The Connecticut Agricultural Experiment Station

123 Huntington Street

New Haven, CT 06511

Bashan Lake

East Haddam, CT

Aquatic Vegetation Survey
Water Chemistry
Invasive Aquatic Plant Management

2022

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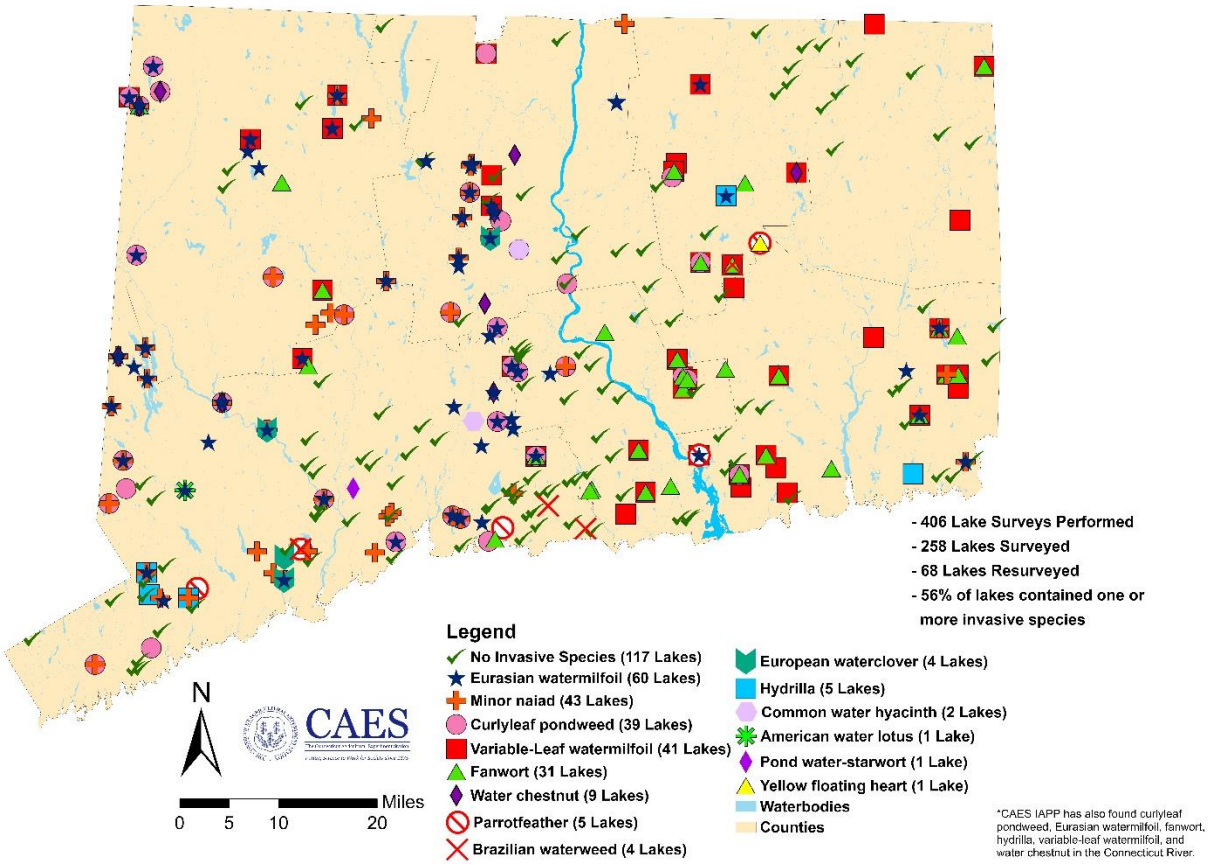

Figure 1. Locations of invasive aquatic plants found by CAES IAPP from 2004 – 2022.

Introduction:

Since 2004, the Connecticut Agricultural Experiment Station Invasive Aquatic Plant Program (CAES IAPP) has surveyed aquatic vegetation and water chemistry in over 400 Connecticut lakes, ponds, and rivers (Figure 1). Of these waterbodies, 56% contain invasive (non-native) plant species that can cause rapid deterioration of aquatic ecosystems and recreational value. CAES IAPP uploads all survey information into an online database where stakeholders can view vegetation maps, transect data, herbarium mounts, temperature and dissolved oxygen profiles, and water chemistry (portal.ct.gov/caes-iapp). This information allows citizens, government officials, and scientists to view past conditions, compare them with current conditions, and make informed management decisions. The presence of invasive species is related to water chemistry, public boat launches, random events, and climate change (June-Wells et al., 2013; Rahel & Olden, 2008).

Bashan Lake is a 273-acre waterbody located in East Haddam, Connecticut. It is one of Connecticut's highest quality state-owned waterbodies. The lake is moderately developed with residential homes and docks along the shoreline. The lake is widely used for recreational boating, fishing, and swimming. It has a public boat launch at the eastern end. All beaches are private and maintained by lake associations. Previous work on Bashan Lake dates to the 1940s when the State Board of Fisheries and Game (1942) described it as having "extensive submerged weed beds due to exceptional transparency". Another publication by the State Board of Fisheries and Game (1959) mentions "very clear water and transparency that exceeds 15 feet" and "scarce submerged and emergent vegetation". It also describes the lake bottom consisting "of sand, gravel, coarse rubble, and boulders". Work by CAES in 1980 ranked Bashan Lake as having the highest water quality of the Connecticut 70 lakes surveyed. Aquatic vegetation was described as moderately dense in a few areas with shallow coves containing native plants such as Robbins' pondweed and bladderwort. No invasive species were mentioned. CAES IAPP has performed aquatic vegetation surveys and researched control strategies for invasive plants in Bashan Lake for nearly 20 years. The work has focused on control of invasive variable-leaf watermilfoil (*Myriophyllum heterophyllum*) and

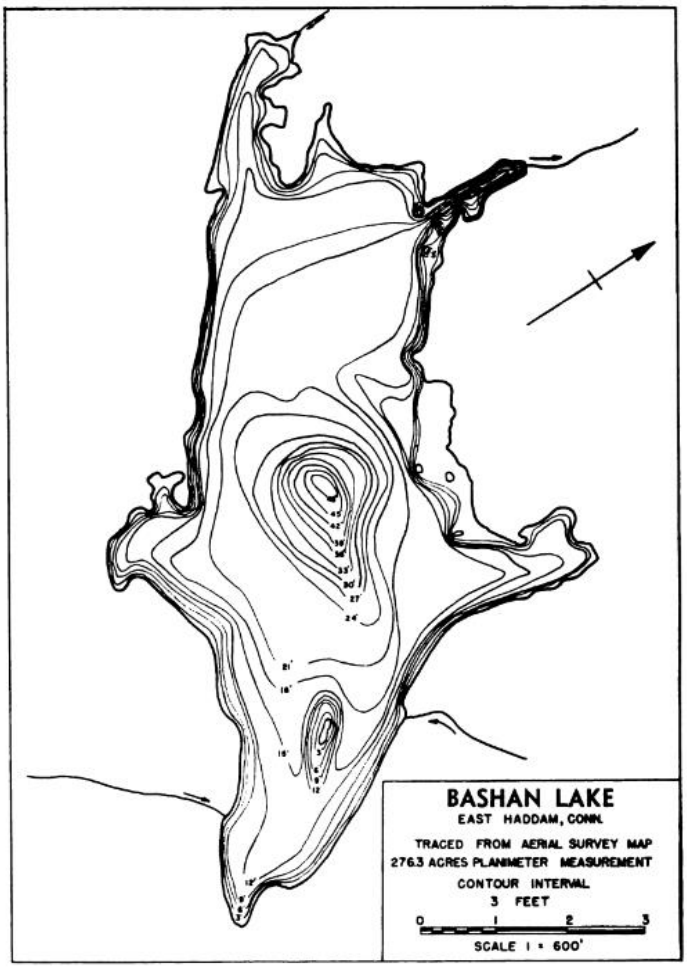

Figure 2. Bathymetry map of Bashan Lake in 1959.

fanwort (*Cabomba caroliniana*). From 1999 to 2017 treatments of variable-leaf watermilfoil with the herbicide 2,4-D were performed with a decline efficacy over time. Herbicide resistance was surmised, and tests began with a new product called ProcellaCOR in 2019. By 2021 variable-leaf watermilfoil was virtually eliminated but fanwort, which is not controlled with ProcellaCOR, began to proliferate. In addition, lake water has been analyzed to track possible changes that could affect aquatic vegetation and harmful algal blooms. Complete surveys for all native and invasive plants as well as water tests were performed by CAES IAPP in 2004, 2014, 2016, 2020, and 2022.

Objectives:

- Perform a fifth complete survey of Bashan Lake for aquatic vegetation and water chemistry.
- Compare with previous surveys and review aquatic plant management.
- Upload vegetation maps and water chemistry information to the CAES IAPP website

Materials and Methods:

Aquatic Plant Surveys and Mapping:

Bashan Lake was surveyed for aquatic vegetation on August 9, 10, and 11, 2022. The survey utilized methods established by CAES IAPP and were consistent with previous CAES IAPP techniques. Surveys were conducted from 16 and 18-foot motorized boats traveling over areas that supported aquatic plants. Plant species were recorded based on visual observation or collections with a long-handled rake or grapple. The Lowrance® HDS 5 sonar system 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 14 transects that were positioned perpendicular to the shoreline in 2004. Transect locations

represented the variety of habitats occurring in the lake. They were located using a Trimble® R1 GNSS global positioning system with sub-meter accuracy. Sampling points were taken along each transect at 0, 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 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, specimens were brought back to the laboratory for review using the taxonomy of Crow and Hellquist (2000*a*, 2000*b*). One specimen of each species collected in the lake was dried and mounted in the CAES IAPP aquatic plant herbarium. Digitized mounts can be viewed online (portal.ct.gov/caes-iapp). Plant species are referred to by common name in the text of this report, however corresponding scientific names can be found in Table 1. Cattail and phragmites are wetland plants included in our survey; however, since they are not aquatic plants, they are not included in our statistical analysis. We post-processed the GPS data in Pathfinder® 5.85 (Trimble Navigation Limited, Sunnyvale, CA) and then imported it into ArcGIS® Pro 2.9.0 (ESRI Inc., Redlands, CA). Data were then overlaid onto recent high-resolution (1m or better) aerial imagery for the continental United States made available by the USDA Farm Services Agency.

Water Analysis:

Water was analyzed from the same point in the "center", the deepest part of the lake, each year. Water temperature and dissolved oxygen were measured 0.5 m beneath the surface and at 1 m intervals using an YSI 58® meter. Water clarity was measured by lowering a six-inch diameter black and white Secchi disk into the water and determining to what depth it could be viewed. Water samples for pH, alkalinity, conductivity, total phosphorus, and total nitrogen testing 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 was used to determine pH and conductivity, and alkalinity (mg/L $CaCO_3$) was quantified by titration with 0.016 N H_2SO_4 to an end point

Table 1. Plants present in Bashan Lake in 2004, 2014, 2016, 2020, and 2022. Present indicates the species presence in the lake while frequency of occurrence (FOQ) indicates how frequently species were found on transects. Transect data was not collected in 2016 because the lake was too shallow due to a drawdown.

Bashan Lake											
Species (invasives in bold)		**2004**		**2014**		**2016**		**2020**		**2022**	
Common Name	**Scientific Name**	**Present**	**FOQ** (%/point)	**Present**	**FOQ** (%/point)	**Present**	**FOQ** (%/point)	**Present**	**FOQ** (%/point)	**Present**	**FOQ** (%/point)
Arrowhead	*Sagittaria species*			X	12	X		X	6	X	9
Berchtold's Pondweed	*Potamogeton berchtolii*									X	
Bur-Reed	*Sparganium species*	X	16	X	21	X		X	5	X	10
Common bladderwort	*Utricularia macrorhiza*			X	37	X		X	26	X	9
Common duckweed	*Lemna minor*							X		X	2
Coontail	*Ceratophyllum demersum*							X	1	X	1
Eelgrass	*Vallisneria americana*	X	1	X						X	
Fanwort	***Cabomba caroliniana***			**X**				**X**		**X**	**2**
Floating bladderwort	*Utricularia radiata*			X		X		X	7	X	24
Golden hedge-hyssop	*Gratiola aurea*			X	4			X	1	X	
Hiddenfruit bladderwort	*Utricularia geminiscapa*	X	27								
Humped bladderwort	*Utricularia gibba*	X	11	X	36	X		X	9	X	44
Leafy pondweed	*Potamogeton foliosus*							X		X	1
Lesser bladderwort	*Utricularia minor*									X	1
Low watermilfoil	*Myriophyllum humile*					X				X	4
Mudmat	*Glossostigma cleistanthum*					X		X	6	X	6
Pickerelweed	*Pontederia cordata*					X				X	
Pondweed	*Potamogeton species*						**Drawdown**	X	2		
Primrose-Willow	*Ludwigia species*					X	**year -**			X	
Purple bladderwort	*Utricularia purpurea*	X	48	X	49	X	**no transect**	X	36	X	39
Quillwort	*Isoetes species*						**data**			X	
Ribbon-leaf pondweed	*Potamogeton epihydrus*	X	4	X	3	X		X	1	X	3
Sevenangle pipewort	*Eriocaulon aquaticum*	X		X	3			X	1	X	
Slender naiad	*Najas flexilis*	X	1							X	20
Small pondweed	*Potamogeton pusillus*	X	5	X	1			X	17	X	15
Snailseed pondweed	*Potamogeton bicupulatus*	X	1	X	9	X		X	8	X	9
Spikerush	*Eleocharis species*	X	10	X	15	X		X	21	X	20
Spineless hornwort	*Ceratophyllum echinatum*	X	6	X	1						
Swollen bladderwort	***Utricularia inflata***									**X**	
Thread-Leaf naiad	*Najas gracillima*							X			
Variable-Leaf watermilfoil	***Myriophyllum heterophyllum***	**X**	**30**	**X**	**11**	**X**				**X**	
Vaysey's pondweed	*Potamogeton vaysei*							X			
Watershield	*Brasenia schreberi*	X	1	X		X		X	1	X	1
Water starwort	*Callitriche species*	X	1	X	3	X				X	2
Waterthread pondweed	*Potamogeton diversifolius*					X					
Waterwort	*Elatine species*			X	9	X		X	4	X	5
Western waterweed	*Elodea nuttallii*	X	2	X	4			X	3	X	5
White water lily	*Nymphaea odorata*	X	1	X	1	X		X	1	X	1
Total Species Richness	37	17	16	21	17	19		24	19	32	23
Total Native Species Richness	34	16	15	19	16	18		23	19	29	22
Total Invasive Species Richness	**3**	**1**	**1**	**2**	**1**	**1**		**1**	**0**	**3**	**1**

