

November 2, 2023

Chuck Roy, President  
Big Alum Lake Association  
PO Box 355  
Fiskdale, MA 01518

**Re: *Big Alum Pond Plant Mapping Report for 2023 with Recommendations for 2024***  
TRC Job No. 563297.0000.0000

Dear Mr. Smith,

TRC Environmental (TRC) provides the Big Alum Lake Association (BALA) with this brief letter report following our August 2023 plant survey and assessment of Big Alum Pond in Sturbridge, MA.

### **Plant Mapping**

TRC conducted one round of aquatic plant mapping at Big Alum Pond on August 24, 2023 during the peak of the plant growth season. The aquatic plant survey was conducted at over 75 points along appropriately spaced transects through the pond using direct observation in shallower water and a throw-rake in deeper areas along with a tablet equipped with a GPS receiver. Plant species, plant coverage and biovolume were recorded at each sampling point along with the depth of the water.

TRC focused our survey on identifying the presence of any non-native or exotic species, such as curly-leaf pondweed, as well as the known nuisance native species (e.g., clasping leaf pondweed). Our maps show the overall plant coverage (the percent of bottom area occupied by plants) within the pond (Figure 1) as well as the biovolume (the amount of water column filled with plants) (Figure 2). We also have prepared a species-specific map showing cover density for clasping leaf pondweed (Figure 3) as this is the obvious target for management action.

Overall, the pond is in very good condition compared with many of the lakes in the central Massachusetts region since it is reported (GZA 2022) to only have two exotic species, curly-leaf pondweed and mudmat. TRC was not able to document either of these species during our survey, and this was not surprising given our focus on deeper waters and the time of year in which our survey occurred.

For the 2023 August assessment, TRC found clasping leaf pondweed to be the dominant plant throughout much of the lake's littoral (shallow water) zone. Clasping leaf covered approximately 18 acres of the lake bottom.

### **Recommended Treatment Program for 2024**

TRC understands that BALA has been working with herbicide application contractors over the past few years to manage both curly-leaf and clasping leaf pondweed with broad spectrum contact herbicides such as diquat and endothall, but the desired results have not been achieved. Generally speaking, when a broad spectrum contact herbicide applied to a lake, the impacts on the target species may be decent initially, but with continued use, the results tend to deteriorate over time and often result in more and more acres to be treated each year. Additionally, the contact herbicide approach will also reduce the densities of the non-target plants that are desirable to maintain bottom coverage and reduce sediment resuspension from waves and boat traffic.

**Contact Herbicide Approach:** If using contact herbicides in Big Alum, we should conduct two contact herbicide treatments annually to get decent control of both curly-leaf and clasping leaf pondweed which develop at different times within the growing season. The first contact herbicide application would target only areas of curly-leaf in early June each year for several years until the seedbeds and turions are depleted. The second contact herbicide application would target clasping leaf pondweed in mid to late July before it drops its seeds.

A single contact herbicide application will not be able to effectively reduce the population of both plants in Big Alum over time. Two applications applied as described above each year for two to three years should be able to significantly reduce the regrowth of these target plants and result in a much reduced treatment program in future years.

Costs for using contact herbicides in accordance with our recommendations should be on the order of \$6,000 (assuming 20 acres at \$300/acre) per application per year for three years with additional applications twice annually thereafter that should be less acreage if the effort is sustained for the entire three-year period. Total cost for implementing this approach is \$36,000.

**Systemic Herbicide Approach:** An alternative approach that TRC would highly recommend would be to use the systemic herbicide Sonar (fluridone) in a slowly dissolving granular form that can target the plant beds of both curly-leaf and clasping leaf. The slow dissolving formula will ideally maintain the target concentration within the plant beds throughout an entire summer with repeated granular applications. Sonar impacts the whole plant, including roots, by starving the plant with prolonged exposure since it acts on the plants chloroplasts (photosynthetic pigment). For Big Alum, the application area cannot be determined based on our single round of mapping in late August since the curly-leaf pondweed was not present. Assuming that it overlaps significantly with the more abundant clasping leaf, we can then assume a treatment area of at least 30-40 acres spanning out from the shoreline to about 8 feet of depth. Some overtreatment is necessary to ensure that the edges of the plant beds are within the area with adequate herbicide concentration. The deeper you go, the more water there is to dilute the targeted concentration and thus more herbicide would be required to control plants at the deeper depths.

