



# Year-End Report for the 2017 Management of: **Baddacook Pond**

*Groton, MA*



**Submitted: December 15, 2017**

SOLitude Lake Management  
590 Lake Street  
Shrewsbury, MA 01545  
Phone: (508) 480-5253  
FAX: (888) 358-0088  
info@solitudelake.com  
www.solitudelakemanagement.com



# Table of Contents

---

Introduction.....	3
Pre-Management Assessment .....	3
Mechanical Harvesting Plan and Operation .....	3
Mechanical Hydro-raking Plan and Operation .....	4
Post-Management Survey Summary .....	5
Summary and Ongoing Management Recommendations .....	6
Appendices/Graphs.....	7



## INTRODUCTION

Below is a summation of the Baddacook Pond 2017 aquatic management project. This report details all aspects of this program including: surveys, harvesting/hydro-raking data, and ArcGIS mapping of the management areas. This project was performed for and funded by the Town of Groton, with the objective of reducing plant biomass and restoring open-water areas throughout the littoral zone of Baddacook Pond.

## PRE-MANAGEMENT ASSESSMENT

The Pre-Management Assessment was performed on May 24, 2017 by a SŌLitude Aquatic Specialist. The waterbody's littoral zone was surveyed using two techniques: throw-rake tosses and hydro-acoustic sonar. Throw-rake tosses were performed periodically to assess the distribution and density of the aquatic vegetation assemblage. Hydro-acoustic sonar provides the ability to determine the extent of growth within the pond. Approximately 36% of the waterbody exhibited some degree of vegetation growth, mostly found in water depths less than 10-feet. The submersed macrophyte community was co-dominated by two invasive species, variable water milfoil (*Myriophyllum heterophyllum*) and fanwort (*Cabomba caroliniana*). Other beneficial native species included large-leaf pondweed (*Potamogeton amplifolius*), with stonewort (*Nitella* sp.) and other pondweed species (*Potamogeton* sp.) less frequently encountered. Shallow areas of the pond, with water depths less than 4-feet, and a mucky substrate were densely populated with white waterlily (*Nymphaea odorata*), yellow waterlily (*Nuphar variagata*), and watershield (*Brasenia schreberi*) that were beginning to have surface leaves. Please refer to **Figure 1**, for a map of the Pre-management acoustic sonar map, exhibiting the biovolume data within Baddacook Pond.

## MECHANICAL HARVESTING PLAN AND OPERATIONS

Prior to harvesting operations, SOLitude Lake Management (SOLitude) applied for a Special Use Permit to use the boat launch during operations. Once this was obtained (Permit #10990), it was determined that mechanical harvesting would begin the week of July 31, 2017. To that end, on July 31<sup>st</sup>, the container service and loader rental were prepared at the Baddacook Pond Boat Launch and operations commenced utilizing the town's aquatic weed harvester.



Seventeen (17) days of mechanical harvesting ensued, concluding on August 29. During operations, all collected material was off-loaded into a skid steer loader at the designated off-loading area. The plant material was then placed into a container to properly de-water (**Image 1**). Once full the containers were transported to the local landfill/composting site. During operations the harvester operator started south and then proceeded around the pond in a counter clockwise fashion, focusing on invasive species removal and recouping open water space. Please refer to **Figure 2** for a map of the harvested areas during this management period.



**Image 1:** Photo of the dumpster at the off-loading area

In sum, the 2017 harvesting effort totaled 136 hours and collected a total of 6 containers, equating to 180 cubic yards of plant material. This comprised of a combination of invasive aquatic vegetation including Fanwort and Variable Milfoil.

## MECHANICAL HYDRO-RAKING PLAN AND OPERATIONS

Prior to mechanical hydro-raking services the loader and container service were placed at the Baddacook Boat Launch. Once complete, mechanical hydro-raking services commenced on September 22, 2017. Nineteen (19) days of mechanical hydro-raking ensued, concluding on October 18, 2017. During operations, the hydro-rake off-loaded the collected organic material onto the harvester conveyor. Once full the harvester operator transported the material to the designated off-loading site. From there, the same process took place as the previous harvesting operation.

