The Connecticut Agricultural Experiment Station

123 Huntington Street
New Haven, CT 06511

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Amos Lake

Preston, CT

Aquatic Vegetation Survey

Water Chemistry

Aquatic Plant Management Options

2022

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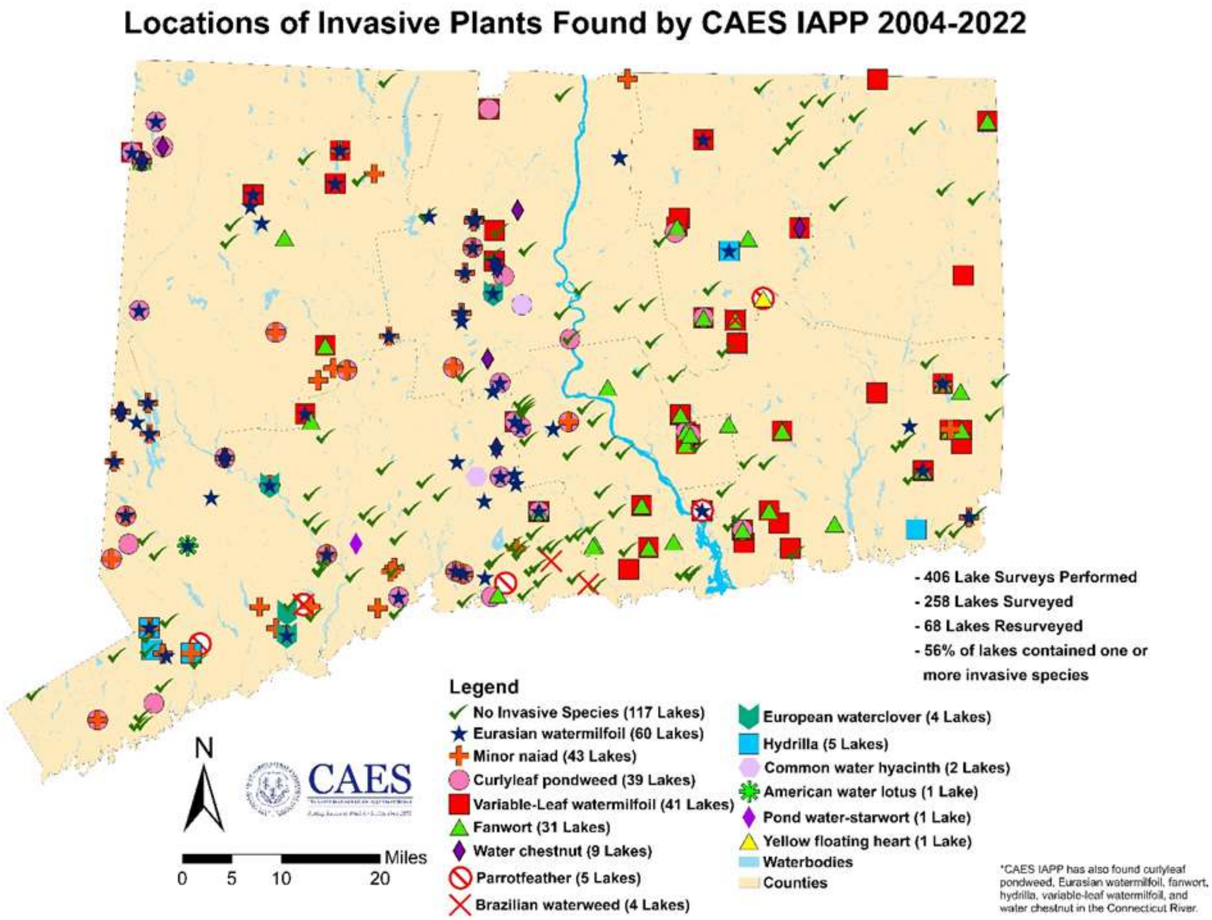


Figure 1. Locations of invasive aquatic plants found by CAES IAPP from 2004 - 2022.

Introduction:

Since 2004, the Connecticut Agricultural Experiment Station (CAES) Invasive Aquatic Plant Program (IAPP) has surveyed or resurveyed aquatic vegetation and monitored the water chemistry of nearly 300 Connecticut lakes, ponds, and rivers (Figure 1). Approximately 56% of the lakes and ponds contain invasive (non-native) plant species that can cause rapid deterioration of aquatic ecosystems, recreational opportunities, and real estate values. The presence of invasive species is related to water chemistry, public boat launches, random events, and climate change (Rahel and Olden, 2008). CAES IAPP provides an online database 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-iapp). This information allows citizens, government officials, and scientists to view past conditions, compare them with current conditions, and make educated management decisions. In 2022, CAES IAPP performed the fourth survey of Amos Lake and updated the CAES IAPP database.

Amos Lake is a 112-acre waterbody located in Preston, CT. A public state boat ramp is located along the middle of the western shoreline. There is an 8 MPH limit with no water-skiing except for June 15 to the first Sunday after Labor Day between 11am and 6pm. A campground with lake access is located at the southern end of the lake, while various homes are scattered around much of the remaining shoreline. It has a maximum depth of approximately 45 feet and an average depth of about 20 feet.

Nuisance aquatic vegetation in Amos Lake has been actively managed by The Pond and Lake Connection since 2021. On August 31, 2021, a total of four acres of Amos Lake was treated with ProcellaCOR EC at a rate of 3-4 PDU/acre ft for variable-leaf watermilfoil, following all guidelines from CT DEEP. On June 27, 2022, 9.5 acres of Amos Lake was treated again with ProcellaCOR EC at the same rate.

Objectives:

- Perform a fourth survey of Amos Lake for aquatic vegetation and quantify water chemistry. Previously surveyed by CAES IAPP in 2006, 2013, and 2018.
- Compare with previous surveys and add vegetation maps and water chemistry information to the CAES IAPP website.
- Update aquatic plant management options.
- Provide a report to the Amos Lake Association

Materials and Methods:

Aquatic Plant Surveys and Mapping:

Figure 2. Performing visual aquatic plant survey.

We surveyed Amos Lake for aquatic vegetation on August 23 & 24, 2022. The survey utilized methods established by CAES IAPP. Surveys were conducted from 16 and 18-foot motorized boats traveling over areas that supported aquatic plants (Figure 2). 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 ground truthed with grapple tosses were used to identify vegetated areas in deep water. Quantitative information on plant abundance was obtained by resurveying 12 transects that were initially positioned perpendicular to the shoreline in 2006. Transect locations represented the variety of habitats in the lake. Transects were located using a Trimble® R1 GNSS global positioning system with sub-meter accuracy. Sampling data points were taken along each transect at points 0, 5, 10, 20, 30, 40, 50, 60, 70, and 80 m from the shore. We measured depth 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 (2000*a*, 2000*b*). One specimen of each species collected 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. Scientific names can be found in Table 1. We post-processed the GPS data in Pathfinder® 5.85 (Trimble Navigation Limited, Sunnyvale, CA) and then imported it into ArcGIS® Pro 3.0.3 (ESRI Inc., Redlands, CA). Data were then overlaid onto recent high-resolution aerial imagery for the continental United States made available by the USDA Farm Services Agency.

Figure 3. Checking water clarity with Secchi disk.

Water Analysis:

Water was analyzed from a deep part of the lake (approximately 33 feet) in the same place as our previous surveys. Water temperature and dissolved oxygen were measured 1.5 feet beneath the surface and at 3-foot intervals to the bottom. Water was tested for temperature and dissolved oxygen 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 (Figure 3).

