Aquatic Evaluation at Minister/Schoolhouse Pond

2017 Final Report October 2017

Prepared For:

Town of Eastham
c/o Jane Crowley, Health Dept.
Eastham, MA 02642

Prepared By:

SŌLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

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INTRODUCTION

SŌLitude Lake Management (SŌLitude) was contracted by the town of Eastham to assess the existing aquatic growth and water quality conditions within Minister/Schoolhouse Pond due to concerns with the effects of watershed development and runoff into the ponds.

The 22.3-acre pond is comprised of two basins located in Eastham, MA. The pond is commonly called Minister Pond, but has a lower basin often individually referred to as Schoolhouse Pond. Water flows into the Minister basin and out through the Schoolhouse basin. The basins have adequate depth for their size, 16.8 acres and 5.6 acres respectively, with a maximum reported depth of 4.30 meters in the Minister basin and 4.54 meters in the Schoolhouse basin. According to StreamStats, nearly the entire watershed is residentially developed, potentially contributing to nutrient influx into the pond. In 2009, an assessment of the Eastham ponds was directed by the Town and Cape Cod Commission, founding the need for remediation of Minister/Schoolhouse Pond.

The Town of Eastham is pursuing a study and management program of Minister/Schoolhouse Pond to assess the development of unbalanced aquatic conditions since 2009. The foci of the survey were to document current plant growth conditions and assess water quality parameters in order to evaluate the overall health of the ponds and develop a recommended management program for maintenance of ecological balance.

The following report will discuss: survey methodology, vegetation assemblage, water quality results, a summary of results and concerns, and management recommendations concentrated on rectifying conditions in Minister/Schoolhouse Pond.

SURVEY METHODOLOGY

A point-intercept survey methodology was employed to document and quantify aquatic vegetation growth within the waterbody. A georeferenced 40-m grid data layer was placed over an orthophoto of Minister/Schoolhouse Pond and data collection points were placed at each vertex, with a total of fifty (50) representative collection sites (Figure 1). A GPS was used to locate each data point in the field, with the following data collected at each point: aquatic plant species, relative density of each species, and overall density. The abundance scale, developed by the US Army Corps of Engineers and modified by Cornell University, was used to categorize total observed plant growth:

T Trace: Finger-full on rake
S Sparse: Handful on rake
M Moderate: Rake-full of plants
D Dense: Difficult to bring into boat

Water quality samples were collected at two locations within the pond, at the relative centers of each basin. The samples were analyzed for the following parameters: pH, turbidity, apparent color, true color, nitrate, ammonia, total phosphorus, dissolved phosphorus, chlorophyll A, total alkalinity, and algae identification and enumeration. Field testing of temperature and dissolved oxygen profiles was also performed at the two locations within the waterbody.

RESULTS & ANALYSIS

Vegetation Inventory

On June 7, 2017, a SŌLitude Biologist performed the detailed survey of Minister/Schoolhouse Pond – no invasive species were documented at the pond. Only 25 of the 50 points contained vegetation, of which 17 native species were identified within the pond (Table 1). Vegetation growth was spread throughout the pond with an average of three (3) species per vegetated point, and a maximum richness of six (6) species. Please see Appendix A for raw data. A list of plant species identified during the survey follows:

Table 1: Identified Vegetation Species	
Common Name	Latin Name
Watershield	*Brasenia schreberi*
Coontail	*Ceratophyllum demersum*
Spikerush	*Eleocharis sp.* likely *E. acicularis*
Western waterweed	*Elodea nuttallii*
Aquatic moss	*Fontinalis sp.*
Stonewort	*Nitella sp.*
Yellow waterlily	*Nuphar variegata*
White waterlily	*Nymphaea odorata*
Floating heart	*Nymphoides cordata*
Ribbonleaf pondweed	*Potamogeton epihydrus*
Small pondweed	*Potamogeton pusillus*
Humped bladderwort	*Utricularia gibba*
Lesser bladderwort	*Utricularia minor*
Whorled bladderwort	*Utricularia purpurea*
Little floating bladderwort	*Utricularia radiata*
Common bladderwort	*Utricularia vulgaris*
Tapegrass	*Vallisneria americana*

Overall density of the pond was low, in-part due to the seasonality of the survey (Figure 2). White waterlily, yellow waterlily, and humped bladderwort were found most commonly throughout Minister/Schoolhouse Pond (Figure 3). Due to the early nature of the survey, the vegetation growth likely increased throughout the growing season at various locations within the pond.