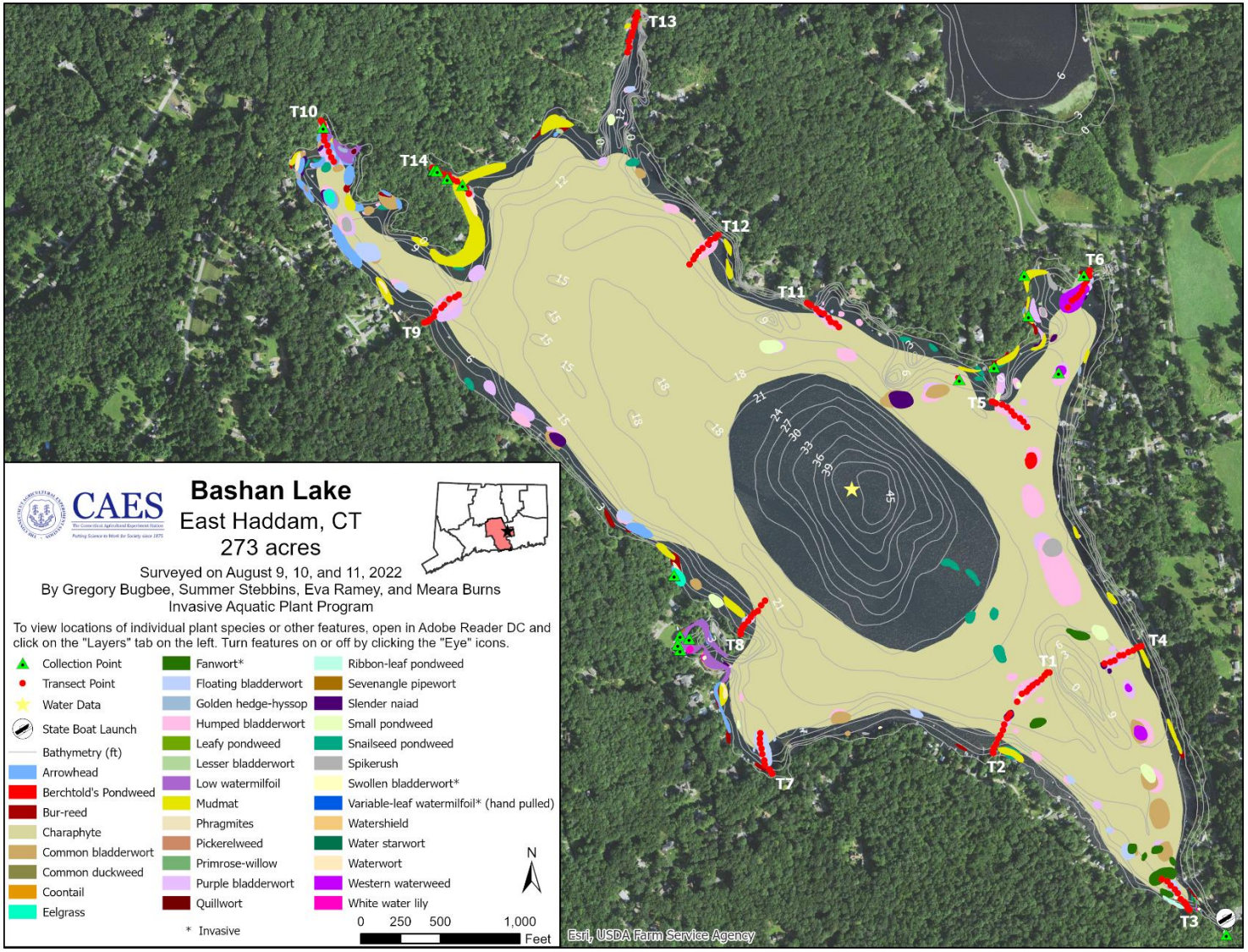

Figure 3. 2022 aquatic plant survey map of Bashan Lake. A PDF version can be found on the CAES IAPP website.

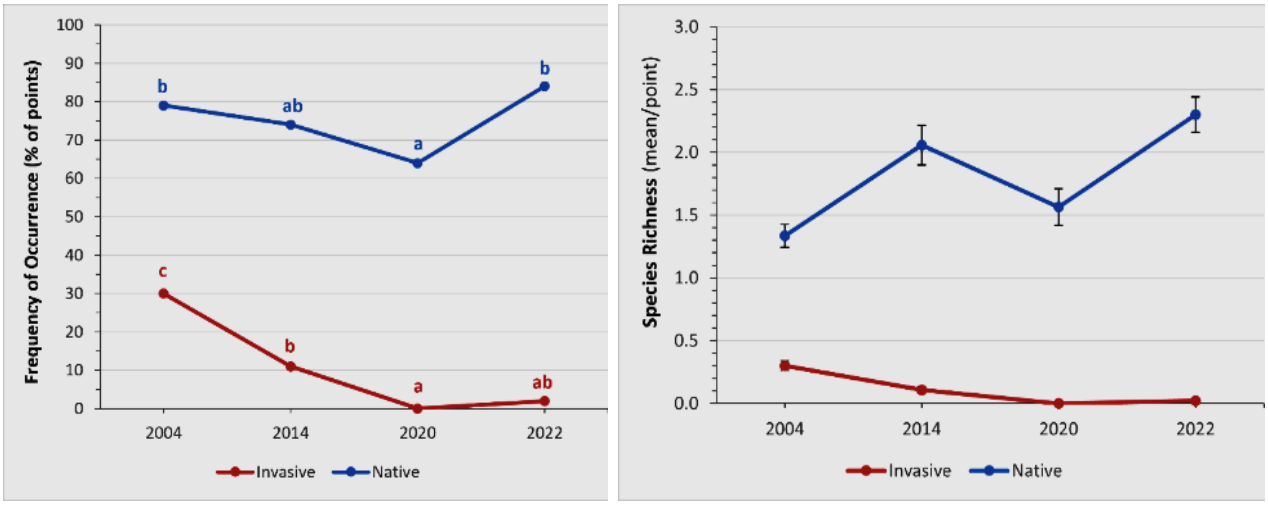

Figure 4. Frequency of occurrence (FOQ, left) and species richness (right) of native and invasive aquatic plants on transects after herbicide treatments in Bashan Lake for years.

of pH 4.5. We determined total phosphorus using the ascorbic acid method preceded by digestion with potassium persulfate (APHA, 1995). Phosphorus was quantified using a Milton Roy Spectronic 20D® spectrometer with a light path of 2 cm and a wavelength of 880 nm. Total Nitrogen was determined with an O-I Analytical 1080® Total Organic Carbon Analyzer.

Results and Discussion:

General Aquatic Plant Surveys and Transects:

The 2022 aquatic vegetation survey of Bashan Lake found a total of 32 aquatic plant species, three of which are invasive (Table 1, Figure 3). This compares to 24 species (1 invasive) found in 2020, 19 species (1 invasive) found in 2016, 21 species (2 invasives) found in 2014, and 17 species (1 invasive) found in 2004. The 2022 survey documented the most diverse aquatic plant community in Bashan Lake to date. The three invasive species found in 2022 were fanwort, swollen bladderwort, and variable-leaf watermilfoil. An expansion of fanwort from the previous surveys was also evident. Only a few variable-leaf watermilfoil plants were observed and were hand pulled during the survey. Swollen bladderwort is a new, potentially invasive species in Connecticut. Plant samples from the 2022

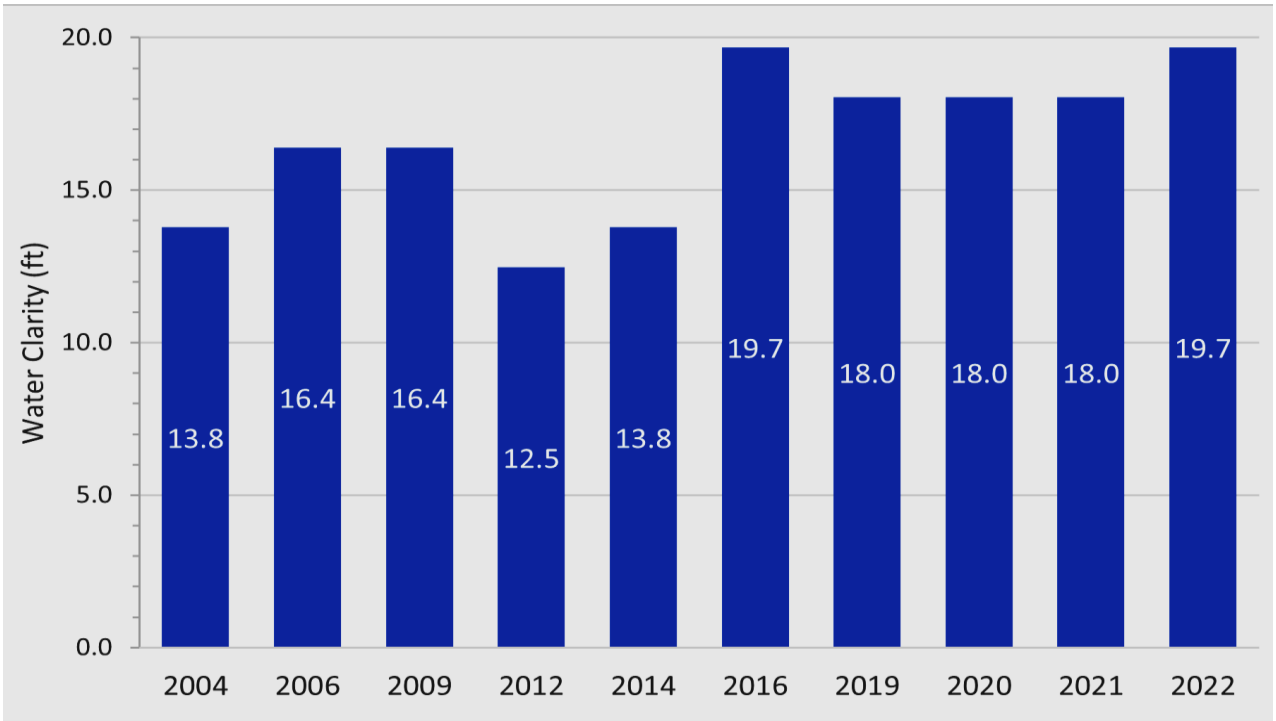

Figure 5. Water clarity measurements in Bashan Lake between 2004 and 2022.

survey were sent for DNA analysis where its identification was confirmed. DNA research of this species is ongoing and potential impacts to waterbodies are being investigated.

Native species that reappeared in 2022 (were not present in 2020) include eelgrass, low watermilfoil, pickerelweed, primrose-willow, slender naiad, and water starwort. Native species found for the first time in 2022 include Berchtold's pondweed, lesser bladderwort, and quillwort. Although providing details on native plants is beyond the scope of this report, information is available at USDA "About PLANTS" website (https://plants.usda.gov/about_plants.html). From 2020 to 2022, there was increase in the coverage of native species such as arrowhead, bur-reed, common bladderwort, floating bladderwort, humped bladderwort, mudmat, snailseed pondweed, and invasive fanwort. Mudmat is considered by some to be a non-native invasive species, however it is not officially recognized as such in Connecticut (Connecticut Invasive Species List, Connecticut General Statutes Sec. 22a-381d). Because of its

extremely low growth habit, mudmat is unlikely to become a nuisance and may prevent the establishment of other nuisance plants. As in 2020, charophyte, an advanced plant-like alga, was very common in deeper water up to a depth of around 20 feet. The CAES IAPP website contains digitized survey maps where individual plant layers can be viewed separately (portal.ct.gov/caes-iapp).

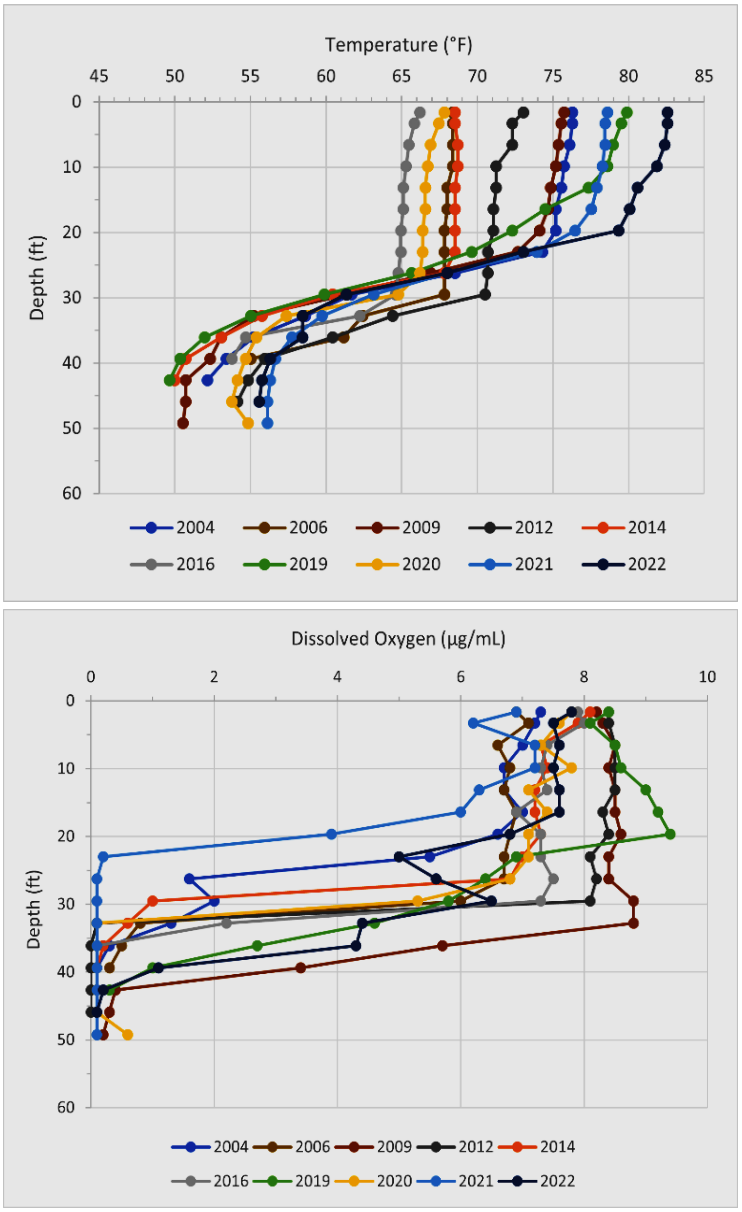

Figure 6. Temperature (top) and dissolved oxygen (bottom) measurements in Bashan Lake between 2004 – 2022.

Frequency of occurrence (FOQ) and species richness are important criteria for assessing an aquatic plant community. Our FOQ data refers to how frequently aquatic plant species are found on transects. Species richness refers to the average number of species found on transect points. Because the same points on the same transects are visited during each year's survey using highly accurate global positioning systems, these transects offer a scientific approach to tracking change over time. Optimal aquatic plant diversity occurs when large numbers of native plant species are abundant at non-nuisance levels. Generally, a coverage of 20-40% of the lakes littoral zone (area where plant growth is not limited by light etc.)