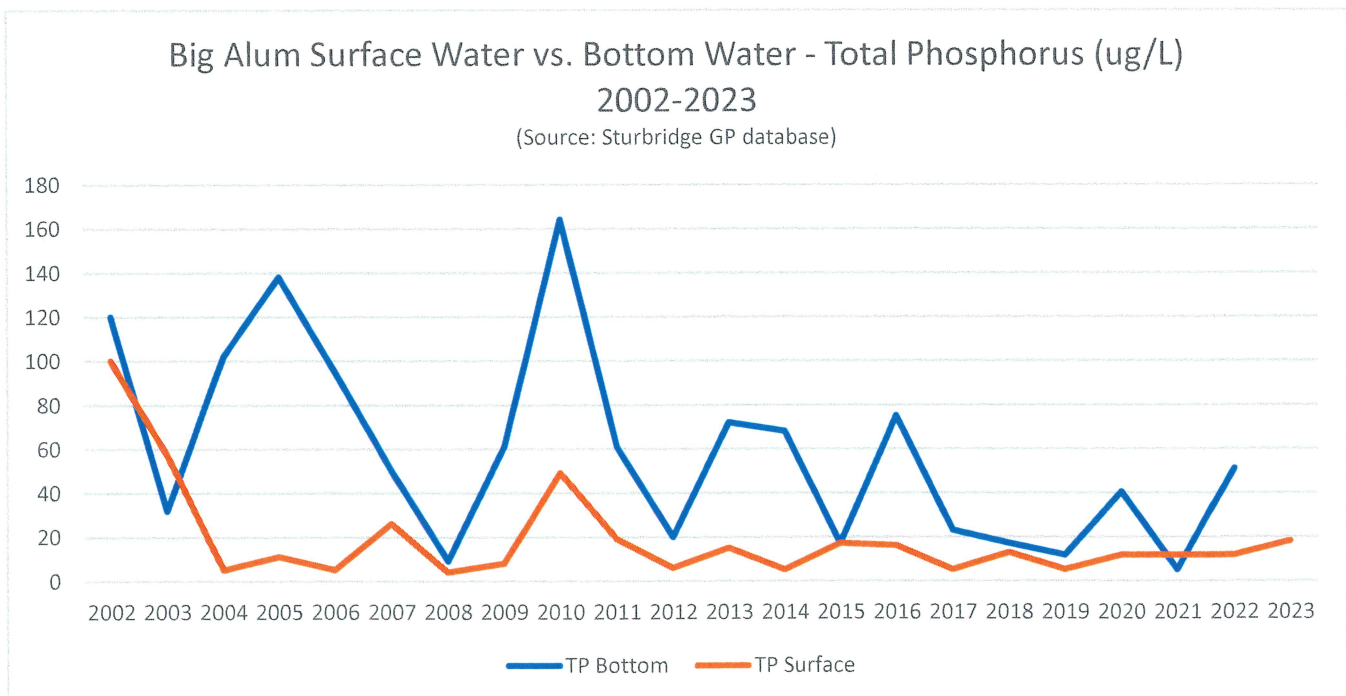
Since Sonar is maintained at the target concentration within the plant beds for the full growing season, you would simply apply it early in the growing season and add booster treatments throughout the season as concentrations within the plant beds fall off.

Anticipated costs for using the systemic herbicide Sonar would be on the order of \$1,200 per acre treated, although deeper areas could approach \$1,500 per acre. Assuming a treatment area of up to 40 acres, a cost of \$48,000 should be expected. Although this cost is more than the 3-year contact herbicide approach, the results should be more effective and longer lasting due to the use of a systemic herbicide. TRC recommends using the Sonar at this time.

### Water Quality

TRC collected a single water quality sample from the pond on September 10, 2023 to assess phosphorus in response to a reported algal bloom. The sample we collected was tested to be 18 ug/L, the highest value since 2011 when compared with the Sturbridge Great Ponds long term database for Big Alum. Values more than 15 ug/L are typically where algal bloom problems begin to occur and values exceeding 25 ug/L routinely result in more severe algae blooms in this region of the country.