The Minister and Schoolhouse basins displayed slight differences in vegetation distribution and species richness. The Minister basin supported 16 of the 17 aquatic plant species found within the pond, while the Schoolhouse basin only supported ten (10). As shown in Figure 3, western waterweed, tapegrass, lesser bladderwort, whorled bladderwort, spike rush, stonewort, and small pondweed were species only found in the Minster basin.

Emergent and wetland edge vegetation grew most prominently along the less developed edges of the pond. A small native population of pennywort (*Hydrocotyle sp.*) was located on the southeastern corner of the Schoolhouse basin, adjacent to the launch (pictured to right). The growth form was too young to speciate between whorled marsh pennywort (state protected) or many-flowered pennywort (common). Three stands of invasive common reed (*Phragmites australis*) were documented along the perimeter of the Minster basin in relation to point locations 1, 2, and 8. Common reed is an aggressive non-native wetland species that rapidly grows and spreads. Invasive species such as common reed are a significant threat to native vegetation buffers, especially small herbaceous species such as pennywort.

Water Quality

Water quality sampling was conducted in order to establish baseline data and identify potential management concerns. The following contains information regarding the 2017 sample analysis results along with more detailed descriptions of each parameter and their significance to the freshwater ecosystem.

Table 2: Water Quality Sampling Results Collected 6/7/2017		
Parameter	Minister basin	Schoolhouse basin
Turbidity (NTU)	2.0	1.7
True Color	26	20
Apparent Color	46	34
Total Alkalinity (mg $CaCO_3$/L)	7.10	7.40
pH	6.5	6.8
Ammonia (mg/L)	ND*	ND*
Nitrate (mg/L)	ND*	ND*
Total Phosphorus (mg/L)	0.034	0.039
Dissolved Phosphorus (mg/L)	ND*	0.013
Chlorophyll A (µg/L)	13.4	15.5
Secchi disk (ft)	4'2.5"	4'4"

*ND is a 'Non-Detect result based off of the minimum value reading of a laboratory meter.

<u>*Turbidity*</u> is a relative measurement of suspended material in the water, measured through a process involving light diffraction of the pond sample as compared to a series of prepared samples. Turbidity values in most waterbodies rarely rise above 5 NTU. A value greater than 10 NTU indicates high suspended solids, often due to increased runoff, high inflow, or activities within the pond and/or the watershed. Suspended solids include soil particles (clay, silt, sand), algae, and plankton. *Both samples low NTU, indicating very little suspended solids were present within the water column at the time of sampling.*

Color is a visual parameter, separated into unfiltered (Apparent) and filtered (True) measurements.

Apparent color is the color of unfiltered pond water, caused by suspended and dissolved matter. This value can change drastically depending on weather condtiions: increase with storm events, decrease with drought. There are four approximate categories for Color: 0-25 is clear, 25-40 is light tea-color, 40-80 is tea color, >80 is dark tea color. *The Minister basin categorizes at tea color, whereas the Schoolhouse basin measures at a light tea color. Some particulates fall out of suspension while water flows from Minister to Schoolhouse.*

True color is the color of filtered pond water, free of particulates; represents only dissolved organic matter (DOM) in the water column. This value can be subtraced from the Apparent color to determine the quality of water inputs. *The Minister basin measures at a light tea color, whereas the Schoolhouse basin measures as clear. At the time of the sampling, 56% of the color of Minister is DOM whereas DOM comprises 59% of the color in Schoolhouse.*

Alkalinity is a measure of buffering capacity of a waterbody against acid additions such as acid rain and pollution, which can be detrimental to wildlife populations. Values below 20 mg/L typically illustrates susceptibility to pH fluctuation. The standard range for surface waters is 20-200 mg/L. *The sample results for both basins fall below the typical range, which is typical of the New England region and indicative that the system is more suceptible to acid additions and ph fluctuations.*

pH ranges from 0-14, where zero is extremely acidic, seven is neutral, and 14 is most basic. pH represents the concentration of hydrogen ions (H+) in solution. A range of 5.5-8.5 is best for maintaining a healthy fishery. A stable pH (±1) is also important – fluctuations can adversely affect water chemistry and pond biota (fish, snails, plankton, plants, etc.). *Both basins fall within normal range.*

Nitrogen is a vital nutrient in the pond environment for plant and algae growth. Nitrogen exists in water as various compounds, influenced by the atmosphere, precipitation, biological activity, and water chemistry.