Water samples for pH, alkalinity, conductivity, total phosphorus, and total nitrogen testing were obtained from 1.5 feet beneath the surface and 1.5 feet above the bottom. The samples were stored at 38°F until testing. A Fisher AR20® meter was used to determine pH and conductivity, and alkalinity (expressed as mg/L $CaCO_3$) was quantified by titration with 0.016 N H_2SO_4 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 using a Milton Roy Spectronic 20D® spectrophotometer with a light path of 2 cm and a wavelength of 880 nm. Total Nitrogen was determined with a O-I Analytical 080® Total Organic Carbon Analyzer.

Table 1. Plants present in Amos Lake during CAES IAPP surveys in 2006, 2013, 2018, and 2022. Present indicates the species was present in the lake while Frequency of Occurrence (FOQ) indicates presence of a species on transects.

Amos Lake									
Species (invasives in bold)		2006		2013		2018		2022	
Common Name	Scientitic Name	Present	FOQ (%/point)	Present	FOQ (%/point)	Present	FOQ (%/point)	Present	FOQ (%/point)
Arrowhead	*Sagittaria* species	X	4.2%	X	0.8%	X	8.3%	X	2.5%
Berchtold's pondweed	*Potamogeton berchtoldii*							X	2.5%
Bur-reed	*Sparganium* species							X	0.8%
Common bladderwort	*Utricularia macrorhiza*	X	2.5%	X	3.3%	X	8.3%		
Coontail	*Ceratophyllum demersum*	X	0.8%					X	0.8%
Eelgrass	*Vallisneria americana*	X	5.0%	X	4.2%	X	9.2%	X	10.0%
Eurasian watermilfoil	***Myriophyllum spicatum***							**X**	**0.0%**
Golden hedge-hyssop	*Gratiola aurea*			X	0.0%	X	0.0%		
Great duckweed	*Spirodela polyrhiza*							X	1.7%
Humped bladderwort	*Utricularia gibba*	X	0.8%	X	2.5%	X	12.5%		
Large-leaf pondweed	*Potamogeton amplifolius*					X	20.0%	X	9.2%
Leafy pondweed	*Potamogeton foliosus*	X	0.0%	X	0.0%				
Little floating heart	*Nymphoides cordata*			X	0.8%			X	0.0%
Mudmat	*Glossostigma cleistanthum*	X	4.2%	X	1.7%	X	3.3%	X	3.3%
Pickerelweed	*Pontederia cordata*			X	0.0%	X	2.5%	X	0.8%
Primrose-willow	*Ludwigia* species			X	0.8%				
Purple bladderwort	*Utricularia purpurea*	X	2.5%	X	1.7%	X	7.5%		
Quillwort	*Isoetes* species	X	0.8%	X	0.0%				
Ribbon-leaf pondweed	*Potamogeton epihydrus*	X	0.0%						
Robbins' pondweed	*Potamogeton robbinsii*	X	36.7%	X	46.7%	X	53.3%	X	49.2%
Slender naiad	*Najas flexilis*	X	0.8%	X	0.0%			X	1.7%
Slender watermilfoil	*Myriophyllum tenellum*	X	2.5%	X	0.8%	X	0.0%	X	1.7%
Small pondweed	*Potamogeton pusillus*					X	0.0%		
Snailseed pondweed	*Potamogeton bicupulatus*	X	0.8%	X	0.0%	X	2.5%		
Spikerush	*Eleocharis* species			X	2.5%	X	0.0%	X	0.0%
Spotted pondweed	*Potamogeton pulcher*	X	4.2%	X	6.7%	X	1.7%	X	7.5%
Swamp loosestrife	*Decodon verticillatus*	X	1.7%	X	0.0%	X	0.8%	X	3.3%
Variable pondweed	*Potamogeton gramineus*	X	1.7%	X	0.8%	X	1.7%	X	3.3%
Variable-leaf watermilfoil	***Myriophyllum heterophyllum***	**X**	**0.8%**	**X**	**0.8%**	**X**	**20.8%**		
Watershield	*Brasenia schreberi*	X	1.7%	X	5.0%	X	5.0%	X	0.0%
Waterwort	*Elatine* species			X	0.0%				
Water starwort	*Callitriche* species			X	0.0%				
White water lily	*Nymphaea odorata*	X	11.7%	X	17.5%	X	33.3%	X	30.8%
Yellow water lily	*Nuphar variegata*	X	0.0%	X	4.2%	X	9.2%	X	10.0%
Total Species Richness	34	21	18	26	17	21	17	21	17
Total Native Species Richnesss	32	20	17	25	16	20	16	20	17
Total Invasive Species Richness	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**

Results and Discussion:

General Aquatic Plant Surveys and Transects:

In 2022, Amos Lake was home to a diverse aquatic plant community comprising 20 native species and one invasive (Eurasian watermilfoil) (Table 1). Much of the lake is too deep for plants to grow; however, most of the area at depths less than 10 feet contained dense vegetation (Figure 4). Eurasian watermilfoil was found for the first time in one location. It was hand pulled by the CAES IAPP surveyors and hopefully will not reappear. Invasive variable-leaf watermilfoil was not found in

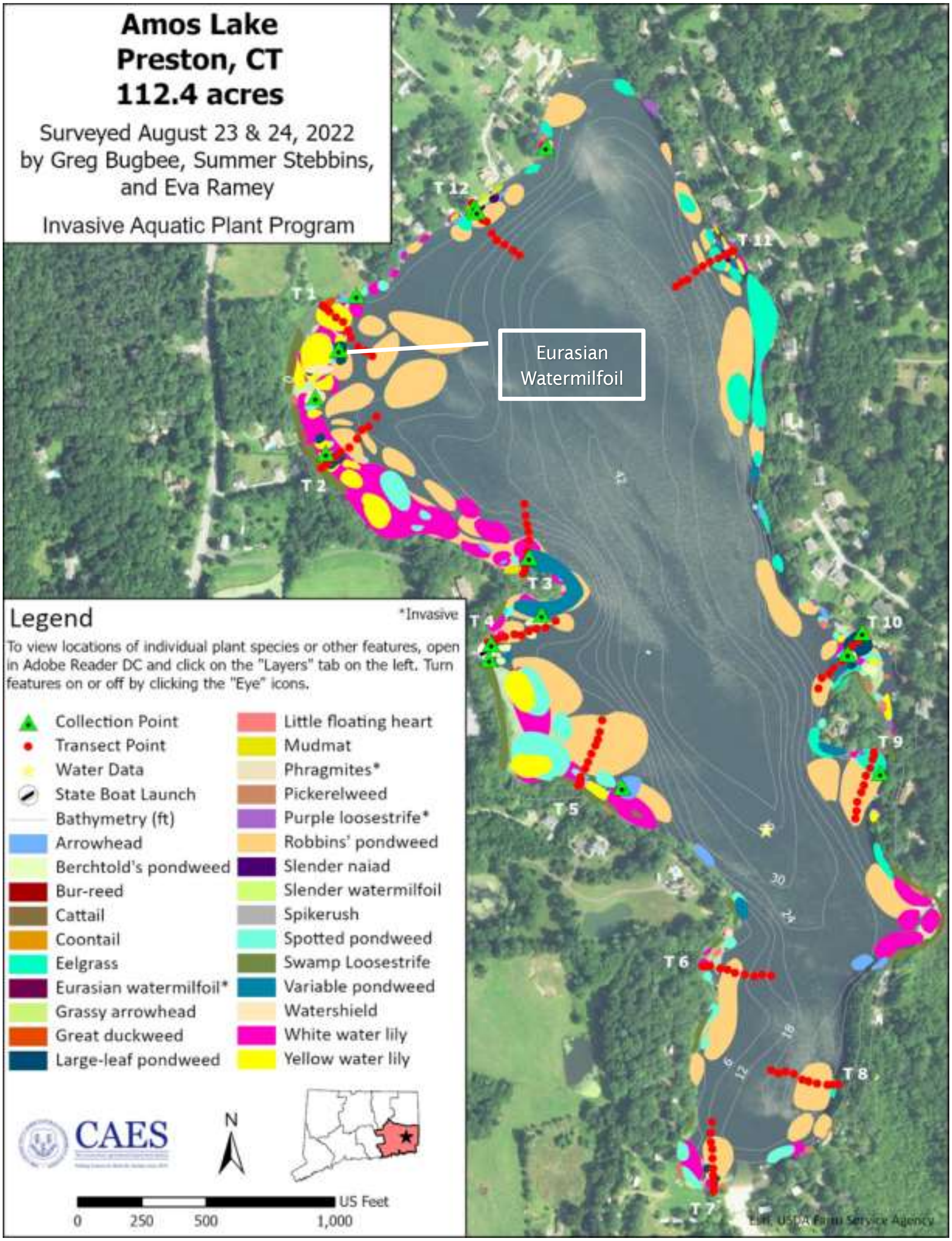
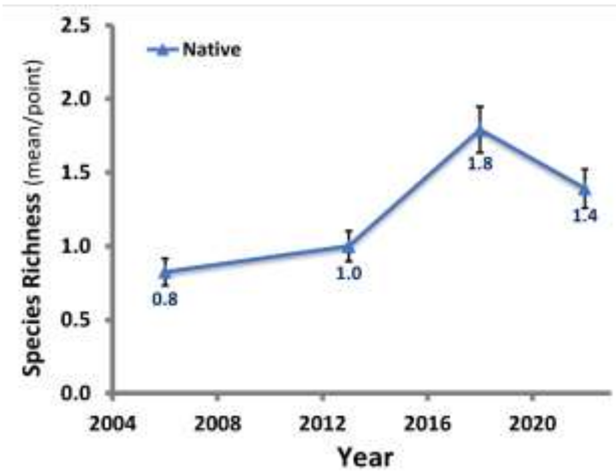