Hydro-raking services were performed on select areas of Baddacook Pond, including both common areas as well as private shoreline areas. Please refer to **Figure 3** for a map of the designated hydro-raking areas, as well as **Appendix A** for a chart of the areas Hydro-raked each day. The collected organic material comprised of a combination of accumulated organic matter, floating islands, emergent vegetation, floating-leaf vegetation, and submersed vegetation.

In sum, the 2017 hydro-raking effort totaled 160 hours and collected a total of 52 containers, equating to 780 cubic yards of plant material, root systems and organic



matter. Please refer to **Image 1** and **2** for photos of before and after hydro-raking around the boat launch.



**Image 1:** Photo of the Baddacook Pond boat launch before the hydro-raking operation



**Image 2:** Photo of the Baddacook Pond boat launch after the hydro-raking operation

## POST MANGMENT SURVEY SUMMARY

The Post-Management Survey was performed by a SŌlitude Aquatic Specialist on October 25, 2017. A similar survey methodology to the Pre-Management Assessment was performed utilizing throw-rake tosses and hydro-acoustic sonar. While variable watermilfoil and fanwort continued to be the co-dominant vegetation observed in the waterbody, neither species were topped-out; both were commonly observed 1-2 feet below the water's surface. The most prevalent areas of their growth were just south of the boat ramp on the western shoreline and the two southern-most coves. Again, large-leaf pondweed was the most common





native species, growing along the western shoreline. Other species observed in trace and sparse densities included stonewort, coontail (*Ceratophyllum demersum*), and other pondweed species. Floating-leaf species growth was senescing, but significant reductions were observed along the portions of the shoreline and high-use areas of the pond. Please refer to **Figure 4** for a map of the collected hydro-acoustic data. As shown, the majority of hydro-raked areas showed a large decrease in collected biovolume in the post management survey. The most prominent reductions were shown in the northern cove area as well as the western cove. These areas contained 80-90% biovolume in the pre-management survey which reduced to about 40-50% in the post management survey.

## SUMMARY AND ONGOING MANAGEMENT RECOMMENDATIONS

Overall, the 2017 program ran smoothly, effectively maintaining Baddacook Pond and reducing a total of 960 cubic yards of plant biomass within the open water space. The harvesting effort successfully controlled the variable watermilfoil and fanwort infestation for two months, with the plants still shown 1 to 2 feet under the water's surface in the post management survey at the end of October. The hydro-raking effort also showed positive results as shown in the attached biovolume maps. Our objective of reducing plant biomass and restoring open-water areas throughout the littoral zone of Baddacook Pond was achieved.

Keeping the objectives of this project in mind, SOLitude is recommending the same management approach next year encompassing both mechanical harvesting and hydro-raking methods. Based on next year's results, we will be able to precisely examine the success of these two management techniques. Looking ahead to 2018, SOLitude recommends coordinating the pre-management survey in close proximity to the commencement of the mechanical harvesting efforts; this will enhance the accuracy of the data regarding the success of the harvesting efforts.