Ammonia is a measure of two constituents, NH_3 and NH_4^+, and is a transitional product in the breakdown of organic nitrogen into nitrate. It is typically short-lived in the pond environment except under conditions of low dissolved oxygen. Waterbodies that have a high pH are susceptible to high ammonia concentration; the higher the pH, the more ammonia will be present within the water column. High levels of ammonia typically indicate a eutrophic pond, and can be toxic to fish at higher levels. Levels lower than 0.3 mg/L can limit plant and algae growth when occurring with low phosphorus levels. *Both basins measured Non-Detect at 0.075 mg/L at the time of sampling.*

Nitrate is another form of nitrogen found in the water column. Nitrate is usually the most prevalent form of inorganic nitrogen in the water and results from natural aerobic bacteria activity and fertilizer use. It is also the form that is most readily available for plant and algae growth. Levels less than 0.05 mg/L are ideal. *Both basins measured Non-Detect at 0.1 mg/L at the time of sampling.*

Phosphorus is considered a limiting nutrient for aquatic plant growth in freshwater systems. Unlike nitrogen, Phosphorus does not interact with the atmosphere and remains contained within the aquatic system.

Total Phosphorus measures both particulate and dissolved phosphorus, where particulate phosphorus is generally not biologically available for algae growth. Generally, a total phosphorus value over 30 parts per billion (ppb, or 0.03 mg/L) is the threshold where algal growth can be problematic. Aquatic systems at <12 ppb are considered nutrient poor and oligotrophic; 12-24 ppb contain a moderate amount of nutrients and mesotrophic; 25-96 ppb are nutrient rich and eutrophic; >96 ppb contain excessive nutrients and hypereutrophic. *Both basins measured as mesotrophic at the time of sampling.*

Dissolved phosphorus remains in the water column, while particulate phosphorus settles to the lake bottom. Dissolved phosphorus is biologically available, and is used in aquatic processes such as plant and algae growth. *The Dissolved Phosphorus in the Minister basin was measured as Non-Detect at 0.02 mg/L and the Schoolhouse basin was measured at 0.013 mg/L, consistent with a mesotrophic status.*

Chlorophyll A is the most common type of chlorophyll in plants and algae that photosynthesize, or use sunlight to grow. Chlorophyll a can be measured as an estimate of phytoplankton within the water column, where concentrations are highest in the top portion of the water column, or the epilimnion. Measuring Chlorophyll A can indirectly monitor nutrient pollution from phosphorus and nitrogen, which can be indicative of eutrophication or potential water quality issues. 0-2.6 ug/L is oligotrophic, 2.7-20 ug/L is mesotrophic, 21-56 ug/L is eutrophic, >56 ug/L is hypereutrophic. *Both basins measure in the mesotrophic category.*

Secchi disk readings determine the clarity or turbidity of the water column in terms of depth, and can be used over consecutive years to analyze water quality trends. Secchi disk measurements can be used as one way to calculate the Trophic State Index (TSI) value of the waterbody. >4 m is oligotrophic, 4-2 m is mesotrophic, 2-1 m is eutrophic, <1 m is hypereutrophic. *Secchi depth readings for both basins were slightly deeper than one (1) meter, measuring as eutrophic.*

Dissolved Oxygen (DO) is important in aquatic systems. Aquatic fauna required adequate levels of oxygen, and the pond chemistry is also heavily affected by available oxygen. Values above 5.0 mg/L are desirable for most aquatic life, including most fish species, however lower values commonly occur near the sediment layer where oxygen and nutrient exchange are at a minimum. *See Figure 4 on the following page.*

Temperature – is one of the limiting factors for algae and plant growth; as temperature increases, biological activity (photosynthesis, respiration, and decomposition) increases to a point. Temperature is directly related to the amount of available dissolved oxygen, where warmer water holds less oxygen. In deeper waterbodies, temperature stratification occurs; a thermocline occurs at depth where the top layer is warmer and actively exchanges nutrients with the air. The bottom layer is distinctly cooler and isolated from surface impacts. *See Figure 4 on the following page.*

