness Rating 1

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover lines. |
| 3 | | The rake is completely covered and lines are not visible. |

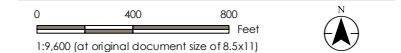
*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

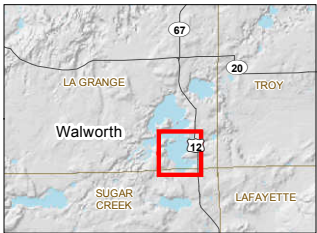
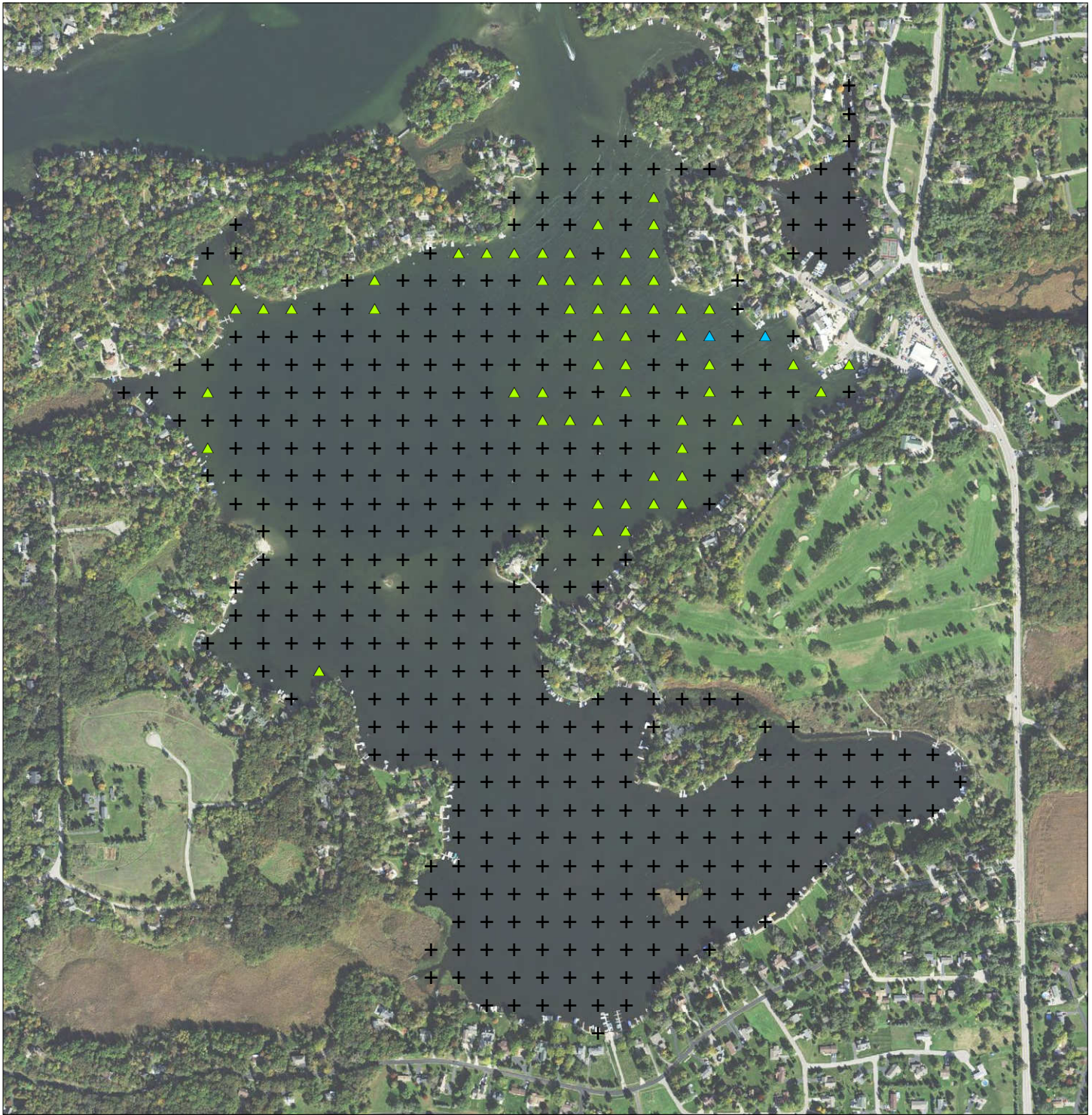
Figure No.
3.2

Title
2014 PI Survey - Mill Lake
Sago Pondweed (*Stuckenia pectinata*)

Client/Project
 Lauderdale Lakes
 Management District

Project Location 193703101
 T. of Ekhorn, Prepared by KAS on 2014-09-25
 Walworth Co., WI Technical Review by AB on 2014-09-25
 Independent Review by JS on 2015-02-05





Notes
 1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
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- Legend**
- ✚ GPS Sample Points*
 - ▲ Fullness Rating 1
 - ▲ Fullness Rating 2

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover lines. |
| 3 | | The rake is completely covered and lines are not visible. |

*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

Figure No. **3.3**

Title
2014 PI Survey - Mill Lake Spiny Naid (*Najas marina*)