Figure 4. 2022 aquatic plant survey map of Amos Lake in Preston, CT.

2022 likely due to the ProcellaCOR® treatments in 2021 and 2022. Phragmites and purple loosestrife, two invasive wetland species, were observed inshore from the lake. Because they are not true aquatic plants, they are not included in our aquatic plant analysis. Waterlilies and other emersed vegetation were common along the shoreline as well as eelgrass and Robbins' pondweed. Detailed information on all the native plants is beyond the scope of this report but is available at USDA "About PLANTS" (https://plants.usda.gov/about_plants.html). In 2022, many of the vegetated areas were covered with lyngbya, a filamentous alga (Figure 5).

Figure 5. Water lilies and pondweeds mixed with a filamentous alga (*Lyngbia* sp.).

Native species found in 2022 were likely influenced by the 2021 and 2022 ProcellaCOR® treatments. Found in all four CAES IAPP surveys (2006, 2013, 2018, 2022) include arrowhead, eelgrass, mudmat, Robbins' pondweed, slender watermilfoil, spotted pondweed, swamp loosestrife, variable pondweed, watershield, white water lily, and yellow water lily. Species gained since our 2018 survey and therefore after the ProcellaCOR® treatments were Berchtold's pondweed, burweed, coontail, great duckweed, little floating heart, and slender naiad. Species lost since 2018 include common bladderwort, golden hedge-hyssop, humped bladderwort, purple bladderwort, small pondweed, and snailseed pondweed. Vegetation did not occur as consistently around the shoreline as in 2018, but abundance in the coves was similar. Many coves had a heavy abundance of emergent vegetation such as



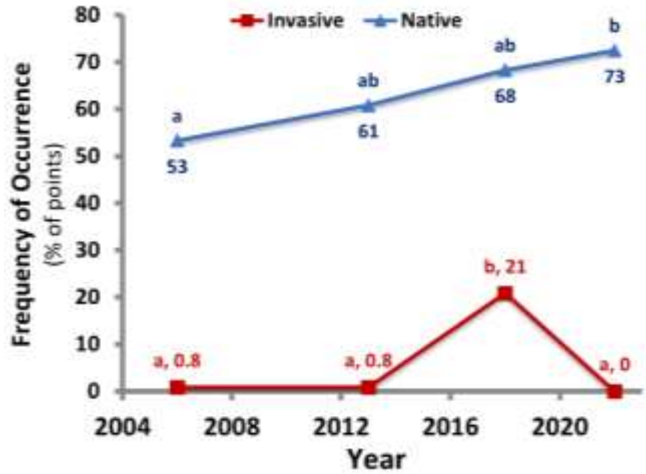


Figure 6. Native species richness (left) and frequency of occurrence (FOQ) of native and invasive aquatic plants (right) on transects in Amos Lake in 2006, 2013, 2018, and 2022.

white and yellow water lily along with lyngbya which can be undesirable for swimmers and boaters (Figure 5). The CAES IAPP website contains digitized survey maps where individual plant layers can be viewed separately (portal.ct.gov/caes-iapp).

Comparisons of our frequency of occurrence (FOQ) transect data from each survey year found a consistent increase in total occurrence of native species, and a decrease in invasive species from 2018 to 2022 (Figure 6, right). Occurrence of native species on transects was the highest in 2022 at 73% with a steady increase from the low of 53% in 2006. The difference from 2006 to 2022 was statistically significant. 2022 was the first year that no invasive species were found on transects. This is likely due to the ProcellaCOR® treatments selectively removing Eurasian watermilfoil and allowing native species to fill the void. As in our previous survey, Robbins' pondweed was the most frequently found native species with an FOQ of 49% (Table 1). Other commonly found plants were white water lily (31%), eelgrass (10%), yellow water lily (10%), and large-leaf pondweed (9%). The most notable difference in native species from survey years is the complete absence of all bladderwort species in 2022. Common bladderwort, humped bladderwort, and purple bladderwort were all found in 2018, but not in 2022. This is likely caused by sensitivity to ProcellaCOR®.

Species richness refers to the average number of species per transect point. A higher species richness indicates more species found. Since only one invasive species was found in each survey year, species richness was only calculated for native species. Overall species richness of native species was 1.4 in 2022 compared to 1.8 in 2018, which was not statistically significant (Figure 6, left).

Water Chemistry:

CAES IAPP 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. Water clarity in Connecticut's lakes ranges from 1-33 feet with an average of 7 feet (CAES IAPP, 2023). Amos Lake had a water clarity of 7 feet in 2022 compared to 13 ft in 2018, 3 feet in 2013, and 8 feet in 2008 (Figure 7). Differences among years may be attributed to natural variation and decaying plants from the 2021 and 2022 herbicide treatments that can increase tannins and promote algae. In all survey years, the summer thermocline began at a depth of around 12 feet. Dissolved oxygen responded similarly, with highly oxygenated water above the thermocline and a rapid depletion to near 0 mg/L below.