Additionally, our review of this extensive long-term data set shows that Big Alum has had very high phosphorus in its bottom water consistently over the past 20 years, which indicates that you are likely experiencing a significant internal recycling of phosphorus from the sediment. This is typical for lakes as they age, but humans have obviously accelerated the process at Big Alum.



BALA should consider having the sediment phosphorus content assessed next season to determine how significant this source of phosphorus is to the overall nutrient budget for the pond. If it's a high percentage, then the pond would be a good candidate for a high dose alum treatment, similar to what was done at nearby South Pond, to stop the sediment release of phosphorus.

Regarding ongoing water quality assessments, the fact that the Town of Sturbridge supports the lakes with such an extensive long-term monitoring program means that lake associations do not need to expend funding to collect this valuable data. We do recommend that BALA initiate a volunteer water quality monitoring program of their own to track water clarity in the middle of the lake every two weeks throughout the summer. Using a simple Secchi disk on a marked line and recording depths every two weeks would be valuable information in understanding the impacts of algae and algae blooms on water clarity over the summer and across multiple years. Costs for such a program would be under \$100 for the Secchi disk and line.

### Recommendations for 2024 and Beyond

Based on our 2023 plant survey we recommend the following actions for 2024:

- Treat the pond to manage growth of curly-leaf and clasping leaf pondweed in accordance with the above recommendations. TRC recommends the use of Sonar in 2024. Estimated Cost \$48,000
- Map plant growth during late April or early May to map curly-leaf pondweed before it would naturally die back (typically late June each year). Cost: \$2,500
- Map plant growth in August to evaluate the effects of the 2024 treatment on clasping leaf pondweed. Cost \$2,500
- Assess algae community in August or during a bloom to determine which species are present and how dense these are within the water column. Cost \$400
- Evaluate the phosphorus content of the sediment and determine whether an alum treatment would be beneficial to the pond to mitigate future algae blooms. Cost \$1,800 if performed with plant assessment.
- Initiate a volunteer supported water clarity tracking database with Secchi Disk measurements every two weeks. Cost \$100.

### Recommendations for 2025 and Beyond

- Map plants annually in May and August to quantify the carry-over control of the curly-leaf and clasping leaf pondweeds and to make recommendations for the upcoming year. Cost \$5,500
- Evaluate the need to perform contact herbicide spot-treatments in 2025 and subsequent years and perform these if necessary.