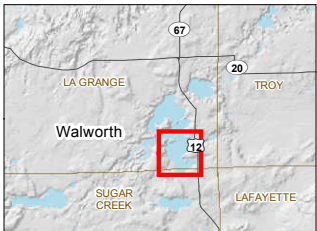
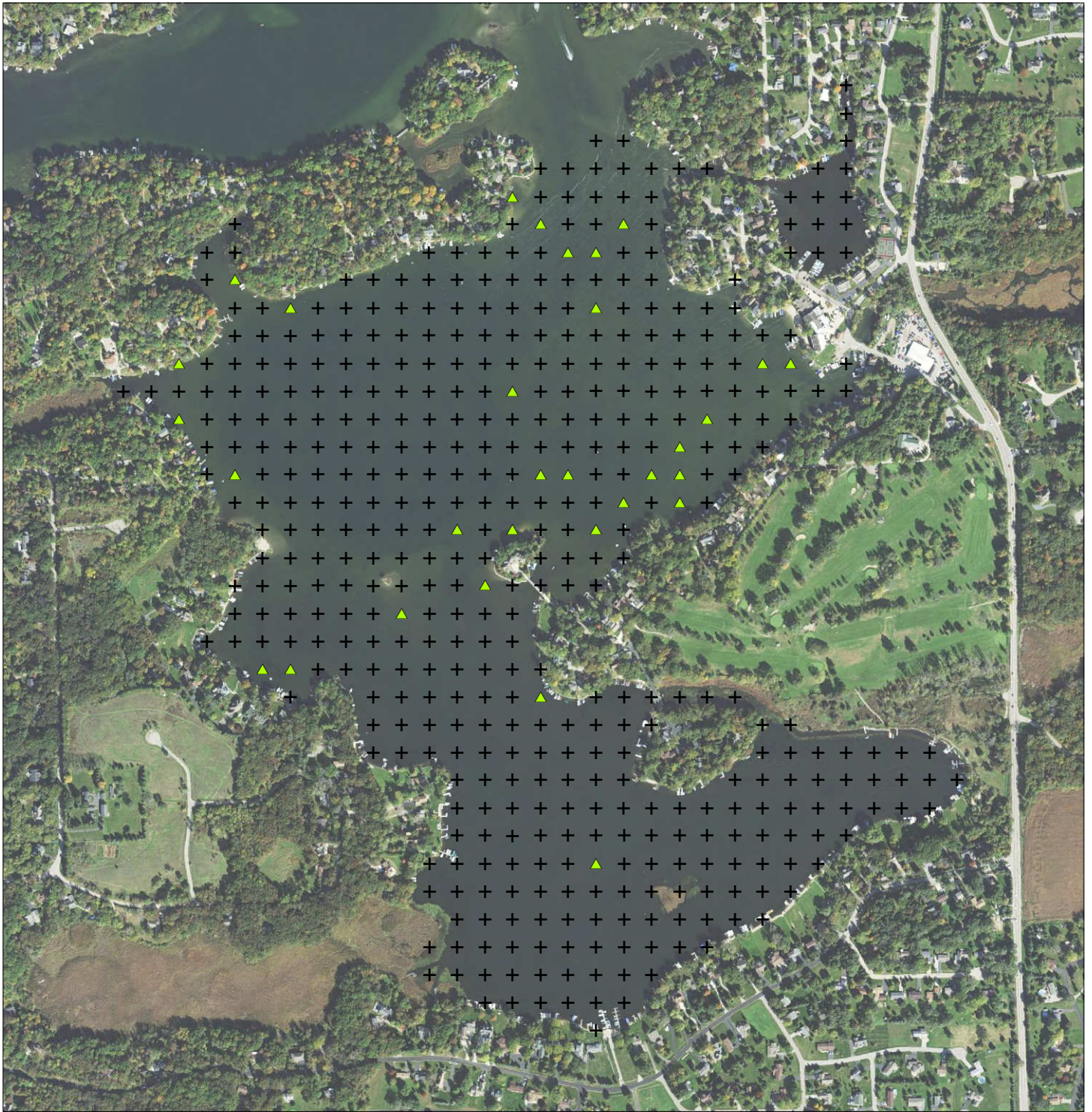
Client/Project
 Lauderdale Lakes Management District

Project Location
 T. of Ekhorn, Walworth Co., WI

193703101
 Prepared by KAS on 2014-09-25
 Technical Review by AB on 2014-09-25
 Independent Review by JS on 2015-02-05

0 400 800 Feet
 1:9,600 (at original document size of 8.5x11)





Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources Include: Stantec
3. Orthophotography: 2015 NAIP

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Legend

- ✚ GPS Sample Points*
- ▲ Fullness Rating 1

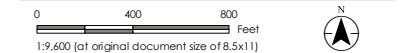
| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover lines. |
| 3 | | The rake is completely covered and lines are not visible. |