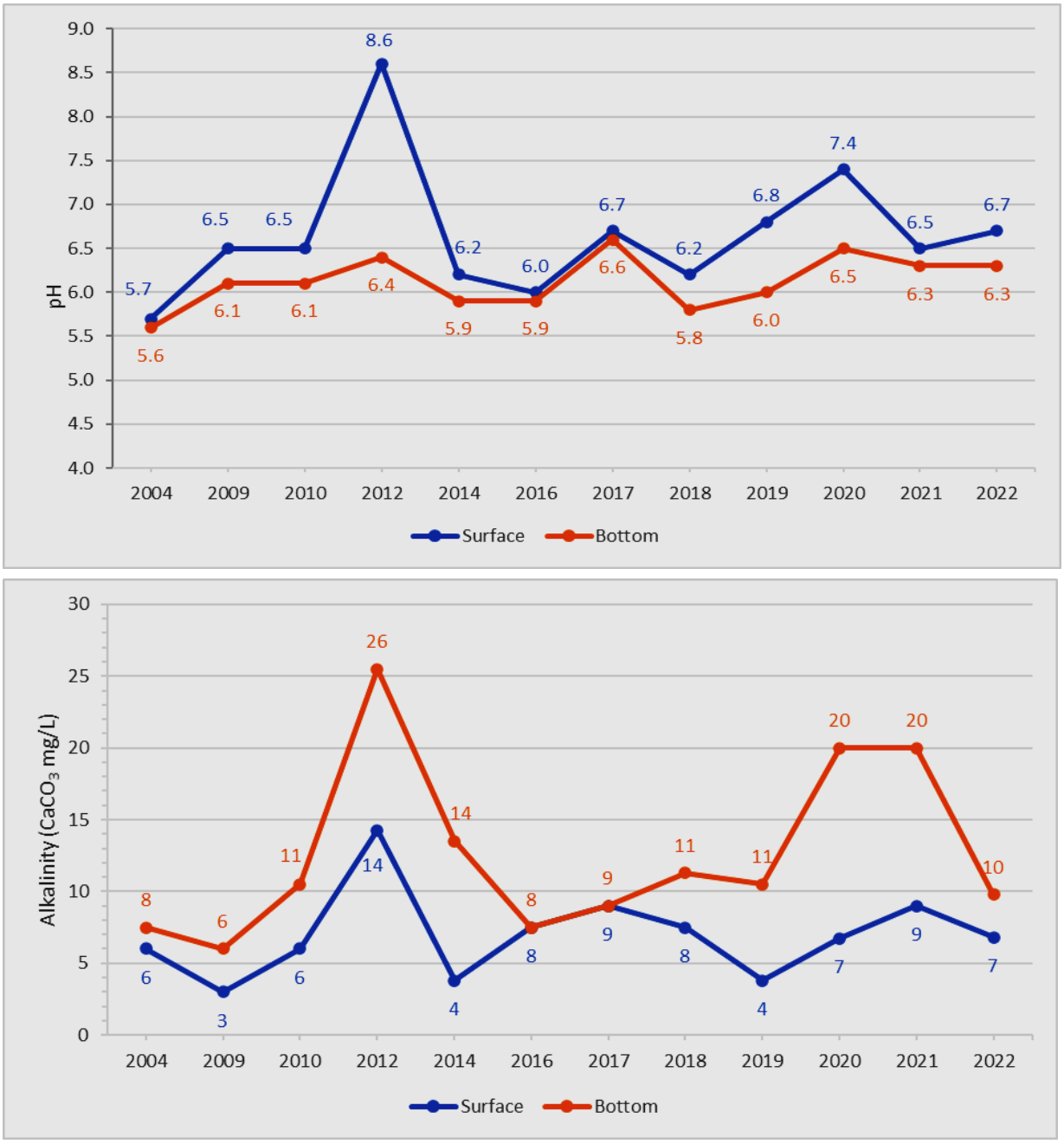

Figure 7. pH (top) and alkalinity (bottom) measurements in Bashan Lake between 2004 and 2022.

is considered optimal for fish habitat (Jacobs & O'Donnell, 2002). Transect data revealed a significant increase ($p \leq 0.05$) in native species from 2020 to 2022 (Figure 4, see appendix for transect data). FOQ of native species in 2022 was the highest recorded in CAES IAPP surveys and it was similar to that of 2004 and 2014. FOQ of

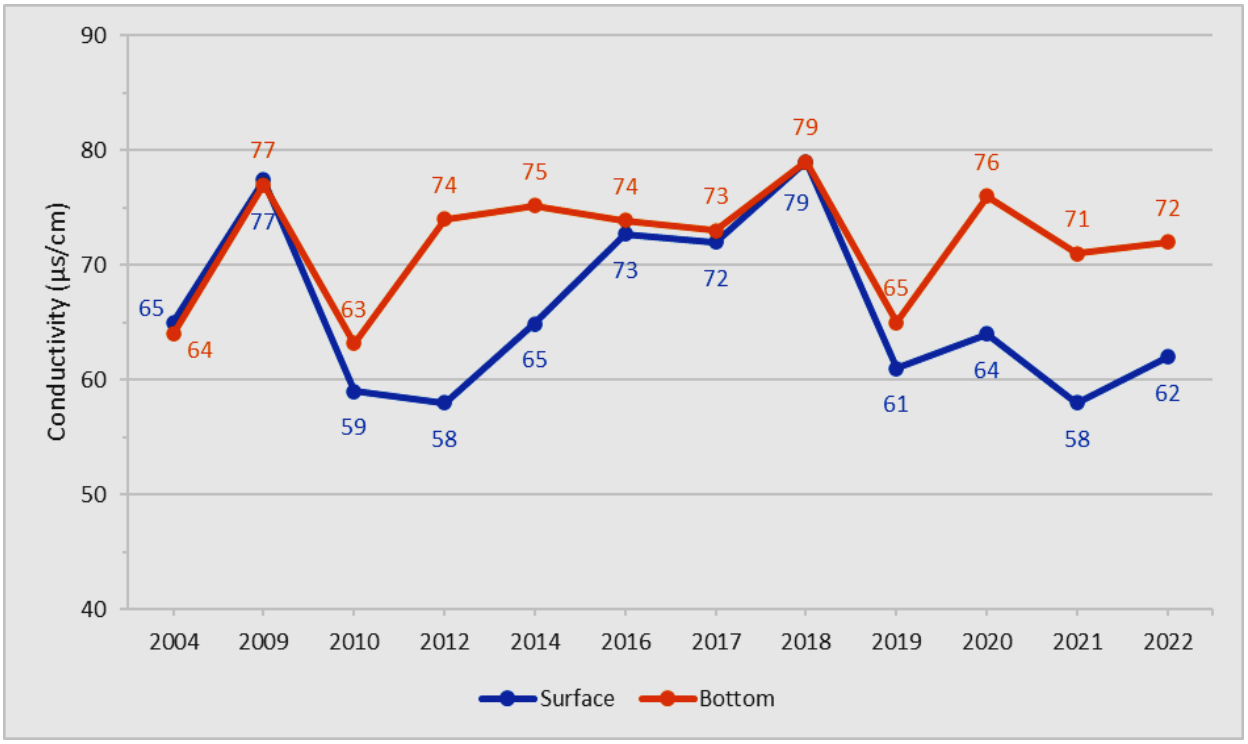

Figure 8. Conductivity measurements in Bashan Lake between 2004 and 2022.

invasive species slightly increased but was not statistically significant. Similarly, native species richness on transects significantly increased (one standard error of the mean) from 2020 to the highest recorded in CAES IAPP surveys.

Water Chemistry:

Water clarity in Connecticut's lakes ranges from 1-33 feet with an average of 7 feet (CAES IAPP, 2023). Bashan Lake had a water clarity of 19.7 feet (6 m) in 2022, which was the same as 2016 and the highest clarity measurement recorded for Bashan Lake by CAES IAPP (Figure 5). In 1980 CAES recorded a clarity of 18 feet (Frink & Norvell, 1984). Bashan Lake stratifies each summer with warmer, more oxygenated water at the surface (0-30 feet) and colder less oxygenated water (30-50 feet) near the bottom (Figure 6).

Bashan Lake's surface pH has ranged between 5.7 – 8.6 throughout the years, while the bottom pH has ranged between 5.6 and 6.6 (Figure 7, top). In 2022, the

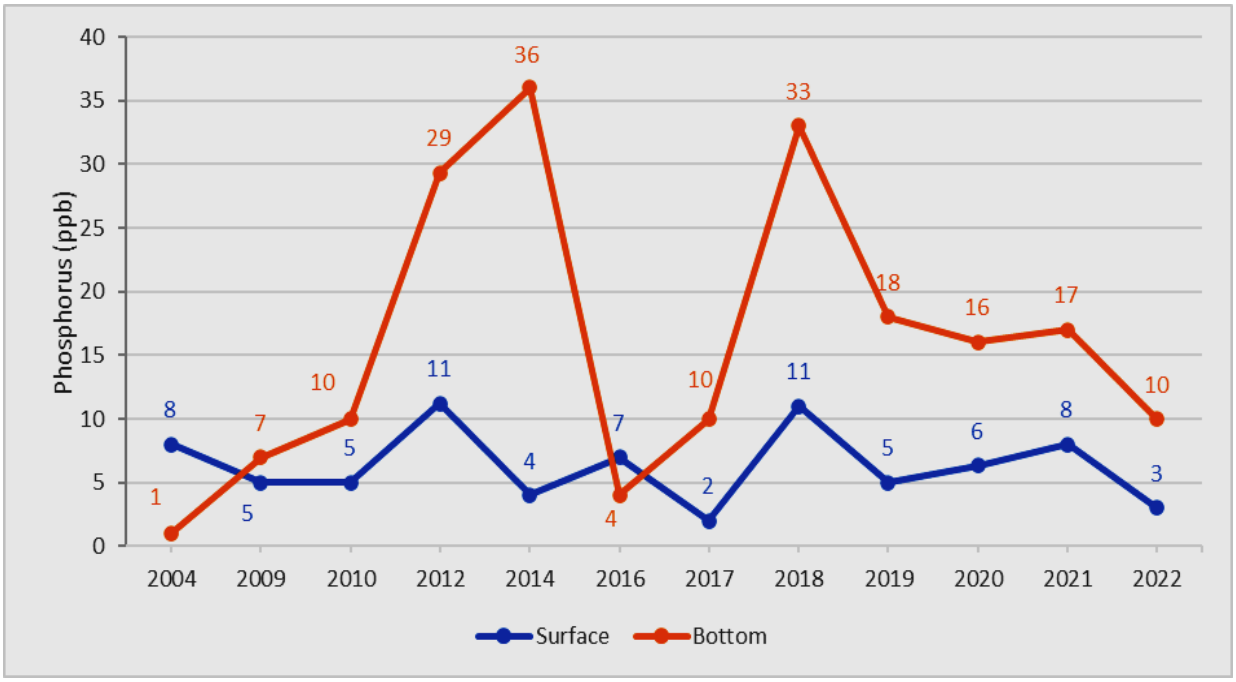

Figure 9. Total phosphorus measurements in Bashan Lake between 2004 and 2022.

surface pH was 6.7 and the bottom pH was 6.3. Higher surface pH's are common during sunny afternoons when more plants and algae are photosynthesizing, and winds are calm to reduce mixing. This may account for the unusually high surface pH in 2012. Bashan Lake had a surface alkalinity between 3 – 14 mg/L $CaCO_3$ throughout the years and a bottom alkalinity between 6 - 26 mg/L $CaCO_3$ (Figure 7, bottom). In 2022, alkalinity was 7 mg/L $CaCO_3$ at the surface and 10 mg/L $CaCO_3$ at the bottom. These measurements are relatively low for Connecticut lakes which range from near zero to greater than 170 mg/L $CaCO_3$ (CAES IAPP, 2023). Low alkalinity waterbodies are more prone to pH change due to outside influences such as watershed activities and acid rain. Bashan Lake's conductivity has ranged between 58 – 79 µS/cm at the surface and 63 – 79 µS/cm at the bottom throughout the years (Figure 8). Conductivity is an indicator of dissolved ions that come from natural and man-made sources (mineral weathering, organic matter decomposition, fertilizers, septic systems, road salts, etc.). Connecticut waterbodies have conductivities that range from 50 - 250 µS/cm.

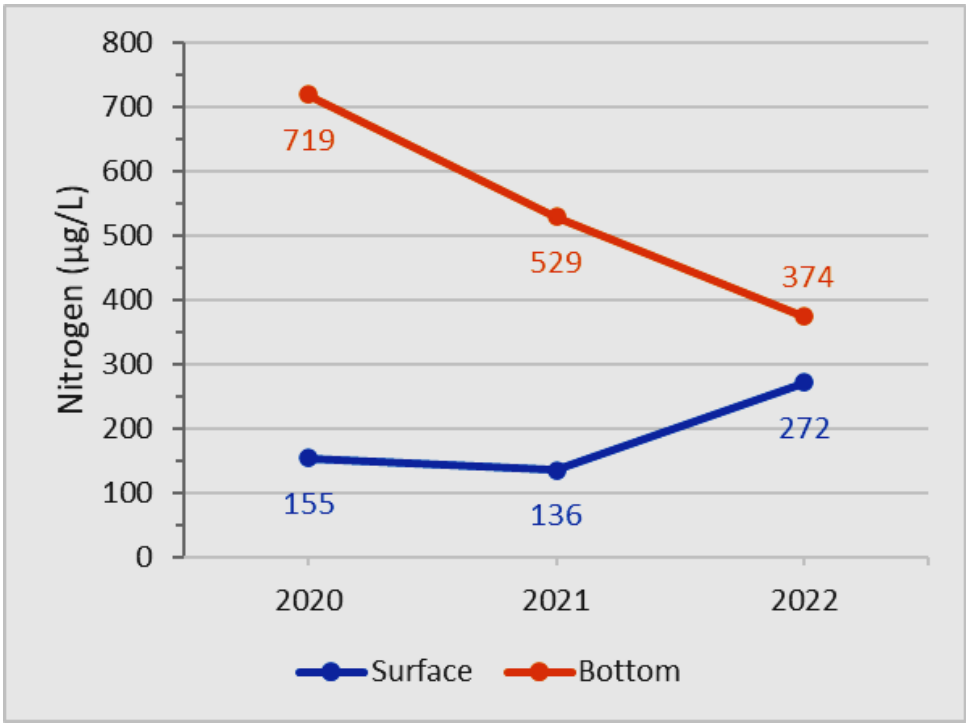

Figure 10. Total nitrogen (TN) measurements in Bashan Lake from 2020 – 2022.

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 & Norvell, 1984; Wetzel, 2001). Rooted macrophytes are less dependent on P from the water column as they obtain most of their nutrients from the hydrosoil (Bristow & Whitcombe, 1971). Lakes with surface P levels from 0 - 10 µg/L are considered nutrient-poor or oligotrophic. When P concentrations reach 15 - 25 µg/L, lakes are classified as moderately fertile or mesotrophic and when P reaches 30 - 50 µg/L they are considered fertile or eutrophic (Frink & Norvell, 1984). Lakes with P concentrations >50 µg/L are categorized as extremely fertile or hypereutrophic. Bashan Lake's P concentration has ranged between 2 – 11 µg/L at the surface and 1 – 36 µg/L at the bottom (Figure 9). Except for lower bottom P during the 2016 and 2017 drawdown years P has changed very little in all surveys. Bottom P is highly dependent on stratification and resulting anerobic conditions and is usually highest from mid to late summer. Thus, sample collection time is important when comparing years.

We tested total nitrogen (TN) for the first time in 2020 and found 155 µg/L at the surface and 719 µg/L near the bottom (Figure 10). In 2021, our TN measurements were lower both at the surface (136 µg/L) and near the bottom (529 µg/L). In 2022, TN increased to 272 µg/L at the surface and continued to decline to 374 µg/L near the bottom. The decline near the bottom may be due to a depletion in N being from decaying vegetation leftover from drawdown for dam repairs. Determining whether the increase in surface N is a trend will take future testing. Although nitrogen is likely less limiting to the growth of aquatic plants and algae compared to terrestrial plants, it may play a role in lake productivity. Frink and Norvell (1984) found TN in Connecticut lakes ranged from 193 - 1830 µg/L and averaged 554 µg/L. Based on the trophic categories reported here Bashan Lake would be classified as oligotrophic or oligo-mesotrophic with little change from 1980 (Frink and Norvell, 1984).