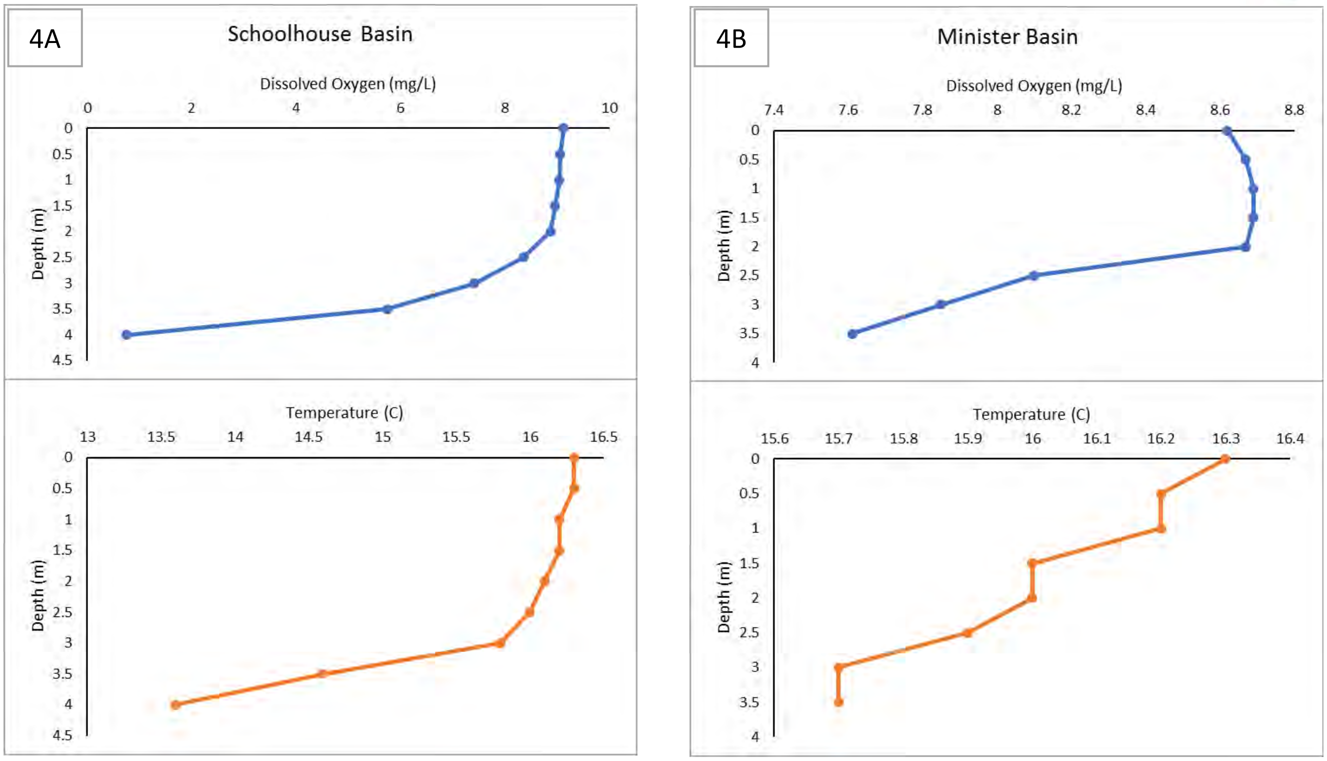


Figure 4A & B: Displays the profiles of Dissolved Oxygen and Temperature throughout the water column, surface to bottom.

At the time of the sampling, stratification had occurred in Schoolhouse basin with a thermocline between 3-3.5 meters depth, whereas the Minister basin was still in the process of mixing/settling.

Algae Identification and Enumeration is used to understand the planktonic-level biota within the waterbody. Algae are an important part of the aquatic food web, acting as primary producers while also providing a food source to zooplankton and planktivorous fish species, among other organisms. The identification of algae species within the surface water (epilimnion) can explain aspects of a waterbody such as odor, clarity, and turbidity. *Very few species and low counts for both basins were analyzed at the time of the sampling, where some species suggest odors during potential bloom events. Please see Appendix B for the Identification and Enumeration report.*

The water quality results classify Minister/Schoolhouse Pond as mesotrophic with eutrophic tendencies at the time of the sampling. The trophic status (Oligo-, Meso-, Eutro-, and Hypereutro-) is used to classify waterbodies in terms of their productivity, ranging from less productive to over-productive. Some nutrient loading seems to be occurring in the Minister basin and concentrating as the flow enters the Schoolhouse basin. A balance of nutrients is required for a sustainable ecosystem, where adequate biologically-available phosphorus is especially important as a driver for ecosystem health. An abundance of organic phosphorus can lead to phytoplankton blooms and speed the effects of eutrophication. Soft water can also challenge the promotion of a healthy fishery and help prevent the establishment of dense vegetation.

While mesotrophic at the time of sampling, aquatic conditions fluctuate throughout the season and are influenced by weather events, such as rain and wind, and any changes in the watershed. Additional sampling throughout the season is required for further analysis.