Figure No.
3.4

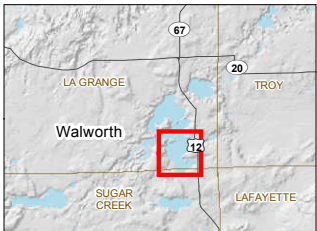
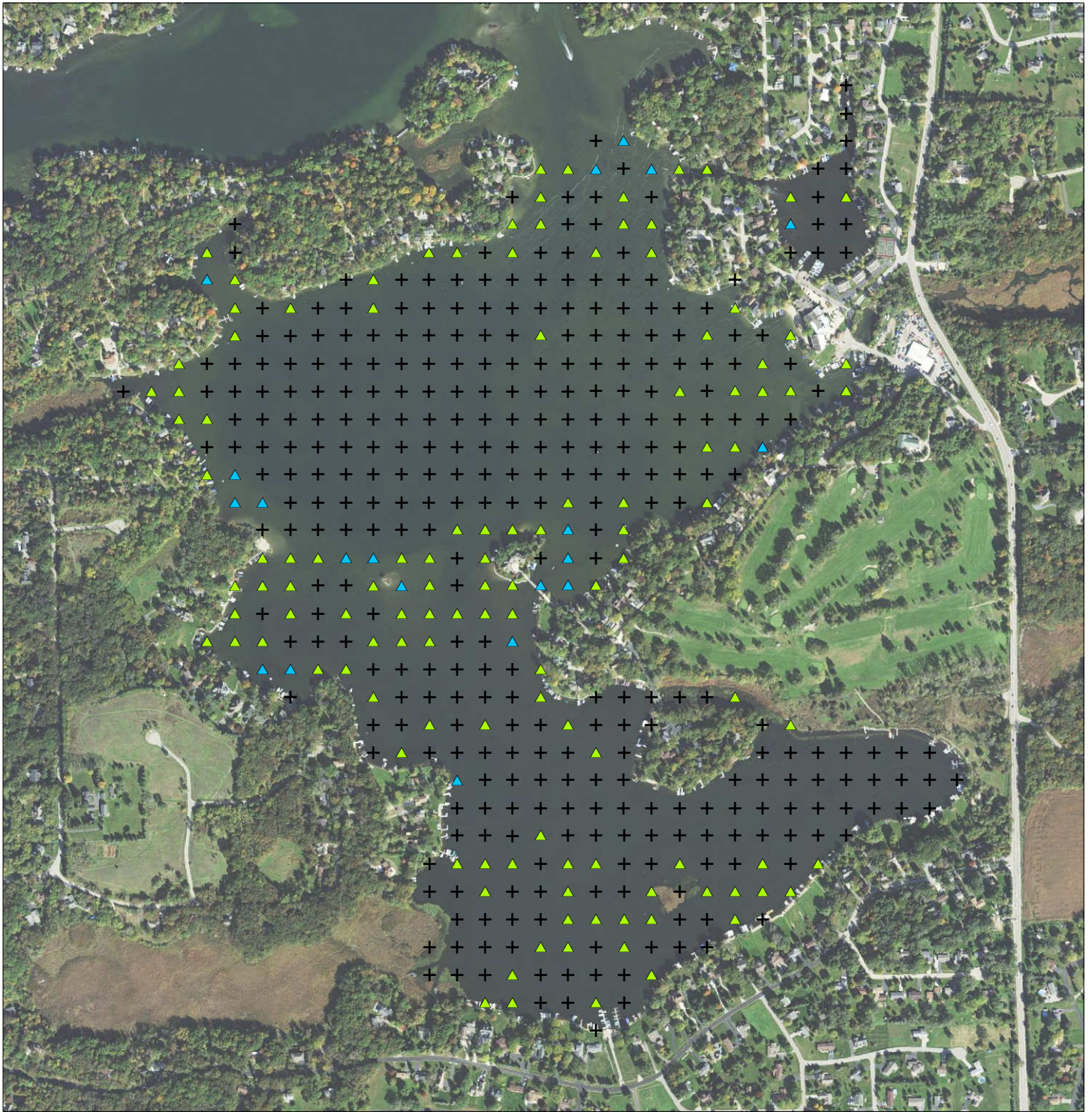
Title
**2014 PI Survey - Mill Lake
Bladderwort (*Utricularia vulgaris*)**

Client/Project
Lauderdale Lakes
Management District

Project Location 193703101
T. of Ekhorn, WI Prepared by KAS on 2014-09-25
Walworth Co., WI Technical Review by AB on 2014-09-25
Independent Review by JS on 2015-02-05



*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa



Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources Include: Stantec
3. Orthophotography: 2015 NAIP

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Legend

- + GPS Sample Points*
- ▲ Fullness Rating 1
- ▲ Fullness Rating 2

| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover lines. |
| 3 | | The rake is completely covered and lines are not visible. |

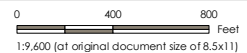
*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

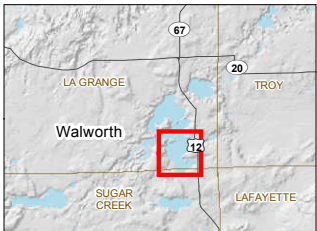
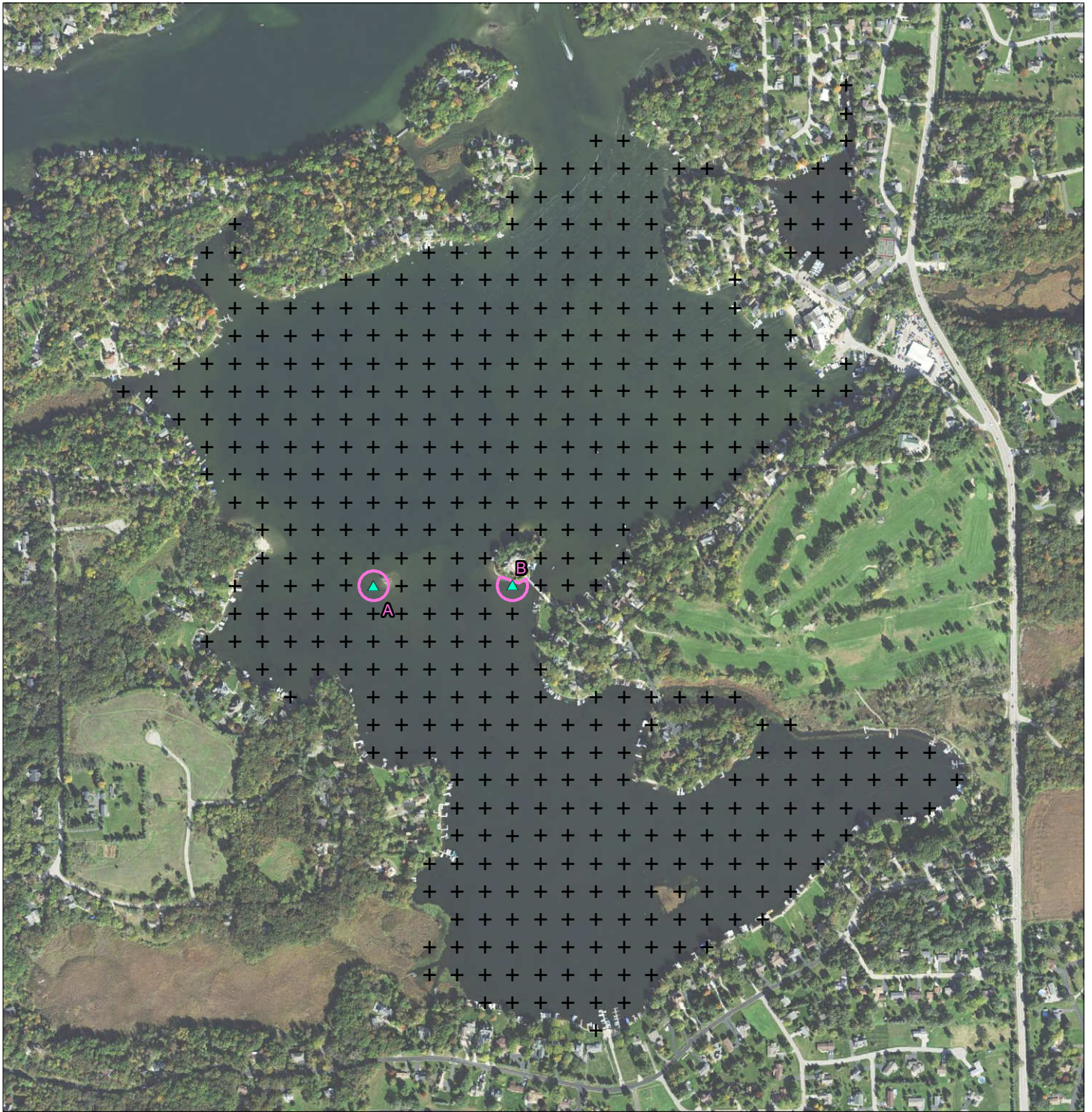
Figure No.
3.5