Figure 11. Treatment of Bashan Lake with Aquacide in 1999 caused variable watermilfoil to break away from the roots requiring hand removal. A switch to the Navigate formulation in the following years solved this problem. (John and Barbara Hoban with dog Abbey, Harold Press photo by Michelle McLoughlin)

Figure 12. Fanwort patch with associated fish population north of the island outside the state boat launch in 2022.

Aquatic Vegetation Management:

CAES IAPP has monitored and treated invasive plants in Bashan Lake for over 20 years. The work has focused on aquatic plant mapping and control of invasive

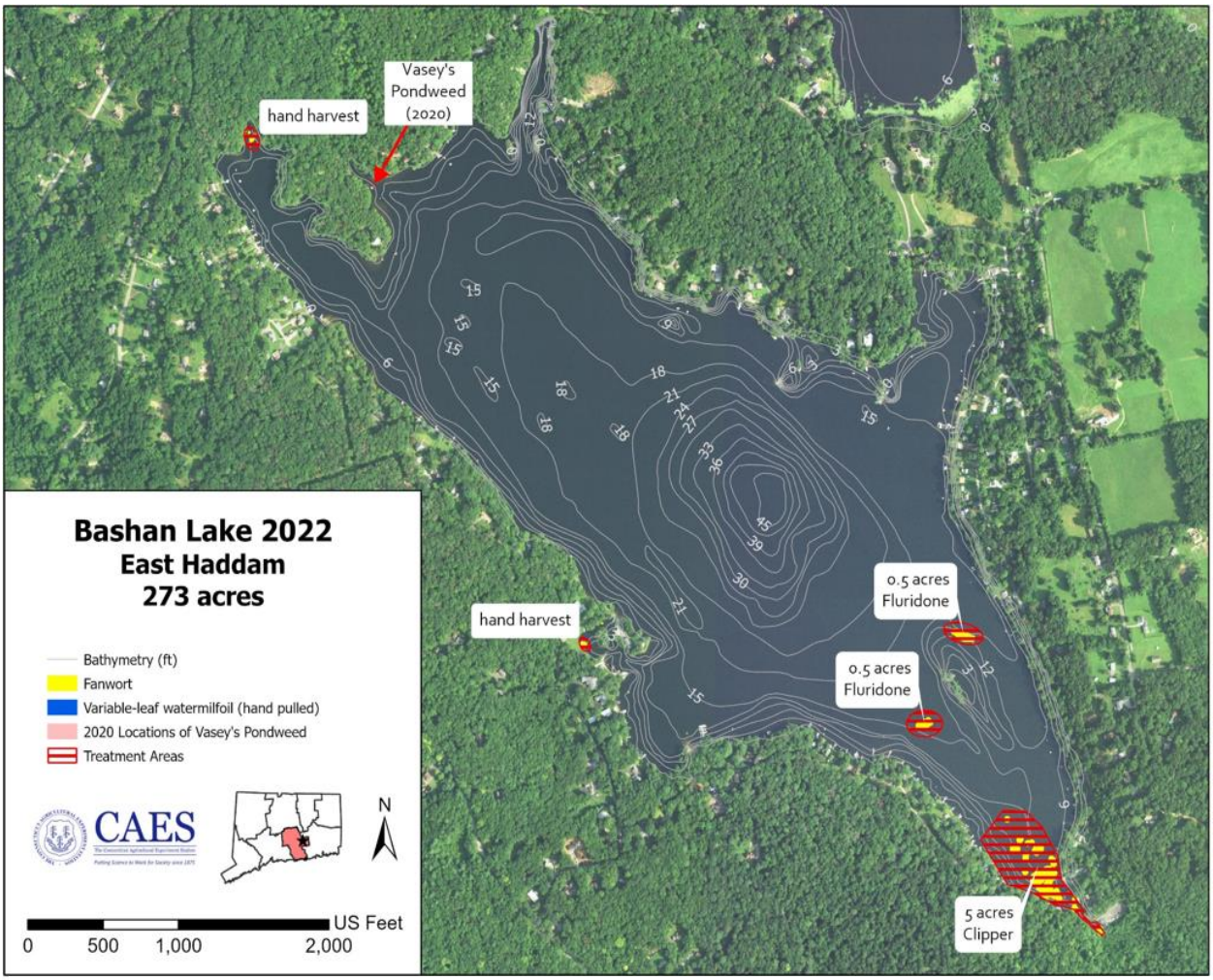

Figure 13. Locations of fanwort management sites scheduled for 2023.

variable watermilfoil and fanwort. From 1999 until 2017 spring and fall treatments of variable watermilfoil with the herbicide 2,4-D were tested (Figure 11) (Bugbee et al., 2003; CAES IAPP, 2023). In 2014, Bashan Lake's dam underwent a complete rebuild. In the process, the water was lowered approximately 18 feet. Rebuilding was completed in early 2015; however, the lake level remained more than four feet below normal through the fall of 2016. When the lake was lowered, most of the variable watermilfoil that escaped CAES IAPP treatment was thought to have been killed by exposure to freezing and desiccation; however, in 2017 considerable areas of the plant reappeared. These areas were treated in the fall of 2017 with the herbicide Navigate. Unlike previous years where the fall Navigate

treatments were very effective, the 2017 application offered little control, and resistance to Navigate was surmised. Fortunately, a new herbicide called ProcellaCOR was approved by the USEPA, and CAES IAPP organized a test in the fall of 2018. Successful control was obtained in all treatment areas except in the boat launch cove. A review of the treatment suggested improved results were likely if ProcellaCOR was applied in early summer. This was performed in June 2020 with apparent complete control of the variable watermilfoil by fall. Unfortunately, the fanwort was not affected and spread. Benthic barriers were installed over some of the fanwort. In 2021, CAES IAPP found no variable watermilfoil confirming the excellent control provided by the 2020 ProcellaCOR treatment. In 2022, a few variable watermilfoil plants were found outside the central northwest inlet and inside Laurel Cove. These plants were pulled by the CAES IAPP surveyors. Unfortunately, fanwort was not controlled and seemed to be spreading. The frequency of occurrence and abundance of fanwort outside the state boat launch increased substantially (Figure 12) and small patches of the plant were documented outside Brooks Cove, the west side of Sunset Acres, and in Laurel Cove.

Plans for 2023 are to study three methods for controlling the fanwort. Emphasis is on reducing adverse effects on the existing plant community including state listed pondweeds. First, will be to hand remove the small patches closest to the state listed Vasey's pondweed. Second, is to spot treat small mid-lake patches with multiple low dose applications of fluridone slow-release pellets (Sonar SRP) in spring/summer. Third, will be to treat the 5-acre state boat launch patch with Flumioxazin (Clipper) in late September. Figure 13 shows the locations of the fanwort and the areas where each control method will be utilized. Fanwort patches nearest the pondweed will be hand harvested thus offering maximum protection. Two small areas of one-quarter acre each, approximately one mile southeast of the Vasey's pondweed, will receive the fluridone treatment in late spring and early summer. To enhance the 30–60-day contact time needed for control, three applications of 15 pounds per acre will be spaced two weeks apart.

This is slightly under the maximum label rate of 49 pounds per acre for plants in 10 feet of water. The actual depth at these sites is about 12 feet. Lake water will be tested for fluridone using the FasTEST® method based on irrigation requirements and to track offsite movement and provide guidance for crop irrigation. The largest fanwort area of five acres is approximately 1.25 miles from the Vasey's pondweed. This area will be treated in September with Flumioxazin at the label recommended rate of 14.8 pounds per acre for a depth of seven feet. The actual depth is about ten feet. Dilution problems are hoped to be avoided by injecting the herbicide near the bottom with a weighted hose. Vasey's pondweed naturally senesces in late summer. This combined with the large distance from the treatment site should offer protection. Pre and post season surveys will be conducted to determine the efficacy of the three methods primarily with a high-definition underwater camera. Documentation with conventional grapple tosses will be avoided to avoid offsite movement of dislodged fragments. All CT DEEP aquatic pesticide notification requirements will be performed.

All aquatic herbicide treatments require approved permits from CT DEEP. When state listed species such as Vasey's pondweed are present, the first step is a review by the Natural Diversity Database (NDDB). CAES IAPP filed this in January 2023 (see appendix) and as of this writing is awaiting a response. Part of this process was a requirement of a full aquatic plant survey of Bashan Lake to be performed in 2022 and is reported here with special emphasis on locating any state listed pondweeds. This was a requirement for future treatments as stated in the 2020 CT DEEP NDDB Determination No: 202001137. The plant community on the 14 established transects, which have been monitored since 2004, were also surveyed. The results of our past surveys can be found here https://portal.ct.gov/CAES/Invasive-Aquatic-Plant-Program/B/Bashan-Lake/Bashan-Lake-Survey-Results. A resurvey using the same protocols to determine overall change in the aquatic plant community will be performed in 2024. An early summer survey for state listed pondweeds will be performed in 2023 and 2024. This request

will also be filed with the CT DEEP Property Management and Aquatic Pesticide Units.

Conclusions:

Bashan Lake has a diverse aquatic plant community with 32 species of which fanwort, swollen bladderwort, and variable watermilfoil are invasive. In 2022 there were significant increases in frequency of occurrence and species richness of native species compared to previous CAES IAPP surveys. Analysis of water chemistry over time found Bashan Lake to have excellent transparency, low alkalinity, and low total phosphorus. This classifies the lake as among the highest quality waterbodies in Connecticut. The ProcellaCOR herbicide treatments in 1999 and 2020 targeting variable-leaf watermilfoil were extremely effective. Fanwort was not controlled with the treatments and is now expanding. Tests, which date to at least the early 1980's. After decades of attempts to alleviate Bashan Lake's variable watermilfoil problem, the ProcellaCOR herbicide treatments in 1999 and 2020 accomplished the task. Unfortunately, fanwort is now becoming a problem. CAES IAPP is initiating tests in 2023 to target the fanwort with targeted herbicide treatments.

Acknowledgments:

The technical assistance of Dr. Robert Capers, Roslyn Selsky (Reeps), Samantha Wysocki, Jesse Schock, Jennifer Fanzutti, Kaysee Shuster, Eva Ramey, and Meara Burns is gratefully acknowledged.

Funding:

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Appendix

NDDB Review Filing

Connecticut Department of
Energy & Environmental Protection
Bureau of Natural Resources
Wildlife Division

CPPU USE ONLY
App #:_____
Doc #:_____
Check #: No fee required
Program: Natural Diversity Database Endangered Species
Hardcopy _____ Electronic _____

Request for Natural Diversity Data Base (NDDB) State Listed Species Review

This form was auto-populated with information provided through the DEEP ezFile portal NDDB review application.
There are no fees associated with NDDB Reviews.

Part I: Preliminary Screening & Request Type

Before submitting this request, you must review the most current Natural Diversity Data Base "State and Federal Listed Species and Significant Natural Communities Maps" found on the DEEP website. These maps are updated twice a year, usually in June and December.

This form is being submitted for a:

☒ *New* NDDB request ☐ *Renewal* of a NDDB Request ***without modifications and within two years of issued NDDB determination*** (no attachments required) [*CPPU Use Only - NDDB-Listed Species Determination #* 1736]	☐ *New* **Safe Harbor Determination**; must be associated with an application for a GP for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities (Attachment D of this form is required) ☐ *Renewal/Extension* of an existing Safe Harbor Determination ☐ With modifications ☐ Without modifications (no attachments required) [*CPPU Use Only - NDDB-Safe Harbor Determination #* 1736]
Enter NDDB Determination Number for Renewal:	Enter Safe Harbor Determination Number for Renewal/Extension:

1. Does your project utilize federal funds or require a federal permit? ☐ Yes ☒ No

If yes, your project may be subject to Federal rules regarding the Northern long-eared bats or other federally listed species. Information on the Northern long-eared bat and the 4-D rule may be found at:

http://www.fws.gov/midwest/endangered/mammals/nleb/

Information on other federally listed species and Section 7 consultations may be found at:

https://www.fws.gov/newengland/EndangeredSpec-Consultation.htm

2. Does your project utilize state funding, involve state agency actions, or relate to a CEPA request?

☒ Yes ☐ No

3. Does your project require state permits, licenses, registrations or authorizations? ☒ Yes ☐ No

If yes, list permit type(s): Aquatic Pesticide Application

If an active enforcement action exists regarding this project, enter number:

If known, enter DEEP analysts reviewing this project:

II: Requester Information

If the requester is a corporation, limited liability company, limited partnership, limited liability partnership, or a statutory trust, it must be registered with the Secretary of State. If applicable, the name shall be stated **exactly as it is registered with the Secretary of State. Please note, for those entities registered with the Secretary of State, the registered name will be the name used by DEEP. This information can be accessed at the Secretary of the State's database CONCORD.* (www.concord-sots.ct.gov/CONCORD/index.jsp)

If the requester is an individual, provide the legal name (include suffix) in the following format: First Name; Middle Initial; Last Name; Suffix (Jr, Sr., II, III, etc.).

If there are any changes or corrections to your company/facility or individual mailing or billing address or contact information, please complete and submit the Request to Change company/Individual Information to the address indicated on the form.

1. Requester*

Company Name: CONNECTICUT AGRICULTURAL EXPERIMENT STATION RESEARCH FOUNDATION, INC.

Contact Name: GREG BUGBEE

Address: 123 Huntington St

City/Town: New Haven

State: CT

Zip Code: 06511

Business Phone: 2039748512 Ext:

**E-mail:

**By providing this email address you are agreeing to receive official correspondence from the department, at this electronic address, concerning this request. Please remember to check your security settings to be sure you can receive emails from "ct.gov" addresses. Also, please notify the department if your e-mail address changes

a) Requester can best be described as:

☐ Individual ☐ Federal Agency ☐ State agency

☐ Municipality ☐ Tribal ☒ *business entity (* if a business entity complete i through iii):

i) Check type ☐ corporation ☐ limited liability company

☐ limited partnership ☐ limited liability partnership

☐ statutory trust ☐ Other:

ii) Provide Secretary of the State Business ID #: 0902924 This information can be accessed at the Secretary of the State's database (CONCORD). (www.concord-sots.ct.gov/CONCORD/index.jsp)

iii) ☐ Check here if your business is **NOT** registered with the Secretary of State's office.

b) Acting as (Affiliation), pick one:

☐ Property owner ☐ Consultant ☐ Engineer

☐ Facility owner ☒ Applicant ☐ Biologist

☐ Pesticide Applicator ☐ Other representative:

Part III: Site Information

This request can only be completed for one site. A separate request must be filed for each additional site.

SITE NAME AND LOCATION

Project Name (for use in correspondence): Bashan Lake Fanwort Control Study

If your Project site has a street address, please enter below:

Street Address:

Town(s):

If your Project has no street address, please enter a description of the site location:

Location Description: Bashan Lake

Town(s): East Haddam

Size in acres, or site dimensions: 275.86

Describe existing land conditions:

See uploaded document

Part IV: Project Information

1. **Project Type**:

   Choose Project Category: Natural Resource/Site Management

   Choose Project Type: Aquatic/Wetland Vegetation Control

   Choose Project Subtype: Aquatic/Wetland Vegetation Removal- Any Herbicide

2. Brief Project Description: 273 acre State owned lake

3. Provide a schedule for all phases of the project including the year, the month that the proposed activity will be initiated and the duration of the activity.

   See uploaded document

4. Is the subject activity limited to the maintenance, repair, or improvement of an existing structure within the existing footprint? ☐ Yes ☒ No If yes, add explanation in No. 4 below.