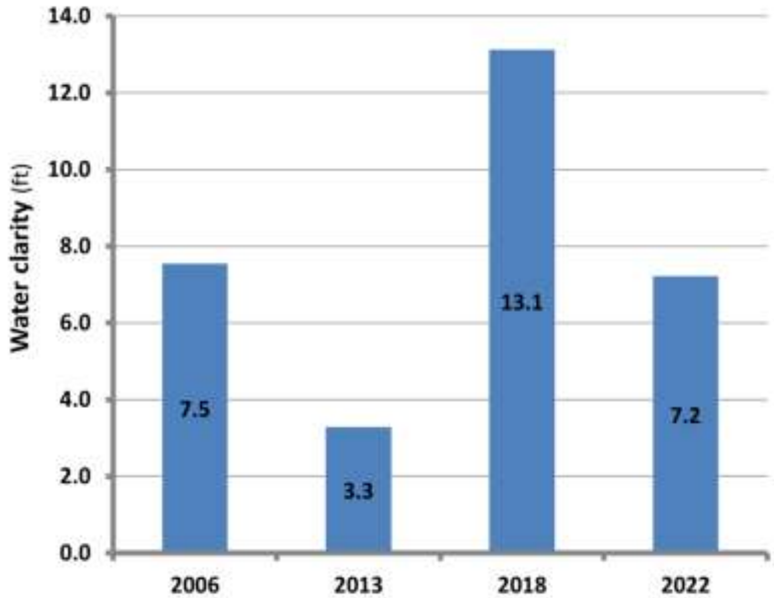


Figure 7. Water clarity in Amos Lake during CAES IAPP surveys.

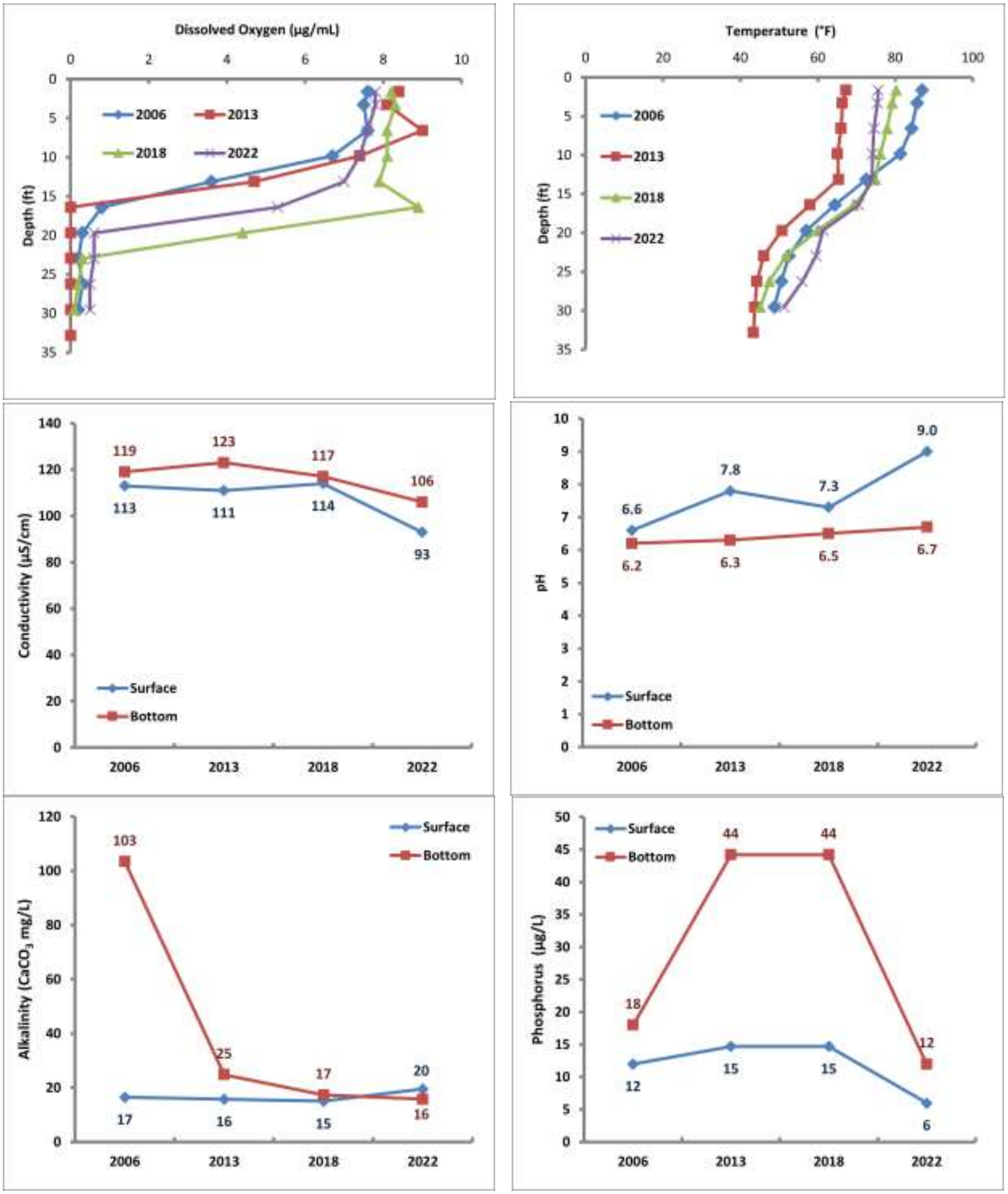


Figure 8. Water chemistry for Amos Lake in 2006, 2013, 2018, and 2022.

Amos Lake's surface pH ranged from 6.7 in 2006 to 9.0 in 2022. The increase could be related to a daytime reduction in carbonic acid associated with photosynthesizing algae/cyanobacteria promote by plant decay. Bottom water pH ranged from 6.2 - 6.7 throughout the years which is considered stable. Amos Lake's surface alkalinity has also remained stable from 2006 – 2022 falling within a narrow range of 17 – 20 mg/L $CaCO_3$. This is relatively low for Connecticut lakes which can range as high as >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. 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. Amos Lake's conductivity of 93 μS/cm at the surface and 106 μS/cm at the bottom in 2022 was lower than in our previous surveys. This may be caused by removal of ions by the increased vegetation, less road salts, or other factors. Amos Lake's low alkalinity and conductivity suggests it is most suitable for variable-leaf watermilfoil and less so for Eurasian watermilfoil. This could limit the spread of the Eurasian watermilfoil found in the one location in 2022 and promote regrowth of variable watermilfoil.

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 less dependent on P from the water column as they obtain most of their nutrients from the hydrosoil (Bristow and Whitcombe 1971). Lakes with 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 and Norvell, 1984). Lakes with P concentrations >50 μg/L are categorized as extremely fertile or hypereutrophic. Amos Lake's P concentration in 2022 was 6 µg/L at surface and 12 µg/L near the bottom. Although this suggests an oligotrophic condition removal of P by vegetation and algae particularly in dry years such as 2022 can skew data (Figure 8).

Conclusions:

In 2022, after the two treatments of ProcellaCOR, no variable-leaf watermilfoil was found in the lake. Although changes in native species occurred such as the reduction in bladderworts, 20 species were observed in 2022 which is similar the number found in 2006, 2013, and 2018. Invasive Eurasian watermilfoil was found in one location in 2022 and was hand-pulled. Most of the coves contained a heavy abundance of waterlilies at the surface with Robbins' pondweed underneath. Lyngbya, a filamentous alga, was found frequently throughout the lake and can be undesirable for swimmers and boaters. Aquatic plant monitoring should continue to ensure a resurgence of variable-leaf watermilfoil is avoided and Eurasian watermilfoil does not become a problem.

