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Pachaug Pond Aquatic Plant Survey Report 2025



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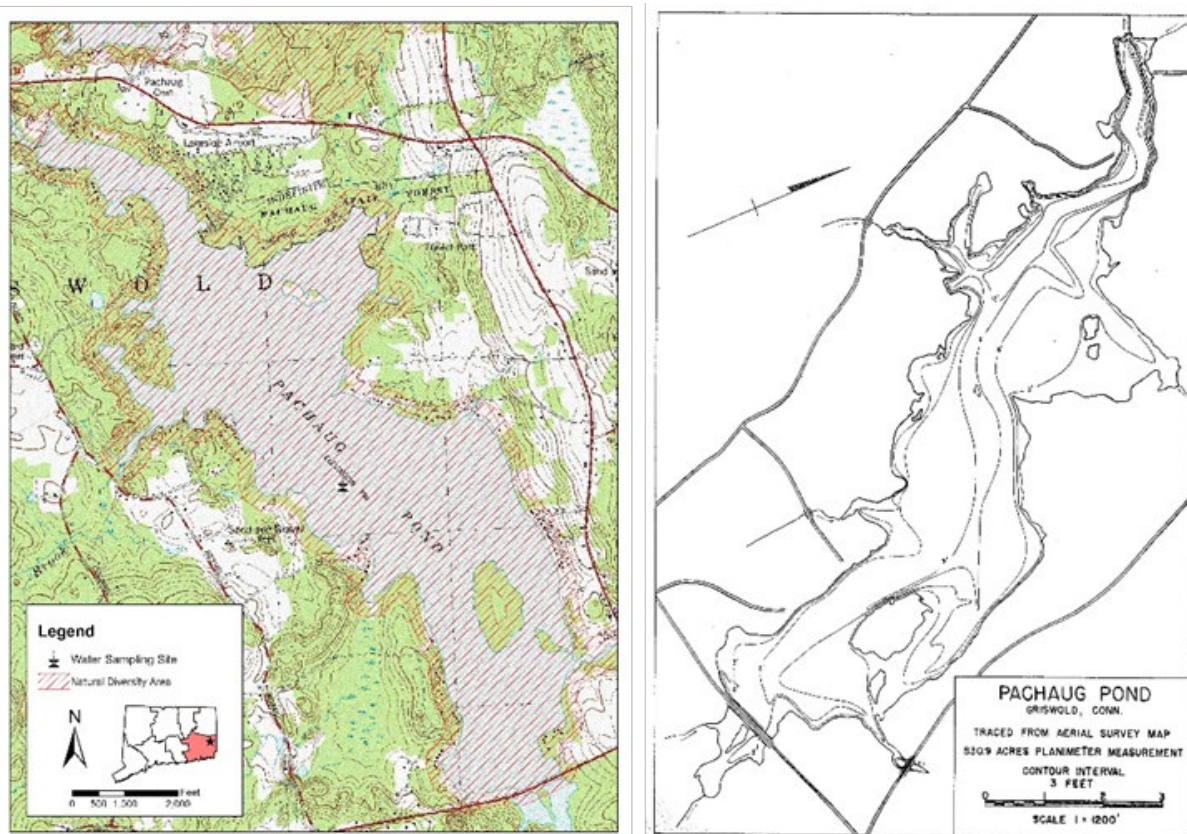


Figure 1. Topographic map of Pachaug Pond including location of state-listed species (Natural Diversity Area) (left) and bathymetry map circa 1959 (right).

INTRODUCTION

Since 2004, the Connecticut Agricultural Experiment Station (CAES) Office of Aquatic Invasive Species (OAIS; formerly the Invasive Aquatic Plant Program) has completed over 400 surveys of aquatic vegetation and water chemistry in Connecticut's lakes, ponds, and rivers. Over 300 waterbodies have been mapped with many, including Pachaug Pond, receiving multiple

resurveys to monitor change (CAES OAIS, 2025). Of the Connecticut waterbodies recorded in our database, 64% contain one or more invasive, non-native plant species capable of causing rapid deterioration of aquatic ecosystems and recreational value. The presence of invasive species is related to water chemistry, public boat launches, random events, and climate change (Rahel and Olden, 2008). A CAES OAIS data repository is available online where stakeholders can view digitized

vegetation maps, detailed transect data, temperature and dissolved oxygen profiles, and water test results for clarity, pH, alkalinity, conductivity, total phosphorus, and total nitrogen (portal.ct.gov/caes-oais). In addition, the database contains digitized herbarium mounts of each waterbody's plant species. This information allows citizens, government officials, and scientists to view past conditions, compare them with the present, and make informed management decisions.

Pachaug Pond is an 817-acre waterbody located in Griswold, CT. It is Connecticut's largest body of freshwater east of the Connecticut River and offers important wildlife habitat and recreational opportunities such as fishing, swimming, boating, cross-country skiing, and snowmobiling with over 200 lakefront property owners. The pond is home to a marina, a campground, a state boat launch, and a fish and game club. Stocked with northern pike, the pond is the site of many fishing tournaments and hosts the Great Pachaug Canoe and Kayak race (PPWCA, 2022). It is a relatively shallow waterbody with a maximum depth of about 16 feet and an average depth of around six feet. This creates a large littoral zone that favors aquatic plant growth. State-listed species are present (Figure 1, left; CT DEEP, 2022) and their protection requires withholding information on species and location without Connecticut Department of Energy and Environmental Protection (CT DEEP) Natural Diversity Database (NDDB) approval. Public access is via a state boat launch on the northern shore. There are no motor restrictions; however, numerous shoals and shallows require caution.

Previous work on Pachaug Pond dates to the 1950's when the State Board of Fisheries and Game (1959) described the lake as being shallow and fertile with

abundant emergent and submergent vegetation (Figure 1, right; see appendix for full description). The specific plant species were not mentioned, but the bottom was described as mud, swampy ooze, and sand. A dense algal bloom was observed that reduced the water clarity to two feet. Bass fishing was described as excellent with fish over five pounds common. The 1959 description mentioned frequent severe summer drawdowns that may have been controlling aquatic vegetation. These drawdowns were stated as needed for "industrial" purposes, which was likely power generation. Apparently, drawdowns were lessening as of 1959, and aquatic vegetation was increasing. CAES studied Pachaug Pond in 1979 as part of a statewide investigation into changes in lake water chemistry (Frink and Norvell, 1984). In addition to detailed water chemistry, the study mentions Pachaug Pond as having moderately dense aquatic weeds in shallow areas and watermilfoil near the boat launch. Interestingly, pioneer infestations of invasive species might first be noticed at boat launches if the plant arrived on a boat or trailer. The 1979 CAES water tests found a water clarity of 3.5 m (12 feet), an alkalinity of 15 mg/L CaCO_3 and a total phosphorus concentration of 16 $\mu\text{g/L}$ at the surface and 13 $\mu\text{g/L}$ at the bottom. These results suggested an oligo-mesotrophic condition where nutrients were not excessive.

Aquatic plant management is organized by the Pachaug Pond Weed Control Association (PPWCA). In response to growing concerns about nuisance aquatic vegetation, the PPWCA commissioned CAES OASIS to conduct annual aquatic vegetation surveys beginning in 2017. These surveys have documented a diverse plant community, with 27–35 native species and 6–8 invasive species.

To maintain navigable paths in areas with dense vegetation, such as water lilies, a mechanical harvester was introduced in 2022. While the harvester has been effective in keeping waterways clear for boat traffic, survey observations suggest it may also be contributing to the spread of fanwort by removing emerged vegetation such as water lilies. Throughout the survey years, fanwort and Eurasian watermilfoil have remained the most troublesome invasive species. Among native plants, water smartweed, white water lily, and eelgrass have caused the greatest nuisance. Northern hydrilla, a troublesome invasive aquatic plant, was discovered in 2024. The following 2025 report describes the ninth consecutive survey of Pachaug Pond by CAES O AIS.

OBJECTIVES

1. Perform a ninth aquatic vegetation survey of Pachaug Pond and test water chemistry.
2. Compare 2025 with previous surveys and add vegetation maps and water chemistry information to the CAES O AIS website.
3. Update aquatic plant management options.
4. Provide a detailed comprehensive report for the Pachaug Pond Weed Control Association (PPWCA).

METHODS

Aquatic Plant Surveys and Mapping:

CAES O AIS surveyed Pachaug Pond for aquatic vegetation on August 11, 12, and 13, 2025. The survey utilized methods established by CAES and is consistent with the past surveys of Pachaug Pond. Surveys were conducted using 16 and 18-foot motorized boats traveling over areas that could support aquatic plants. Plant

species were recorded based on visual observation or collections with a long-handled rake or grapple. Lowrance[®] Hook 5 and HDS 5 sonar systems as well as ground-truthing with occasional grapple tosses were used to identify vegetated areas in deep water. Quantitative information on plant abundance was obtained by resurveying 10 transects that were positioned perpendicular to the shoreline in 2017, representing the variety of habitats occurring in the lake. Transect points were located using Trimble[®] R1 GNSS global positioning systems with sub-meter accuracy. Ten sampling data points were taken along each transect at 0.5, 5, 10, 20, 30, 40, 50, 60, 70, and 80 m from the shore. Depth was measured with a rake handle, drop line, or digital depth finder, and sediment type was estimated. Abundances of species present at each point were ranked on a scale of 1 – 5 (1 = very sparse, 2 = sparse, 3 = moderately abundant, 4 = abundant, 5 = very abundant). When field identifications of plants were questionable, samples were brought back to the lab for review using the taxonomy of Crow and Hellquist (2000a, 2000b). One specimen of each species collected in the lake was dried and mounted in the CAES O AIS aquatic plant herbarium. Digitized mounts can be viewed online (portal.ct.gov/caes-oais). Plant species are referred to by common name in the text of this report; however, corresponding scientific names can be found in the appendix. Cattail and phragmites are wetland plants included in our survey at the request of the PPWCA. Phragmites is an invasive wetland species and is marked as such in our report. We post-processed the GPS data in Pathfinder[®] 5.85 (Trimble Navigation Limited, Sunnyvale, CA) and then imported it into ArcGIS[®] Pro 3.4.0 (ESRI Inc., Redlands, CA). Data were then overlaid onto recent high-resolution aerial imagery for the continental United

Table 1 The total number of species, total number of native species, and total number of invasive/non-native species found in Pachaug Pond during CAES OAIS surveys from 2017-2025.

	2017	2018	2019	2020	2021	2022	2023	2024	2025
Number of Species	33	34	35	36	40	36	39	42	43
Number of Native Species	27	28	29	30	34	29	32	34	35
Number of Invasive Species/Non-Native Species	6	6	6	6	6	7	7	8	8

States made available by the USDA Farm Services Agency.

Water Analysis:

Water was analyzed from the deepest part of the lake in the same location as the previous eight surveys. Water temperature and dissolved oxygen were measured 0.5 m beneath the surface and at 1 m intervals to the bottom. Water was tested for temperature and dissolved oxygen using a YSI 58[®] meter.

Temperature and dissolved oxygen were measured 0.5 m beneath the surface and at 1 m intervals to the bottom. Water clarity was measured by lowering a six-inch black and white Secchi disk into the water in order to determine at what depth it could be viewed. Water samples (250 mL) for pH, alkalinity, conductivity, and total phosphorus were obtained from 0.5 m beneath the surface and 0.5 m above the bottom. The samples were stored at 38°C until testing. A Fisher AR20[®] meter determined pH and conductivity.

Alkalinity (mg/L CaCO₃) was quantified by titration with 0.016 N H₂SO₄ to an end point of pH 4.5. We determined total phosphorus using the ascorbic acid method preceded by digestion with potassium persulfate (APHA, 1995). Phosphorus was quantified with a Milton Roy Spectronic 20D[®] spectrometer with a light path of 2 cm and a wavelength of 880 nm.

RESULTS

General Aquatic Plant Surveys and Transects:

CAES OAIS found eight invasive/non-native and 35 native plant species in Pachaug Pond in 2025 (Table 1). This is the highest number of native species found in all survey years, and the same number of invasive/non-native species found in 2024. Pachaug Pond contains among the greatest number of plant species found in any waterbody surveyed by CAES OAIS (2025). A full list of the native and invasive plants found in Pachaug Pond from 2017-2025 can be found in the appendix. Providing details on the specifics of the native plants is beyond the scope of this report; however, information is available at the USDA “About PLANTS” website (plants.usda.gov/home). The CAES OAIS website contains digitized survey maps where individual plant layers can be viewed separately (portal.ct.gov/caes-oais).