5. Give a detailed description of the activity which is the subject of this request and describe the methods and equipment that will be used. Include a description of steps that will be taken to minimize impacts to any known listed species.

   See uploaded document

6. If this is a renewal or extension of an existing Safe Harbor request *with* modifications, explain what about the project has changed.

Part VI: Supporting Documents

Check each attachment submitted as verification that *all* applicable attachments have been supplied with this request form. Label each attachment as indicated in this part (e.g., Attachment A, etc.) and be sure to include the requester's name, site name and the date. **Please note that Attachments A and B are required for all new requests. Attachment C is required for requests associated with: new state or federal permit applications, modifications of existing permits, permit enforcement actions, site management/planning that requires details species recommendations, and state funded projects, state agency activities, and CEPA requests.** Renewals/Extensions with no modifications do not need to submit any attachments. Attachments C and D are supplied at the end of this form.

☒ Attachment A:	**Project Detail Map:** an 8 1/2" X 11" print/copy of the relevant portion of a USGS Topographic Quadrangle Map clearly indicating the exact location of the site.
☒ Attachment B:	**GIS file (for uploaded GIS polygons):** fine scaled map showing site boundary and area of work details on aerial imagery with relevant landmarks labeled. (Site and work boundaries in GIS [ESRI ArcView shapefile, in NAD83, State Plane, feet] format can be substituted for detailed maps, see instruction document)
☒ Attachment C:	**Supplemental Information (attached, DEEP-APP-007C):** Site plans, photographs and biological reports
☐ Attachment D:	**Safe Harbor Report Requirements (attached, DEEP-APP-007D)**

Part VII: Requester Certification

The requester *and* the individual(s) responsible for actually preparing the request must sign this part. A request will be considered incomplete unless all required signatures are provided.

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief."

Bugbee Greg	1/20/2023
Signature of Preparer (a typed name will substitute for a handwritten signature)	Date
Bugbee Greg	
Name of Preparer (print or type)	Title (if applicable)
Signature of Preparer (if different than above)	Date
Name of Preparer (print or type)	Title (if applicable)

Note: Please submit the completed Request Form and all Supporting Documents to:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Or email request to: **deep.nddbrequest@ct.gov**

Attachment C: Supplemental Information and Attachments

1. **Existing & Proposed Conditions**

   If available provide site plans, drawings or imagery showing existing conditions and proposed changes. If not available, describe all natural and man-made features including wetlands, watercourses with direction of flow, fish and wildlife habitat, floodplains and any existing structures potentially affected by the subject activity. Such features should be depicted and labeled on the site plan.

   ☐ **Annotated Site Plan(s) attached**

2. **Photographs** depicting site conditions can be helpful to reviewers. Provide and label photographs, if available.

   ☐ **Site Photographs (optional) attached**

3. **Biological Surveys**

   Has a biologist visited the site and conducted a biological survey to determine the presence of any endangered, threatened or special concern species ☐ Yes ☐ No

   If yes, submit any reports of biological surveys, documentation of the biologist's qualifications, and any NDDB survey forms. Reports should include biologist(s) name, habitat and/or species targeted by survey, plant and animal species observed, dates when surveys were conducted.

   ☐ **Reports of biological surveys attached**

   ☐ **Documentation of biologist's qualifications attached**

   ☐ **NDDB Survey forms for any listed species observations attached**

Attachment D: Safe Harbor Report Requirements

Submit a report, as Attachment D, that synthesizes and analyzes the information listed below. Those providing synthesis and analysis need appropriate qualifications and experience. A request for a safe harbor determination shall include:

1. **Habitat Description and Map(s), including GIS mapping overlays, of a scale appropriate for the site, identifying:**

   - wetlands, including wetland cover types;
   - plant community types;

- topography;
- soils;
- bedrock geology;
- floodplains, if any;
- land use history; and
- water quality classifications/criteria.

2. **Photographs** - The report should include photographs of the site taken from the ground and also all reasonably available aerial or satellite photographs and an analysis of such photographs.

3. **Inspection** - A visual inspection(s) of the site should be conducted, preferably when the ground is visible, and described in the report. This inspection can be helpful in confirming or further evaluating the items noted above.

4. **Biological Surveys** - The report should include all biological surveys of the site where construction activity will take place that are reasonably available to a registrant. A registrant shall notify the Department's Wildlife Division of biological studies of the site where construction activity will take place that a registrant is aware of but are not reasonably available to the registrant.

5. **Based on items #1 through 4 above, the report shall include a Natural Resources Inventory of the site of the construction activity.** This inventory should also include a review of reasonably available scientific literature and any recommendations for minimizing adverse impacts from the proposed construction activity on listed species or their associated habitat.

6. **In addition, to the extent the following is available at the time a safe harbor determination is requested, a request for a safe harbor determination shall include and assess:**
   - Information on Site Disturbance Estimates/Site Alteration information
   - Vehicular Use
   - Construction Activity Phasing Schedules, if any; and
   - Alteration of Drainage Patterns

The efficacy of hand pulling, fluridone spot treatments, and late season flumioxazin on fanwort in Bashan Lake with emphasis on protection of state listed pondweed and the native plant community.

Greg Bugbee

Associate Scientist

Connecticut Agricultural Experiment Station

Invasive Aquatic Plant Program

Office of Aquatic Invasive Species

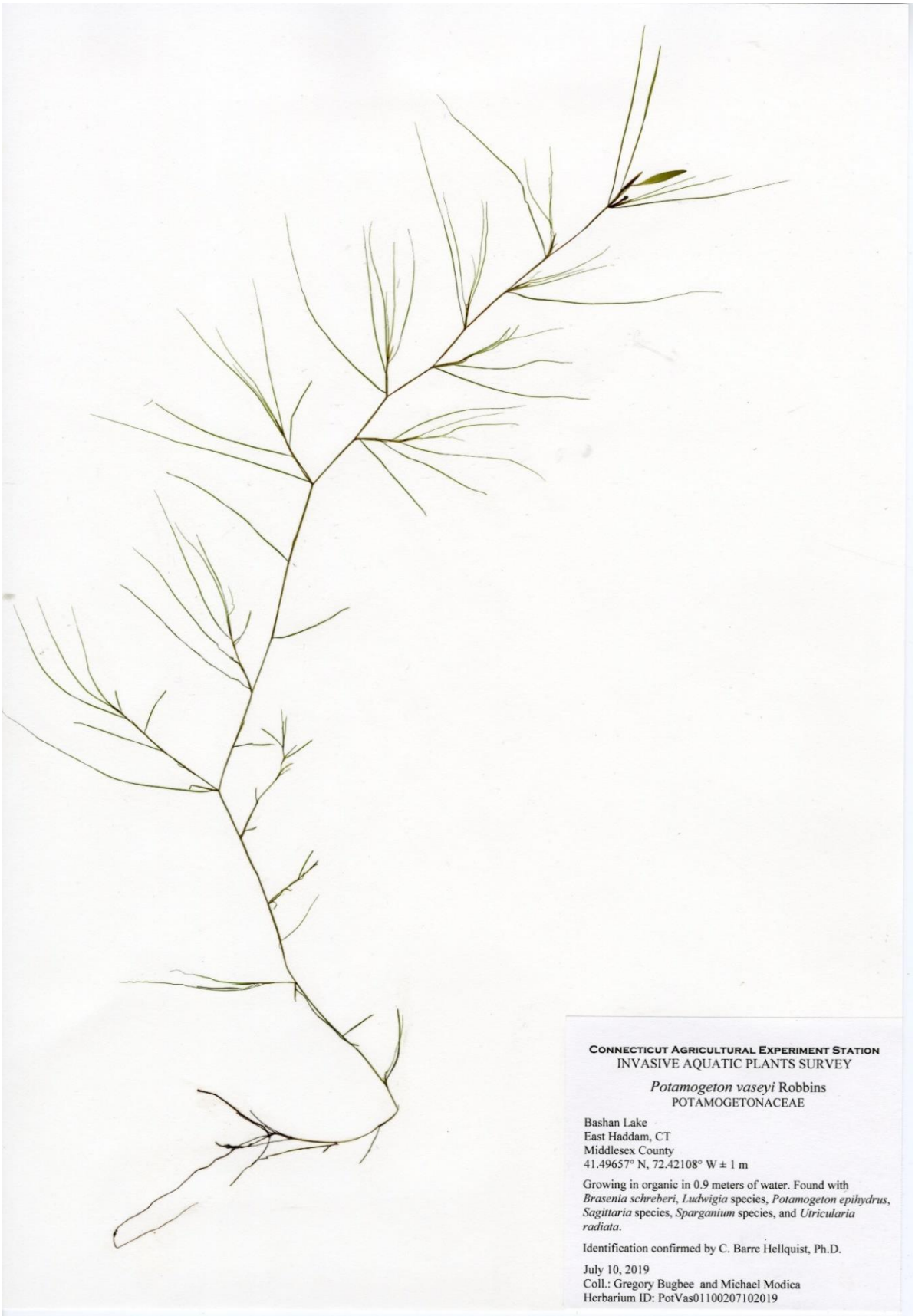
Bashan Lake is one of Connecticut's highest quality State-owned waterbodies. The lake has a long history of problems with invasive variable watermilfoil (*Myriophyllum heterophyllum*). For over 20 years, CAES has provided guidance and experimented with control methods using aquatic herbicides. Results varied until 2020 when a new product called ProcellaCOR was tested, and exceptional control was achieved. A small population of state listed Vasey's pondweed (*Potamogeton vaseyi*) or budding pondweed (*Potamogeton gemmiparus*), present in a small cove in Bashan Lake's northwest corner, was not impacted. Difficulties in distinguishing between the two species particularly if Vasey's pondweeds floating leaves are absent may account for the various reports. CAES IAPP had the Bashan Lake pondweed confirmed by Dr. C. B. Hellquist in 2019 (see attached herbarium mount). pondweed Since the variable watermilfoil has been controlled, invasive fanwort (*Cabomba caroliniana*) has expanded. The fanwort exists in a 5-acre area outside the State boat launch, two distinct smaller patches several hundred feet away, and a few minor patches in other portions of the lake (see attached map).

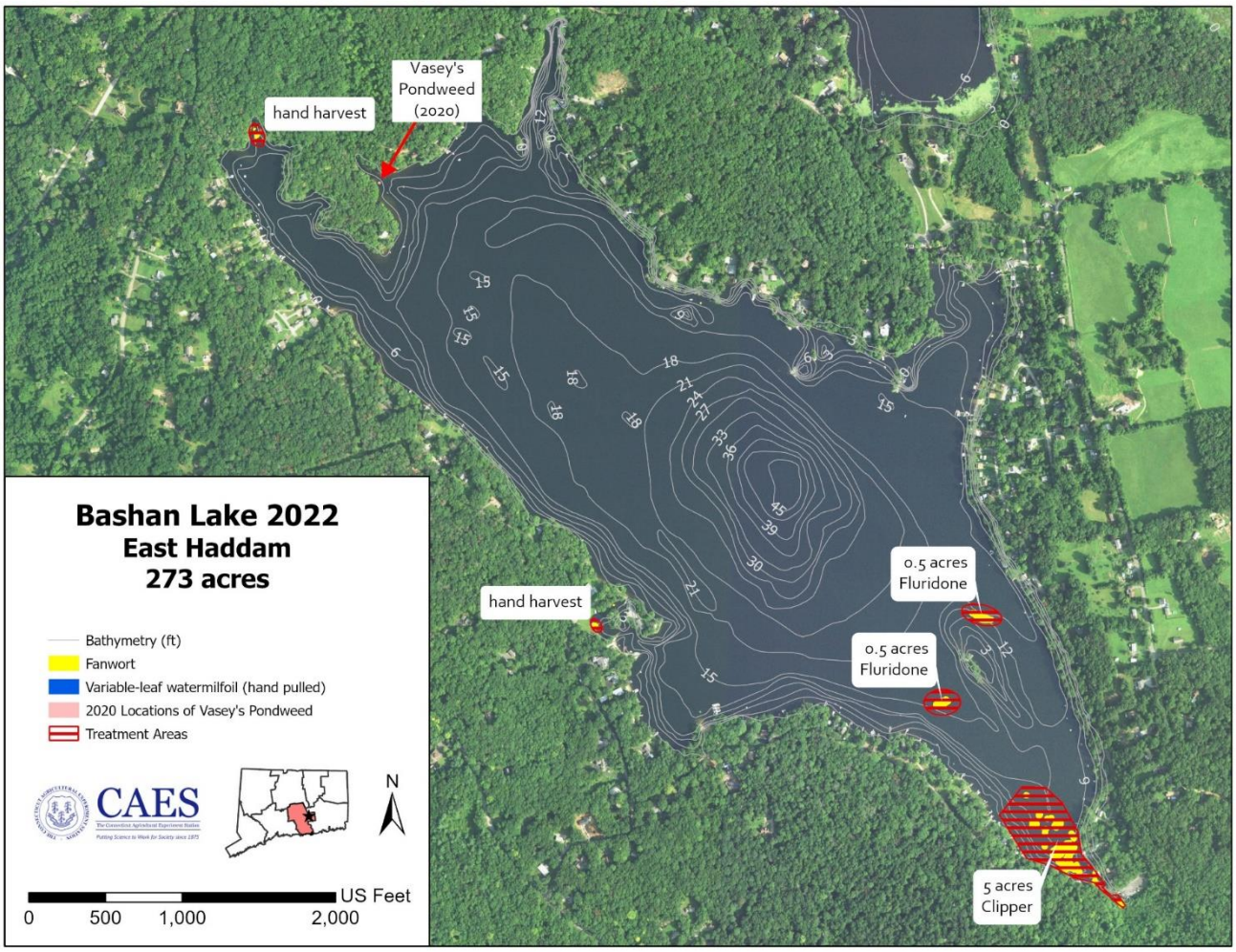
We are proposing a study utilizing three methods for controlling the fanwort. Emphasis is on reducing adverse effects on the existing plant community including state listed pondweeds. The first method will be to hand remove the small patches closest to the state listed pondweed. The second method is to spot treat small mid-lake patches with multiple low dose applications of fluridone slow-release pellets (Sonar SRP) to in spring/summer. The third method will be to treat the 5-acre state boat launch patch with Flumioxazin (Clipper) in late September. The attached map shows the locations of the fanwort and the areas where each control method will be utilized. Fanwort patches nearest the pondweed will be hand harvested thus offering maximum protection. Two small areas one-quarter acre each, approximately one mile southeast of the pondweed will receive the fluridone treatment in late spring and early summer. To minimize promote the 30–60-day contact time needed for control three applications of 15 pounds per acre each will be spaced two weeks apart. This is slightly under the maximum label rate of 49 pounds per acre for plants in 10 feet of water. The actual depth at these sites is about 12 feet. Lake water will be tested for fluridone concentrations using the FasTEST method based on irrigation requirements and need to track offsite movement. The largest fanwort area of five acres is approximately 1.25 miles from the pondweed and will be treated in September with Flumioxazin at the label recommended rate of 14.8 pounds per acre for a depth of seven feet. The actual depth is about ten feet. Dilution problems are hoped to be avoided by injecting the herbicide near the bottom with a weighted hose. Both Vasey's and budding pondweed naturally senesce in the late summer combined with the large distance from the treatment site should offer protection. Pre and post season surveys will be conducted to determine the efficacy of the three methods primarily with a high-definition underwater camera. Documentation with conventional grapple tosses will be avoided to avoid offsite movement of dislodged fragments. All CT DEEP aquatic pesticide notification requirements will be performed.