CONCLUSIONS & MANAGEMENT RECOMMENDATIONS

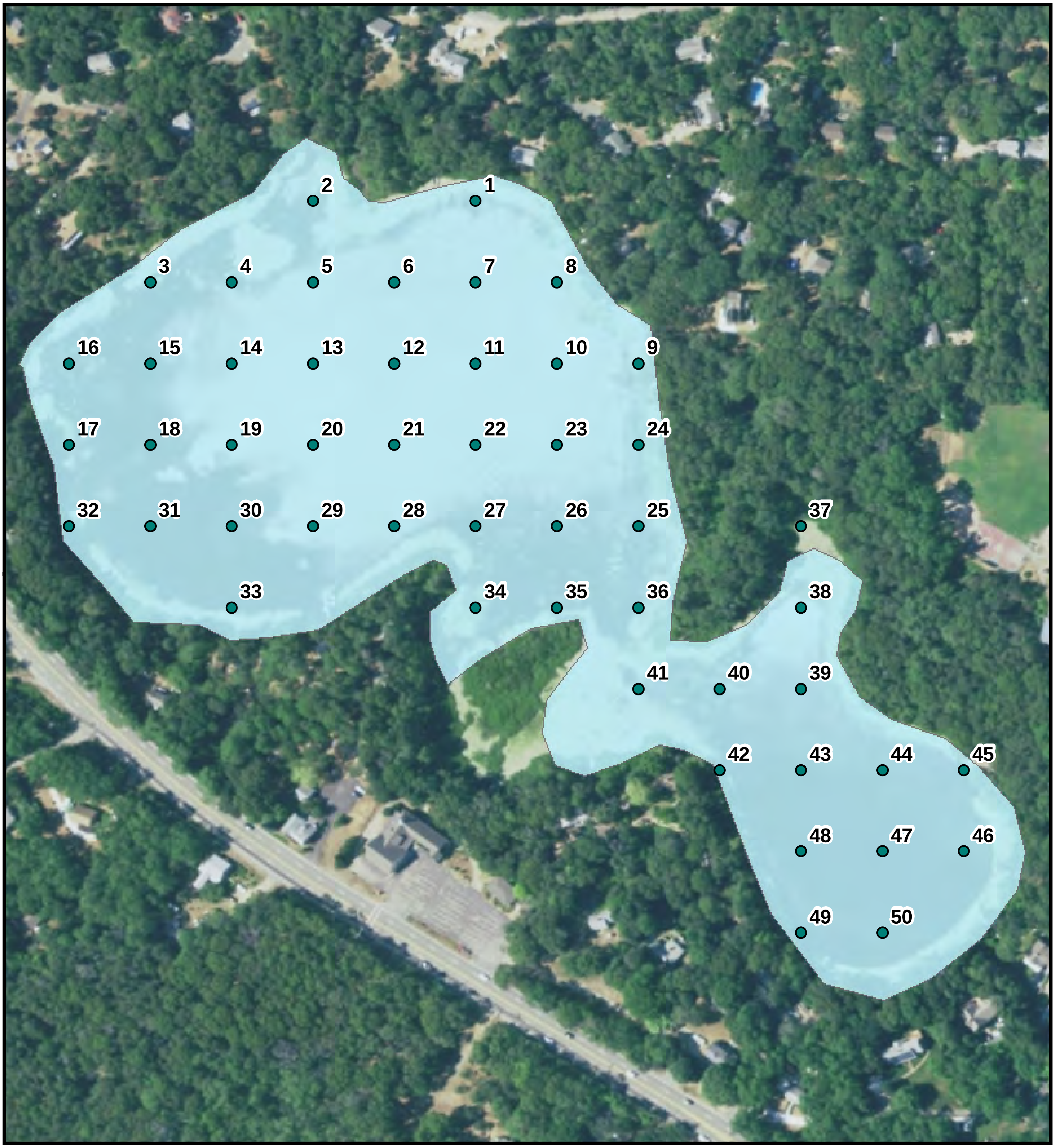
The elevated concentration of phosphorus and chlorophyll A, combined with the low secchi disk reading, are suggestive of increased productivity and future management issues. Low water clarity can inhibit excessive plant growth, while also deterring a balanced amount of native vegetation and phytoplankton necessary for pond and wildlife health.

We believe continued water quality monitoring is paramount to understanding the nutrient fluctuations occurring within the Minister/Schoolhouse Pond, and will ultimately proactively aid future management decisions. Since the two basins seem to have different turn-over seasonality (when stratification occurs), nutrient loading may also have variable consequence for each basin. We suggest four sampling sessions to outline the changes in water quality throughout the season, with a late-season point-intercept survey to monitor the extent of aquatic plant growth compared with the 2017 survey. This monitoring regime will document the seasonality of nutrient fluctuations for Minister/Schoolhouse Pond and potential nutrient loading affecting the pond.

Furthermore, we suggest management of the pioneer *Phragmites* infestation through the use of the herbicides Glyphosate or Imazamox. Due to the fecundity of *Phragmites* growth, herbicide use is the most selective and effective means of Phragmites control, especially in the early stages of an infestation.