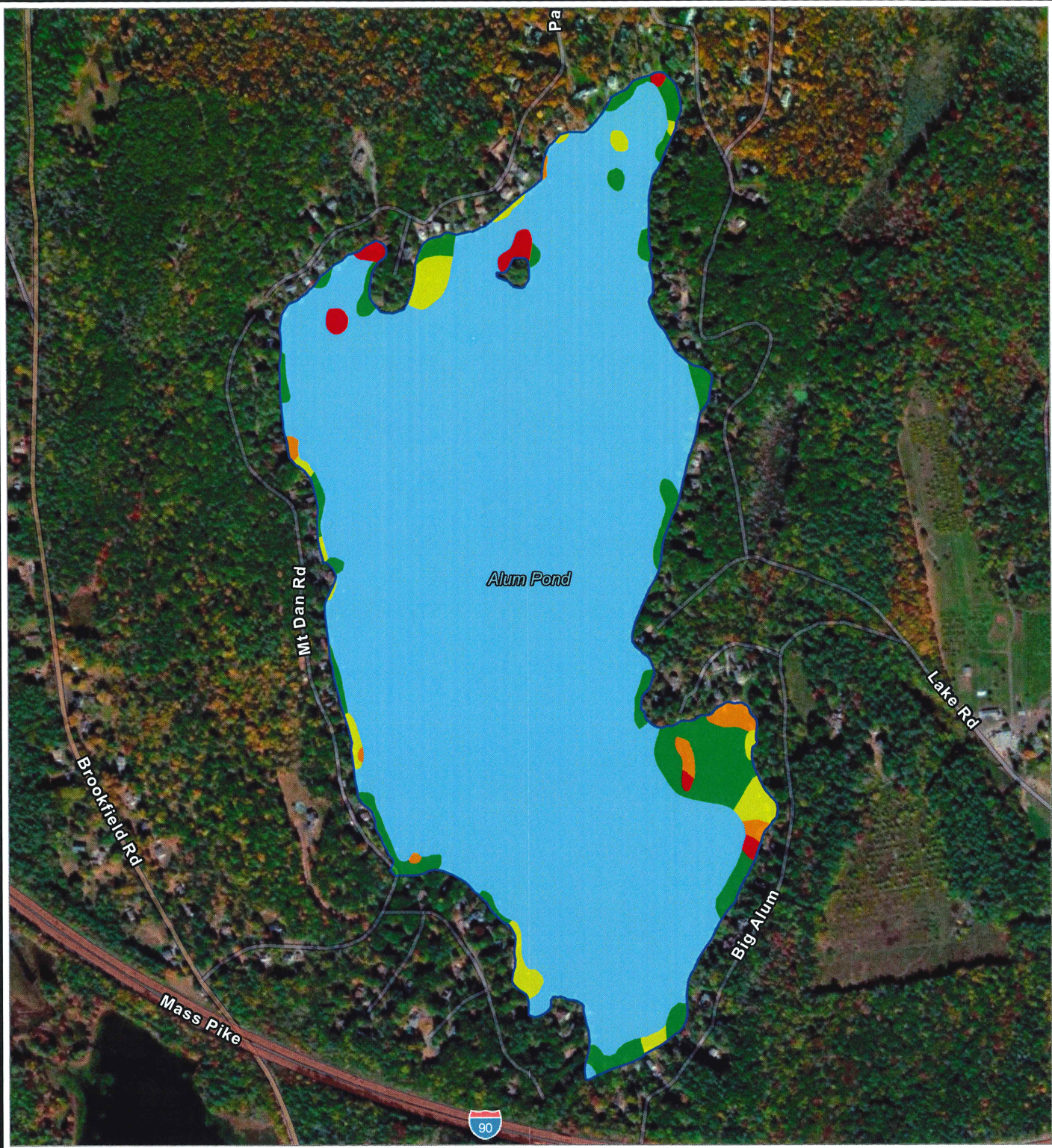
Sincerely,







**TRC ENVIRONMENTAL CORPORATION**

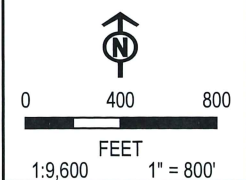


Carl Nielsen, CLM  
Sr. Program Manager

Attachments: Figures 1, 2 and 3



	POND OUTLINE
<b>PLANT COVER</b>	
	0% (178.8 ACRES)
	1% - 25% (12.1 ACRES)
	26% - 50% (4.4 ACRES)
	51% - 75% (1.6 ACRES)
	76% - 100% (1.7 ACRES)