Eurasian watermilfoil, fanwort, northern hydrilla, minor naiad, phragmites, swollen bladderwort, and variable-leaf watermilfoil comprise the invasive species found in 2025 (see descriptions in appendix). Northern hydrilla was first reported in the Connecticut River in 2016 and was widespread south of Agawam, MA. It is currently known to have spread

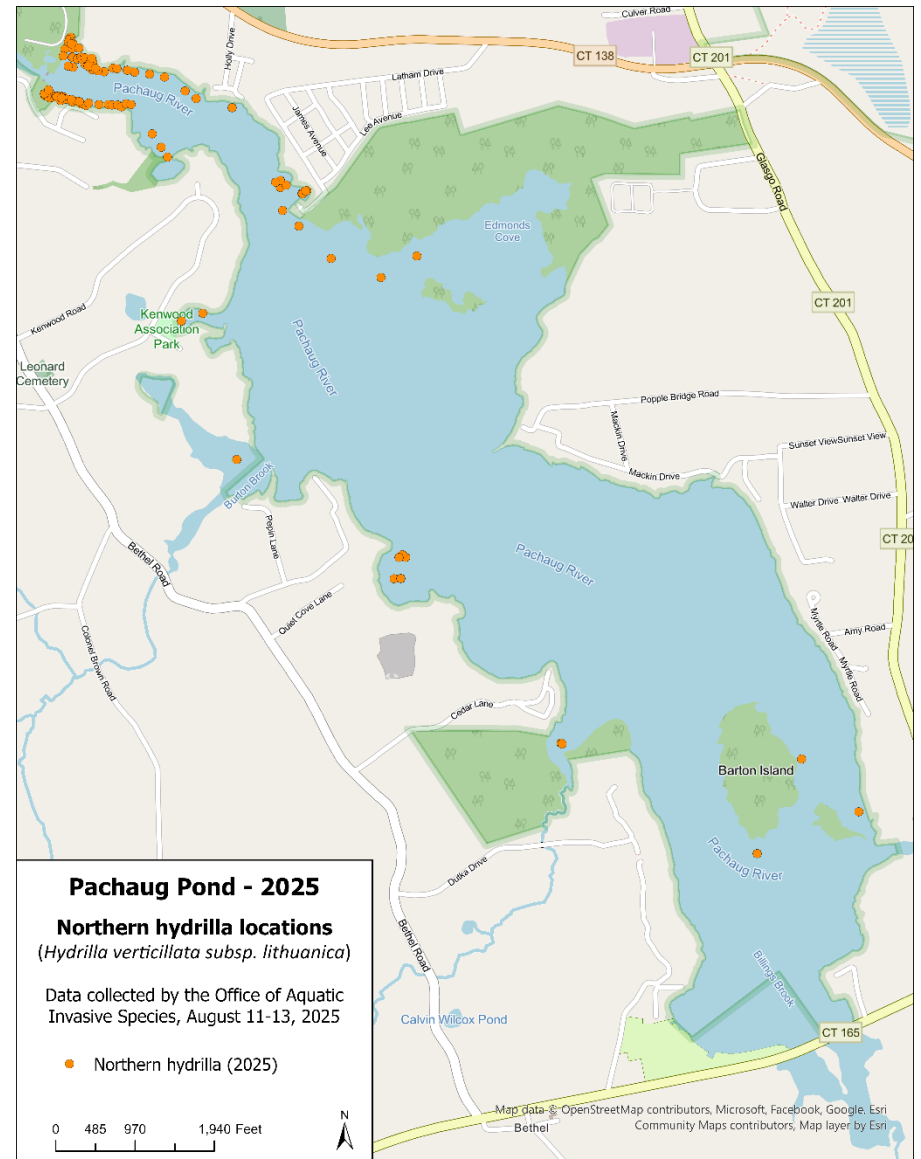
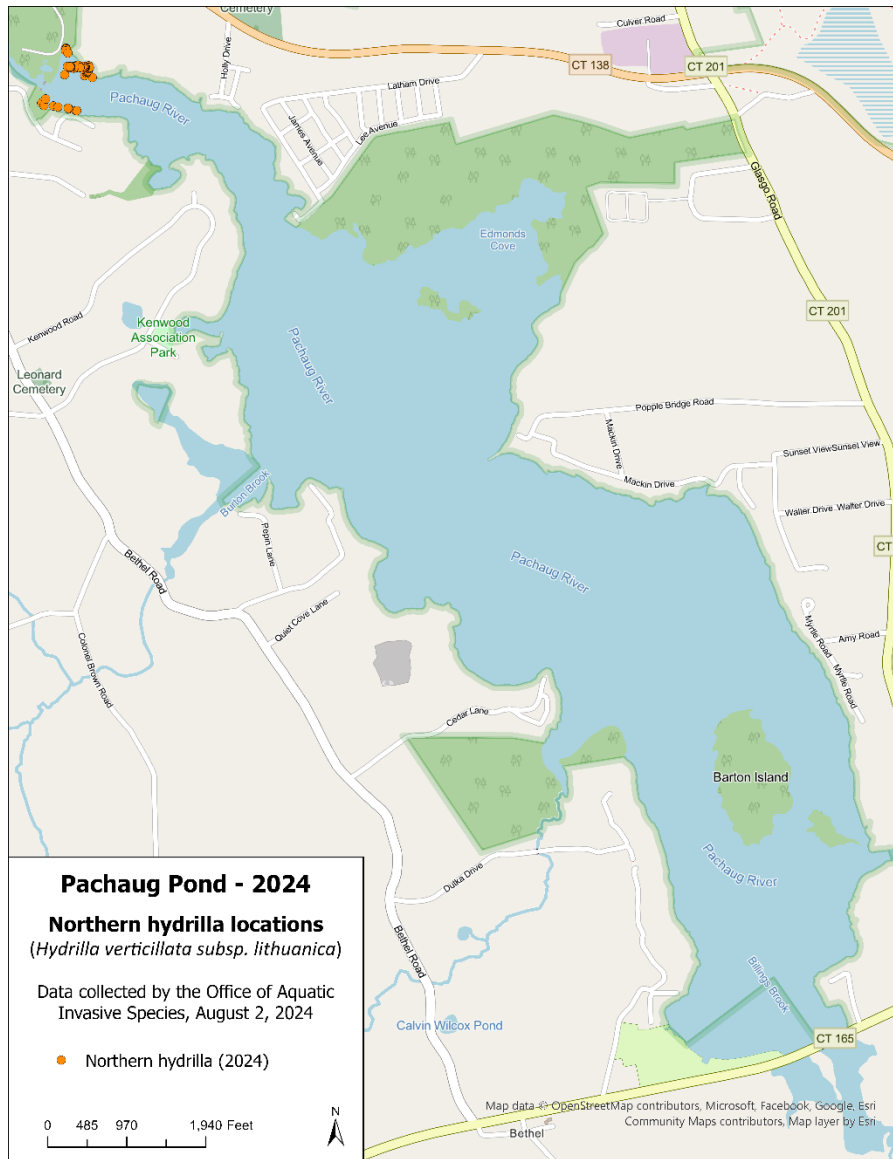


Figure 2 Maps of invasive northern hydrilla locations in Pachaug Pond in 2024 (left) and 2025 (right).



Figure 3 Patch of invasive northern hydrilla in a new location of Pachaug Pond in 2025.

to ten other waterbodies in Connecticut. Northern hydrilla was found for the first time in Pachaug Pond during the 2024 survey at the northernmost end near the State boat launch (Figure 2, left). Its introduction to Pachaug Pond was likely due to boat/trailer activity. This plant is highly adaptable, grows quickly, and can spread rapidly. Unfortunately, in 2025, northern hydrilla was found in small patches throughout the pond in many of its coves and near Barton Island (Figure 2, right, Figure 3). The spread was substantial, at a 40% increase from 2024. Northern hydrilla grows aggressively and can tolerate low-light conditions, meaning it can grow under lily pads and water smartweed making it hard to detect. It is possible it has spread even further in areas undetected. Visit the [Pachaug Pond Hydrilla Tracker](https://arcg.is/9SKnW0) to compare the 2024 and 2025 locations in greater detail: <https://arcg.is/9SKnW0>.

Fanwort and variable-leaf watermilfoil have steadily increased over the past four years (Figure 4). Fanwort was the most frequently found plant on transects with a frequency of occurrence of 71% in 2025, its highest frequency of all survey years (Figure 4, top). Variable-leaf

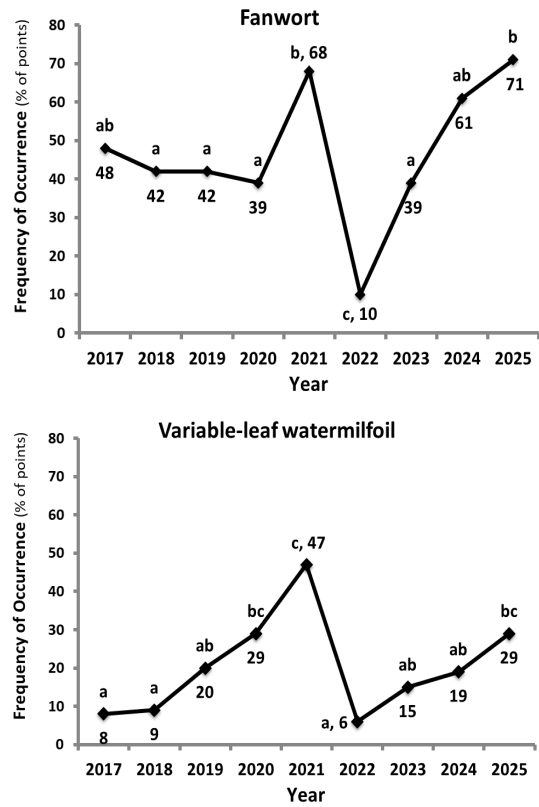


Figure 4 Frequency of occurrence of invasive fanwort (top) and variable-leaf watermilfoil (bottom) on 100 transect points in Pachaug Pond. The same letter on different years indicates no statistically significant difference.

watermilfoil showed a similar trend, increasing from 6% in 2022 to 15% in 2023, 19% in 2024, and 29% in 2025 (Figure 4, bottom). While not as frequent as fanwort, the increase is worrisome.

Eurasian watermilfoil has remained stable throughout the years, present throughout the pond in small patches. Minor naiad is an annual, low-growing plant that appears in summer and senesces each fall. Its occurrence was extremely sparse, and it is not likely to be a nuisance. Phragmites is a semi-aquatic, invasive wetland species that was found in various areas along the shoreline. Its presence has remained stable throughout all survey years. Swollen bladderwort was first documented in 2021. Due to its resemblance to other native bladderworts, it may have been previously overlooked.

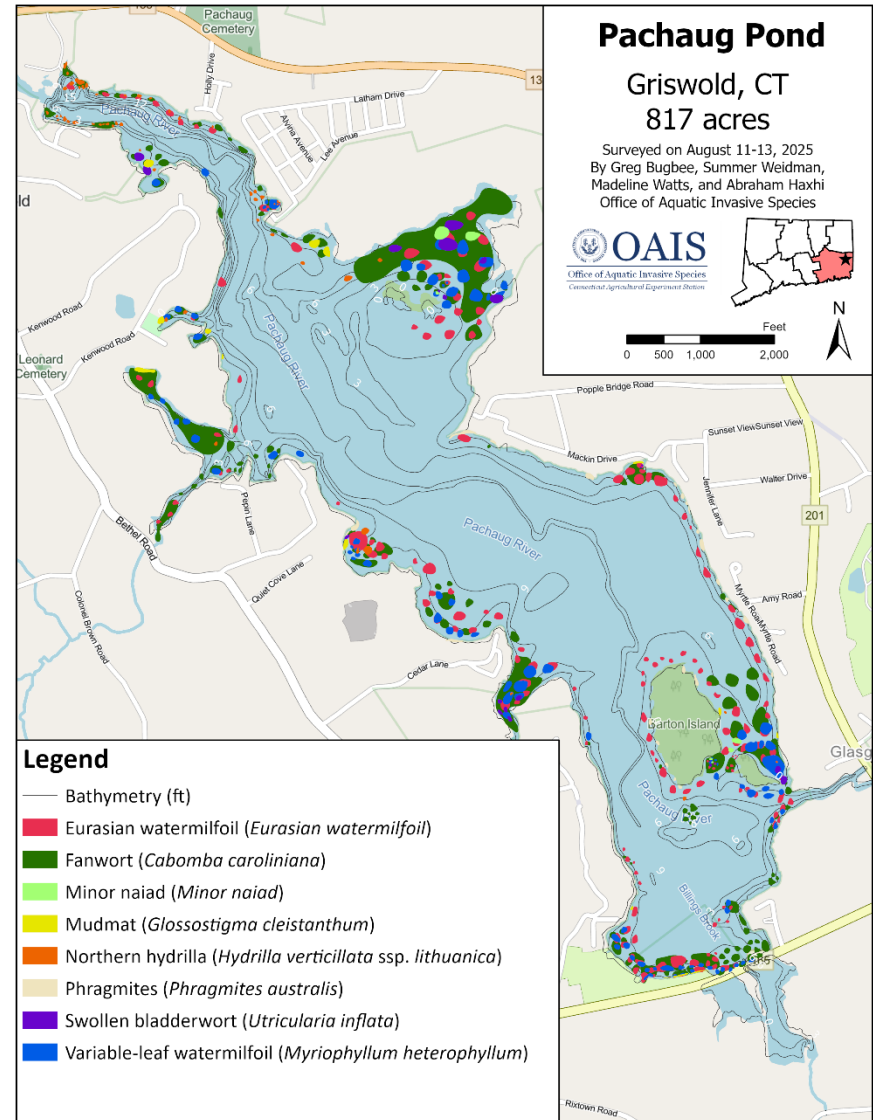
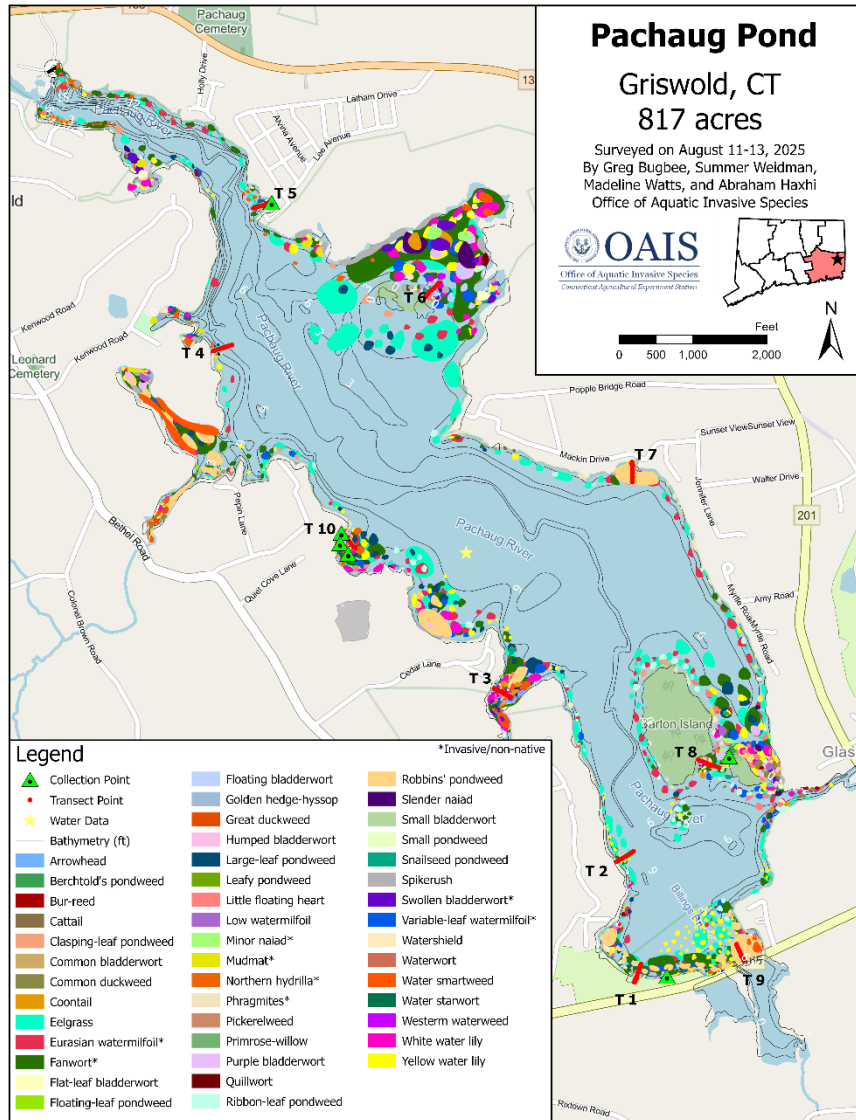


Figure 5 Vegetation maps of Pachaug Pond from 2025. All native and invasive vegetation is mapped on the left image. Only invasive/non-native species are mapped on the right.