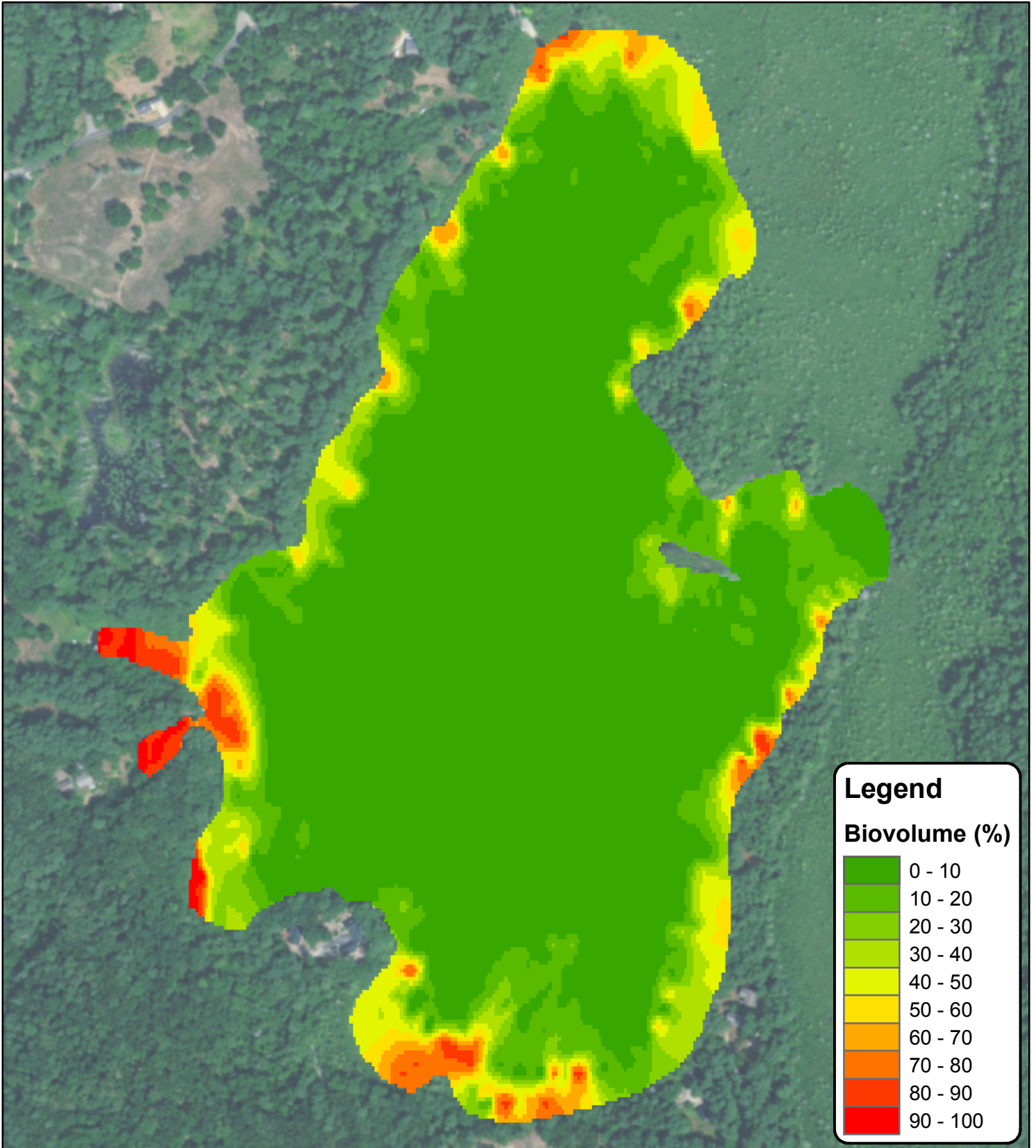
## **Appendix A:**

A chronology of this past year's management events follows:

Date	Area Hydro-raked
9/22/2017	Area 1
9/25/2017	Area 1
9/26/2017	Area 1
9/27/2017	Area 1 & 2
9/28/2017	Area 4
9/29/2017	Area 5
10/2/2017	Area 5
10/3/2017	Area 5
10/4/2017	Area 6
10/5/2017	Area 6
10/6/2017	Area 7
10/9/2017	Area 8
10/10/2017	Area 8
10/11/2017	Area 8 & 9
10/12/2017	Area 9
10/13/2017	Area 2
10/16/2017	Area 2
10/17/2018	Area 2
10/18/2017	Area 2



FIGURE 1: Pre-management Biovolume (May 2017)