PROJECT: **BIG ALUM LAKE ASSOCIATION**  
STURBRIDGE, MASSACHUSETTS

TITLE: **PLANT COVER**

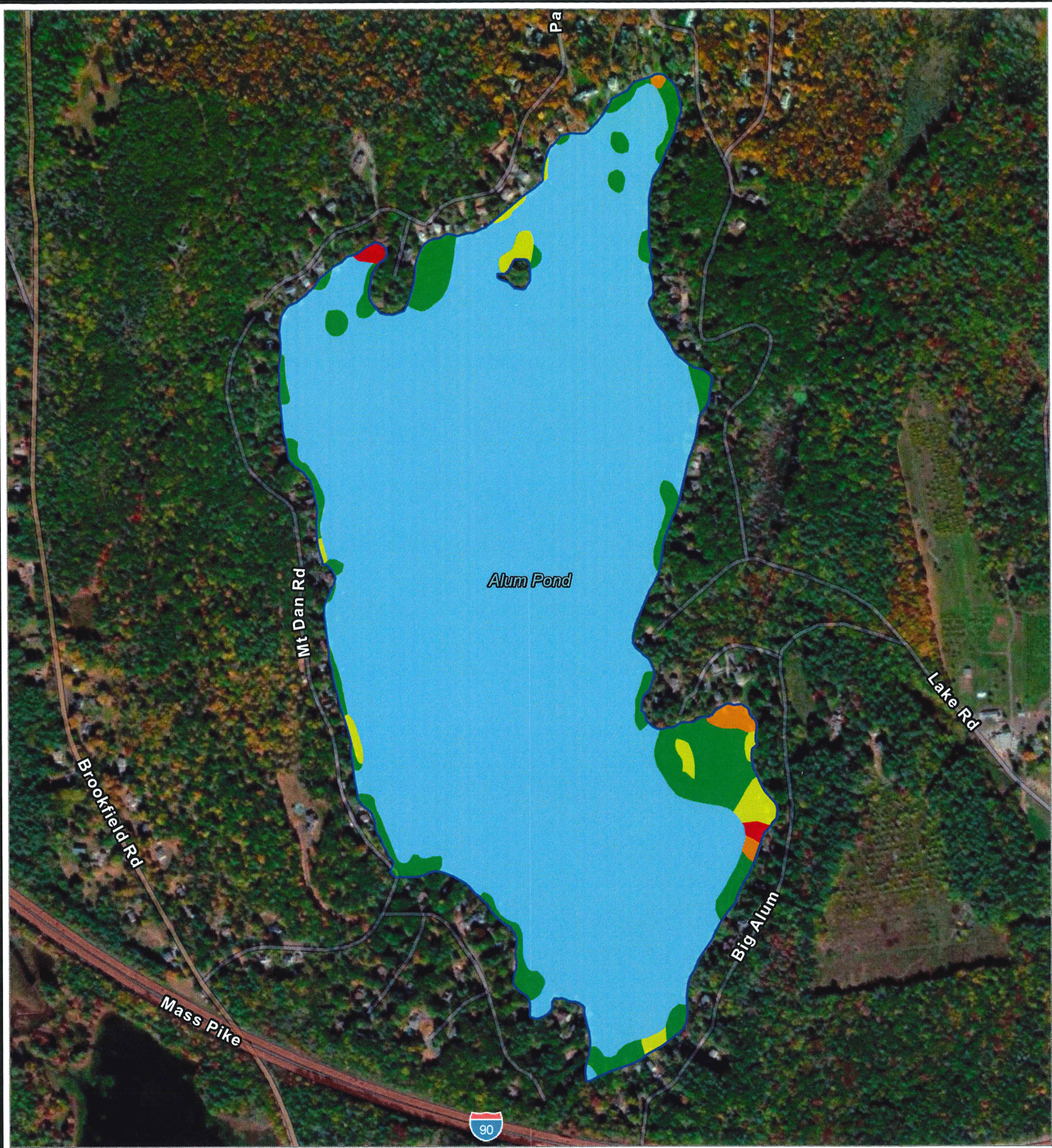
DRAWN BY: K. BACHAND	PROJ. NO.: 563297
CHECKED BY: S. DEHAINAUT	<b>FIGURE 1</b>
APPROVED BY: C. NIELSEN	
DATE: SEPTEMBER 2023	

 10 HEMINGWAY DRIVE  
2ND FLOOR  
EAST PROVIDENCE, RI 02915  
PHONE: 401.330.1236

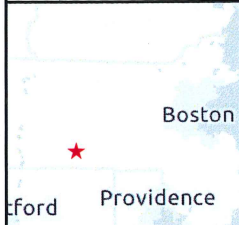
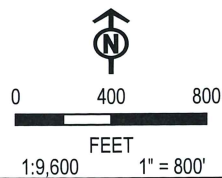
FILE: 563297\_BIGALUMLAKE\_PLANTMAPPINGFIGS

BASE MAP: ESRI WORLD IMAGERY, 2020  
DATA SOURCES: TRC, GPS LOCATIONS, 8/24/2023

COORDINATE SYSTEM: NAD 1983 STATEPLANE MASSACHUSETTS MIDDLEBURY FIPS 5001 FEET; PROJECTION: NAD83 STATEPLANE MASSACHUSETTS MIDDLEBURY FIPS 5001 FEET; DATA SOURCES: TRC, GPS LOCATIONS, 8/24/2023