A full aquatic plant survey of Bashan Lake was performed in 2022 with special emphasis on locating any state listed pondweeds (see attached map). This was a

requirement for future treatments stated in the CT DEEP 2020 NDDB Determination No: 202001137. The plant community on 14 transects with 10 points each, that have been monitored since 2004, were transects also monitored. The results of our past surveys can be found here https://portal.ct.gov/CAES/Invasive-Aquatic-Plant-Program/B/Bashan-Lake/Bashan-Lake-Survey-Results . A resurvey using the same protocols to determine overall change in the aquatic plant community will be performed in 2024. An early summer survey for state listed pondweeds will be performed in 2023 and 2024.

This request will also be filed with the CT DEEP Property Management and Aquatic Pesticide Units.


CONNECTICUT AGRICULTURAL EXPERIMENT STATION
INVASIVE AQUATIC PLANTS SURVEY
Potamogeton vaseyi Robbins
POTAMOGETONACEAE
Bashan Lake
East Haddam, CT
Middlesex County
41.49657° N, 72.42108° W ± 1 m
Growing in organic in 0.9 meters of water. Found with *Brasenia schreberi*, *Ludwigia* species, *Potamogeton epihydrus*, *Sagittaria* species, *Sparganium* species, and *Utricularia radiata*.
Identification confirmed by C. Barre Hellquist, Ph.D.
July 10, 2019
Coll.: Gregory Bugbee and Michael Modica
Herbarium ID: PotVas01100207102019


Vasey's Pondweed (2020)
hand harvest
hand harvest
0.5 acres Fluridone
0.5 acres Fluridone
5 acres Clipper
Bashan Lake 2022
East Haddam
273 acres
Bathymetry (ft)
Fanwort
Variable-leaf watermilfoil (hand pulled)
2020 Locations of Vasey's Pondweed
Treatment Areas
CAES
N
US Feet
0
500
1,000
2,000

Narrative from State Board of Fisheries and Game Lake and Pond Survey Unit – 1959

Bashan Lake

Bashan Lake is located in Middlesex County in the township of East Haddam. It is natural in origin with the level raised by a 25-foot masonry and earthen dam. It is fed by small tributary streams, bottom springs and surface runoff. This impoundment has a surface area of 276.3 acres, a maximum depth of 48 feet and an average depth of 15.9 feet. The lake bottom is of sand, gravel, coarse rubble and boulders. Submerged and emergent vegetation is scarce in all parts of the lake. The water is very clear and transparency exceeds 15 feet. The lake is thermally stratified and the deep water is well supplied with dissolved oxygen. The upper warm-water layer extends beyond 30 feet. Cold water is confined to the depth between 35 feet and 48 feet and this constitutes a very small percentage of the total volume of the lake.

Public access to Bashan Lake is confined to one small boat livery at the northern end of the lake. The lake is owned by the Moodus Water Company and water is drawn from this impoundment to maintain the water level in Moodus Reservoir. As a result of this water use, Bashan Lake is subject to a moderate fluctuation of the water level.

The lake has been stocked with land-locked salmon, rainbow trout, smallmouth bass, largemouth bass, yellow perch, chain pickerel, bullheads, calico bass, sunfish and golden shiners.

Largemouth bass are common in abundance and exhibit average growth. Smallmouth bass and yellow perch are scarce and grow at rates equal to the state averages for these species. Chain pickerel are present, but scarce. The growth rate for pickerel is average. Bluegill sunfish and common sunfish are common in abundance. Golden shiners and bullheads are scarce.

This lake should be managed for largemouth bass, chain pickerel and yellow perch. Most species are not abundant, but fish growth in all cases is at least equal to the state averages. No special regulations are needed at this time.

It is desirable to reduce the numbers of common sunfish and bluegill sunfish. Cottage owners can aid in reducing the sunfish population by raking over the nests of these fish or by dropping sodium hydroxide pellets in the sunfish nests.

Invasive Plant Descriptions

Cabomba caroliniana

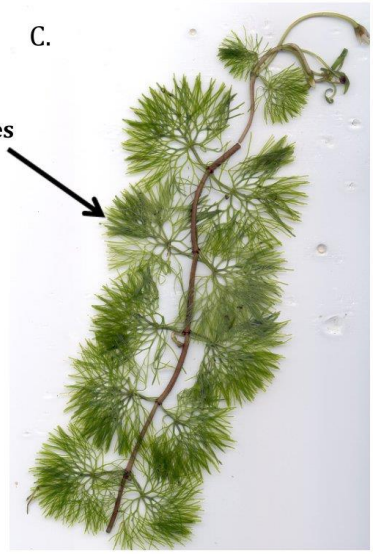
Common names:
Fanwort
Carolina fanwort

Origin:
Southeast United States
South America

Key features:
Plants are submersed
Stems: Can be 6 feet (2 m) long
Leaves: Dissected, opposite leaves 0.8-2 inches (2-5 cm) are fan-like and made up of forked leaflets attached to the stem by a petiole. Floating leaves 0.2-0.8 inches (6-20 mm) wide are oblong and produced on flower shoots
Flowers: Small, solitary flowers are usually white to pinkish
Fruits/Seeds: Flask shaped
Reproduction: Seed and fragmentation

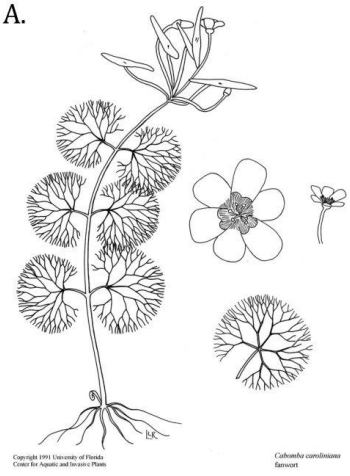
Easily confused species:
Watermilfoils: *Myriophyllum* spp.
White water crowfoot: *Ranunculus longirostris*
Water marigold: *Megalodonta beckii*

C.



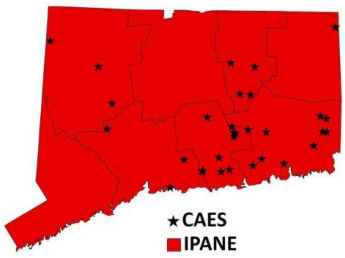
Opposite Leaves

A.



B.

A. Copyright 1991 Univ. of Florida, Center for Aquatic and Invasive Plants
B. Copyright 2002 Univ. of Florida, Photo by A. Murray
C. Photo by A. Smagula



Myriophyllum heterophyllum

Common names:
Variable-leaf watermilfoil
Variable watermilfoil
Two-leaf watermilfoil

Origin:
Southern United States

Key features:
Plants are submersed

Stems: Dark brown stems extend to the water's surface and spread to form large mats

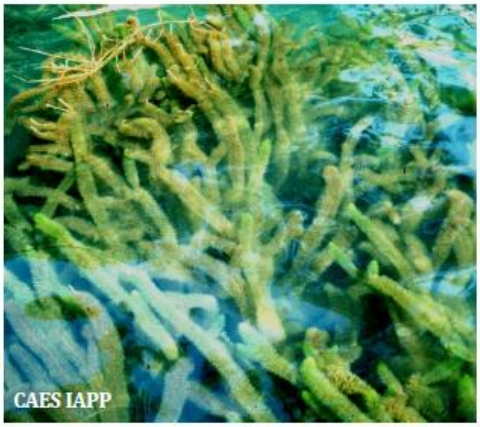
Leaves: Triangular with ≤ 11 pairs of leaflets. Leaves are dissected and whorled (4-6 leaves/whorl) resulting in a feathery appearance with leaf whorls < 1 inch apart giving it a ropy appearance

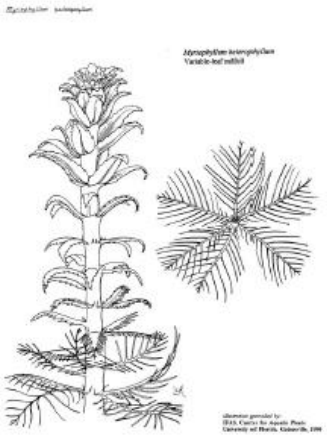
Flowers: Inflorescence spike 2-14 inches (5-35 cm) long extend beyond the water's surface with flowers in whorls of four with reddish petals

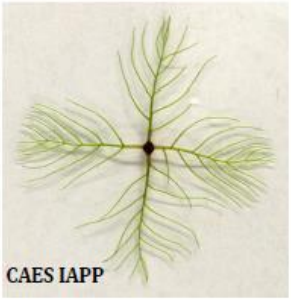
Fruits/Seeds: Fruits are almost round, with a rough surface

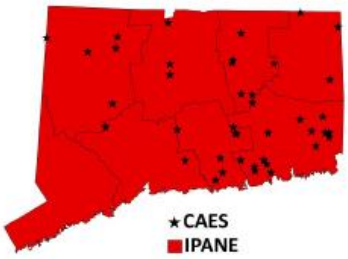
Reproduction: Fragmentation and seeds

Easily confused species:
Eurasian watermilfoil: *Myriophyllum spicatum*
Low watermilfoil: *Myriophyllum humile*









Connecticut's Invasive Aquatic Plant, Clam, and Mussel Identification Guide - Page 21

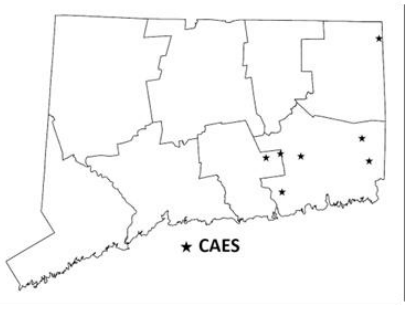
Utricularia inflata

Common names:
Swollen bladderwort

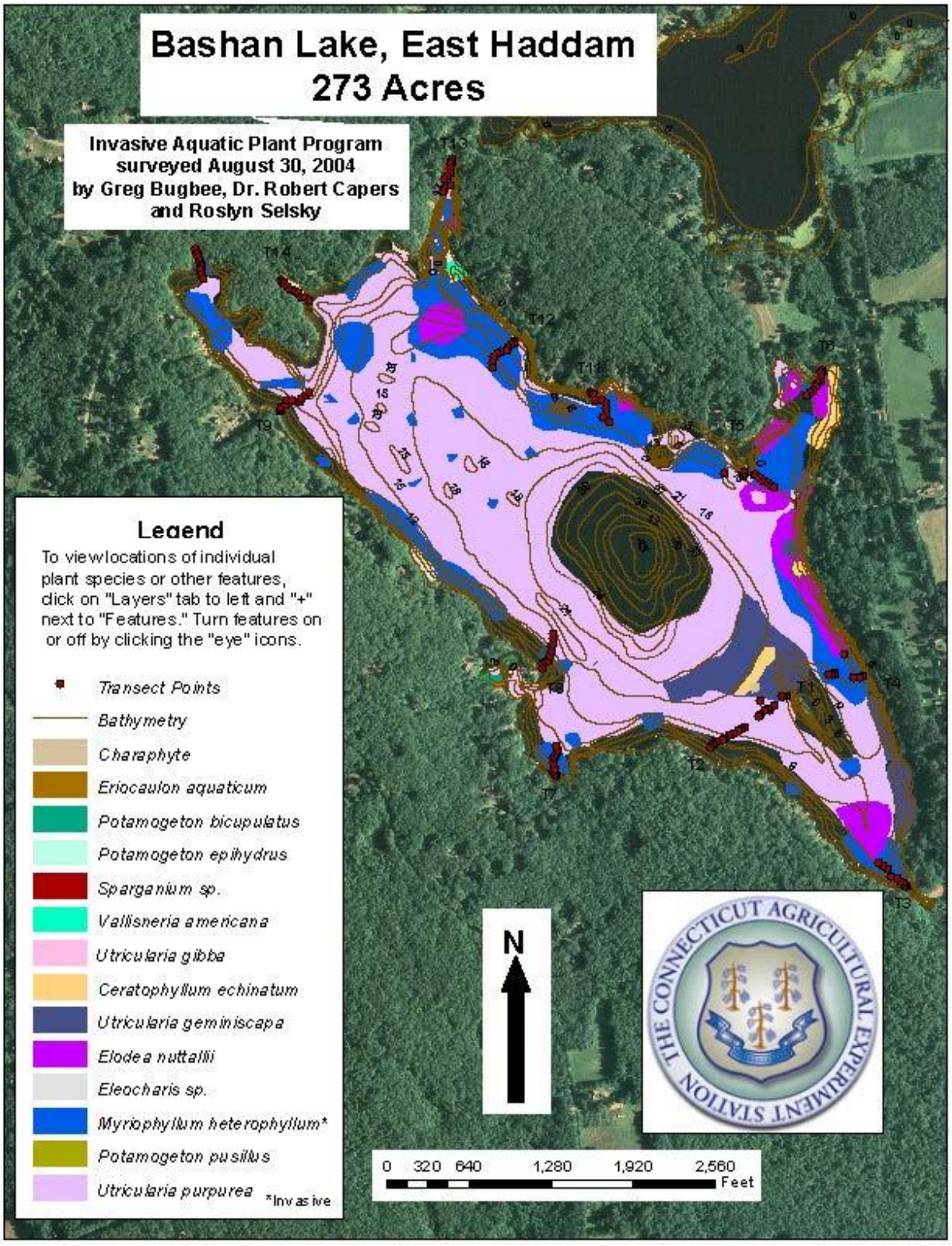
Origin:
Southern and Eastern North America