Acknowledgments:

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Appendix

Invasive Plant Descriptions

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

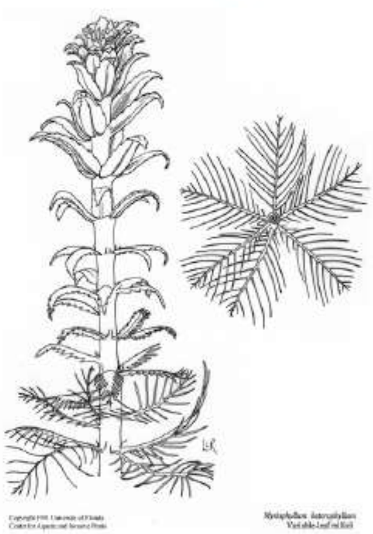
Leaves: Triangular with ≤ 11 pairs of leaflets. Leaves are dissected and whorled (4-6 leaves/whorl) resulting in a feathery appearance with leaf whorls < 1 inch apart giving it a ropy appearance

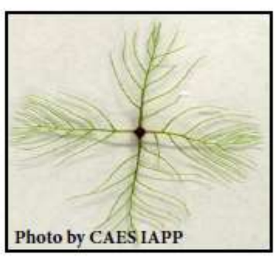
Flowers: Inflorescence spike 2-14 inches (5-35 cm) long extend beyond the water's surface with flowers in whorls of four with reddish petals

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*





Myriophyllum spicatum

Common name:
Eurasian watermilfoil

Origin:
Europe and Asia

Key features:
Plants are submersed

Stems: Stem diameter below the inflorescence is greater with reddish stem tips

Leaves: Leaves are rectangular with ≥ 12 pairs of leaflets per leaf and are dissected giving a feathery appearance, arranged in a whorl, whorls are 1 inch (2.5 cm) apart

Flowers: Small pinkish male flowers that occur on reddish spikes, female flowers lack petals and sepals and have 4 lobed pistil

Fruits/Seeds: Fruit are round 0.08-0.12 inches (2-3 mm) and contain 4 seeds

Reproduction: Fragmentation and seeds

Easily confused species:
Variable-leaf watermilfoil: *Myriophyllum heterophyllum*
Low watermilfoil: *Myriophyllum humile*
Northern watermilfoil: *Myriophyllum sibiricum*
Whorled watermilfoil: *Myriophyllum verticillatum*

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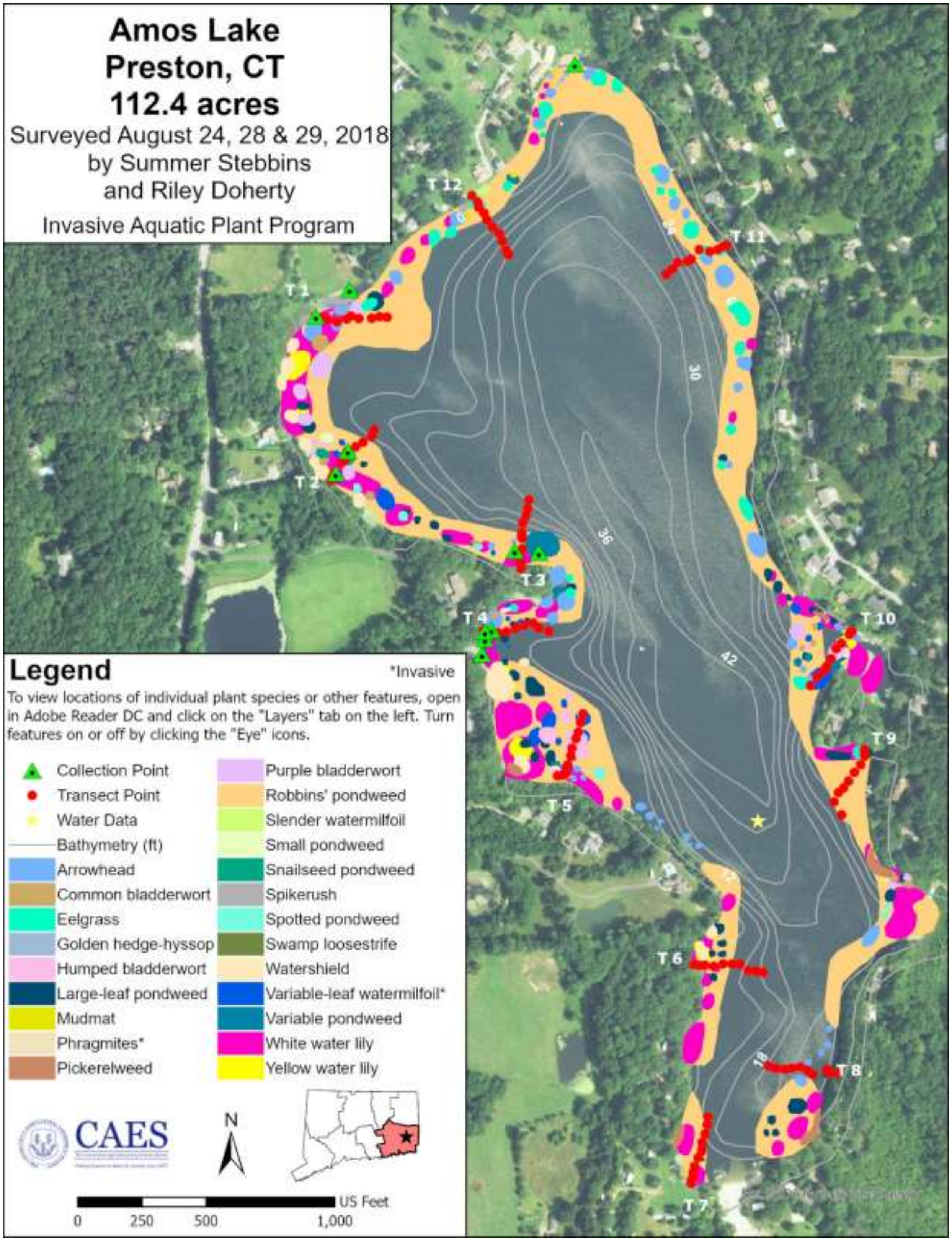
Previous Years Aquatic Plant Survey Maps