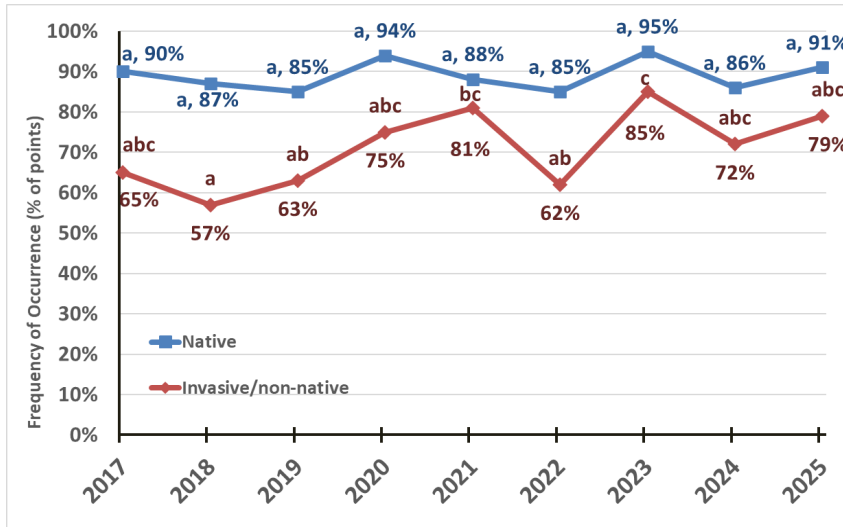


Figure 6 Frequency of occurrence of native and invasive/non-native species on 100 transect points in Pachaug Pond from 2017-2025.

common as eelgrass and large-leaf pondweed (Figure 5, right). As mentioned earlier, fanwort and variable-leaf watermilfoil have increased over the past few years, and it is evident in the large coves throughout the pond. Eurasian watermilfoil was found in small patches throughout the shoreline. Maps from 2023 and 2024

Mudmat is a non-native species originally from New Zealand and Australia (Crow and Hellquist, 2023), which has been documented in Pachaug Pond since 2017. Despite its non-native status, mudmat is not classified as an invasive species in Connecticut. It has not exhibited harmful effects and poses little risk of becoming a nuisance due to its small size.

as well as close up maps of various areas of the pond can be found in the appendix.

The shallow coves were dominated by nuisance vegetation, including fanwort, water smartweed, and various species of water lilies (Figure 5). Floating vegetation including water smartweed, white water lily, and yellow water lily were most common in the long, narrow coves on the western side of the pond. Eelgrass and large-leaf pondweed were the most abundant native species, found throughout every vegetated area of the pond (Figure 5, left). Fanwort, Eurasian watermilfoil, and variable-leaf watermilfoil were the most abundant invasive vegetation and were as

Much of the lake did not have problematic vegetation despite it being shallow enough to support luxuriant growth. Reasons for this may include light limitation caused by tannic, tea-colored water, infertile substrate, previous drawdowns, or factors yet to be determined.

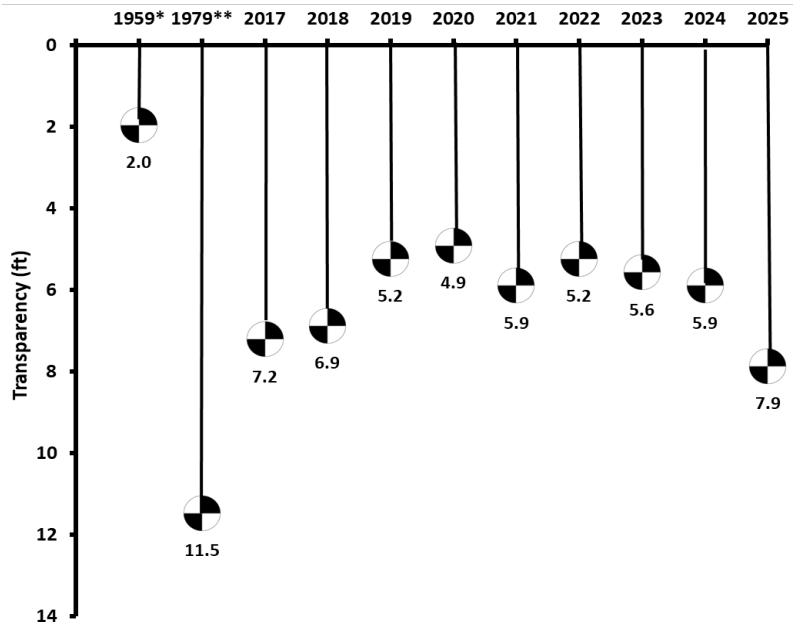


Figure 7 Water clarity in Pachaug Pond as measured with a Secchi disk from 1959 to 2023. *State Board of Fisheries and Game Lake and Pond Survey Unit, 1959. **Norvell and Frink, 1984.

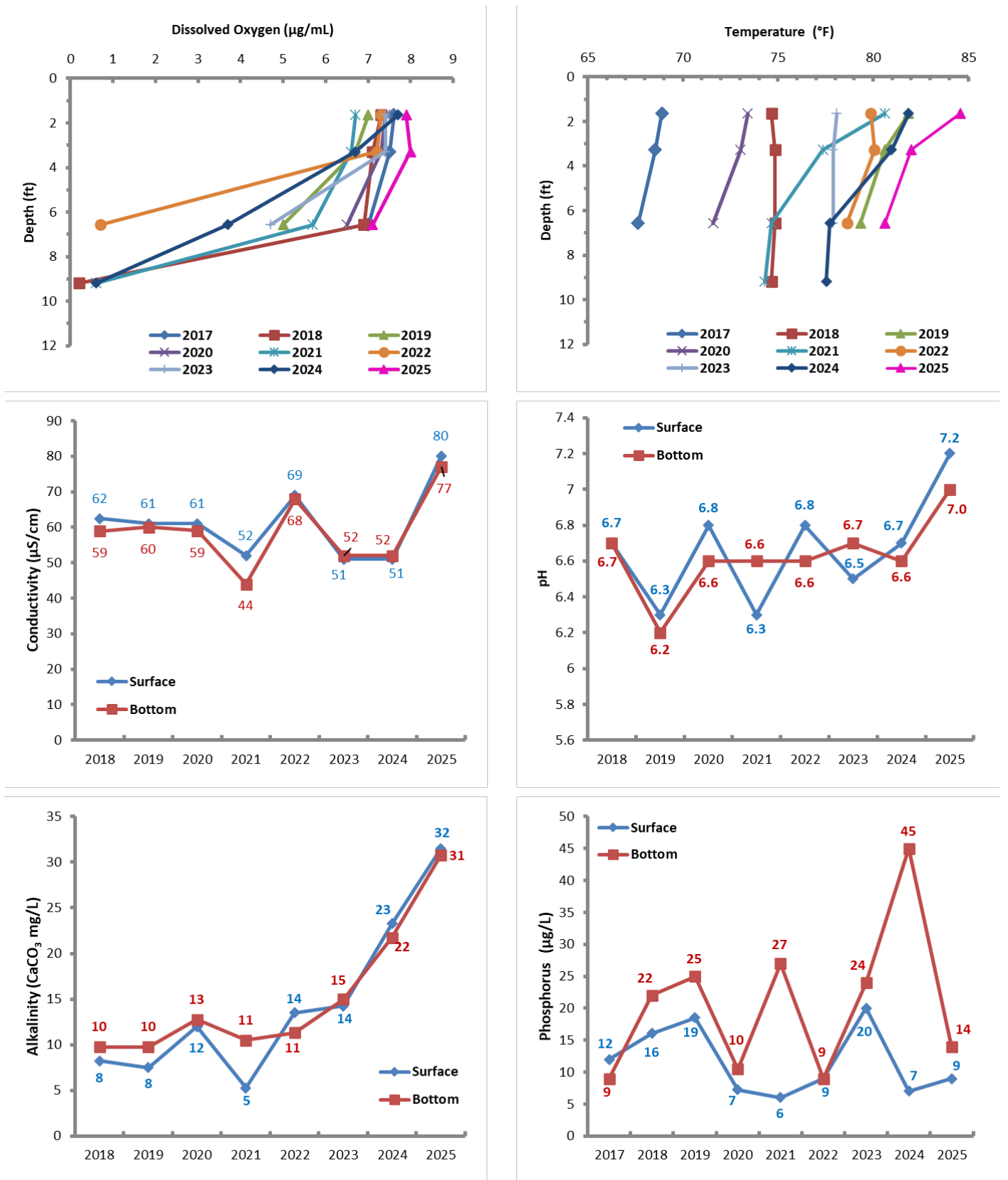


Figure 8 Dissolved oxygen, temperature, pH, alkalinity, conductivity, and phosphorus measurements. Data for each year was collected on one day from the deepest part of the pond.

Comparisons of the frequency of occurrence on 100 transect points from 2017 to 2025 revealed minimal change in native vegetation over the survey years (Figure 6). The frequency of occurrence of invasive/non-native species increased slightly from 72% in 2024 to 79% in 2025, though this change was not statistically significant. There appears to be an upward trend in invasive species frequency of occurrence; however, there are no statistically significant differences between 2017 and 2025. Pachaug Pond is highly vegetated lake, and the frequency of occurrence of 91% for native species and 79% for invasive species is high compared to other large lakes in the state.

Water Chemistry

Water clarity in Connecticut's lakes ranges from 1-33 ft with an average of 7 ft (CAES OASIS, 2025). Pachaug Pond had a water clarity of 7.9 ft (2.4 m) in 2025, which is slightly greater than water clarity levels in 2019 - 2024 (4.9 – 5.9 ft or 1.6 – 1.8 m) but similar to 2017 and 2018 (6.8 - 7.2 ft or 2.1 – 2.2 m) (Figure 7). Measurements in 1979 found a much higher transparency of 12 ft (Frink and Norvell, 1984) while in the 1950's it was only 2.0 ft (State Board of Fisheries and Game, 1959). The poor water clarity in the 1950's was attributed to an algal bloom. This could have been due to the reported industrial use of water. Our 2025 observation was consistent with previous years, with water clarity not reduced by algal blooms but rather the brown coloration caused by naturally occurring organic derivatives.

The shallow nature of Pachaug Pond usually results in no summertime temperature stratification and therefore no thermocline. Because our measurements are taken at 1 m (3.3 ft) intervals and the sampling site depth is slightly less than 3 m (2.8 m or 9.2 ft), in some years our measurements stopped at

2 m (6.5 ft) to avoid the probe penetrating the sediment. This was based on surveyor judgment and resulted in the differences in sampling depth from year to year.

In 2025, there was slight stratification similar to 2021 and 2024. The water temperature was about 85 °F near the surface and decreased to about 80 °F around 6.5 ft (2 m) below the surface. In previous years, the temperature was similar throughout the water column ranging from 68 – 82 °F (Figure 8). In 2025, dissolved oxygen levels were steady throughout the water column with 7.9 µg/mL at the surface and 7.1 µg/mL at the bottom. In the previous year's surveys, dissolved oxygen ranged from 7.4 µg/L at the surface to 0.2 µg/L near the bottom (Figure 8). In 2019, 2020, 2022, and 2023, measurements were only recorded to a depth of 2 m (6.5 ft). The only year dissolved oxygen declined to near zero at a depth of 2 m (6.5 ft) was 2022. When dissolved oxygen falls below 5 µg/L, most fish will need to seek more oxygenated areas. In addition, anoxic conditions promote the liberation of sediment phosphorus that if mixed with surface water can promote algal blooms.

Since 2017, water pH has remained near neutral, between 6.2 and 7.2 with little difference between the surface and the bottom (Figure 8). Alkalinity has measured between 5 and 32 mg/L CaCO₃, with negligible difference between surface and bottom. An upward trend in recent years is evident. Alkalinity in Connecticut lakes ranges from near 0 to >170 mg/L CaCO₃, therefore Pachaug Pond's alkalinity is considered relatively low (CAES OASIS, 2025). Low alkalinity waterbodies are more prone to pH change due to outside influences such as watershed activities and acid rain. Conductivity is an indicator of dissolved ions that come from natural and man-made sources (mineral weathering, organic matter decomposition, fertilizers,



Figure 9 A eco-harvester in Pachaug Pond (left) and plant fragments floating near the harvesting operation (right).

septic systems, road salts, etc.). Connecticut waterbodies typically have conductivity measurements ranging from 50 to 250 $\mu\text{S}/\text{cm}$. In 2025, Pachaug Pond recorded a conductivity of 80 $\mu\text{S}/\text{cm}$ at the surface and 77 $\mu\text{S}/\text{cm}$ at the bottom, a slight increase from previous years (Figure 8).

A key parameter used to categorize a lake's trophic state is phosphorus (P) in the water column. High levels of P can lead to nuisance or toxic algal blooms (Frink and Norvell, 1984; Wetzel, 2001). Rooted macrophytes are considered to be less dependent on P from the water column as they obtain a majority of their nutrients from the hydrosol (Bristow and Whitcombe, 1971). Lakes with P levels from 0 - 10 $\mu\text{g}/\text{L}$ are considered nutrient-poor or oligotrophic. When P concentrations reach 15 - 25 $\mu\text{g}/\text{L}$, lakes are classified as moderately fertile or mesotrophic and when P reaches 30 - 50 $\mu\text{g}/\text{L}$ they are considered fertile or eutrophic (Frink and Norvell, 1984). Lakes with P concentrations >50 $\mu\text{g}/\text{L}$ are categorized as extremely fertile or hypereutrophic. Pachaug Pond's P concentration in 2025 was 9 $\mu\text{g}/\text{L}$ at surface and 14 $\mu\text{g}/\text{L}$ near the bottom, which classifies the lake as mesotrophic (Figure 8). Analysis of the water by CAES in 1979 (Frink and Norvell, 1984)

found P concentrations of 16 $\mu\text{g}/\text{L}$ at surface and 13 $\mu\text{g}/\text{L}$ near the bottom.