	POND OUTLINE
<b>PLANT BIOVOLUME</b>	
	0% (178.8 ACRES)
	1% - 25% (15.4 ACRES)
	26% - 50% (2.9 ACRES)
	51% - 75% (1.0 ACRES)
	76% - 100% (0.59 ACRES)



PROJECT: **BIG ALUM LAKE ASSOCIATION  
STURBRIDGE, MASSACHUSETTS**

TITLE: **PLANT BIOVOLUME**

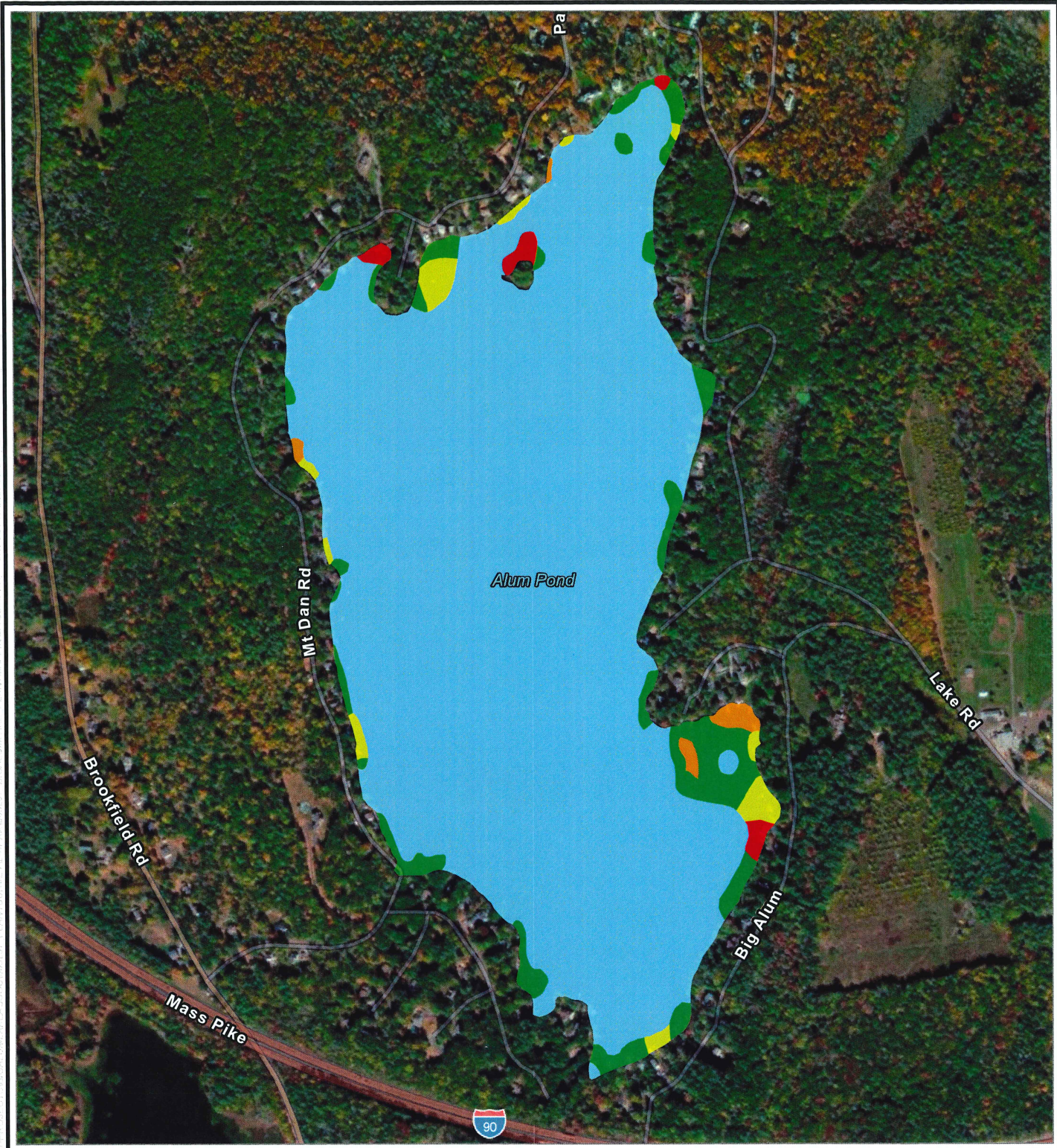
DRAWN BY: K. BACHAND	PROJ. NO.: 563297
CHECKED BY: S. DEHAINAUT	<b>FIGURE 2</b>
APPROVED BY: C. NIELSEN	
DATE: SEPTEMBER 2023	