Amos Lake
Preston, CT
112.4 acres
Surveyed August 24, 28 & 29, 2018
by Summer Stebbins
and Riley Doherty
Invasive Aquatic Plant Program
T 1
T 2
T 3
T 4
T 5
T 6
T 7
T 8
T 9
T 10
T 11
T 12
30
36
42
18
Legend
*Invasive
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
Water Data
Bathymetry (ft)
Arrowhead
Common bladderwort
Eelgrass
Golden hedge-hyssop
Humped bladderwort
Large-leaf pondweed
Mudmat
Phragmites*
Pickerelweed
Purple bladderwort
Robbins' pondweed
Slender watermilfoil
Small pondweed
Snailseed pondweed
Spikerush
Spotted pondweed
Swamp loosestrife
Watershield
Variable-leaf watermilfoil*
Variable pondweed
White water lily
Yellow water lily
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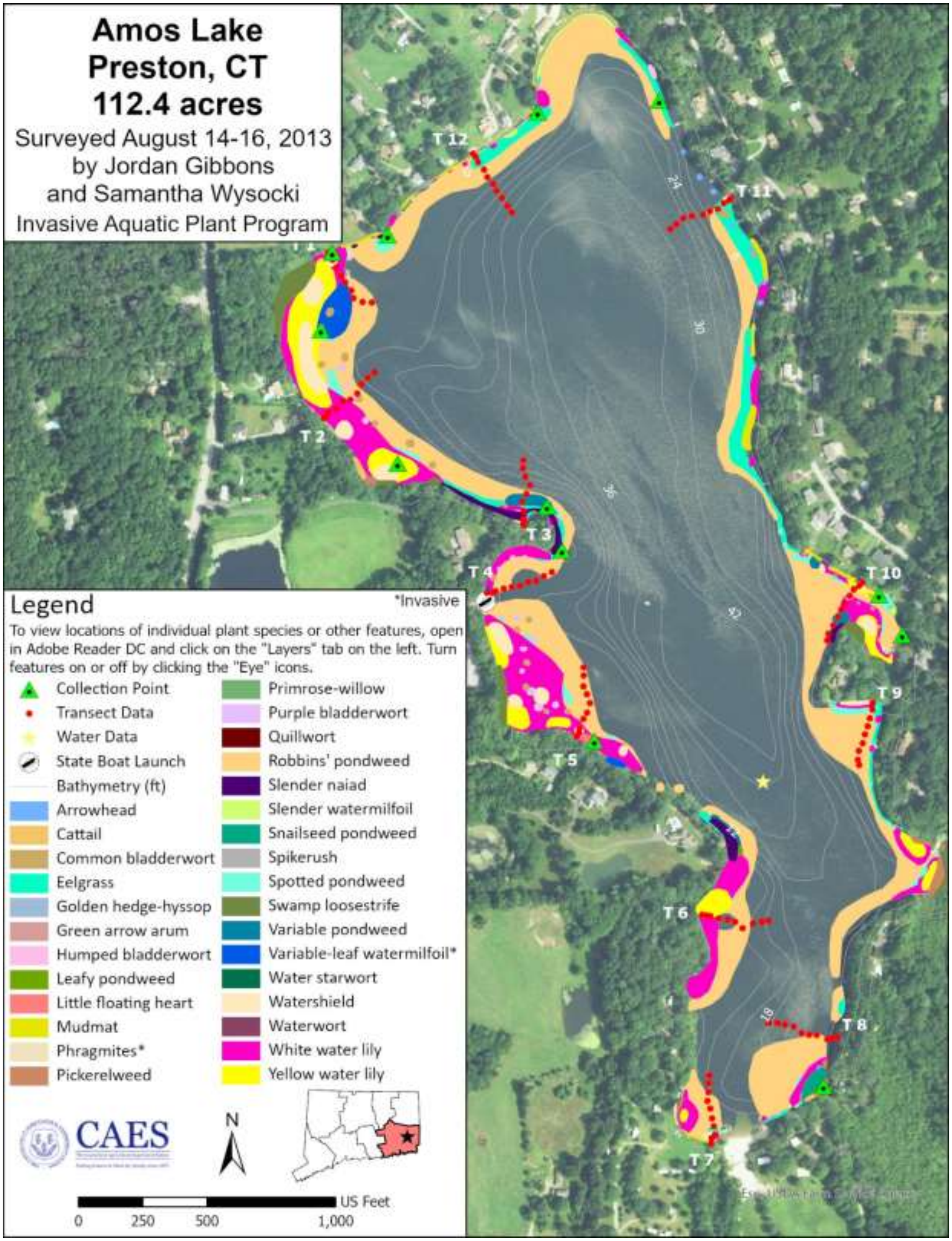
Amos Lake
Preston, CT
112.4 acres
Surveyed August 14-16, 2013
by Jordan Gibbons
and Samantha Wysocki
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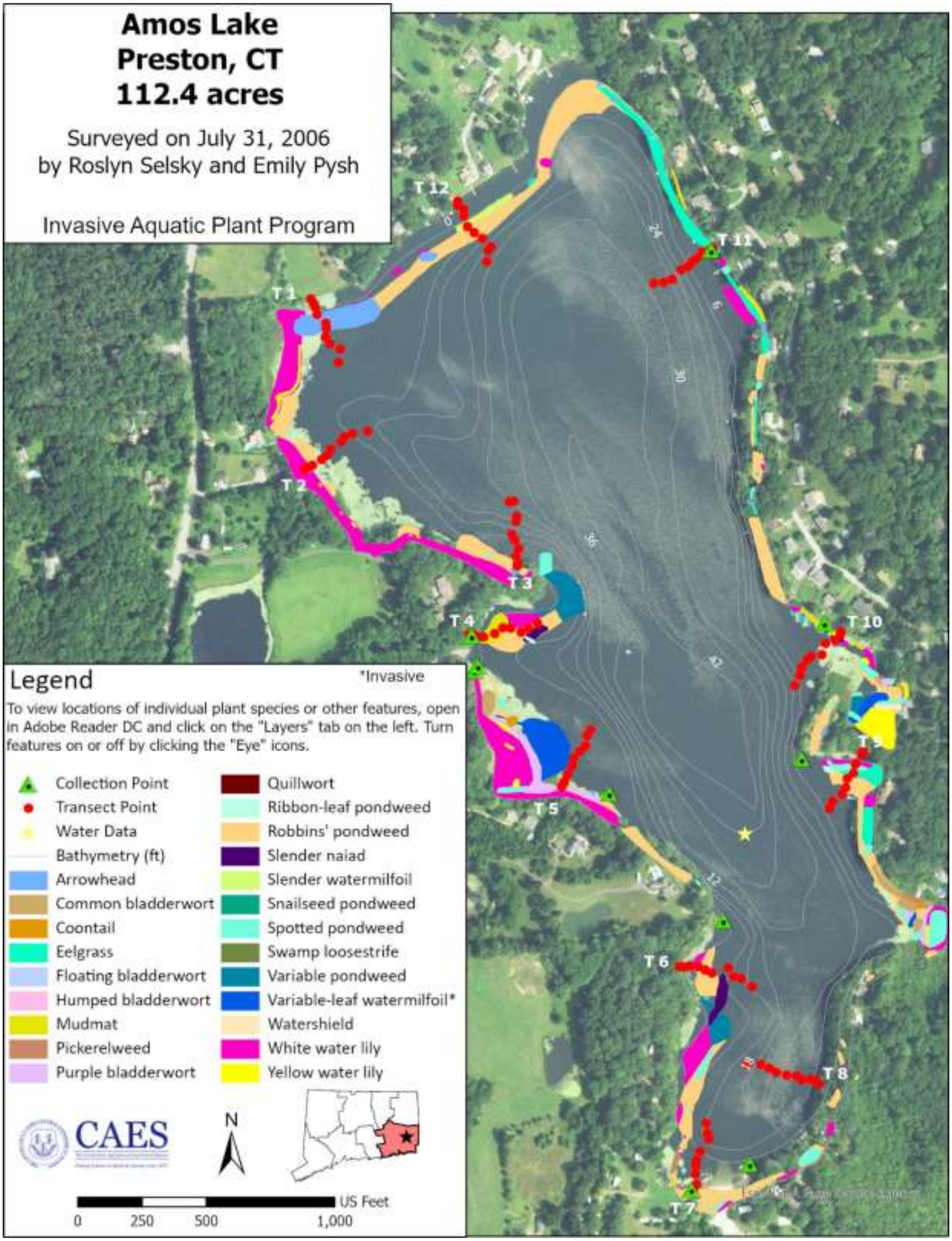
To view locations of individual plant species or other features, open in Adobe Reader DC and click on the "Layers" tab on the left. Turn features on or off by clicking the "Eye" icons.
Collection Point
Transect Data
Water Data
State Boat Launch
Bathymetry (ft)
Arrowhead
Cattail
Common bladderwort
Eelgrass
Golden hedge-hyssop
Green arrow arum
Humped bladderwort
Leafy pondweed
Little floating heart
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Quillwort
Robbins' pondweed
Slender naiad
Slender watermilfoil
Snailseed pondweed
Spikerush
Spotted pondweed
Swamp loosestrife
Variable pondweed
Variable-leaf watermilfoil*
Water starwort
Watershield
Waterwort
White water lily
Yellow water lily
CAES
N
US Feet
0
250
500
1,000
T 2
T 3
T 4
T 5
T 6
T 7
T 8
T 9
T 10
T 11
T 12