Based on the potential nutrient influence and cycling, a future program addressing water quality remediation can prove proactive and preventative of further eutrophication. We have had success in reducing heightened levels of phosphorus through the use of Aluminum sulfate or Polyaluminum Chloride (PAC), which inactivates the bioavailable phosphorus within the water column.

We hope that you find this information helpful in making your pond management decisions. In the following section, we provide a breakdown of the estimated costs for the recommended management program. If you have any questions or need anything further, please contact our office.



Minister/Schoolhouse Pond

Eastham, MA

Survey Points

FIGURE:	SURVEY DATE:	MAP DATE:
1	6/7/17	9/8/17

Legend:

N

Survey Points

0 60 120 240 360 480 Feet

SOLITUDE LAKE MANAGEMENT

590 LAKE STREET
SHREWSBURY, MASSACHUSETTS 01545
PHONE: (508) 865-1000
WEB: WWW.SOLITUDELAKE.COM

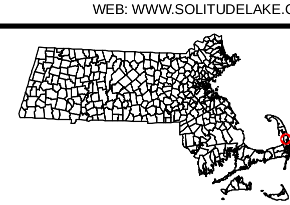
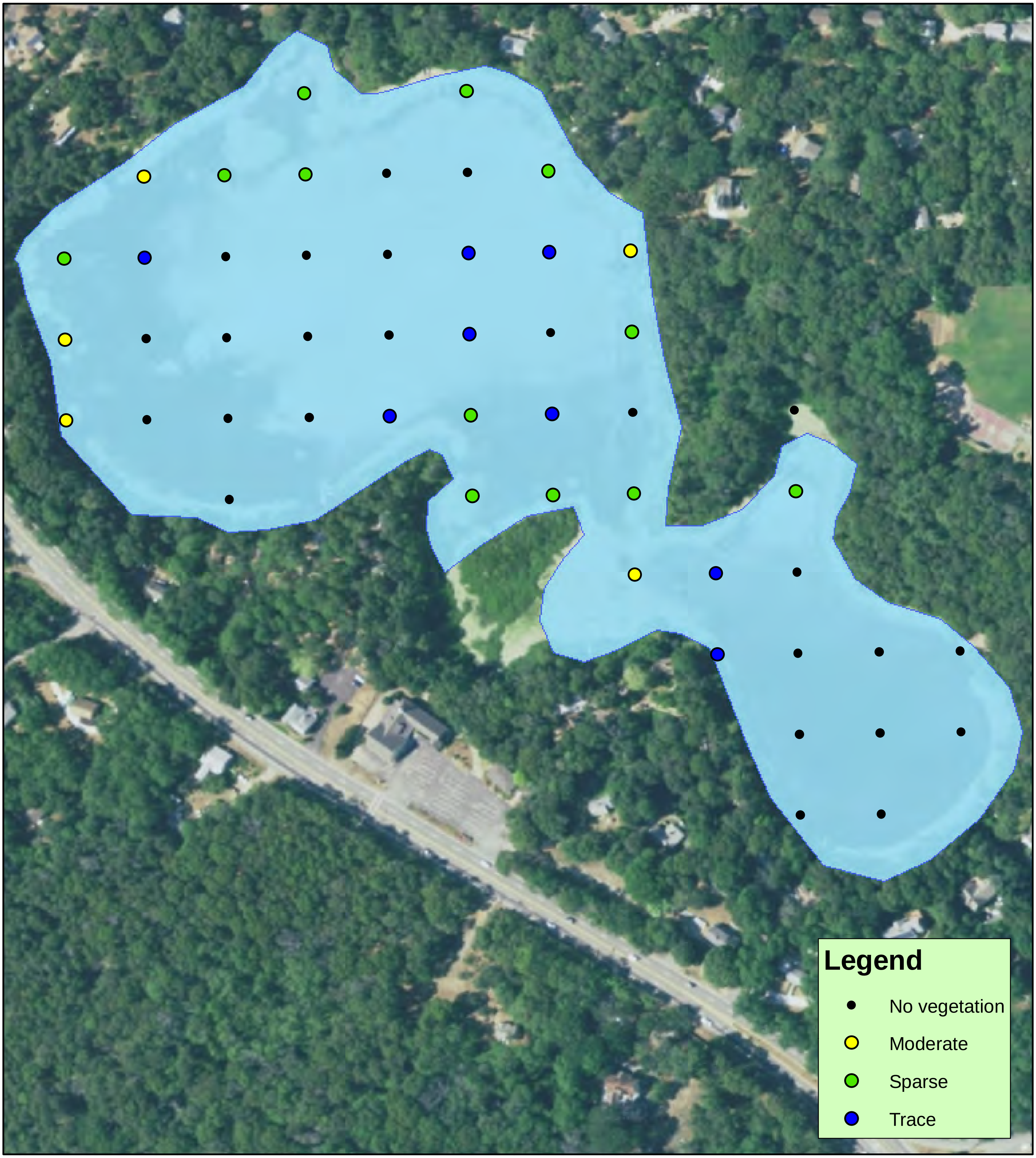
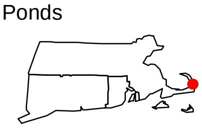