Title
**2014 PI Survey - Mill Lake
Muskgrass (*Chara sp.*)**

Client/Project
Lauderdale Lakes
Management District

Project Location 193703101
T. of Ekhorn, Prepared by KAS on 2014-09-25
Walworth Co., WI Technical Review by AB on 2014-09-25
Independent Review by JS on 2015-02-05





Notes
 1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec
 3. Orthophotography: 2015 NAIP

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Legend

- + GPS Sample Points*
- ▲ Fullness Rating 1
- Aquatic Invasive Plant Area

| Curly-leaf Pondweed (acreage) | |
|-------------------------------|------|
| A | 0.45 |
| B | 0.36 |
| Total = 0.81 | |

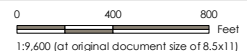
| Fullness Rating | Coverage | Description |
|-----------------|----------|--|
| 1 | | Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer. |
| 2 | | There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines. |
| 3 | | The rake is completely covered and tines are not visible. |

Figure No.
3.7

Title
2014 PI Survey - Mill Lake
Curly-leaf Pondweed

Client/Project
 Lauderdale Lakes
 Management District

Project Location 193703101
 T. of Elkhorn, WI Prepared by KAS on 2014-09-25
 Walworth Co., WI Technical Review by AB on 2014-09-25
 Independent Review by JS on 2015-02-05