Amos Lake
Preston, CT
112.4 acres
Surveyed on July 31, 2006
by Roslyn Selsky and Emily Pysh
Invasive Aquatic Plant Program
T 1
T 2
T 3
T 4
T 5
T 6
T 7
T 8
T 10
T 11
T 12
Legend
*Invasive
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
Water Data
Bathymetry (ft)
Arrowhead
Common bladderwort
Coontail
Eelgrass
Floating bladderwort
Humped bladderwort
Mudmat
Pickerelweed
Purple bladderwort
Quillwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Slender watermilfoil
Snailseed pondweed
Spotted pondweed
Swamp loosestrife
Variable pondweed
Variable-leaf watermilfoil*
Watershield
White water lily
Yellow water lily
CAES
N
US Feet
0
250
500
1,000

Transect Data

Appendix Amos Lake Transect Data (1 of 3)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	CerDem	DecVar	GloCle	LytSal	MyrTen	NajFle	NupVar	NymOdo	PonCor	PotAmp	PotBer	PotGra	PotPul	PotRob	SagSpp	SpaSpp	SpiPol	ValAme
1	1	0.5	Greg Bugbee	41.52036	-71.98045	8/23/2022	0.5	Muck	2	2	0	0	0	0	2	4	0	0	0	0	0	0	2	2	2	0
1	2	5	Greg Bugbee	41.52034	-71.98042	8/23/2022	0.8	Muck	0	2	0	0	0	0	3	4	0	0	0	0	0	0	0	0	2	0
1	3	10	Greg Bugbee	41.52030	-71.98035	8/23/2022	1.0	Muck	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0	0
1	4	20	Greg Bugbee	41.52024	-71.98026	8/23/2022	1.0	Muck	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0	0
1	5	30	Greg Bugbee	41.52019	-71.98016	8/23/2022	1.0	Muck	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	0	0
1	6	40	Greg Bugbee	41.52009	-71.98009	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
1	7	50	Greg Bugbee	41.52002	-71.98005	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	8	60	Greg Bugbee	41.51992	-71.97995	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	9	70	Greg Bugbee	41.51988	-71.97985	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	10	80	Greg Bugbee	41.51982	-71.97975	8/23/2022	1.9	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
2	1	0.5	Greg Bugbee	41.51863	-71.98049	8/23/2022	0.5	Muck	0	2	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0
2	2	5	Greg Bugbee	41.51866	-71.98043	8/23/2022	0.8	Muck	0	0	0	0	0	0	3	2	0	1	0	0	0	0	0	0	0	0
2	3	10	Greg Bugbee	41.51869	-71.98038	8/23/2022	1.0	Muck	0	0	0	0	0	0	2	4	0	2	0	0	0	0	0	0	0	0
2	4	20	Greg Bugbee	41.51874	-71.98030	8/23/2022	1.2	Muck	0	0	0	0	0	0	3	4	0	2	0	0	0	3	0	0	0	0
2	5	30	Greg Bugbee	41.51880	-71.98021	8/23/2022	1.6	Muck	0	0	0	0	0	0	0	2	0	2	0	0	2	3	0	0	0	0
2	6	40	Greg Bugbee	41.51885	-71.98009	8/23/2022	1.8	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
2	7	50	Greg Bugbee	41.51894	-71.97998	8/23/2022	2.3	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
2	8	60	Greg Bugbee	41.51903	-71.97991	8/23/2022	4.7	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2	9	70	Greg Bugbee	41.51907	-71.97981	8/23/2022	5.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	10	80	Greg Bugbee	41.51917	-71.97970	8/23/2022	5.6	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0.5	Greg Bugbee	41.51748	-71.97764	8/23/2022	0.2	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	2	5	Greg Bugbee	41.51751	-71.97761	8/23/2022	0.5	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	10	Greg Bugbee	41.51755	-71.97760	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	3	0	0	0	0	0	2	2	0	0	0
3	4	20	Greg Bugbee	41.51764	-71.97759	8/23/2022	1.6	Muck	0	0	0	0	0	0	0	2	0	0	0	0	2	3	0	0	0	0
3	5	30	Greg Bugbee	41.51773	-71.97758	8/23/2022	2.0	Muck	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0
3	6	40	Greg Bugbee	41.51784	-71.97755	8/23/2022	2.3	Muck	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0
3	7	50	Greg Bugbee	41.51793	-71.97756	8/23/2022	5.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	8	60	Greg Bugbee	41.51801	-71.97758	8/23/2022	6.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	9	70	Greg Bugbee	41.51810	-71.97759	8/23/2022	8.2	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	10	80	Greg Bugbee	41.51823	-71.97761	8/23/2022	9.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0.5	Greg Bugbee	41.51675	-71.97815	8/23/2022	0.1	Gravel	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
4	2	5	Greg Bugbee	41.51677	-71.97807	8/23/2022	1.0	Gravel	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
4	3	10	Greg Bugbee	41.51679	-71.97800	8/23/2022	1.8	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
4	4	20	Greg Bugbee	41.51681	-71.97790	8/23/2022	2.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
4	5	30	Greg Bugbee	41.51683	-71.97777	8/23/2022	2.5	Muck	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0
4	6	40	Greg Bugbee	41.51682	-71.97767	8/23/2022	3.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
4	7	50	Greg Bugbee	41.51687	-71.97756	8/23/2022	3.5	Muck	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
4	8	60	Greg Bugbee	41.51689	-71.97745	8/23/2022	3.6	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	9	70	Greg Bugbee	41.51690	-71.97732	8/23/2022	4.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	10	80	Greg Bugbee	41.51697	-71.97718	8/23/2022	3.2	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
5	1	0.5	Greg Bugbee	41.51521	-71.97688	8/23/2022	0.2	Gravel	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
5	2	5	Greg Bugbee	41.51526	-71.97685	8/23/2022	1.1	Gravel	0	0	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0
5	3	10	Greg Bugbee	41.51531	-71.97685	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0
5	4	20	Greg Bugbee	41.51539	-71.97678	8/23/2022	1.6	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
5	5	30	Greg Bugbee	41.51546	-71.97674	8/23/2022	1.8	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
5	6	40	Greg Bugbee	41.51555	-71.97669	8/23/2022	2.2	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
5	7	50	Greg Bugbee	41.51564	-71.97663	8/23/2022	3.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
5	8	60	Greg Bugbee	41.51570	-71.97660	8/23/2022	2.2	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
5	9	70	Greg Bugbee	41.51578	-71.97657	8/23/2022	2.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
5	10	80	Greg Bugbee	41.51591	-71.97653	8/23/2022	2.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0