**TRC**  
10 HEMINGWAY DRIVE  
2ND FLOOR  
EAST PROVIDENCE, RI 02915  
PHONE: 401.330.1236

FILE: 563297\_BIGALUMLAKE\_PLANTMAPPINGFIGS

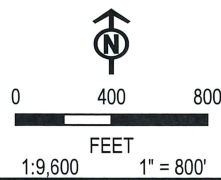
BASE MAP: ESRI WORLD IMAGERY, 2020  
DATA SOURCES: TRC, GPS LOCATIONS, 8/24/2023

COORDINATE SYSTEM: NAD 1983 STATEPLANE MASSACHUSETTS MIDDLEBURY FIPS 5004 FEET, 5000 FOOT UTM ZONE 18Q UTM  
SOURCE: B. F. ROBINSON, JR. 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023



**CLASPING LEAF PONDWEED COVER**

- 0% (181.0 ACRES)
- 1% - 25% (11.7 ACRES)
- 26% - 50% (3.2 ACRES)
- 51% - 75% (1.3 ACRES)
- 76% - 100% (1.5 ACRES)



PROJECT: **BIG ALUM LAKE ASSOCIATION  
STURBRIDGE, MASSACHUSETTS**

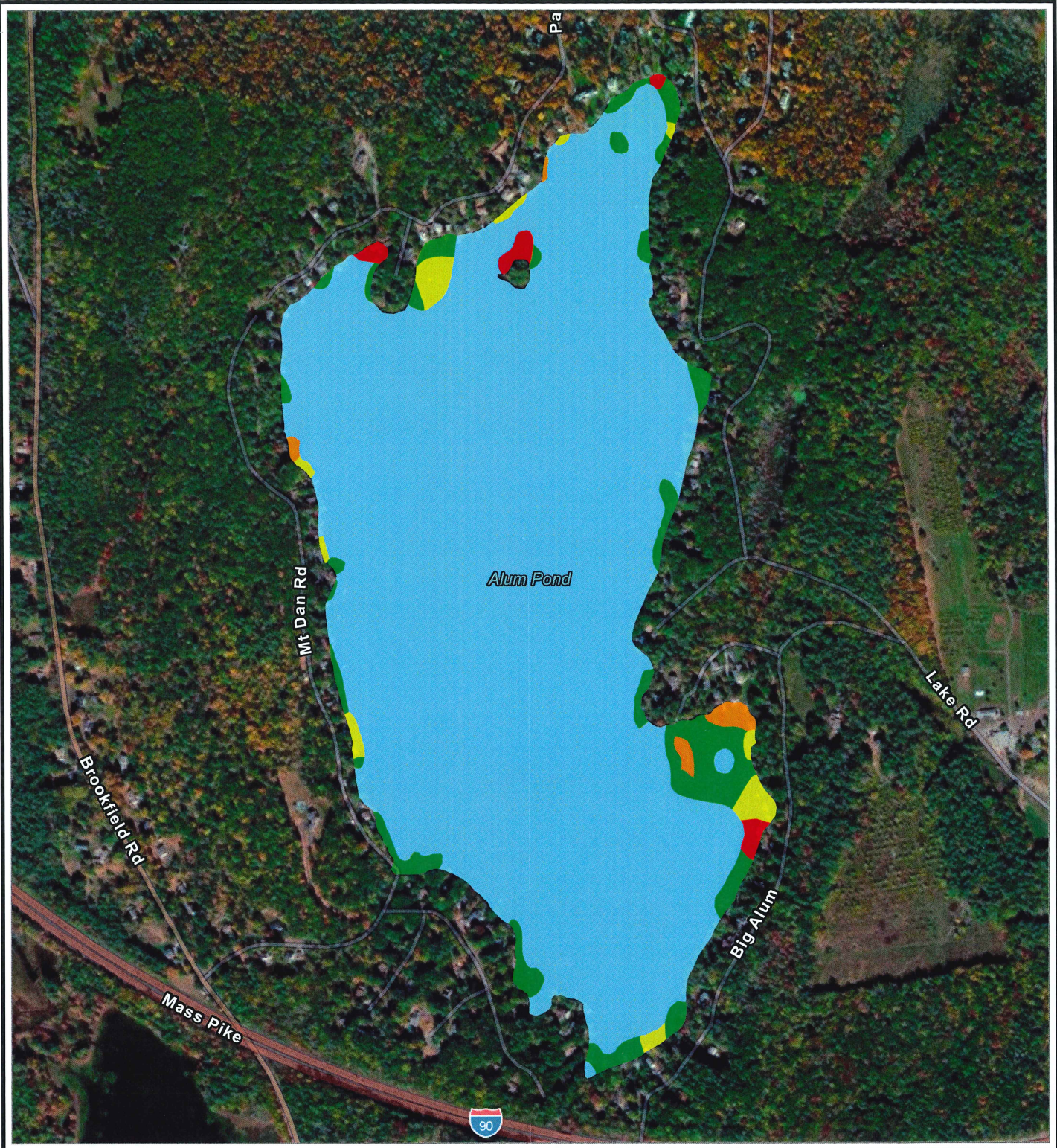
TITLE: **CLASPING LEAF PONDWEED COVER**

DRAWN BY: K. BACHAND	PROJ. NO.: 563297
CHECKED BY: S. DEHAINAUT	<b>FIGURE 3</b>
APPROVED BY: C. NIELSEN	
DATE: SEPTEMBER 2023	

	10 HEMINGWAY DRIVE 2ND FLOOR EAST PROVIDENCE, RI 02915 PHONE: 401.330.1236
FILE:	563297_BIGALUMLAKE_PLANTMAPPINGFIGS

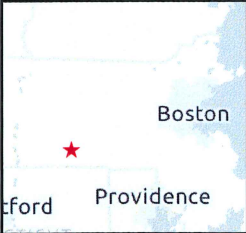
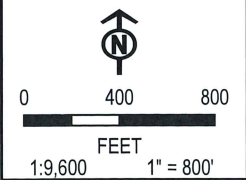