**Baddacook Pond**  
Groton, MA  
Middlesex County  
42.620853°, -71.530631°



**Baddacook Pond**

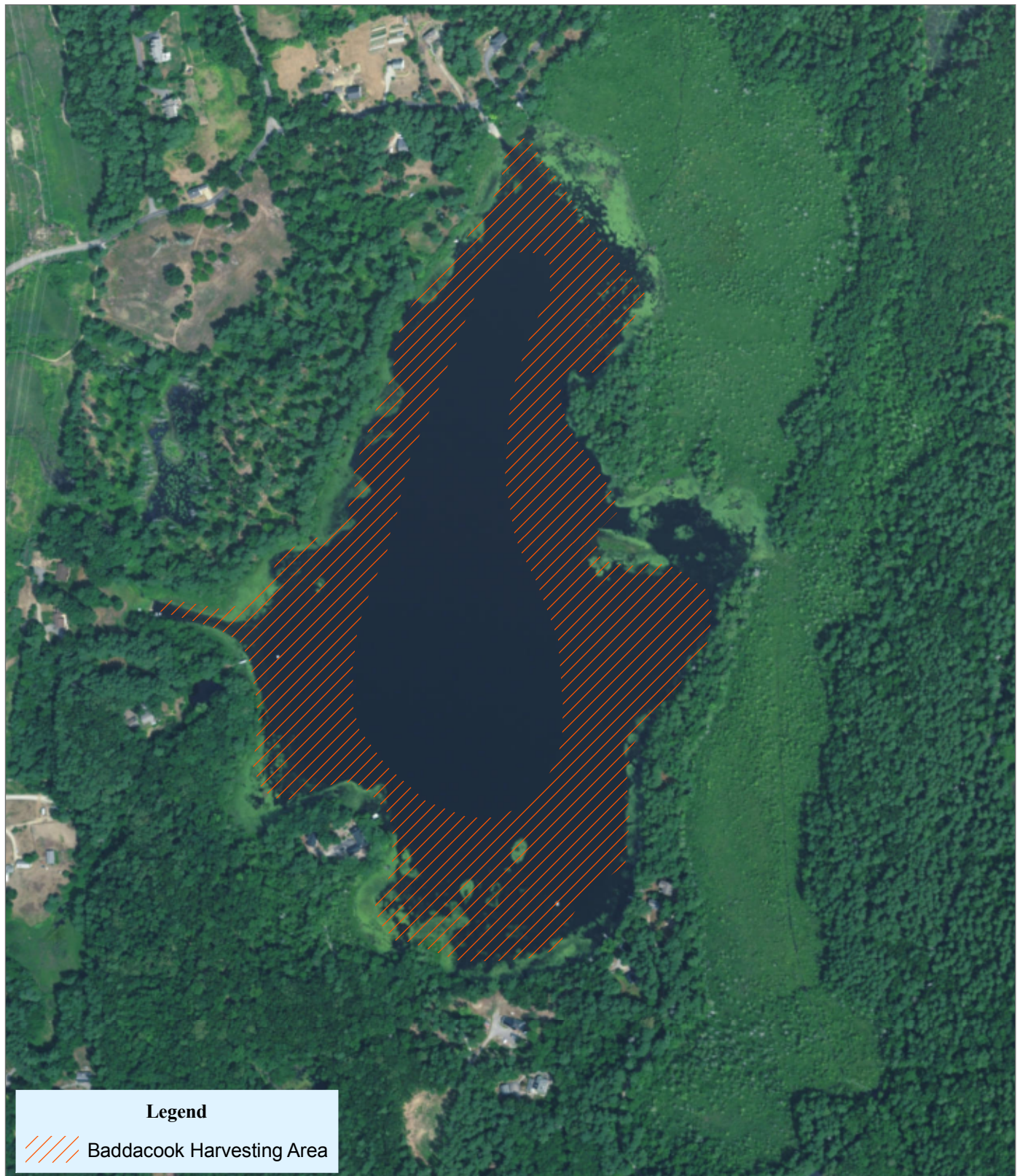
0 250 500  
Feet  
1:4,500



Map Date: 12/4/17  
Prepared by: MS  
Office: SHREWSBURY, MA



Figure 2: 2017 Harvested Areas



**Baddacook Pond**  
**Groton**  
**Massachusetts**



Map Prepared: 08/23/17  
Basemap © 2013 Esri

0 250 500  
1:6,050 Feet



**SOLITUDE**  
LAKE MANAGEMENT



Figure 3: 2017 Hydro-raked Areas