*Survey Completed 2014/07/29 by James Scharl & Tom Lamppa

Appendix D

Raw Plant Survey Data

Appendix E

Aquatic Plant Harvesting Guidance and Disposal Site Map

GENERAL GUIDANCE FOR HARVESTER OPERATION

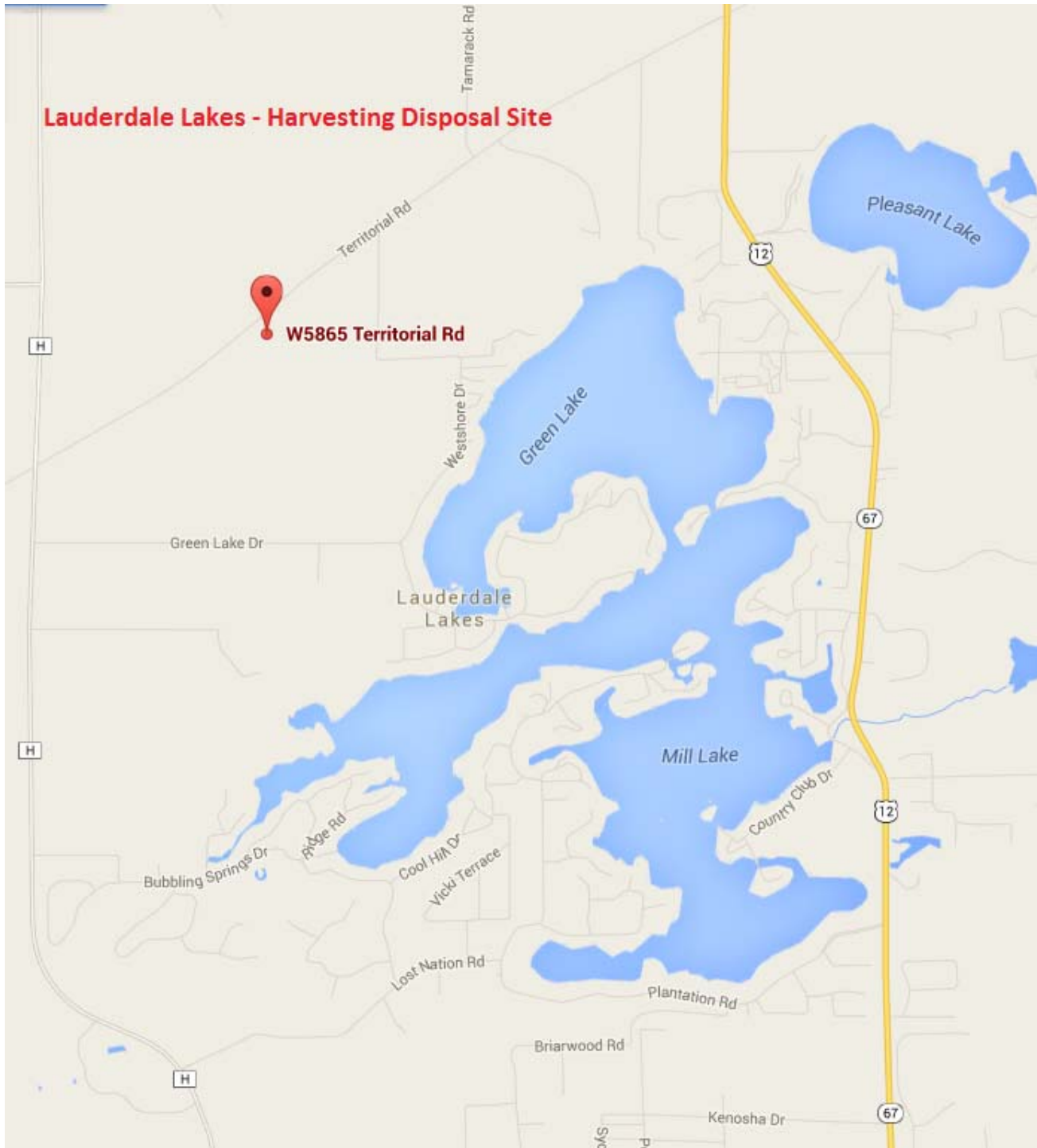
- EXCEPT FOR NAVIGATIONAL ACCESS LANES, ONLY CUT IN DEPTHS MORE THAN THREE FEET
- PRIORITIZE HARVESTING AREAS TO FOCUS ON GREATEST NEED – Highest priority should be on maintaining navigation access lanes to/from boat landings and common navigational lanes. In these areas, you must leave 12 inches of plant on the lake bottom. Individual areas by priority are included in the table below.
- TOP CUT IN AREAS FOR EWM MANAGEMENT – These areas are of moderate priority. Restrict cutting up to a depth of 4', leaving a minimum of 12 inches of plant growth on the lake bottom in areas shallower than 5 feet.
- RECREATIONAL HARVESTING AREAS – These areas of low priority and are to alleviate nuisance, surface-matting growth for riparian owners. Restrict harvesting from the end of pier heads to open water. Harvesting from pier-heads to shore should be done manually only.
- WILD CELERY – Removal of water celery shall be limited to areas that reach “nuisance” conditions – when water celery is closer than 2 feet from the water’s surface
- Harvesting of native pondweeds and/or muskgrass is prohibited.
- MINIMIZE IMPACTS TO WDNR ENVIRONMENTALLY SENSITIVE AREAS – Restrict harvesting to navigation channels only within these areas and to a depth of 2 feet, leaving 12 inches of plant growth on the lake bottom. Harvesting to occur after June 30th only.
- SURFACE SKIMMING ALLOWED IN ALL LOCATIONS EXCEPT FOR WDNR SENSITIVE AREAS – Outside of mapped areas, harvester may surface skim free-floating vegetation that has been previously cut or uprooted, but not collected, to a depth of 1 ft. **Use of the cutter head is not permitted for this action.**
- ALL CUT MATERIAL SHOULD BE INSPECTED FOR FISH AND ANIMALS. ANY ORGANISMS FOUND SHOULD BE IMMEDIATELY RETURNED TO THE WATER.
- ALL CUT MATERIALS SHOULD BE COLLECTED AND DEPOSITED AT THE DESIGNATED DISPOSAL SITE – Mr. Donald West’s property at W5865.
- Maps of all harvesting location and disposal site are included in Appendix E.

| Area | Description | Instructions |
|--------------------------------|-------------------------------|--|
| HIGH PRIORITY AREAS | | |
| A ₁ | Common access navigation lane | Cut a lane 50' wide to the 5' contour - must leave 12" of plant growth on the bottom* |
| A ₂ | Boating access lane | Cut a lane 15' wide to the 5' contour - must leave 12" of plant growth on the bottom* |
| MODERATE PRIORITY AREAS | | |
| B ₁ | EWM management areas | EWM Management Areas: Top cut to a depth of 4' to control surface matting of EWM growth and promote native species growth. Must leave 12" of plant growth on the bottom. |
| B ₂ | Riparian access | Top cut 2' from pier heads to open water for riparian access |
| LOW PRIORITY AREAS | | |
| C | Recreational areas | Surface cut only from pier heads to open water (variable widths). Manual harvest ONLY from shore to pier heads |

* - In Middle Lake, cutting depth limited to 2 feet, beginning after June 30th ONLY