CAES OAIS has found that the occurrence of invasive plants in lakes can be attributed to specific water chemistries (June-Wells et al., 2013). For instance, lakes with higher alkalinities and conductivities are more likely to support Eurasian watermilfoil, minor naiad, and curlyleaf pondweed while lakes with lower values support fanwort and variable-leaf watermilfoil. Pachaug Pond's water chemistry appears to be an outlier to this trend as its low alkalinity and conductivity suggests Eurasian watermilfoil and minor naiad should be less abundant than observed.

Aquatic Vegetation Management:

Managing nuisance aquatic vegetation in Pachaug Pond will be challenging because the lake has extensive areas of desirable native vegetation, and state-listed species may need protection. In addition, large numbers of residents utilize the lake for recreational activities, particularly fishing, boating, and swimming. The 2024 discovery of northern hydrilla places increased urgency on finding a management option to stop its spread. Options include water level drawdown, harvesting, herbicides, biological controls, and benthic barriers (Cooke et al., 2005). Dredging may also



Figure 10 A northern hydrilla fragment floating in Pachaug Pond.

be employed but is usually impractical for large lakes like Pachaug.

Water level drawdown can be an effective and economical means of controlling nuisance vegetation in large shallow lakes like Pachaug Pond. The vegetation reductions reported in 2022 were likely a side effect of the drawdown needed for the 2021/22 dam repairs (Grahn, 2021). Fortunately, the new dam has an outlet suitable for the technique and future utilization for weed management is possible with CT DEEP approval.

In 2025, the eco-harvester, purchased by the PPWCA in 2022, was used for the fourth year (Figure 9, left). Benefits of mechanical harvesting include quick results, the ability to target areas and avoid damage to species needing protection, avoidance of aquatic herbicides, and removal of nutrients contained in the harvested vegetation. Drawbacks include the initial expense of the machine, maintenance costs, regrowth, spread of fragments (Figure 9, right), and disposal. In addition, if emergent vegetation such as waterlilies are removed, sunlight reaching the bottom could promote the growth of submersed species.

Surveyors observed the use of the harvester (Figure 9, left) and noted that some areas seemed more navigable.

However, numerous plant fragments were seen floating throughout the lake (Figure 9, right). Many invasive aquatic plants, such as Eurasian watermilfoil, fanwort, hydrilla (Figure 10), swollen bladderwort, and variable-leaf watermilfoil, spread through fragmentation. In areas where water lilies appeared to have been removed, nuisance submersed vegetation, particularly fanwort, appears to have been favored.

Herbicides can be effective in controlling unwanted aquatic vegetation. Aquatic herbicide use requires clearance from the CT DEEP Pesticides Unit and the Natural Diversity Database. Herbicides must be chosen carefully as some have efficacy on certain target species and not others. Also, any desirable plants, including state-listed species, may need to be tolerant. Specifics on the use of aquatic herbicides in Connecticut are found in the CT DEEP publication entitled “Nuisance Aquatic Vegetation Management: A Guidebook” (CTDEP, 2005)., CAES OAS tested the herbicide ProcettaCOR for variable-leaf watermilfoil control and flumioxazin for fanwort control with excellent results. Demonstration projects on controlling Connecticut River hydrilla were performed by the United States Army Corp of Engineers in 2024 and results are promising.

Although efforts are underway to find biological controls for nuisance aquatic vegetation, breakthroughs have been limited. To date the only biological control used in Connecticut is sterile grass carp (*Ctenopharyngodon idella*; Figure 11). Grass carp are herbivorous fish that feed on most submersed aquatic plants. The introduction of grass carp into Connecticut lakes requires approval by CT DEEP, and only sterile (triploid) grass carp are permitted. Introducing grass carp in Pachaug Pond could cause damage to non-target plants necessary to maintain the current fishery. Grass carp primarily



Figure 11. Grass carp were introduced into Candlewood Lake in 2015 to control invasive Eurasian watermilfoil (left). After near complete elimination of all aquatic vegetation, CT DEEP began a grass carp removal program in 2023 (right).

feed on submergent vegetation, so the water lilies and water smartweed impacting many of the coves would likely be unaffected. Grass carp introductions in Connecticut waterbodies such as Candlewood Lake, Taunton Lake, and Squantz Pond have resulted in an undesirable with total elimination of aquatic vegetation occurred (Figure 11). Grass carp have preference for hydrilla over most other plants. The potential for a very small number of introduced sterile (triploid) grass carp to selectively remove hydrilla is a possible option if approved by CT DEEP. CAES is working with officials from the United States Department of Agriculture to find new aquatic plant biocontrol's. Unfortunately, testing involves many years, and none are likely to be available soon.

Benthic barriers or “bottom blankets” are effective at eliminating nuisance vegetation in small areas such as swim zones, around docks, and pioneer infestations. CAES OAS has tested short-term placement (<30 days) of the barriers in Lake Quonnipaug, Bashan Lake, and Lake Beseck (Figure 12). Season-long control for Eurasian watermilfoil and fanwort was achieved. Although labor intensive, benthic barriers

can be moved from place to place during a season for effective control. They can also be used over multiple years, reducing the cost of materials. Pachaug Pond's hydrilla has spread beyond what can be managed with these barriers.

CONCLUSIONS

The 2025 vegetation survey of Pachaug Pond found an increase in aquatic vegetation from 2024. A total of 43 plant species were documented, of which eight were invasive/non-native. Pachaug Pond is among the most plant species rich lakes in Connecticut. The invasive species found were Eurasian watermilfoil, fanwort, minor naiad, northern hydrilla (CT River), swollen bladderwort, and variable-leaf watermilfoil. Removal of emerged vegetation and fragmentation of plants by harvesting may be promoting submersed vegetation such as fanwort. Many of the coves contained nuisance vegetation such as fanwort, water smartweed, and water lilies. The discovery of northern hydrilla near the State boat launch is very concerning, especially since there are now small populations of northern hydrilla in many coves of the pond. Much of the remainder of Pachaug Pond, in areas less than six

feet deep, contained a mixture of non-nuisance invasive and native species that did not reach the surface. If limiting conditions such as light limitation, infertile substrate, water level, and control from previous drawdowns change nuisance vegetation could expand dramatically.

Aquatic plant management and monitoring are critical to ensure a potential rapid decline in the quality of Pachaug Pond is avoided. Documenting the effects of the mechanical harvester, commissioned into service in 2022, on Pachaug Pond will provide valuable information for others. Water level drawdowns via the new dam's outlet have potential to be a cost-effective means of aquatic plant control. Other management practices with potential include herbicides, benthic barriers, and grass carp. Grass carp introductions may face increased scrutiny from CT DEEP regulators as excessive plant removal has occurred in several Connecticut lakes. This may be lessened by an ultra-low stocking rate aimed at targeting the hydrilla, which is highly preferred by grass carp. Our water tests found Pachaug Pond to be mesotrophic with low alkalinity and minimal stratification. Water clarity was limited by the water's brown coloration. Changes over the course of our surveys have been minimal.

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REFERENCES

- American Public Health Association. 1995. Standard methods for the examination of water and wastewater. 19th ed. American Public Health Association, 1015 Fifteenth St. NW Washington, DC 20005. 4:108-116.
- Bristow JM and Whitcombe M. 1971. The role of roots in the nutrition of aquatic vascular plants. *Amer. J. Bot.*, 58:8-13.
- CAES OAIS. 2025. The Connecticut Agricultural Experiment Station Office of Aquatic Invasive Species (CAES OAIS). Retrieved January 30, 2024. <https://portal.ct.gov/caes-oais>.
- CT DEEP. 2022. Connecticut Department of Energy and Environmental Protection. Natural Diversity Database Area. Retrieved June 2022. <https://ct-deep-gis-open-data-website-ctdeep.hub.arcgis.com/>
- Connecticut Department of Environmental Protection (CT DEP). 2005. Nuisance Aquatic Vegetation Management: A Guidebook. Pesticide Management Program, 79 Elm St. Hartford, CT 06106-5127. <https://portal.ct.gov/-/media/DEEP/pesticides/Certification/Supervisor/aweeds.pdf?la=en>
- Cooke GD, Welch EB, Peterson SA and Nichols SA. 2005. Restoration and Management of Lakes and Reservoirs. Boca Raton, FL. Taylor and Francis Group LLC.
- Crow GE, Hellquist CB. 2000a. Aquatic and Wetland Plants of Northeastern North America. Volume One Pteridophytes, Gymnosperms, and Angiosperms: Dicotyledons. Madison, Wisconsin. The University of Wisconsin Press. 480 pp.
- Crow GE, Hellquist CB. 2000b. Aquatic and Wetland Plants of Northeastern North America. Volume Two Angiosperms: Monocotyledons. Madison, Wisconsin. The University of Wisconsin Press. 400 pp.
- Frink CR and Norvell WA. 1984. Chemical and physical properties of Connecticut lakes. *Conn. Agric. Exp. Sta. Bull.* 817.
- Grahn M. 2021. Don't plan on putting a boat in at the Pachaug Pond boat launch as dam project starts. *The Norwich Bulletin*. <https://www.norwichbulletin.com/story/news/local/2021/09/13/griswold-pachaug-pond-dam-repairs-underway/5782981001/>. Retrieved December 22, 2021.
- June-Wells MF, Gallagher J, Gibbons JA, Bugbee GJ. 2013. Water chemistry preferences of five nonnative aquatic macrophyte species in Connecticut: A preliminary risk assessment tool. *Lake and Reservoir Management*. 29:303-316.
- Pachaug Pond Weed Control Association Inc. (PWCA). 2022. We Love Pachaug Pond. Retrieved February 8, 2022. <https://www.pachaugpond.org/copy-of-membership-2>
- Rahel FJ, Olden JD, 2008. Assessing the Effects of Climate Change on Aquatic Invasive Species. *Conservation Biology*. 22(3):521-533.
- State Board of Fisheries and Game Lake and Pond Survey Unit. 1959. A Fishery Survey of Lakes and Ponds of Connecticut. Report No.1. State Board of Fisheries and Game. 395 pp.
- Wetzel RG. 2001. *Limnology: Lake and River Ecosystems* 3rd ed. Academic Press, San Diego, CA. <http://www.academicpress.com>.

APPENDIX

Species List

Table of every species found in Pachaug Pond from 2017-2025 with the frequency of occurrence of each species found on 100 transect points.

Native Species	2017	2018	2019	2020	2021	2022	2023	2024	2025
Arrowhead (<i>Sagittaria</i> species)	9%	13%	6%	13%	6%	8%	19%	11%	6%
Berchtold's pondweed (<i>Potamogeton berchtoldii</i>)	— ^a	—	—	—	—	—	—	3%	0%
Bur-reed (<i>Sparganium</i> species)	12%	—	4%	4%	8%	17%	6%	6%	0%
Cattail (<i>Typha</i> species)	0%	0%	0%	0%	0%	2%	0%	1%	0%
Clasping-leaf pondweed (<i>Potamogeton perfoliatus</i>)	2%	—	1%	1%	1%	—	2%	1%	1%
Common bladderwort (<i>Utricularia vulgaris</i>)	8%	54%	1%	—	—	0%	8%	6%	10%
Common duckweed (<i>Lemna minor</i>)	—	—	0%	—	8%	6%	0%	0%	0%
Coontail (<i>Ceratophyllum demersum</i>)	17%	17%	16%	10%	7%	6%	9%	14%	7%
Eelgrass (<i>Vallisneria americana</i>)	65%	59%	53%	72%	53%	46%	67%	56%	56%
Flat-leaf bladderwort (<i>Utricularia intermedia</i>)	—	—	—	—	0%	—	1%	0%	—
Floating bladderwort (<i>Utricularia radiata</i>)	48%	—	32%	1%	10%	4%	19%	0%	19%
Floating-leaf pondweed (<i>Potamogeton natans</i>)	3%	1%	0%	2%	1%	5%	3%	1%	2%
Golden hedge-hyssop (<i>Gratiola aurea</i>)	5%	1%	—	—	0%	2%	1%	—	2%

Native Species	2017	2018	2019	2020	2021	2022	2023	2024	2025
Great duckweed (<i>Spirodela polyrhiza</i>)	—	4%	9%	7%	5%	—	6%	7%	5%
Humped bladderwort (<i>Utricularia gibba</i>)	1%	8%	9%	16%	21%	0%	1%	8%	9%
Large-leaf pondweed (<i>Potamogeton amplifolius</i>)	9%	19%	8%	19%	31%	5%	11%	6%	30%
Leafy pondweed (<i>Potamogeton foliosus</i>)	1%	3%	1%	2%	—	4%	—	1%	2%
Lesser bladderwort (<i>Utricularia minor</i>)	—	1%	—	—	0%	—	—	—	1%
Little floating heart (<i>Nymphoides cordata</i>)	—	9%	10%	6%	10%	3%	10%	11%	9%
Low watermilfoil (<i>Myriophyllum humile</i>)	8%	4%	—	2%	8%	4%	3%	1%	0%
Pickereelweed (<i>Pontederia cordata</i>)	12%	22%	13%	17%	17%	24%	16%	20%	13%
Pondweed (<i>Potamogeton</i> species)	—	—	—	7%	—	—	—	—	—
Primrose-willow (<i>Ludwigia</i> species)	2%	5%	4%	1%	3%	32%	4%	5%	2%
Purple bladderwort (<i>Utricularia purpurea</i>)	1%	3%	6%	6%	15%	0%	1%	12%	16%
Quillwort (<i>Isoetes</i> species)	—	3%	—	0%	0%	—	4%	—	0%
Ribbon-leaf pondweed (<i>Potamogeton epihydrus</i>)	35%	13%	14%	29%	21%	0%	12%	19%	18%
Robbins' pondweed (<i>Potamogeton robbinsii</i>)	35%	41%	40%	32%	38%	18%	18%	27%	36%