FIGURE 2: Overall Vegetation Density

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Minister & Schoolhouse Ponds
Eastham, MA



Minister/Schoolhouse Pond

1:2,600

0 180 360 Feet

N

Map Date: 7/24/17
Prepared by: BNA
Office: SHREWSBURY, MA

FIGURE 3: Vegetation Distribution

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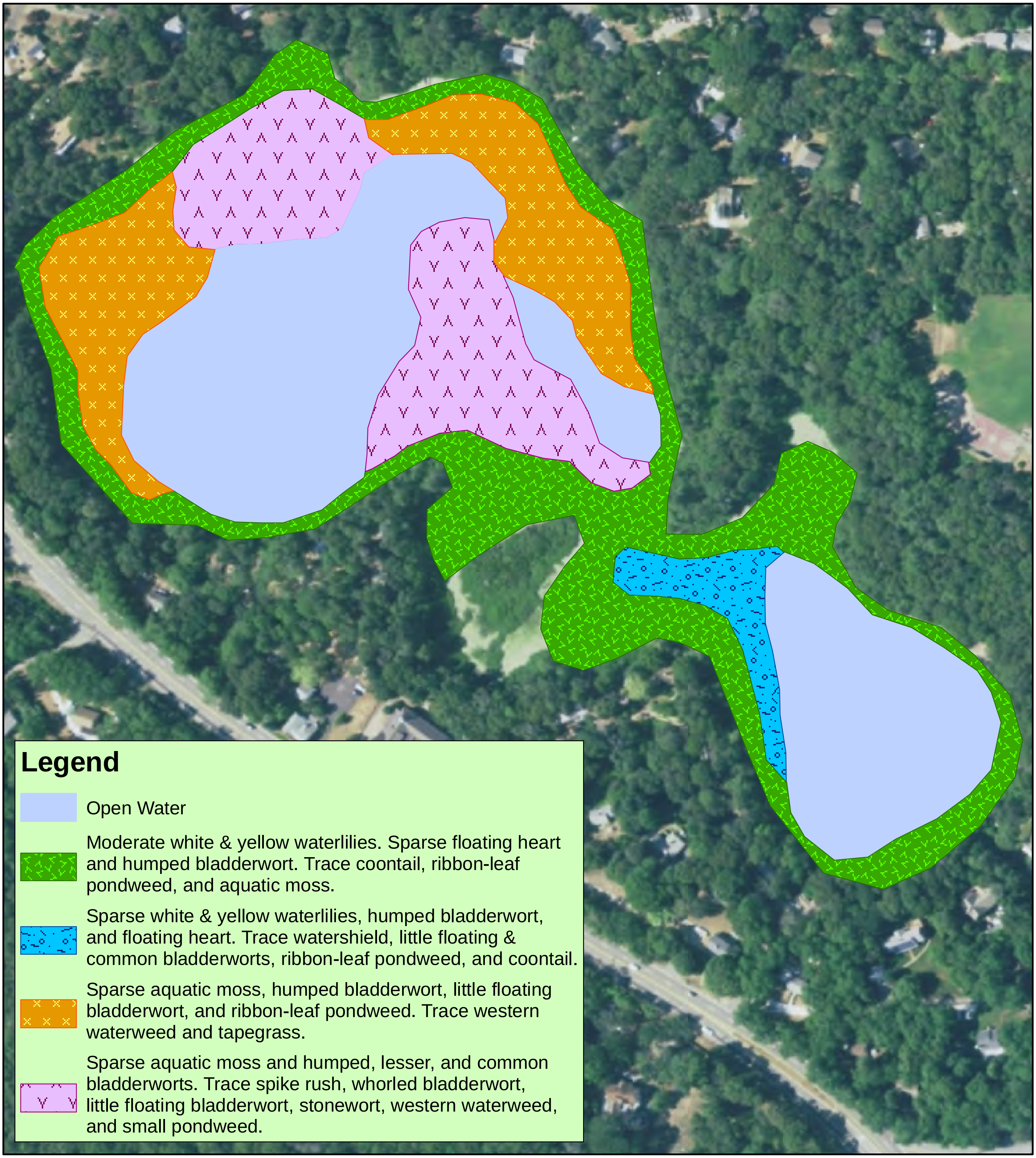
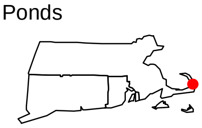