Lauderdale Lakes - Harvesting Disposal Site

 **W5865 Territorial Rd**



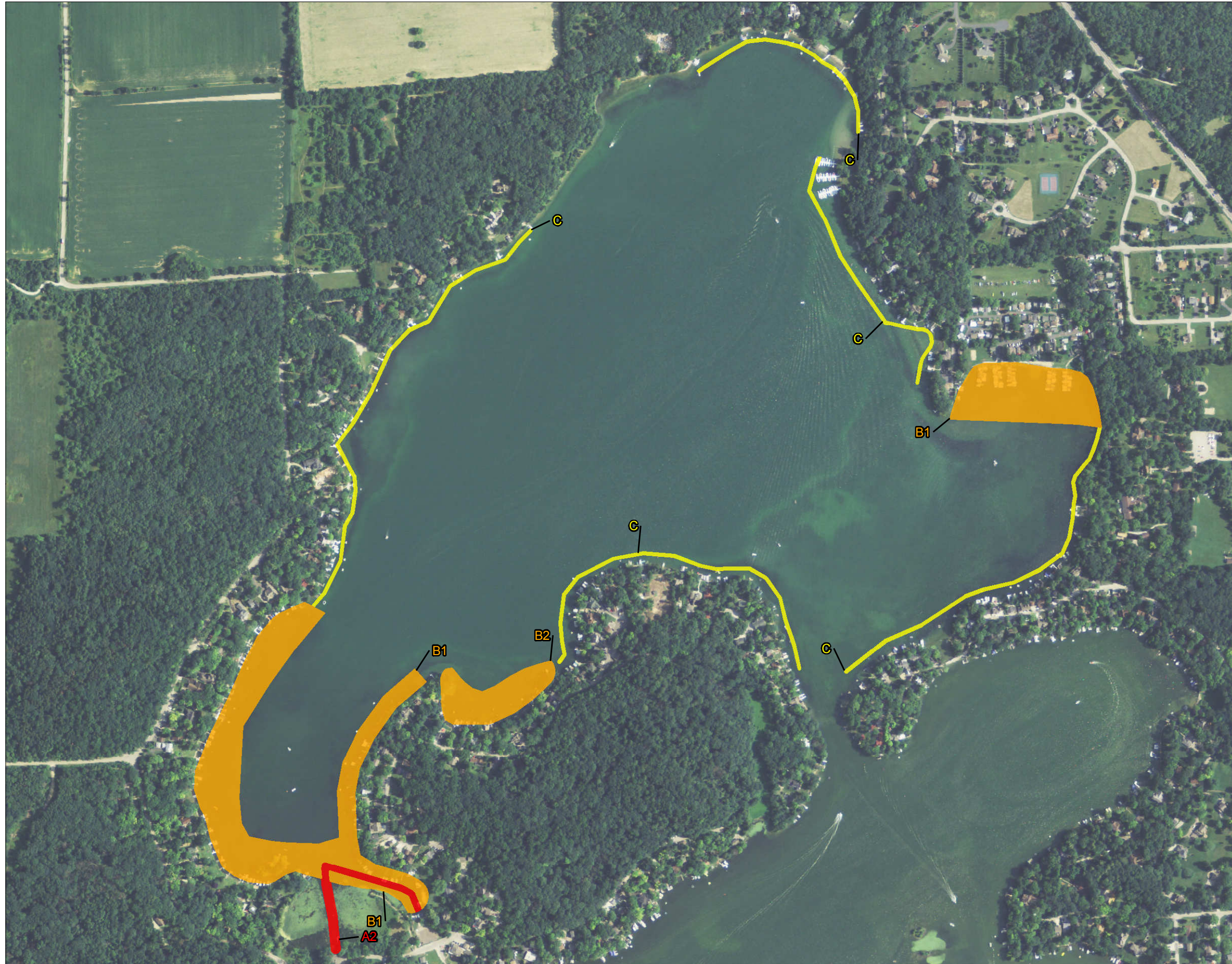
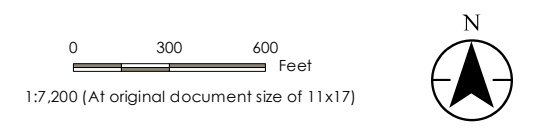
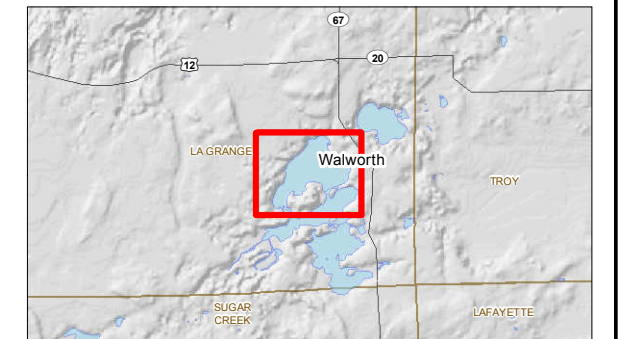


Figure No. **1**
 Title **Green Lake 2015 Harvest Plan**
 Client/Project **Lauderdale Lakes Management District**
 Project Location **T. of Elkhorn, Walworth Co., WI** 193703101
 Prepared by KAS on 2015-02-11
 Technical Review by AB on 2015-02-11
 Independent Review by JS on 2015-02-11



| Area | Instructions |
|---|---|
| HIGH PRIORITY AREAS - 1.34 ac | |
| A ₁ | Cut a lane 50' wide to the 5' contour - Must leave 12" of plant growth on the bottom |
| A ₂ | Cut a lane 15' wide to the 5' contour - Must leave 12" of plant growth on the bottom |
| MODERATE PRIORITY AREAS - 24.12 ac | |
| B ₁ | EWM Management Areas: Top cut to a depth of 4' to control to control surface matting of EWM growth and promote native species growth - Must leave 12" of plant growth on the bottom |
| B ₂ | Top cut 2' from pier heads out to the 5' contour for riparian access |
| LOW PRIORITY AREAS | |
| C | Surface cut only from pier heads to open water (variable widths) - Manual harvest ONLY from shore to pier heads |



- Notes**
- Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 - Data Sources Include: Stantec and WDNR
 - Orthophotography: 2013 NAIP



K:\Data\Other_PCS\193703101_LAS_Lauderdale Lakes\07_04\mxd\Green_Harvest_Plan.mxd - Revised: 2015-04-08 Ric.LaBou

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P:\Data\Other_PCA\193703101_LAS_Lauderdale_Lakes\07_04\mxd\Wilde_Harvest_Forum.mxd - Revised: 2015-11-17 Bc & Kallou