Native Species	2017	2018	2019	2020	2021	2022	2023	2024	2025
Slender naiad (<i>Najas flexilis</i>)	11%	19%	18%	32%	10%	12%	12%	17%	9%
Small pondweed (<i>Potamogeton pusillus</i>)	—	—	—	12%	0%	0%	—	3%	0%
Snailseed pondweed (<i>Potamogeton bicupulatus</i>)	10%	13%	7%	8%	4%	—	2%	4%	4%
Spikerush (<i>Eleocharis</i> species)	8%	11%	14%	16%	19%	23%	25%	9%	19%
Water smartweed (<i>Polygonum amphibium</i>)	4%	12%	11%	9%	9%	9%	9%	5%	5%
Water starwort (<i>Callitriche</i> species)	—	—	—	—	—	0%	—	0%	0%
Watermeal (<i>Wolffia</i> species)	1%	—	—	—	3%	—	—	—	—
Watershield (<i>Brasenia schreberi</i>)	31%	30%	32%	35%	32%	8%	11%	19%	30%
Waterwort (<i>Elatine</i> species)	—	7%	1%	3%	0%	1%	1%	4%	0%
Western waterweed (<i>Elodea nuttallii</i>)	—	1%	1%	—	5%	—	11%	1%	5%
White water lily (<i>Nymphaea odorata</i>)	18%	22%	26%	24%	27%	14%	29%	46%	17%
Yellow water lily (<i>Nuphar variegata</i>)	13%	14%	6%	11%	11%	19%	10%	20%	40%

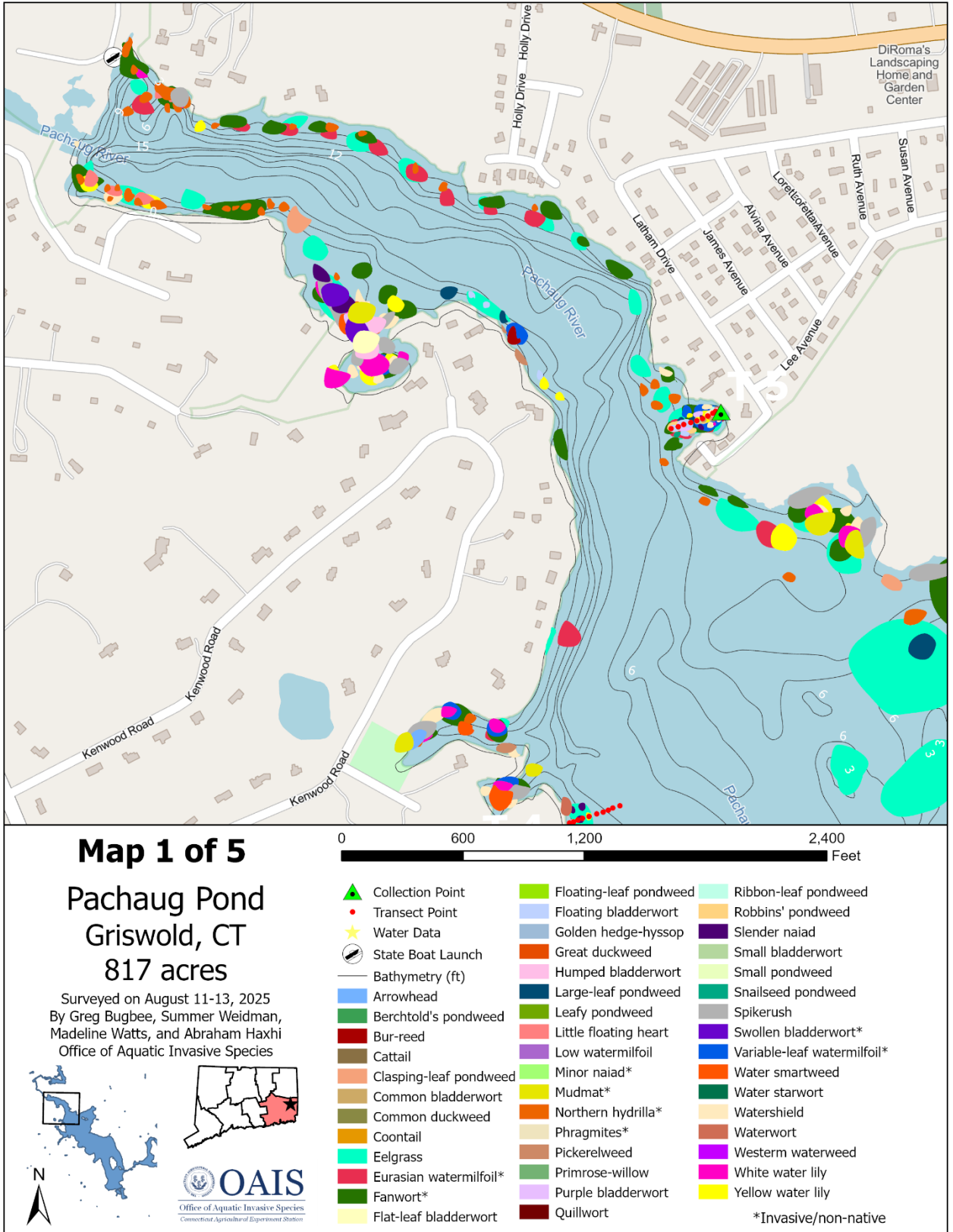
Non-Native Species	2017	2018	2019	2020	2021	2022	2023	2024	2025
Mudmat (<i>Glossostigma cleistanthum</i>)	1%	7%	3%	8%	2%	10%	2%	2%	1%

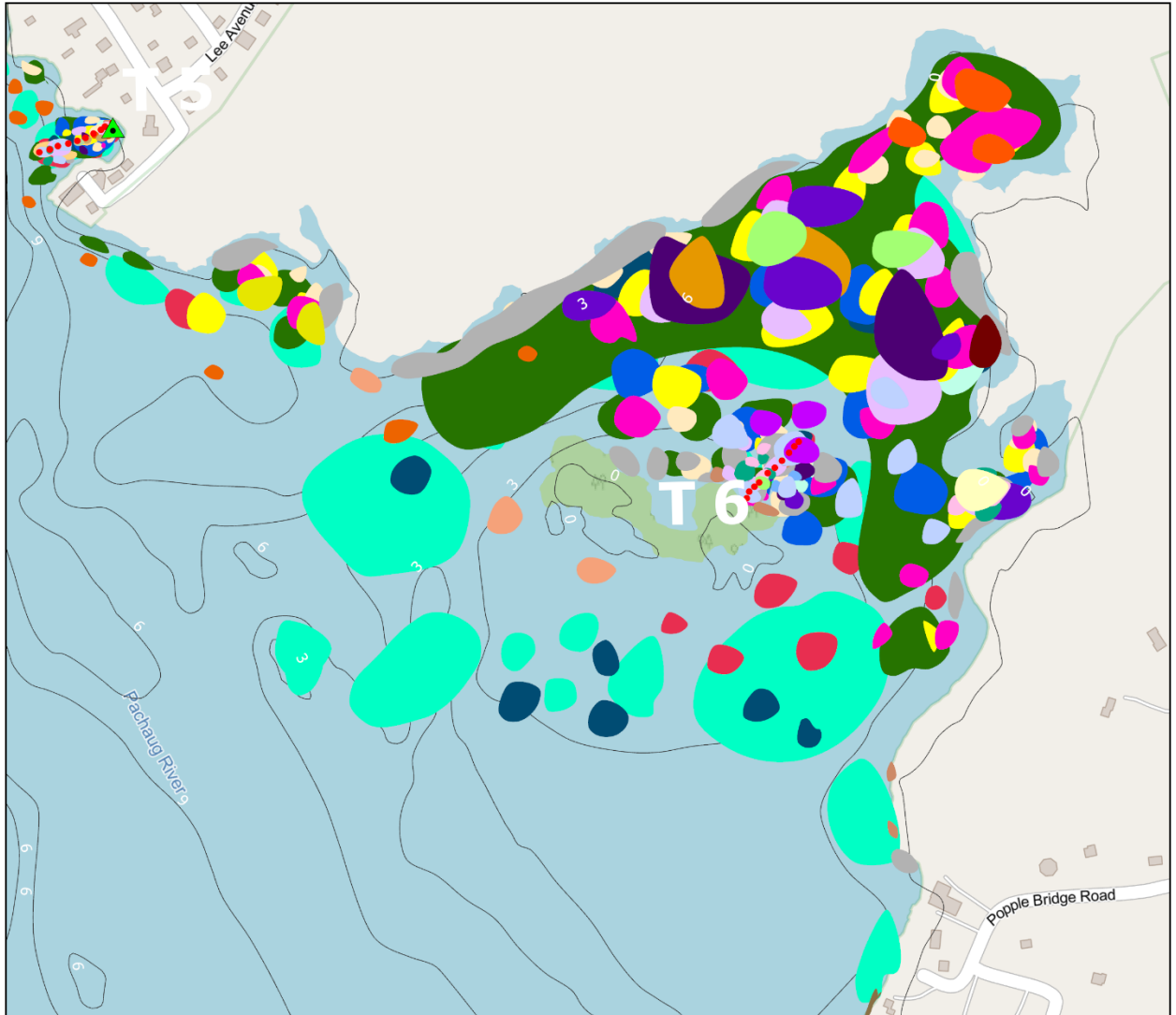
Invasive Species	2017	2018	2019	2020	2021	2022	2023	2024	2025
Eurasian watermilfoil (<i>Myriophyllum spicatum</i>)	31%	45%	28%	26%	45%	33%	48%	31%	39%
Fanwort (<i>Cabomba caroliniana</i>)	48%	42%	42%	39%	68%	10%	39%	61%	71%
Northern hydrilla (<i>Hydrilla verticillata</i> subsp. <i>lithuanica</i>)	—	—	—	—	—	—	—	0%	4%
Minor naiad (<i>Najas minor</i>)	4%	20%	3%	30%	—	35%	10%	4%	2%
Phragmites (<i>Phragmites australis</i>)	1%	2%	0%	3%	1%	3%	3%	4%	3%
Swollen bladderwort (<i>Utricularia inflata</i>) ^b	—	—	—	—	43%	3%	37%	25%	5%
Variable-leaf watermilfoil (<i>Myriophyllum heterophyllum</i>)	8%	9%	20%	29%	47%	6%	15%	19%	29%

^a"—" = Species not found in Pachaug Pond; 0% indicates found in the waterbody but not on any transect points

^bSwollen bladderwort is easily confused with common bladderwort. DNA analysis identified swollen bladderwort in 2021. It is possible common bladderwort plants found in the past were swollen bladderwort.

Aquatic Plant Survey Maps by Section

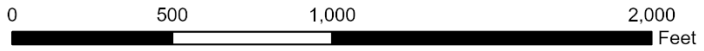
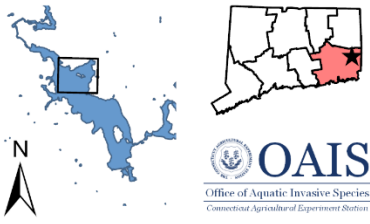




Map 2 of 5

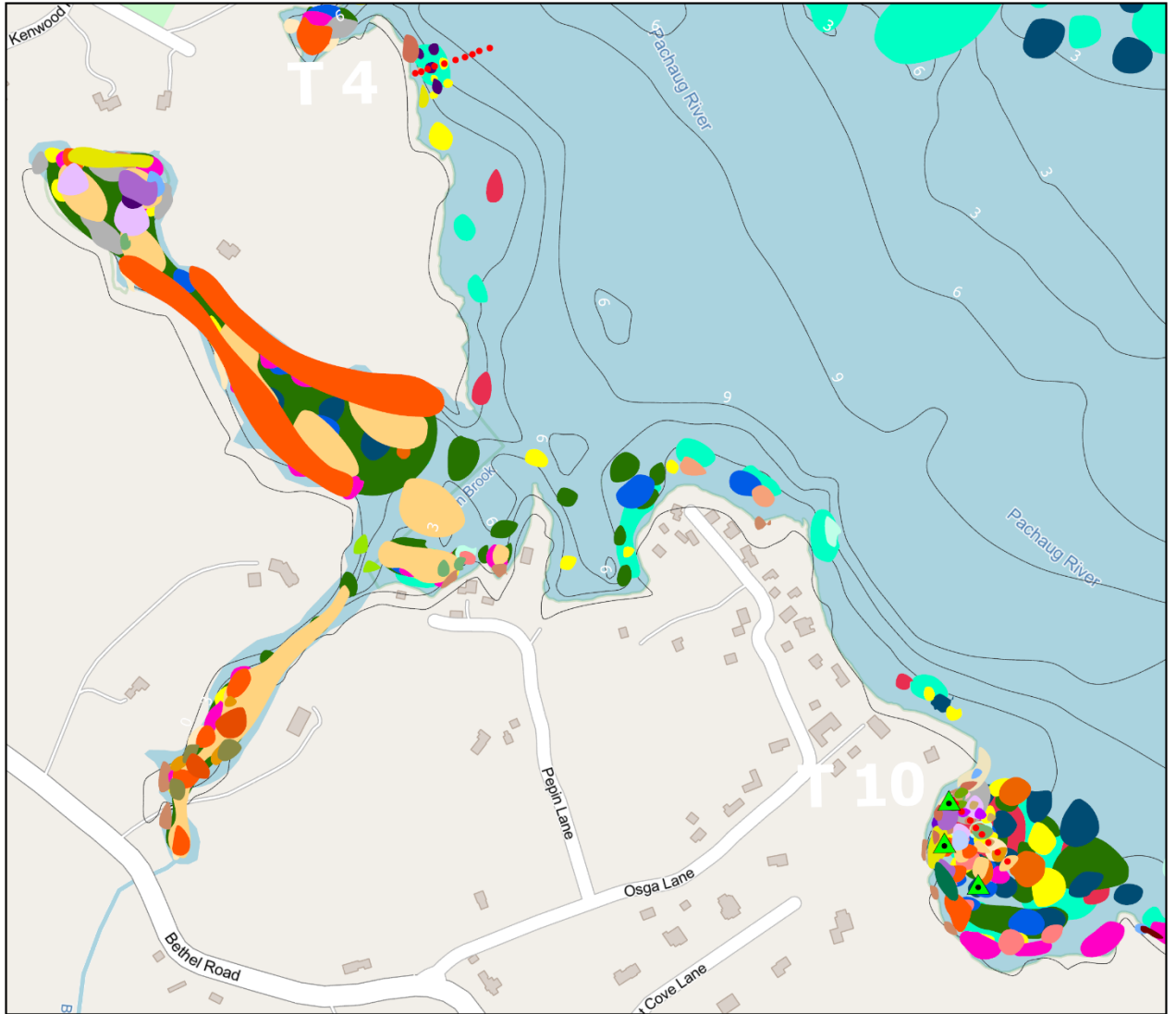
**Pachaug Pond
Griswold, CT
817 acres**

Surveyed on August 11-13, 2025
By Greg Bugbee, Summer Weidman,
Madeline Watts, and Abraham Haxhi
Office of Aquatic Invasive Species