Appendix Amos Lake Transect Data (2 of 3)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	CerDem	DecVer	GloCle	LytSal	MyrTen	NajFle	NupVar	NymOdo	PonCor	PotAmp	PotBer	PotGra	PotPul	PotRob	SagSpp	SpaSpp	SpiPol	ValAme
6	1	0.5	Greg Bugbee	41.51327	-71.97514	8/23/2022	0.3	Muck	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
6	2	5	Greg Bugbee	41.51327	-71.97510	8/23/2022	1.0	Muck	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
6	3	10	Greg Bugbee	41.51327	-71.97503	8/23/2022	1.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	4	20	Greg Bugbee	41.51324	-71.97489	8/23/2022	1.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	5	30	Greg Bugbee	41.51323	-71.97479	8/23/2022	1.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
6	6	40	Greg Bugbee	41.51319	-71.97468	8/23/2022	2.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
6	7	50	Greg Bugbee	41.51318	-71.97454	8/23/2022	4.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	8	60	Greg Bugbee	41.51316	-71.97441	8/23/2022	6.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	9	70	Greg Bugbee	41.51318	-71.97429	8/23/2022	6.6	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	10	80	Greg Bugbee	41.51316	-71.97417	8/23/2022	7.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	0.5	Greg Bugbee	41.51086	-71.97501	8/23/2022	0.3	Gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	2	5	Greg Bugbee	41.51091	-71.97501	8/23/2022	0.5	Gravel	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0
7	3	10	Greg Bugbee	41.51096	-71.97501	8/23/2022	1.2	Muck	0	0	0	0	0	0	0	3	0	2	0	0	0	2	0	0	0	0
7	4	20	Greg Bugbee	41.51104	-71.97502	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0
7	5	30	Greg Bugbee	41.51111	-71.97502	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
7	6	40	Greg Bugbee	41.51122	-71.97502	8/23/2022	1.8	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
7	7	50	Greg Bugbee	41.51131	-71.97503	8/23/2022	2.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
7	8	60	Greg Bugbee	41.51139	-71.97504	8/23/2022	3.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
7	9	70	Greg Bugbee	41.51149	-71.97504	8/23/2022	4.8	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	10	80	Greg Bugbee	41.51160	-71.97502	8/23/2022	6.3	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	0.5	Greg Bugbee	41.51200	-71.97322	8/23/2022	0.2	Gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	2	5	Greg Bugbee	41.51199	-71.97330	8/23/2022	1.6	Gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8	3	10	Greg Bugbee	41.51199	-71.97338	8/23/2022	3.0	Gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8	4	20	Greg Bugbee	41.51201	-71.97353	8/23/2022	3.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8	5	30	Greg Bugbee	41.51203	-71.97365	8/23/2022	3.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
8	6	40	Greg Bugbee	41.51205	-71.97374	8/23/2022	4.3	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
8	7	50	Greg Bugbee	41.51211	-71.97386	8/23/2022	6.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	8	60	Greg Bugbee	41.51214	-71.97397	8/23/2022	6.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	9	70	Greg Bugbee	41.51212	-71.97407	8/23/2022	6.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	10	80	Greg Bugbee	41.51215	-71.97418	8/23/2022	6.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	0.5	Greg Bugbee	41.51554	-71.97268	8/23/2022	0.2	Gravel	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	2
9	2	5	Greg Bugbee	41.51551	-71.97267	8/23/2022	0.8	Gravel	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	0	2
9	3	10	Greg Bugbee	41.51546	-71.97270	8/23/2022	1.5	Muck	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	3
9	4	20	Greg Bugbee	41.51537	-71.97273	8/23/2022	1.8	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2
9	5	30	Greg Bugbee	41.51529	-71.97279	8/23/2022	2.6	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
9	6	40	Greg Bugbee	41.51519	-71.97282	8/23/2022	3.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
9	7	50	Greg Bugbee	41.51511	-71.97286	8/23/2022	3.3	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
9	8	60	Greg Bugbee	41.51501	-71.97292	8/23/2022	3.3	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
9	9	70	Greg Bugbee	41.51491	-71.97293	8/23/2022	3.3	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
9	10	80	Greg Bugbee	41.51483	-71.97295	8/23/2022	4.0	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
10	1	0.5	Summer Stebbins	41.51682	-71.97282	8/24/2022	0.2	Muck	0	0	0	2	0	0	0	2	2	2	0	0	2	2	0	0	0	0
10	2	5	Summer Stebbins	41.51678	-71.97284	8/24/2022	0.7	Muck	0	0	0	0	0	0	2	1	0	2	0	0	2	2	0	0	0	0
10	3	10	Summer Stebbins	41.51673	-71.97289	8/24/2022	0.7	Muck	0	0	0	0	0	0	2	2	0	2	0	0	2	0	0	0	0	0
10	4	20	Summer Stebbins	41.51668	-71.97297	8/24/2022	0.7	Muck	0	0	0	0	0	0	2	2	0	2	0	0	4	2	0	0	0	0
10	5	30	Summer Stebbins	41.51660	-71.97304	8/24/2022	0.3	Muck	0	0	0	0	0	0	0	3	0	2	3	0	2	2	0	0	0	2
10	6	40	Summer Stebbins	41.51651	-71.97312	8/24/2022	0.5	Muck	0	0	0	0	0	0	0	3	0	0	0	2	3	2	0	0	0	2
10	7	50	Summer Stebbins	41.51645	-71.97324	8/24/2022	0.5	Muck	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
10	8	60	Summer Stebbins	41.51639	-71.97330	8/24/2022	0.5	Gravel	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
10	9	70	Summer Stebbins	41.51634	-71.97341	8/24/2022	0.8	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
10	10	80	Summer Stebbins	41.51623	-71.97346	8/24/2022	0.9	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0

Appendix Amos Lake Transect Data (3 of 3)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	CerDem	DecVer	GloCle	LytSal	MyrTen	NajFle	NupVar	NymOdo	PonCor	PotAmp	PotBer	PotGra	PotPul	PotRob	SagSpp	SpaSpp	SpiPol	ValAme
11	1	0.5	Summer Stebbins	41.52091	-71.97461	8/24/2022	0.1	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	2	5	Summer Stebbins	41.52090	-71.97465	8/24/2022	0.1	Sand	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
11	3	10	Summer Stebbins	41.52087	-71.97474	8/24/2022	0.4	Silt	0	0	0	0	0	1	0	0	0	0	0	2	0	3	0	0	0	4
11	4	20	Summer Stebbins	41.52083	-71.97482	8/24/2022	0.7	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4
11	5	30	Summer Stebbins	41.52080	-71.97494	8/24/2022	1.0	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
11	6	40	Summer Stebbins	41.52075	-71.97505	8/24/2022	3.1	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
11	7	50	Summer Stebbins	41.52069	-71.97515	8/24/2022	4.6	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	8	60	Summer Stebbins	41.52061	-71.97526	8/24/2022	5.9	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	9	70	Summer Stebbins	41.52058	-71.97535	8/24/2022	6.4	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	10	80	Summer Stebbins	41.52054	-71.97543	8/24/2022	6.6	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	0.5	Summer Stebbins	41.52145	-71.97831	8/24/2022	0.1	Sand	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2	5	Summer Stebbins	41.52140	-71.97829	8/24/2022	0.2	Sand	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	2
12	3	10	Summer Stebbins	41.52136	-71.97824	8/24/2022	0.9	Silt	0	0	0	0	0	1	0	0	0	0	0	0	0	3	3	0	0	4
12	4	20	Summer Stebbins	41.52127	-71.97817	8/24/2022	1.0	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
12	5	30	Summer Stebbins	41.52125	-71.97811	8/24/2022	1.5	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
12	6	40	Summer Stebbins	41.52112	-71.97804	8/24/2022	4.5	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	7	50	Summer Stebbins	41.52104	-71.97797	8/24/2022	7.5	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	8	60	Summer Stebbins	41.52100	-71.97786	8/24/2022	8.9	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	9	70	Summer Stebbins	41.52094	-71.97774	8/24/2022	9.5	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	10	80	Summer Stebbins	41.52089	-71.97765	8/24/2022	10.0	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0