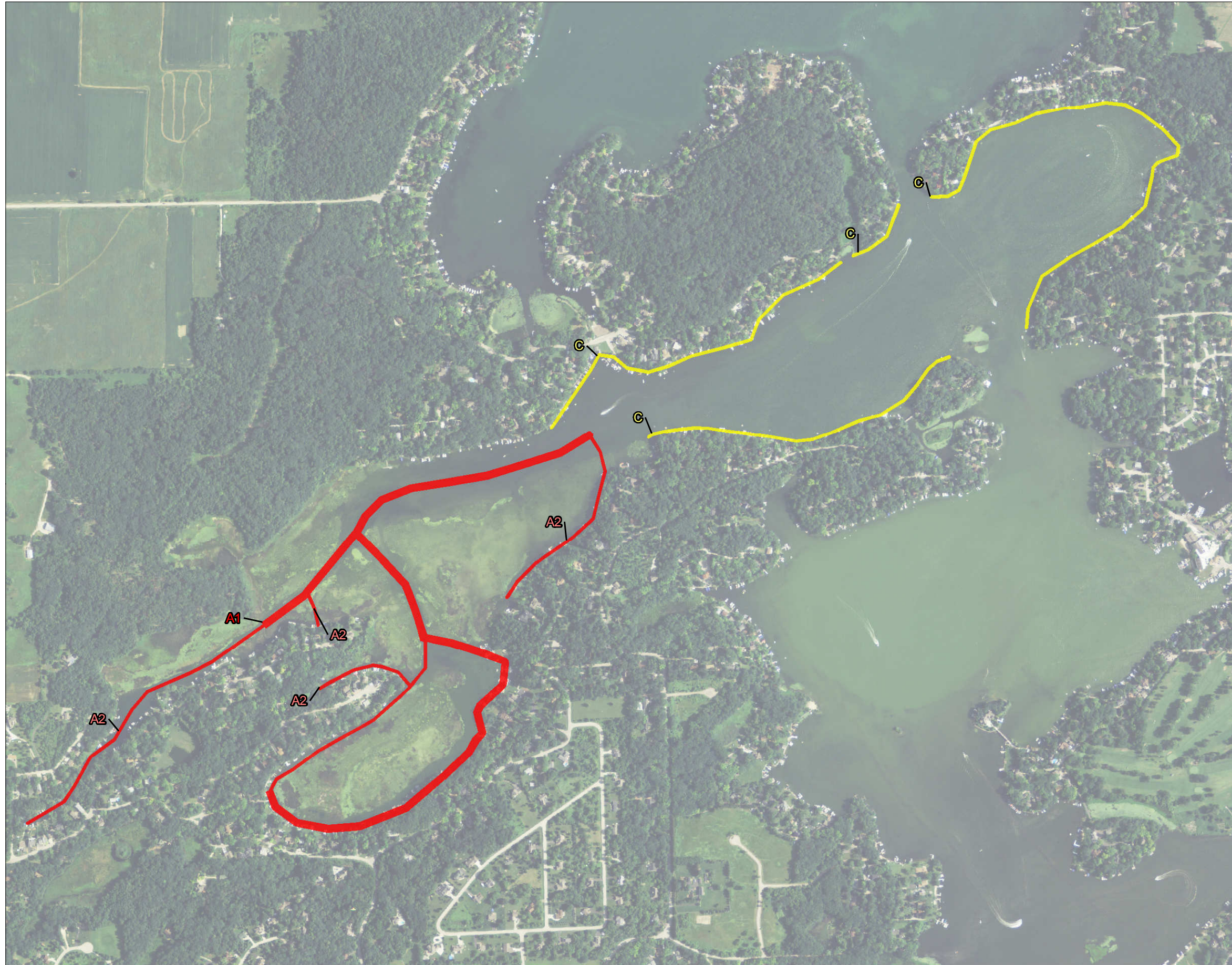


Figure No.

2

Title

**Middle Lake
2015 Harvest Plan**

Client/Project

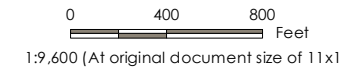
Lauderdale Lakes
Management District

Project Location

T. of Elkhorn,
Walworth Co., WI

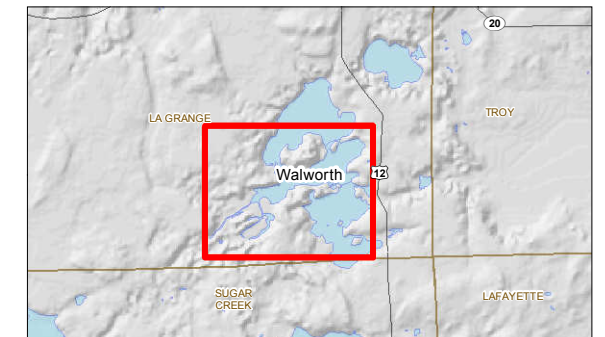
193703101

Prepared by KAS on 2015-02-11
Technical Review by AB on 2015-02-11
Independent Review by JS on 2015-02-11



| Area | Instructions |
|--|--|
| HIGH PRIORITY AREAS* - 11.04 ac | |
| A ₁ | Cut a lane 50' wide to the 5' contour - Must leave 12" of plant growth on the bottom |
| A ₂ | Cut a lane 15' wide to the 5' contour - Must leave 12" of plant growth on the bottom |
| MODERATE PRIORITY AREAS - None | |
| B ₁ | EWM Management Areas: Top cut to a depth of 4' to control surface matting of EWM growth and promote native species growth - Must leave 12" of plant growth on the bottom |
| B ₂ | Top cut 2' from pier heads out to the 5' contour for riparian access |
| LOW PRIORITY AREAS | |
| C | Surface cut only from pier heads to open water (variable widths) - Manual harvest ONLY from shore to pier heads |