- | | | |
|------------------------|------------------------|-----------------------------|
| Collection Point | Floating-leaf pondweed | Ribbon-leaf pondweed |
| Transect Point | Floating bladderwort | Robbins' pondweed |
| Water Data | Golden hedge-hyssop | Slender naiad |
| State Boat Launch | Great duckweed | Small bladderwort |
| Bathymetry (ft) | Humped bladderwort | Small pondweed |
| Arrowhead | Large-leaf pondweed | Snailseed pondweed |
| Berchtold's pondweed | Leafy pondweed | Spikerush |
| Bur-reed | Little floating heart | Swollen bladderwort* |
| Cattail | Low watermilfoil | Variable-leaf watermilfoil* |
| Clasp-leaf pondweed | Minor naiad* | Water smartweed |
| Common bladderwort | Mudmat* | Water starwort |
| Common duckweed | Northern hydrilla* | Watershield |
| Coontail | Phragmites* | Waterwort |
| Eelgrass | Pickerelweed | Western waterweed |
| Eurasian watermilfoil* | Primrose-willow | White water lily |
| Fanwort* | Purple bladderwort | Yellow water lily |
| Flat-leaf bladderwort | Quillwort | |

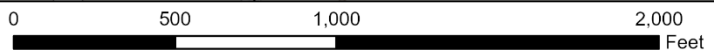
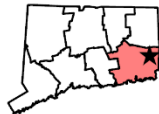
*Invasive/non-native



Map 3 of 5

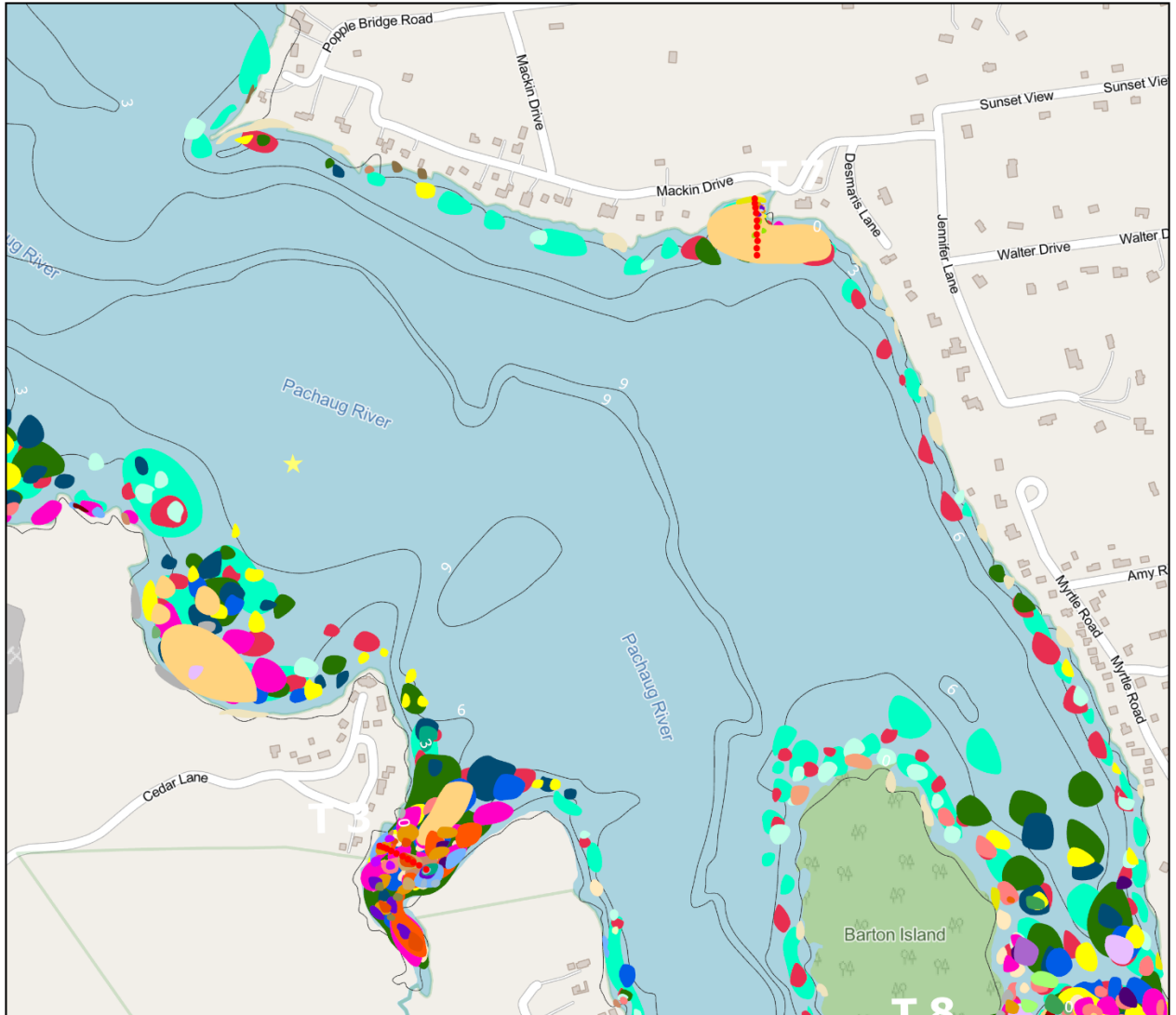
Pachaug Pond Griswold, CT 817 acres

Surveyed on August 11-13, 2025
By Greg Bugbee, Summer Weidman,
Madeline Watts, and Abraham Haxhi
Office of Aquatic Invasive Species



- | | | |
|------------------------|------------------------|-----------------------------|
| Collection Point | Floating-leaf pondweed | Ribbon-leaf pondweed |
| Transect Point | Floating bladderwort | Robbins' pondweed |
| Water Data | Golden hedge-hyssop | Slender naiad |
| State Boat Launch | Great duckweed | Small bladderwort |
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| Berchtold's pondweed | Leafy pondweed | Spikerush |
| Bur-reed | Little floating heart | Swollen bladderwort* |
| Cattail | Low watermilfoil | Variable-leaf watermilfoil* |
| Clasp-leaf pondweed | Minor naiad* | Water smartweed |
| Common bladderwort | Mudmat* | Water starwort |
| Common duckweed | Northern hydrilla* | Watershield |
| Coontail | Phragmites* | Waterwort |
| Eelgrass | Pickerelweed | Western waterweed |
| Eurasian watermilfoil* | Primrose-willow | White water lily |
| Fanwort* | Purple bladderwort | Yellow water lily |
| Flat-leaf bladderwort | Quillwort | |

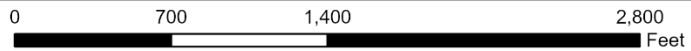
*Invasive/non-native



Map 4 of 5

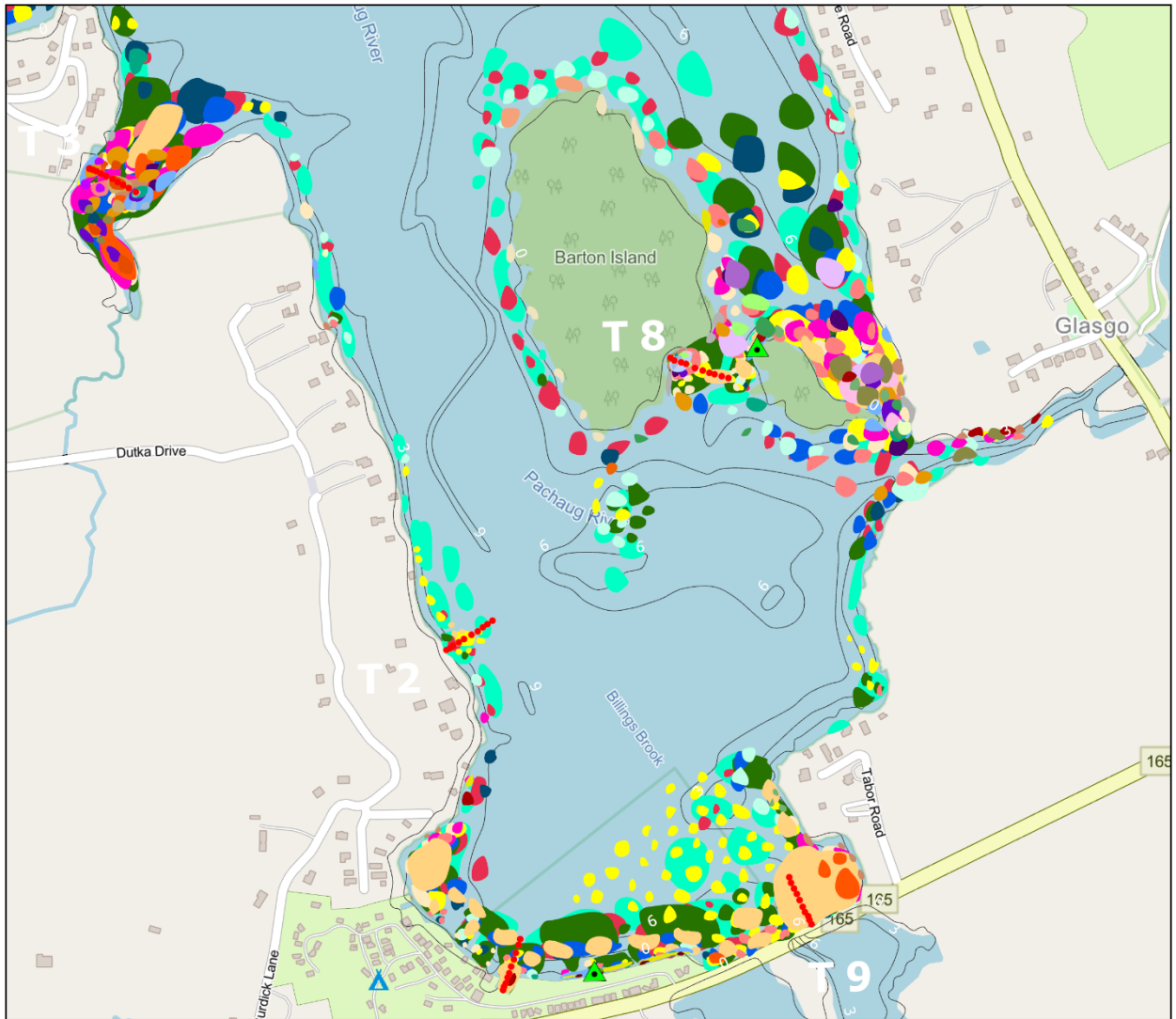
Pachaug Pond Griswold, CT 817 acres

Surveyed on August 11-13, 2025
By Greg Bugbee, Summer Weidman,
Madeline Watts, and Abraham Haxhi
Office of Aquatic Invasive Species



Collection Point	Floating-leaf pondweed	Ribbon-leaf pondweed
Transect Point	Floating bladderwort	Robbins' pondweed
Water Data	Golden hedge-hyssop	Slender naiad
State Boat Launch	Great duckweed	Small bladderwort
Bathymetry (ft)	Humped bladderwort	Small pondweed
Arrowhead	Large-leaf pondweed	Snailseed pondweed
Berchtold's pondweed	Leafy pondweed	Spikerush
Bur-reed	Little floating heart	Swollen bladderwort*
Cattail	Low watermilfoil	Variable-leaf watermilfoil*
Clasp-leaf pondweed	Minor naiad*	Water smartweed
Common bladderwort	Mudmat*	Water starwort
Common duckweed	Northern hydrilla*	Watershield
Coontail	Phragmites*	Waterwort
Eelgrass	Pickerelweed	Western waterweed
Eurasian watermilfoil*	Primrose-willow	White water lily
Fanwort*	Purple bladderwort	Yellow water lily
Flat-leaf bladderwort	Quillwort	

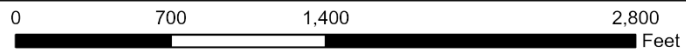
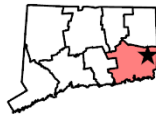
*Invasive/non-native