BASE MAP: ESRI WORLD IMAGERY, 2020  
 DATA SOURCES: TRC, GPS LOCATIONS, 8/24/2023

COORDINATE SYSTEM: NAD 83 STATEPLANE MASSACHUSETTS BANGOR FIPS 5001 FEET, BMAP PROJID=10  
 DRAWN BY: K. BACHAND, DATE: 09/20/23, 17:48:09 PM, FILE PATH: C:\PROJECTS\2023\563297\_BIGALUMLAKE\_PLANTMAPPING\FIGS\FIGURE 3



**CLASPING LEAF PONDWEED COVER**

- 0% (181.0 ACRES)
- 1% - 25% (11.7 ACRES)
- 26% - 50% (3.2 ACRES)
- 51% - 75% (1.3 ACRES)
- 76% - 100% (1.5 ACRES)



PROJECT: **BIG ALUM LAKE ASSOCIATION  
STURBRIDGE, MASSACHUSETTS**

TITLE: **CLASPING LEAF PONDWEED COVER**

DRAWN BY: K. BACHAND	PROJ. NO.: 563297
CHECKED BY: S. DEHAINAUT	<b>FIGURE 3</b>
APPROVED BY: C. NIELSEN	
DATE: SEPTEMBER 2023	

	10 HEMINGWAY DRIVE 2ND FLOOR EAST PROVIDENCE, RI 02915 PHONE: 401.330.1236
FILE:	563297_BIGALUMLAKE_PLANTMAPPINGFIGS

BASE MAP: ESRI WORLD IMAGERY, 2020  
 DATA SOURCES: TRC, GPS LOCATIONS, 8/24/2023

COORDINATE SYSTEM: NAD 83 UTM ZONE 18Q UTM PROJECTION  
 DATUM: NAD 83  
 UNIT: METERS  
 AUTHORITY: ESRI  
 SOURCE: ESRI WORLD IMAGERY, 2020  
 DATA SOURCES: TRC, GPS LOCATIONS, 8/24/2023