**Baddacook Pond**  
**Groton**  
**Massachusetts**



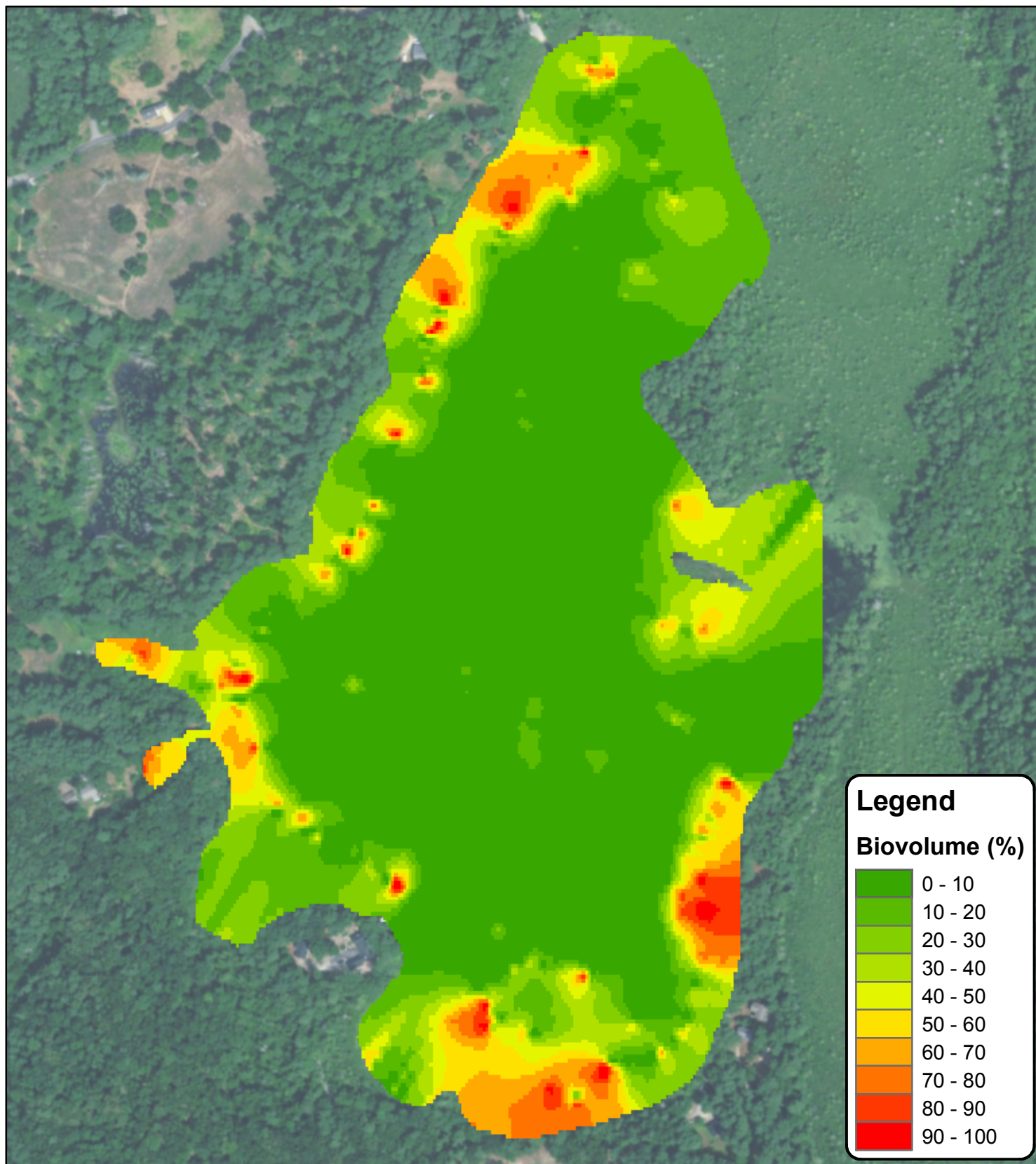
Map Prepared: 10/8/17  
Basemap © 2013 Esri

0 250 500  
1:5,000 Feet



**SOLITUDE**  
LAKE MANAGEMENT

FIGURE 4: Post-management Biovolume (October 2017)



**Baddacook Pond**  
Groton, MA  
Middlesex County  
42.620853°, -71.530631°



**Baddacook Pond**

0 240 480  
Feet  
1:4,500



Map Date: 12/12/17  
Prepared by: MS  
Office: SHREWSBURY, MA