Map 5 of 5

Pachaug Pond Griswold, CT 817 acres

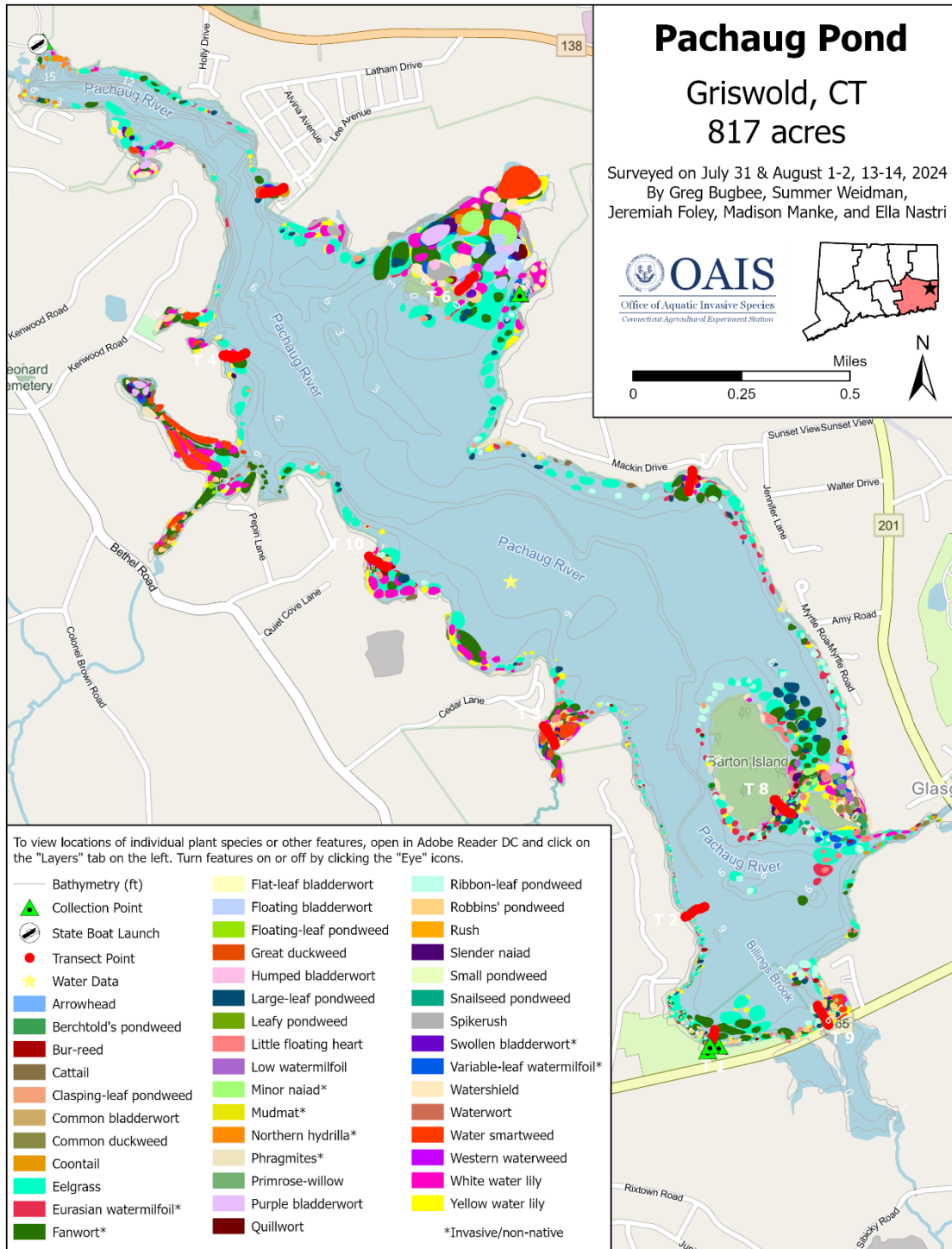
Surveyed on August 11-13, 2025
By Greg Bugbee, Summer Weidman,
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Office of Aquatic Invasive Species

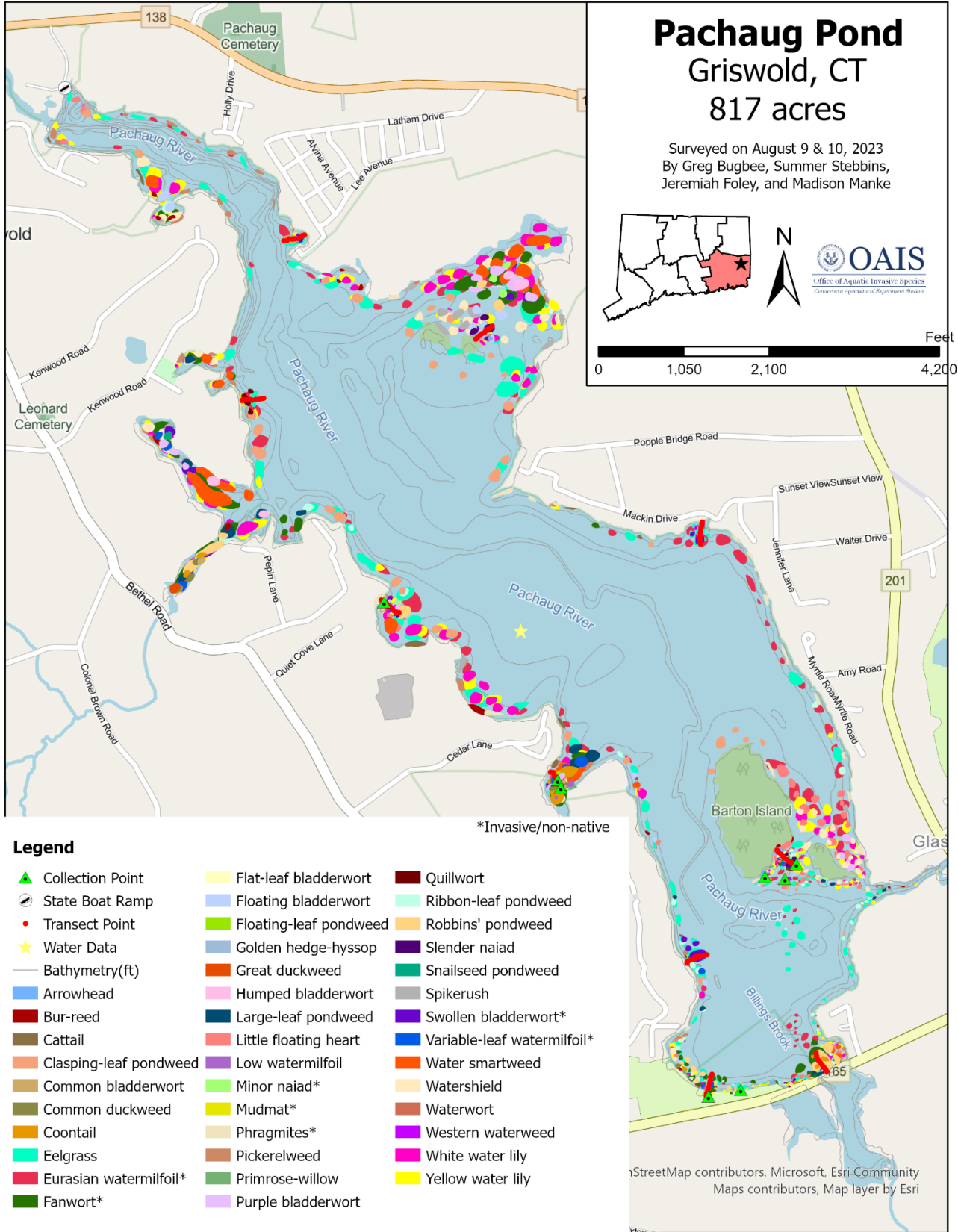


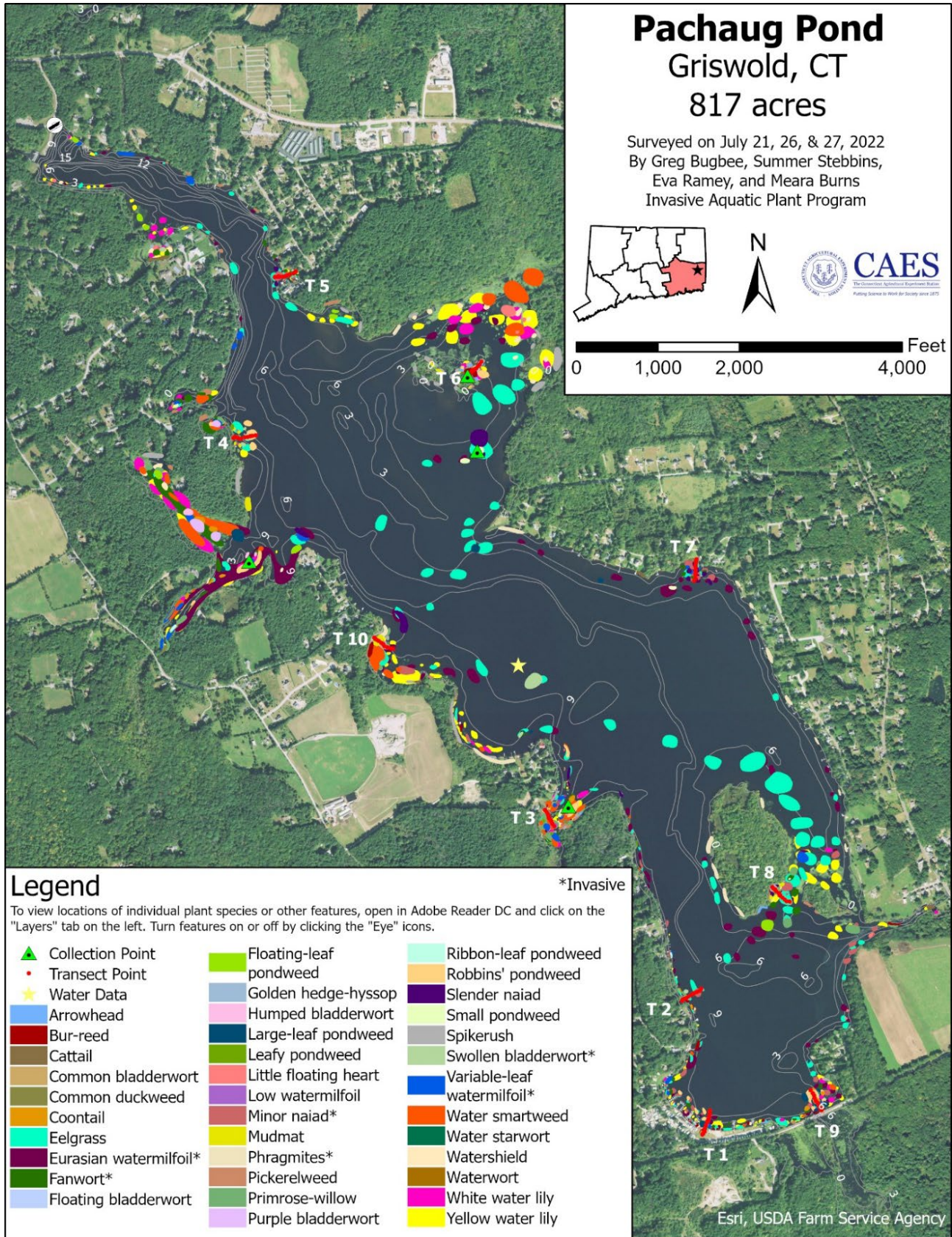
- | | | |
|------------------------|------------------------|-----------------------------|
| Collection Point | Floating-leaf pondweed | Ribbon-leaf pondweed |
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| Coontail | Phragmites* | Waterwort |
| Eelgrass | Pickerelweed | Western waterweed |
| Eurasian watermilfoil* | Primrose-willow | White water lily |
| Fanwort* | Purple bladderwort | Yellow water lily |
| Flat-leaf bladderwort | Quillwort | |