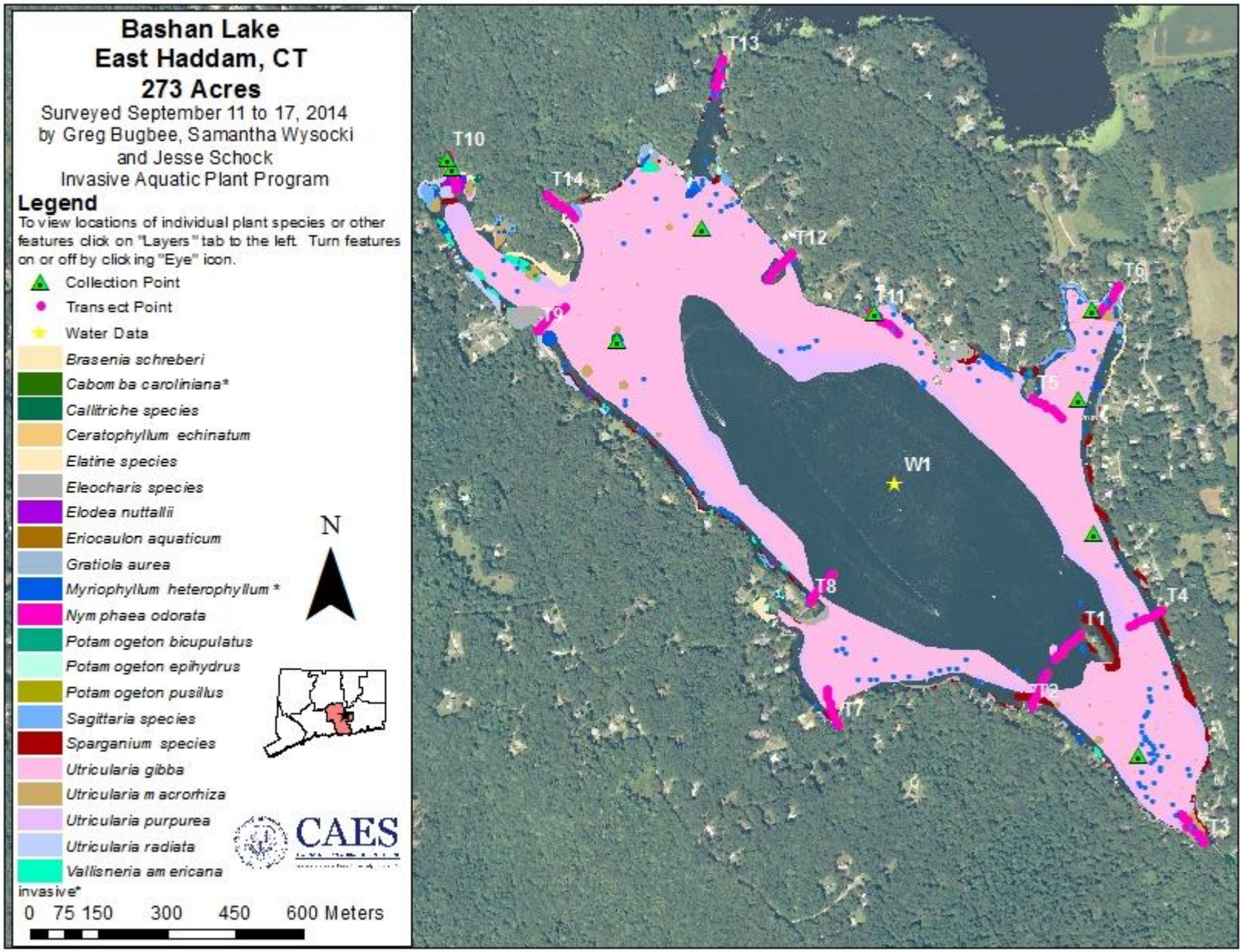
Key features:
Plants floating in water, sometimes appearing anchored
Stems: Stem is submersed, slender and elongated
Leaves: Submersed leaves (<18 cm) are alternate, bushy, repeatedly forked with bladders along the sides. Uppermost leaves are whorled and inflated, floating on the water's surface (3-8 cm).
Flowers: Flowers located at the center of inflated leaves and have five bright yellow petals
Fruits/Seeds: Fruit is dry and splits open when dry (3-6 mm)
Reproduction: Fragmentation and Tubers

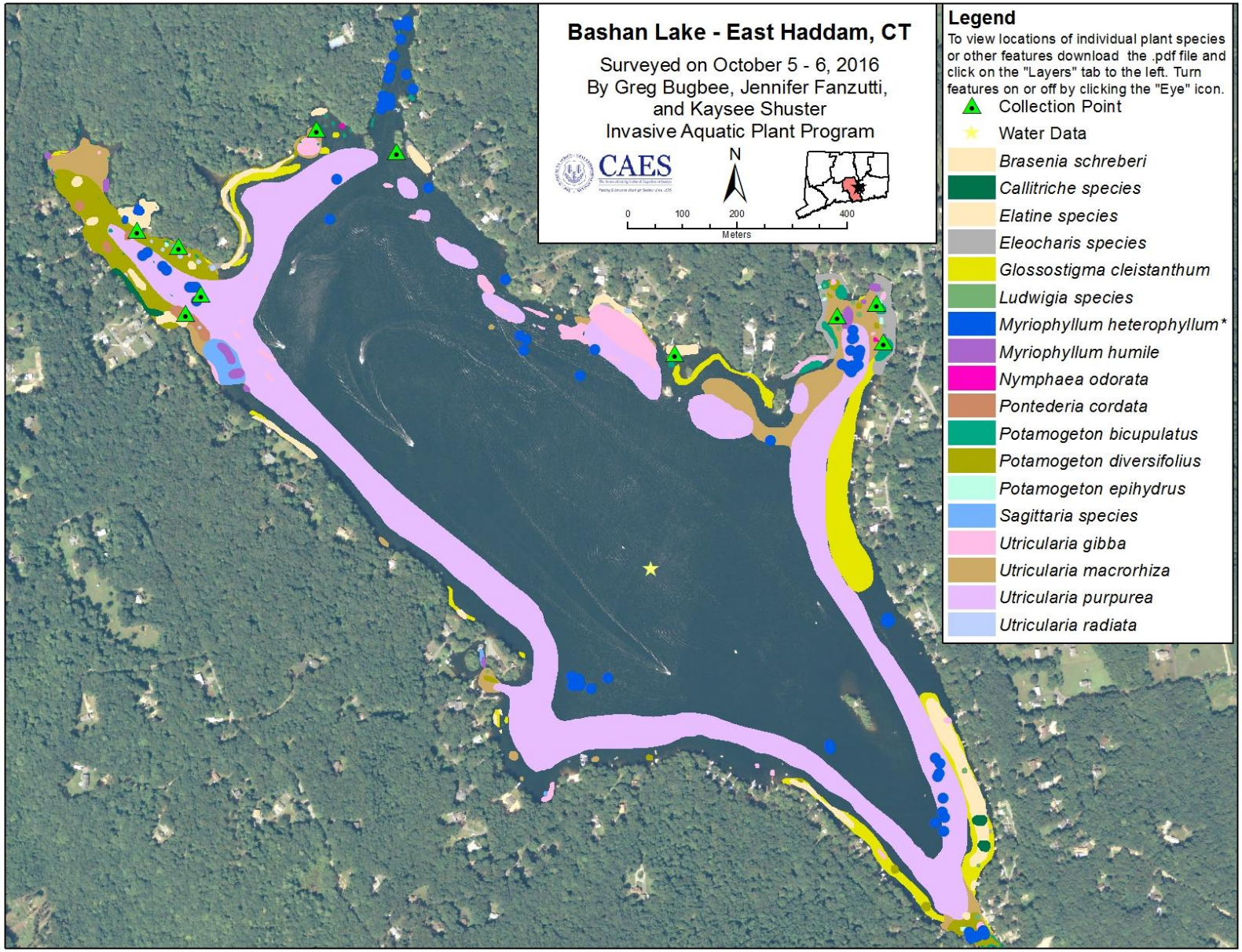
Easily confused species:
Common bladderwort: *Utricularia macrorhiza*
Floating bladderwort: *Utricularia radiata*

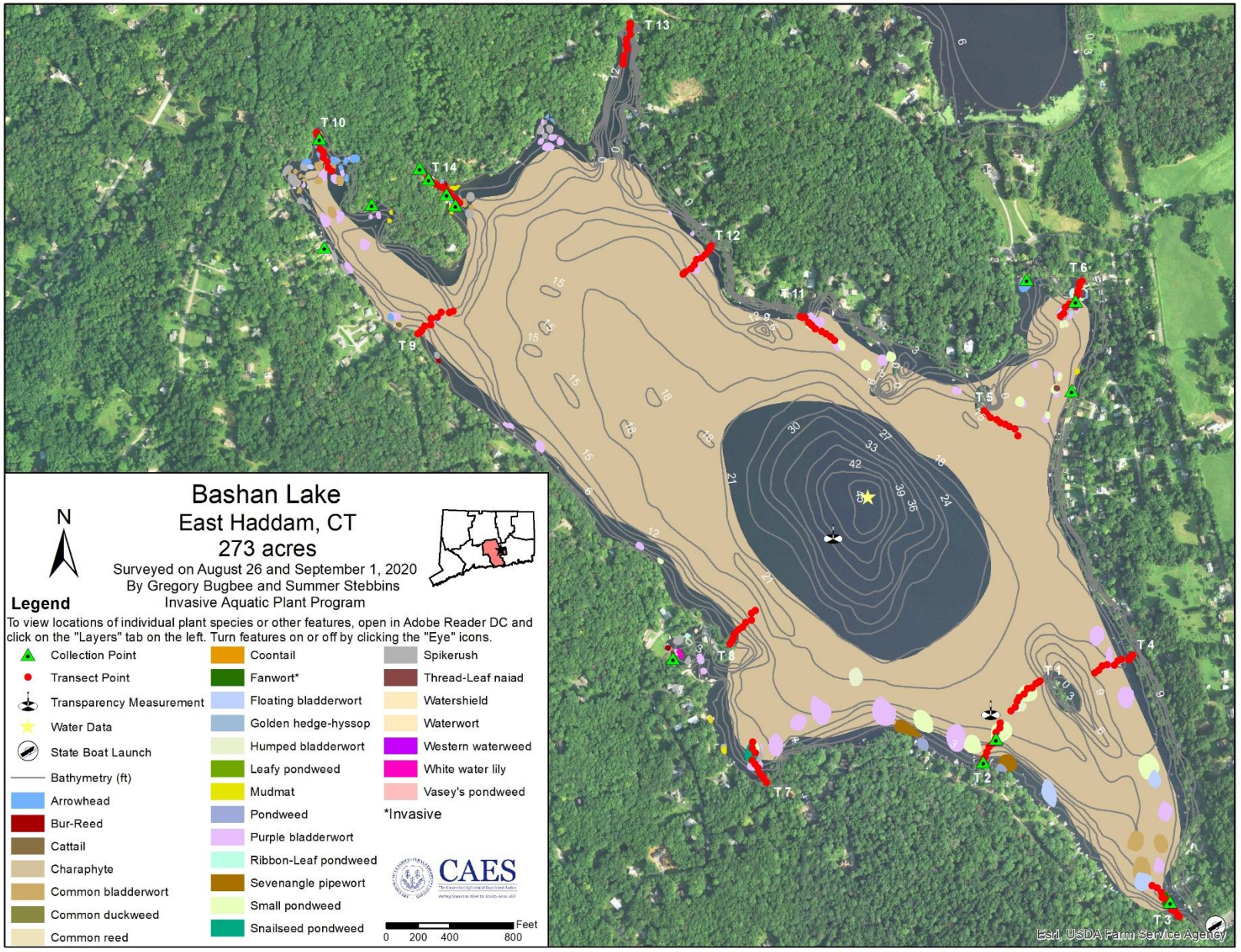


Previous Years Aquatic Plant Survey Maps


Bashan Lake, East Haddam
273 Acres
Invasive Aquatic Plant Program
surveyed August 30, 2004
by Greg Bugbee, Dr. Robert Capers
and Roslyn Selsky
Legend
To view locations of individual plant species or other features, click on "Layers" tab to left and "+" next to "Features." Turn features on or off by clicking the "eye" icons.
Transect Points
Bathymetry
Charaphyte
Eriocaulon aquaticum
Potamogeton bicupulatus
Potamogeton epihydrus
Sparganium sp.
Vallisneria americana
Utricularia gibba
Ceratophyllum echinatum
Utricularia geminiscapa
Elodea nuttallii
Eleocharis sp.
Myriophyllum heterophyllum*
Potamogeton pusillus
Utricularia purpurea
*Invasive
N
THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION
0 320 640 1,280 1,920 2,560
Feet


Bashan Lake
East Haddam, CT
273 Acres
Surveyed September 11 to 17, 2014
by Greg Bugbee, Samantha Wysocki
and Jesse Schock
Invasive Aquatic Plant Program
Legend
To view locations of individual plant species or other features click on "Layers" tab to the left. Turn features on or off by clicking "Eye" icon.
Collection Point
Transect Point
Water Data
Brasenia schreberi
Cabomba caroliniana*
Callitriche species
Ceratophyllum echinatum
Elatine species
Eleocharis species
Elodea nuttallii
Eriocaulon aquaticum
Gratiola aurea
Myriophyllum heterophyllum *
Nymphaea odorata
Potamogeton bicupulatus
Potamogeton epihydrus
Potamogeton pusillus
Sagittaria species
Sparganium species
Utricularia gibba
Utricularia macrorhiza
Utricularia purpurea
Utricularia radiata
Vallisneria americana
invasive*
N
CAES
0 75 150 300 450 600 Meters
T13
T10
T14
T12
T6
T11
T9
T5
W1
T8
T4
T1
T2
T7
T3


Bashan Lake - East Haddam, CT
Surveyed on October 5 - 6, 2016
By Greg Bugbee, Jennifer Fanzutti,
and Kaysee Shuster
Invasive Aquatic Plant Program
CAES
N
0
100
200
400
Meters
Legend
To view locations of individual plant species or other features download the .pdf file and click on the "Layers" tab to the left. Turn features on or off by clicking the "Eye" icon.
Collection Point
Water Data
Brasenia schreberi
Callitriche species
Elatine species
Eleocharis species
Glossostigma cleistanthum
Ludwigia species
Myriophyllum heterophyllum*
Myriophyllum humile
Nymphaea odorata
Pontederia cordata
Potamogeton bicupulatus
Potamogeton diversifolius
Potamogeton epihydrus
Sagittaria species
Utricularia gibba
Utricularia macrorhiza
Utricularia purpurea
Utricularia radiata


Bashan Lake
East Haddam, CT
273 acres
Surveyed on August 26 and September 1, 2020
By Gregory Bugbee and Summer Stebbins
Invasive Aquatic Plant Program
N
Legend
To view locations of individual plant species or other features, open in Adobe Reader DC and click on the "Layers" tab on the left. Turn features on or off by clicking the "Eye" icons.
Collection Point
Transect Point
Transparency Measurement
Water Data
State Boat Launch
Bathymetry (ft)
Arrowhead
Bur-Reed
Cattail
Charaphyte
Common bladderwort
Common duckweed
Common reed
Coontail
Fanwort*
Floating bladderwort
Golden hedge-hyssop
Humped bladderwort
Leafy pondweed
Mudmat
Pondweed
Purple bladderwort
Ribbon-Leaf pondweed
Sevenangle pipewort
Small pondweed
Snailseed pondweed
Spikerush
Thread-Leaf naiad
Watershield
Waterwort
Western waterweed
White water lily
Vasey's pondweed
*Invasive
CAES
Feet
0 200 400 800
T 1
T 2
T 3
T 4
T 5
T 6
T 7
T 8
T 9
T 10
T 11
T 12
T 13
T 14
Esri, USDA Farm Service Agency