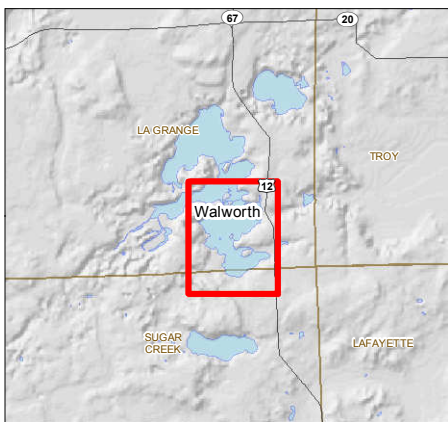
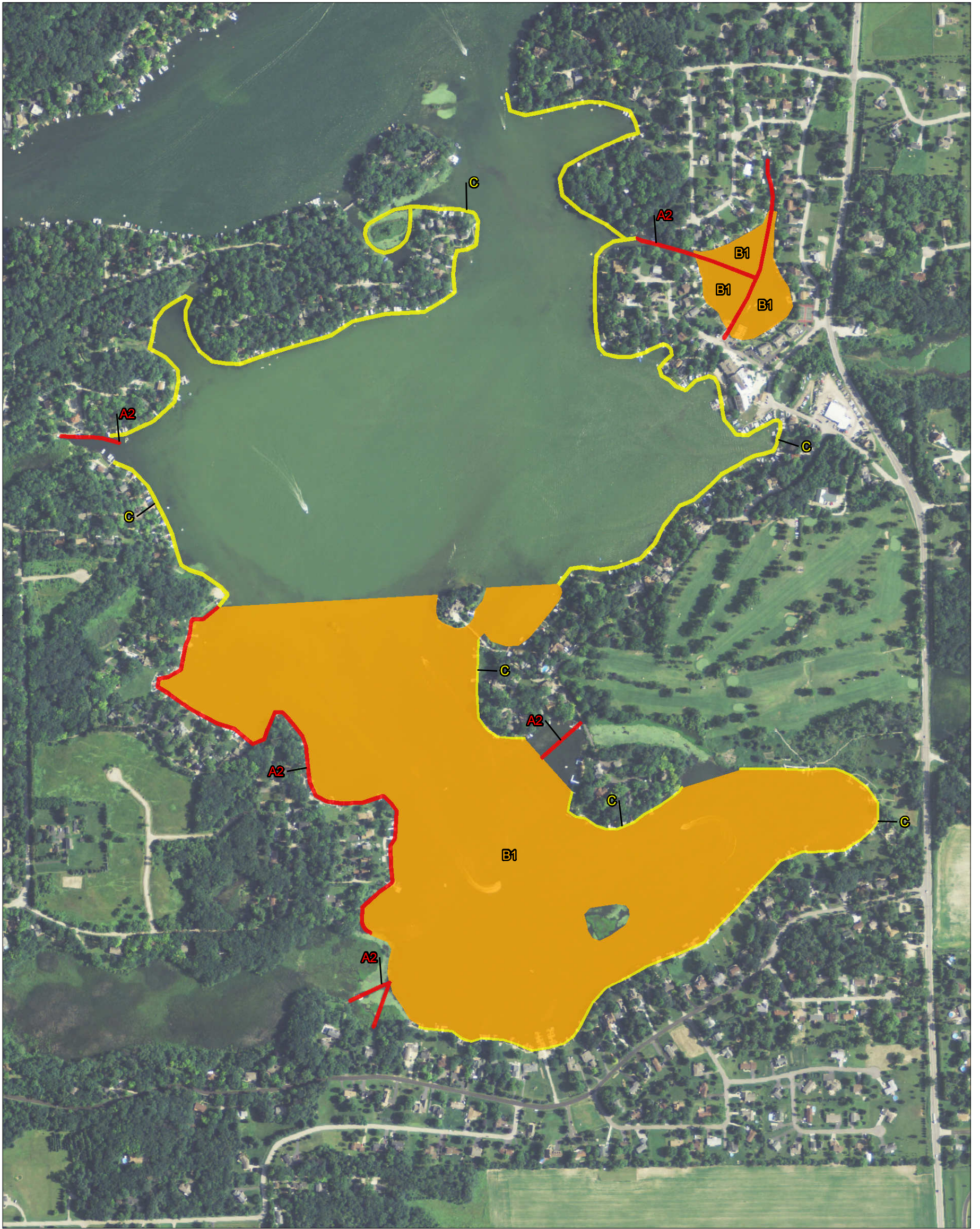
*Harvesting to begin after June 30th ONLY and limited to 2' depth of cut



Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources Include: Stantec, WDOT, and WDNR
3. Orthophotography: 2013 NAIP





- Notes**
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
 2. Data Sources Include: Stantec and WDNR
 3. Orthophotography: 2013 NAIP

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| Area | Instructions |
|--|---|
| HIGH PRIORITY AREAS - 2.27 ac | |
| A ₁ | Cut a lane 50' wide to the 5' contour - Must leave 12" of plant growth on the bottom |
| A ₂ | Cut a lane 15' wide to the 5' contour - Must leave 12" of plant growth on the bottom |
| MODERATE PRIORITY AREAS - 112.42 ac | |
| B ₁ | EWM Management Areas: Top cut to a depth of 4' to control to control surface matting of EWM growth and promote native species growth - Must leave 12" of plant growth on the bottom |
| B ₂ | Top cut 2' from pier heads out to the 5' contour for riparian access |
| LOW PRIORITY AREAS | |
| C | Surface cut only from pier heads to open water (variable widths) - Manual harvest ONLY from shore to pier heads |

Figure No.

3

Title

**Mill Lake
2015 Harvest Plan**

Client/Project

Lauderdale Lakes
Management District

Project Location
T. of Elkhorn,
Walworth Co., WI

193703101
Prepared by KAS on 2015-02-12
Technical Review by PM on 2015-02-12
Independent Review by JS on 2015-02-12

0 300 600 Feet
1:7,200 (At Original document size of 11x17)