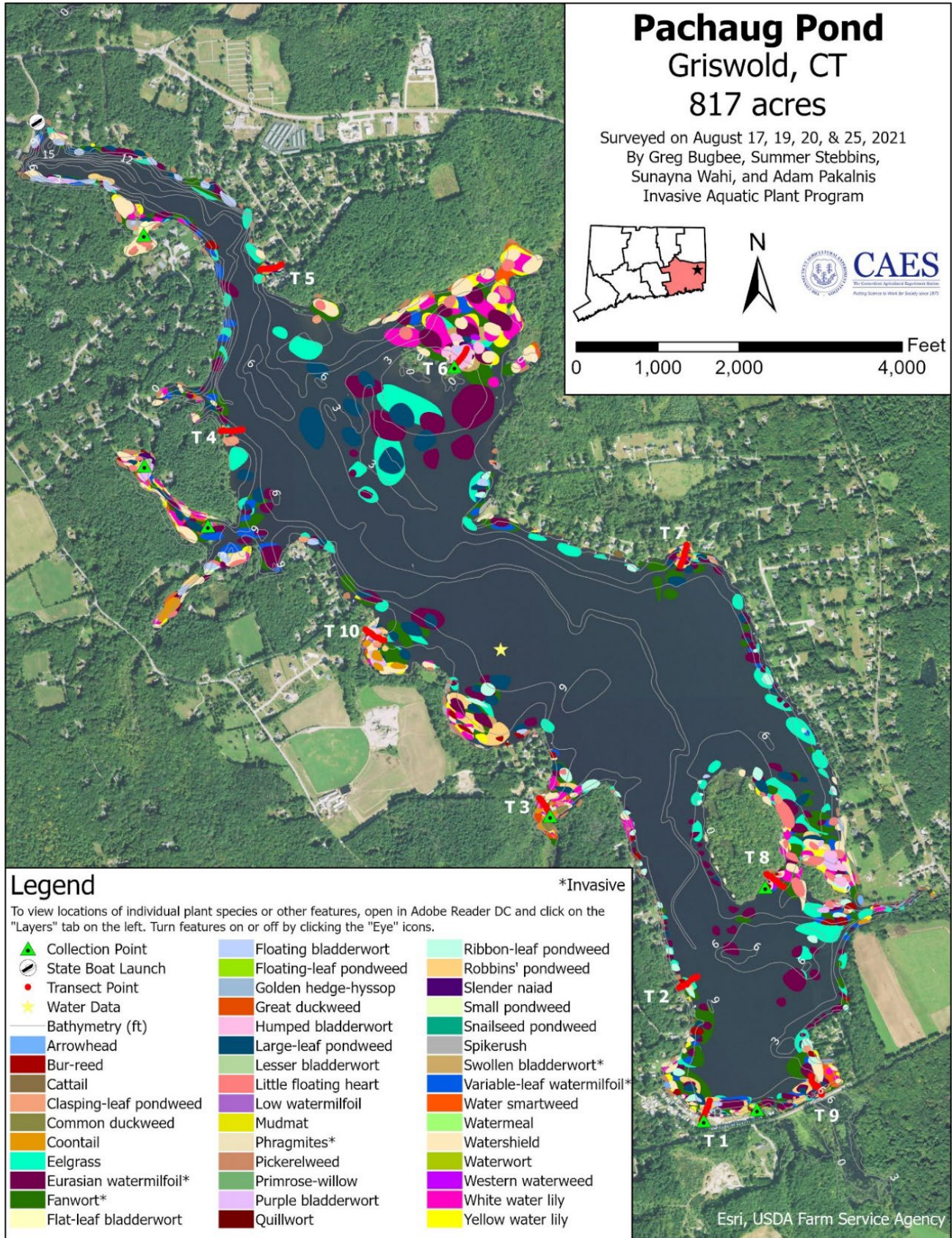
*Invasive/non-native

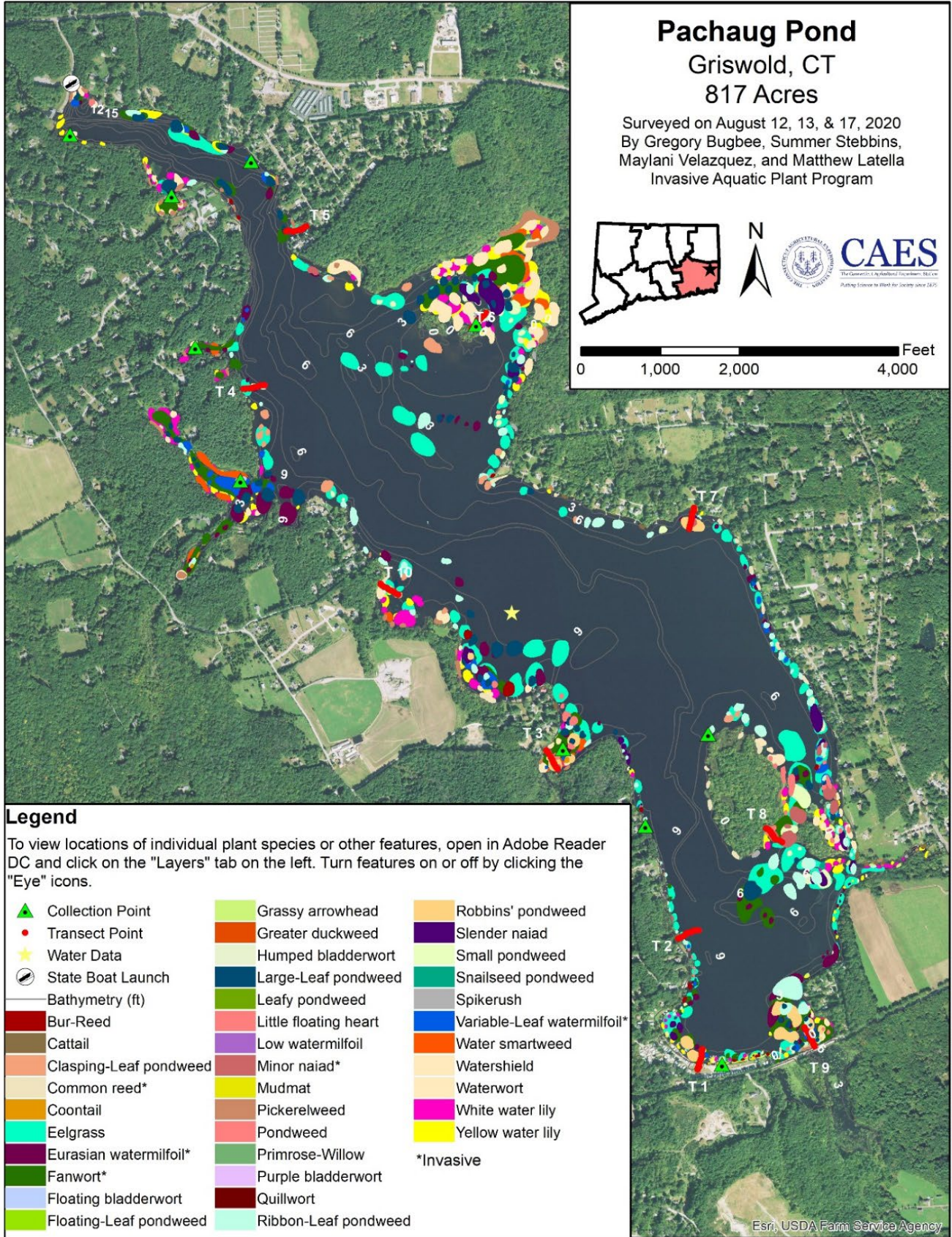
Previous Years Aquatic Plant Survey Maps

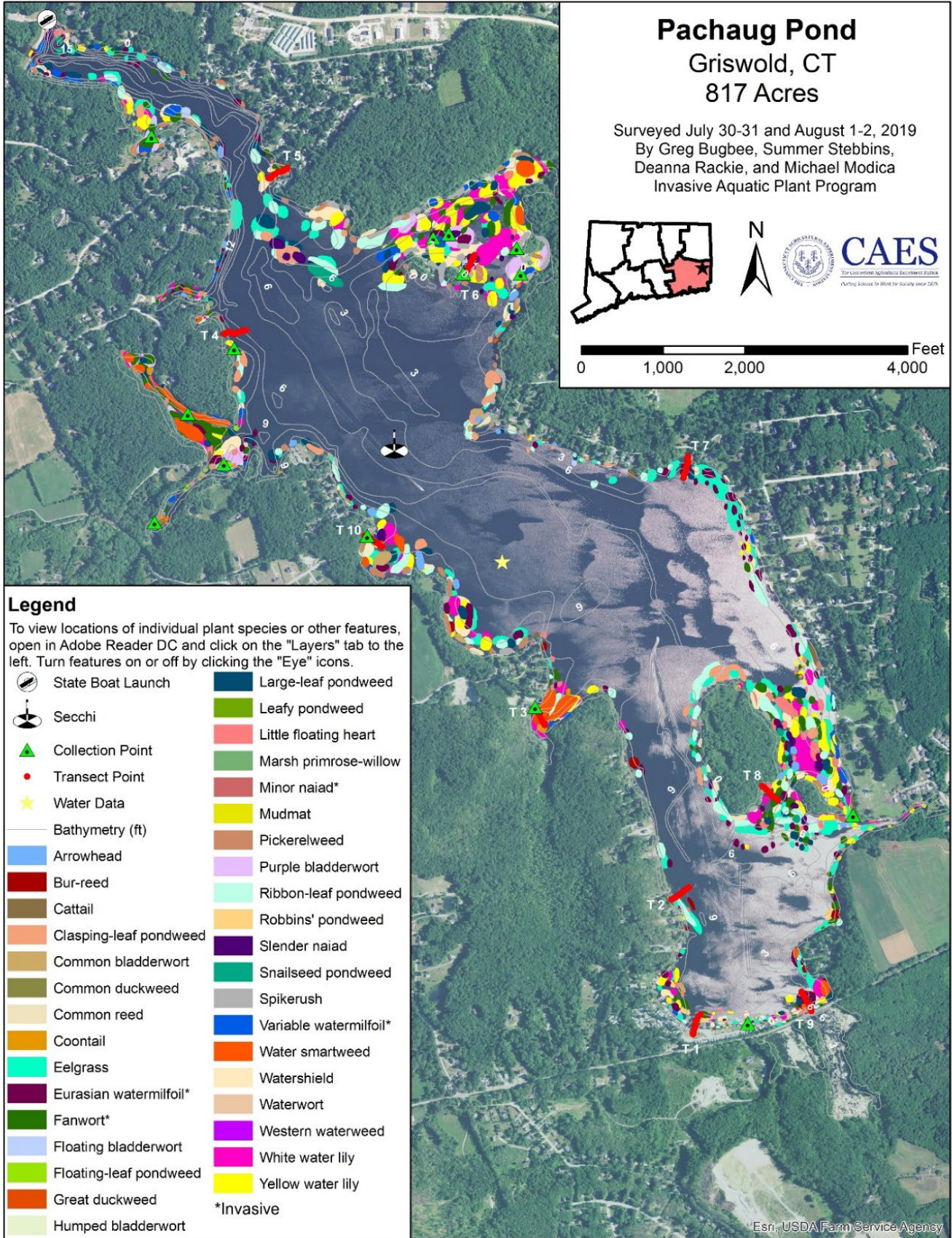


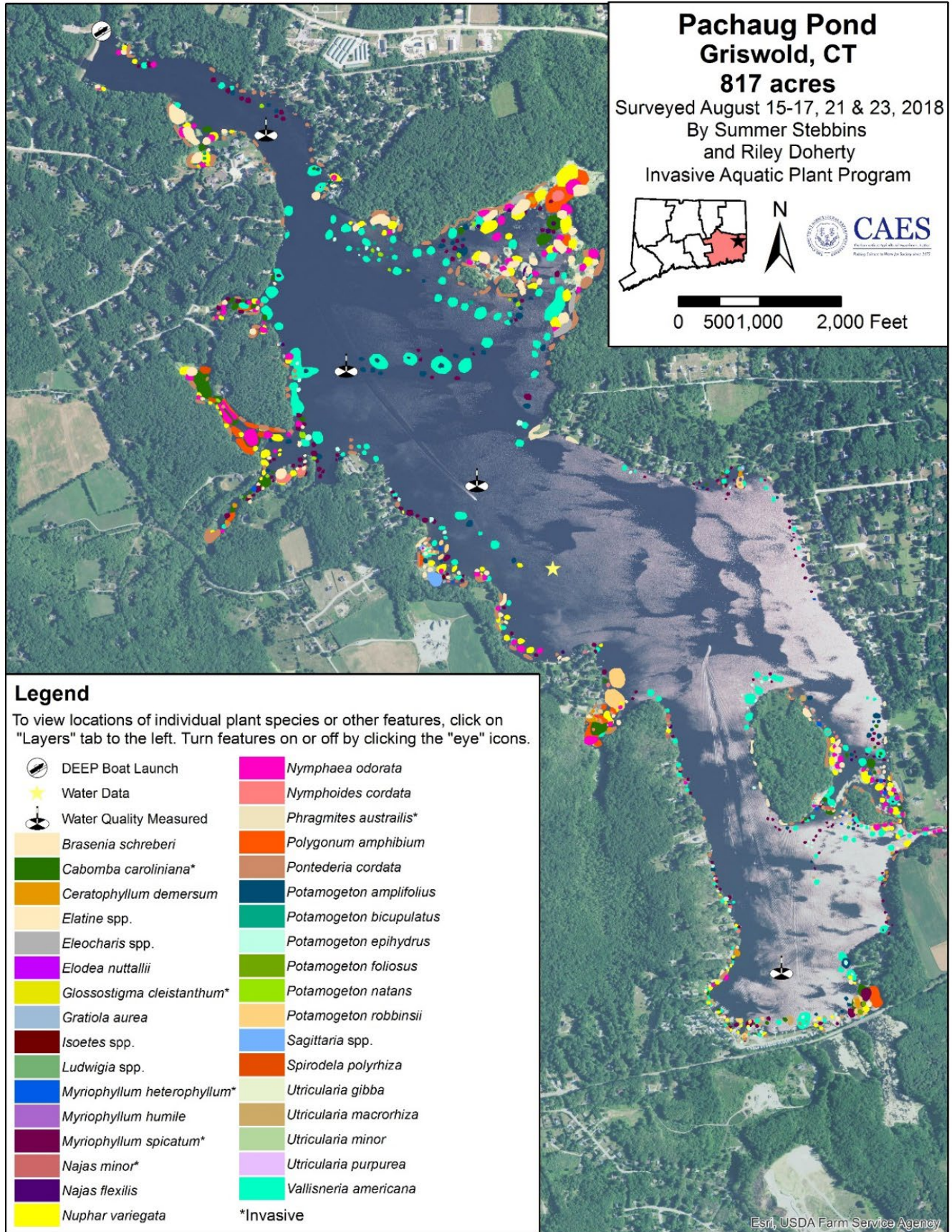


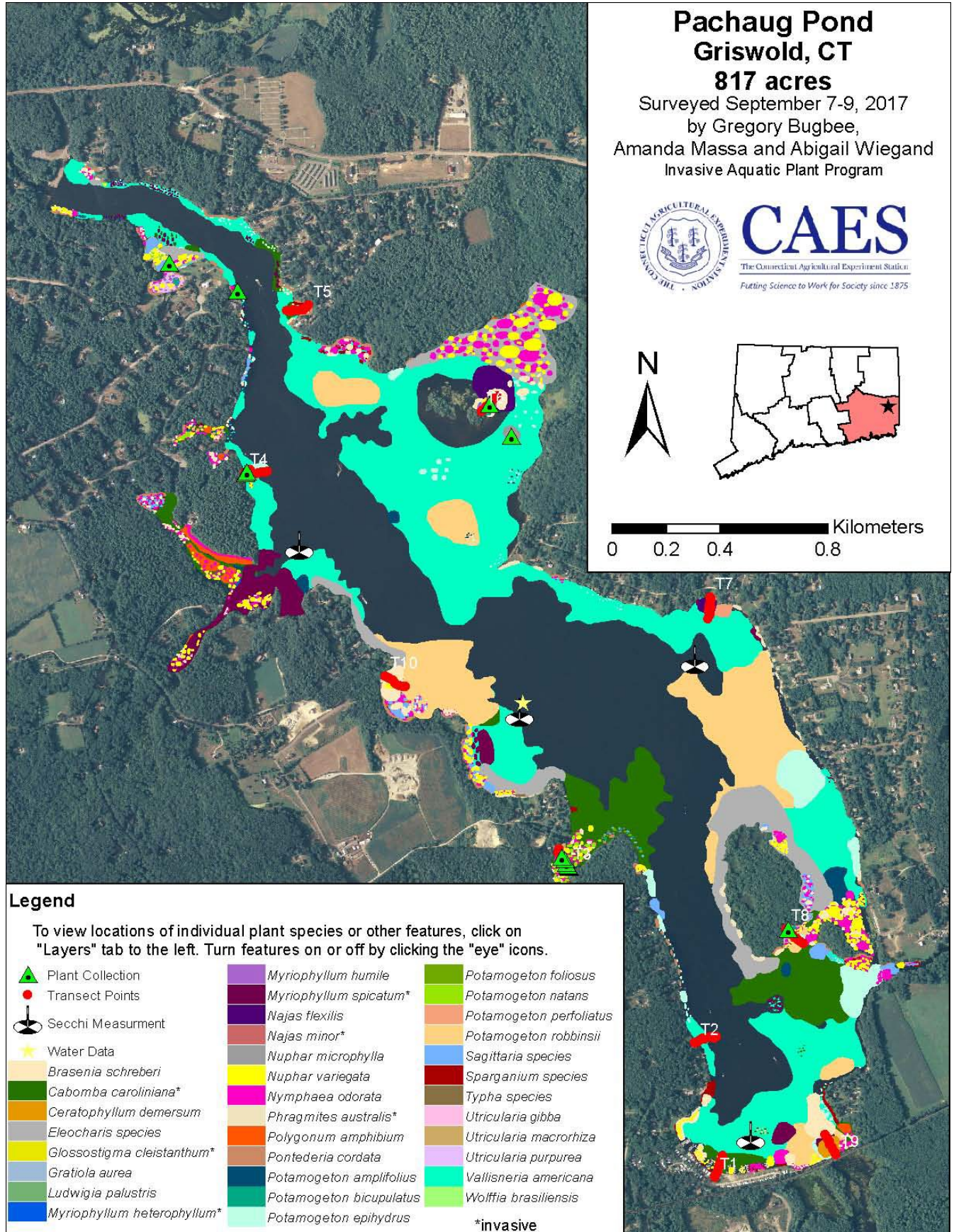












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