Transect Data

Appendix Bashan Lake Transect Data (1 of 3)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	Notes	Brasch	CabCar	CalSpp	CerDem	ElaSpp	EleSpp	EloNut	GloCle	LemMin	MyrHum	NajFle	NymOdo	PotBic	PotEpi	PotFol	PotPus	SagSpp	SpaSpp	UtrGib	UtrMac	UtrMin	UtrPur	UtrRad
1	1	0.5	Greg Bugbee	41.48787	-72.40710	8/9/2022	1.0	Bedrock		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
1	2	5	Greg Bugbee	41.48787	-72.40715	8/9/2022	2.0	Bedrock	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	3	10	Greg Bugbee	41.48782	-72.40721	8/9/2022	2.0	Bedrock	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0
1	4	20	Greg Bugbee	41.48776	-72.40728	8/9/2022	4.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0
1	5	30	Greg Bugbee	41.48770	-72.40738	8/9/2022	5.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	2	0
1	6	40	Greg Bugbee	41.48765	-72.40749	8/9/2022	5.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	2	0	0	2	0
1	7	50	Greg Bugbee	41.48760	-72.40756	8/9/2022	5.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	2	0
1	8	60	Greg Bugbee	41.48754	-72.40762	8/9/2022	5.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
1	9	70	Greg Bugbee	41.48751	-72.40773	8/9/2022	5.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	2	0
1	10	80	Greg Bugbee	41.48737	-72.40784	8/9/2022	5.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	2	0
2	1	0.5	Greg Bugbee	41.48649	-72.40840	8/9/2022	0.2	Gravel	Charaphyte	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	5	Greg Bugbee	41.48652	-72.40840	8/9/2022	1.0	Gravel	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
2	3	10	Greg Bugbee	41.48658	-72.40838	8/9/2022	1.0	Gravel		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
2	4	20	Greg Bugbee	41.48665	-72.40833	8/9/2022	1.2	Gravel		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
2	5	30	Greg Bugbee	41.48674	-72.40828	8/9/2022	2.3	Gravel		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
2	6	40	Greg Bugbee	41.48680	-72.40823	8/9/2022	2.4	Gravel	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0
2	7	50	Greg Bugbee	41.48689	-72.40817	8/9/2022	4.0	Gravel	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
2	8	60	Greg Bugbee	41.48698	-72.40814	8/9/2022	4.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
2	9	70	Greg Bugbee	41.48708	-72.40807	8/9/2022	4.6	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0
2	10	80	Greg Bugbee	41.48716	-72.40801	8/9/2022	4.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0
3	1	0.5	Greg Bugbee	41.48377	-72.40391	8/9/2022	0.5	Bedrock		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
3	2	5	Greg Bugbee	41.48381	-72.40395	8/9/2022	1.5	Bedrock	Fontinalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
3	3	10	Greg Bugbee	41.48386	-72.40398	8/9/2022	1.5	Muck		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	2
3	4	20	Greg Bugbee	41.48391	-72.40402	8/9/2022	2.2	Muck		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	2
3	5	30	Greg Bugbee	41.48396	-72.40411	8/9/2022	2.4	Muck		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	2
3	6	40	Greg Bugbee	41.48406	-72.40417	8/9/2022	2.4	Muck		0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
3	7	50	Greg Bugbee	41.48412	-72.40424	8/9/2022	2.9	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3
3	8	60	Greg Bugbee	41.48419	-72.40434	8/9/2022	3.2	Muck	Charaphyte	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
3	9	70	Greg Bugbee	41.48426	-72.40441	8/9/2022	3.2	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3
3	10	80	Greg Bugbee	41.48430	-72.40454	8/9/2022	3.3	Muck	Charaphyte	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0.5	Greg Bugbee	41.48832	-72.40499	8/10/2022	0.8	Bedrock	Fontinalis	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
4	2	5	Greg Bugbee	41.48831	-72.40505	8/10/2022	1.7	Gravel	Charaphyte	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	3	10	Greg Bugbee	41.48830	-72.40509	8/10/2022	2.0	Gravel	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4	20	Greg Bugbee	41.48825	-72.40518	8/10/2022	3.5	Gravel	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
4	5	30	Greg Bugbee	41.48822	-72.40529	8/10/2022	4.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
4	6	40	Greg Bugbee	41.48817	-72.40540	8/10/2022	4.2	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	2	0
4	7	50	Greg Bugbee	41.48816	-72.40549	8/10/2022	4.3	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0
4	8	60	Greg Bugbee	41.48807	-72.40560	8/10/2022	4.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0
4	9	70	Greg Bugbee	41.48805	-72.40570	8/10/2022	4.3	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
4	10	80	Greg Bugbee	41.48802	-72.40583	8/10/2022	4.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	2	0
5	1	0.5	Greg Bugbee	41.49255	-72.40839	8/10/2022	1.0	Bedrock	Nothing	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
5	2	5	Greg Bugbee	41.49253	-72.40835	8/10/2022	3.6	Bedrock	Nothing	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
5	3	10	Greg Bugbee	41.49252	-72.40830	8/10/2022	4.3	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	3	0	0	2	0
5	4	20	Greg Bugbee	41.49249	-72.40816	8/10/2022	4.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	2	0
5	5	30	Greg Bugbee	41.49245	-72.40805	8/10/2022	4.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	1	0
5	6	40	Greg Bugbee	41.49238	-72.40795	8/10/2022	4.7	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	2	0
5	7	50	Greg Bugbee	41.49231	-72.40788	8/10/2022	4.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
5	8	60	Greg Bugbee	41.49225	-72.40775	8/10/2022	4.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
5	9	70	Greg Bugbee	41.49220	-72.40767	8/10/2022	4.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
5	10	80	Greg Bugbee	41.49211	-72.40759	8/10/2022	4.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0

Appendix Bashan Lake Transect Data (2 of 3)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	Notes	Brasch	CabCar	CalSpp	CerDem	ElaSpp	EleSpp	EloNut	GloCle	LemMin	MyrHum	NajFle	NymOdo	PotBic	PotEpi	PotFol	PotPus	SagSpp	SpaSpp	UtrGib	UtrMac	UtrMin	UtrPur	UtrRad
6	1	0.5	Greg Bugbee	41.49480	-72.40614	8/10/2022	0.3	Sand	Fontinalis	0	0	0	0	3	1	0	2	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
6	2	5	Greg Bugbee	41.49474	-72.40616	8/10/2022	1.0	Sand		0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	3	10	Greg Bugbee	41.49470	-72.40614	8/10/2022	1.2	Sand		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
6	4	20	Greg Bugbee	41.49462	-72.40621	8/10/2022	1.8	Sand	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
6	5	30	Greg Bugbee	41.49455	-72.40627	8/10/2022	2.0	Muck	Charaphyte	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
6	6	40	Greg Bugbee	41.49445	-72.40632	8/10/2022	2.1	Muck	Charaphyte	0	0	0	0	0	0	2	0	0	0	2	0	0	2	0	0	0	0	2	0	0	1	0
6	7	50	Greg Bugbee	41.49438	-72.40639	8/10/2022	2.1	Muck	Charaphyte	0	0	0	0	0	2	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
6	8	60	Greg Bugbee	41.49433	-72.40646	8/10/2022	2.1	Bedrock	Charaphyte	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
6	9	70	Greg Bugbee	41.49428	-72.40655	8/10/2022	2.5	Muck	Charaphyte	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	2	0	0	2	0
6	10	80	Greg Bugbee	41.49417	-72.40664	8/10/2022	2.7	Muck	Charaphyte	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0
7	1	0.5	Greg Bugbee	41.48615	-72.41347	8/9/2022	0.8	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2	5	Greg Bugbee	41.48616	-72.41348	8/9/2022	1.0	Sand		0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
7	3	10	Greg Bugbee	41.48622	-72.41353	8/9/2022	1.0	Sand	Fontinalis	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
7	4	20	Greg Bugbee	41.48630	-72.41364	8/9/2022	1.6	Muck	Charaphyte	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
7	5	30	Greg Bugbee	41.48637	-72.41365	8/9/2022	2.3	Muck	Charaphyte	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7	6	40	Greg Bugbee	41.48648	-72.41369	8/9/2022	3.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
7	7	50	Greg Bugbee	41.48658	-72.41371	8/9/2022	3.1	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	2	0	0	0	2
7	8	60	Greg Bugbee	41.48667	-72.41374	8/9/2022	3.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	2
7	9	70	Greg Bugbee	41.48675	-72.41375	8/9/2022	3.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	2	0	0	0	2
7	10	80	Greg Bugbee	41.48685	-72.41374	8/9/2022	3.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	2	0	0	0	2
8	1	0.5	Greg Bugbee	41.48855	-72.41418	8/9/2022	0.2	Sand	Fontinalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	2	5	Greg Bugbee	41.48861	-72.41418	8/9/2022	0.2	Sand	Fontinalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
8	3	10	Greg Bugbee	41.48866	-72.41414	8/9/2022	0.2	Bedrock	Fontinalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	4	20	Greg Bugbee	41.48872	-72.41408	8/9/2022	3.9	Bedrock	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
8	5	30	Greg Bugbee	41.48878	-72.41400	8/9/2022	4.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	2
8	6	40	Greg Bugbee	41.48885	-72.41395	8/9/2022	5.3	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	2
8	7	50	Greg Bugbee	41.48892	-72.41387	8/9/2022	5.7	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	8	60	Greg Bugbee	41.48895	-72.41378	8/9/2022	6.0	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	9	70	Greg Bugbee	41.48905	-72.41371	8/9/2022	6.5	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	10	80	Greg Bugbee	41.48913	-72.41361	8/9/2022	6.9	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	0.5	Greg Bugbee	41.49395	-72.42141	8/9/2022	0.1	Gravel	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	10	Greg Bugbee	41.49396	-72.42133	8/9/2022	1.0	Gravel		0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	3	10	Greg Bugbee	41.49400	-72.42129	8/9/2022	1.7	Gravel		0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9	4	20	Greg Bugbee	41.49405	-72.42119	8/9/2022	2.3	Sand		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2
9	5	30	Greg Bugbee	41.49414	-72.42116	8/9/2022	3.0	Muck		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0
9	6	40	Greg Bugbee	41.49420	-72.42102	8/9/2022	3.3	Muck		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	2
9	7	50	Greg Bugbee	41.49425	-72.42096	8/9/2022	3.4	Muck		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0
9	8	60	Greg Bugbee	41.49435	-72.42084	8/9/2022	3.5	Muck	Charapyhte	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0
9	9	70	Greg Bugbee	41.49438	-72.42070	8/9/2022	3.5	Muck	Charapyhte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0
9	10	80	Greg Bugbee	41.49442	-72.42062	8/9/2022	3.0	Muck	Charapyhte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	0.5	Greg Bugbee	41.49743	-72.42376	8/10/2022	1.0	Muck	Fontinalis	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
10	2	5	Greg Bugbee	41.49741	-72.42374	8/10/2022	1.0	Muck	Fontinalis	0	0	1	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	2
10	3	10	Greg Bugbee	41.49736	-72.42370	8/10/2022	1.0	Muck	Fontinalis	0	0	1	0	0	3	0	0	0	3	2	0	2	0	0	0	3	1	0	0	0	2	2
10	4	20	Greg Bugbee	41.49728	-72.42370	8/10/2022	1.2	Muck	Fontinalis	0	0	0	0	0	2	0	0	0	2	2	0	2	0	0	0	2	0	0	0	0	2	2
10	5	30	Greg Bugbee	41.49717	-72.42369	8/10/2022	1.2	Muck		0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	4	0
10	6	40	Greg Bugbee	41.49709	-72.42369	8/10/2022	1.5	Muck		0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0
10	7	50	Greg Bugbee	41.49701	-72.42362	8/10/2022	1.8	Muck		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	4	0
10	8	60	Greg Bugbee	41.49690	-72.42358	8/10/2022	1.8	Muck		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	3	2
10	9	70	Greg Bugbee	41.49680	-72.42353	8/10/2022	1.9	Muck		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	3	2
10	10	80	Greg Bugbee	41.49672	-72.42347	8/10/2022	1.7	Muck		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0

Appendix Bashan Lake Transect Data (3 of 3)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	Notes	Brasch	CabCar	CalSpp	CerDem	ElaSpp	EleSpp	EloNut	GloCle	LemMin	MyrHum	NajFle	NymOdo	PotBic	PotEpi	PotFol	PotPus	SagSpp	SpaSpp	UtrGib	UtrMac	UtrMin	UtrPur	UtrRad
11	1	0.5	Greg Bugbee	41.49426	-72.41263	8/10/2022	0.2	Gravel	Fontinalis	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	2	1	0	0	0	0	0
11	2	5	Greg Bugbee	41.49423	-72.41258	8/10/2022	1.8	Gravel		0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	3	10	Greg Bugbee	41.49422	-72.41253	8/10/2022	2.6	Gravel	Fontinalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	4	20	Greg Bugbee	41.49415	-72.41242	8/10/2022	3.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
11	5	30	Greg Bugbee	41.49410	-72.41235	8/10/2022	3.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	2	0
11	6	40	Greg Bugbee	41.49407	-72.41224	8/10/2022	3.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	2	2
11	7	50	Greg Bugbee	41.49400	-72.41213	8/10/2022	4.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
11	8	60	Greg Bugbee	41.49393	-72.41208	8/10/2022	4.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0
11	9	70	Greg Bugbee	41.49390	-72.41197	8/10/2022	4.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0
11	10	80	Greg Bugbee	41.49384	-72.41190	8/10/2022	4.4	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	1	0
12	1	0.5	Greg Bugbee	41.49544	-72.41466	8/10/2022	1.0	Bedrock	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2	5	Greg Bugbee	41.49542	-72.41469	8/10/2022	2.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	3	10	Greg Bugbee	41.49538	-72.41473	8/10/2022	2.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
12	4	20	Greg Bugbee	41.49535	-72.41484	8/10/2022	3.8	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	2
12	5	30	Greg Bugbee	41.49528	-72.41489	8/10/2022	4.4	Muck	Charaphyte	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	2	0	0	2	0	0	2	0
12	6	40	Greg Bugbee	41.49521	-72.41502	8/10/2022	4.6	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0
12	7	50	Greg Bugbee	41.49515	-72.41511	8/10/2022	4.7	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	2	0
12	8	60	Greg Bugbee	41.49508	-72.41518	8/10/2022	5.0	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0
12	9	70	Greg Bugbee	41.49502	-72.41523	8/10/2022	5.1	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	10	80	Greg Bugbee	41.49493	-72.41532	8/10/2022	5.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	0.5	Greg Bugbee	41.49927	-72.41650	8/10/2022	0.1	Muck	Charaphyte	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	0
13	2	10	Greg Bugbee	41.49922	-72.41650	8/10/2022	1.0	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	3	10	Greg Bugbee	41.49917	-72.41653	8/10/2022	2.3	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	4	20	Greg Bugbee	41.49912	-72.41654	8/10/2022	2.3	Muck	Nothing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	5	30	Greg Bugbee	41.49904	-72.41657	8/10/2022	4.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
13	6	40	Greg Bugbee	41.49894	-72.41661	8/10/2022	5.1	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	7	50	Greg Bugbee	41.49887	-72.41664	8/10/2022	5.1	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	8	60	Greg Bugbee	41.49878	-72.41669	8/10/2022	5.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	9	70	Greg Bugbee	41.49868	-72.41668	8/10/2022	5.7	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	10	80	Greg Bugbee	41.49859	-72.41672	8/10/2022	4.5	Muck	Charaphyte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
14	1	0.5	Greg Bugbee	41.49661	-72.42121	8/10/2022	0.5	Muck	Fontinalis	1	0	0	0	0	2	0	0	2	0	0	2	0	2	0	0	2	2	0	1	0	0	0
14	2	5	Greg Bugbee	41.49659	-72.42116	8/10/2022	0.7	Muck	Fontinalis	0	0	0	0	0	3	0	0	2	0	0	0	0	2	0	0	2	2	1	1	0	0	0
14	3	10	Greg Bugbee	41.49656	-72.42107	8/10/2022	0.7	Muck	Fontinalis	0	0	0	0	0	3	0	0	2	0	0	0	0	2	0	0	0	2	1	1	0	0	0
14	4	20	Greg Bugbee	41.49650	-72.42095	8/10/2022	0.7	Muck	Fontinalis	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	5	30	Greg Bugbee	41.49648	-72.42084	8/10/2022	0.7	Muck		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
14	6	40	Greg Bugbee	41.49641	-72.42075	8/10/2022	0.7	Sand		0	0	0	0	0	2	0	3	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
14	7	50	Greg Bugbee	41.49638	-72.42065	8/10/2022	1.0	Sand		0	0	0	0	0	2	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
14	8	60	Greg Bugbee	41.49632	-72.42053	8/10/2022	1.2	Sand		0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0
14	9	70	Greg Bugbee	41.49625	-72.42044	8/10/2022	1.5	Sand		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
14	10	80	Greg Bugbee	41.49617	-72.42038	8/10/2022	2.0	Sand	Charaphyte	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0