Minister & Schoolhouse Ponds
Eastham, MA



Minister/Schoolhouse Pond

0 190 380 Feet
1:2,600
N

Map Date: 7/24/17
Prepared by: BNA
Office: SHREWSBURY, MA

APPENDIX A

RAW DATA

Appendix A: Raw Data

Point	Overall Density	Coontail	Tapegrass	Nuttall's Waterweed	Spikerush	Humped Bladderwort	Lesser Bladderwort	Common Bladderwort	Whorled Bladderwort	Little Floating Bladderwort	Small Pondweed	Ribbonleaf Pondweed	Yellow Waterlily	White Waterlily	Floating Heart	Watershield	Benthic Filamentous Algae	Aquatic Moss	Stonewort
1	S											T	S					S	
2	S									T	S		S	T	T				
3	M				T	T								S					
4	S				S	T			T	T			S		T				
5	S					T	T						T		S				
6	Z																		
7	Z																		
8	S			T		T							S	S					
9	M									T			T	S	S			S	
10	T									T									
11	T																		T
12	Z																		
13	Z																		
14	Z																		
15	T					T								T					
16	S		T			T						T		S	S				
17	M					S								S	T			S	
18	Z																		
19	Z																		
20	Z																		
21	Z																		
22	T																	T	
23	Z																		
24	S												T	S	S				
25	Z																		
26	T			T									T						
27	S							T		T		T	T						
28	T																	T	
29	Z																		
30	Z																		
31	Z																		
32	M			T		S								S	S			S	
33	Z																		
34	S	T				T	T					T							
35	S			T			T				T							T	
36	S									S			T	S					
37	Z																		
38	S									T				S					
39	Z																		
40	T						T			T		T							
41	M					T								S		M	T		
42	T	T				T													
43	Z																		
44	Z																		
45	Z																		
46	Z																		
47	Z																		
48	Z																		
49	Z																		
50	Z																		

SŌLITUDE
LAKE MANAGEMENT

APPENDIX B

ALGAE ID & ENUMERATION REPORT

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

EMAIL ADDRESS:
BArvidson@solitudelake.com

Report Date:	7/05/2017	Date Sampled:	6/07/2017
Laboratory ID#:	1770409-01	Date Received:	6/16/2017
		Date Tested:	6/26/2017

Sample Site: SURFACE WATER: MINISTER POND

MICROSCOPIC EXAMINATION == Natural Units Count & Blue/Green Cell Counts

ORGANISM	#/ml	ORGANISM	#/ml	ORGANISM	Cell #/ml	#/ml	ORGANISM	#/ml
Diatomaceae		Chlorophyceae		Cyanophyceae			Protozoa	
Amphora		Actinastrum		Anabaena*	170	2	Actinophrys	
Asterionella*		Arthrodesmus		Anabaenopsis			Amoeba	
Amphiprora		Ankistrodesmus		Aphanocapsa			Arcella	
Cocinodiscus		Chorella		Aphanizomenon*			Bursaria*	
Cyclotella*	40	Closterium	73	Aphanothece			Ceratium	
Cymbella		Coelastrum		Aulosira			Cercomonas	
Diatoma*		Cosmarium		Arthrospira			Chilomonas	
Frustulia		Dictyosphaerium*		Chroococcus			Chlamydomonas	
Fragilaria		Eudorina*		Clathrocystis*			Codonella	
Gyrosigma		Elakatothrix		Coelosphaerium*			Cryptomonas*	
Gomphonema		Gleocystis		Cylindrospermum			Difflugia	
Melosira		Micrasterias		Cuspidothrix			Dinobryon*	
Meridion*		Mougeotia		Dactylococcopsis			Euglena	
Navicula		Pandorina*		Eucapsis			Glenodinium*	
Nitzschia		Pediastrum		Gleocapsa			Gonium	
Pleurosigma		Protococcus		Galucocystis			Halteria	
Stephanodiscus		Quadrigula		Gloeothece			Mallomonas*	
Surirella		Scenedesmus		Gomphosphaeria			Monas	
Synedra		Sphaerocystis		Hydrocoleum			Peridinium*	
Tabellaria*		Sphaerozosma		Microcystis			Synura*	
		Spirogyra		Merismopedia			Trachelomonas	
		Staurastrum	2	Nostoc			Uroglenopsis*	
		Tetraspora		Nodularia			Vorticella	
Rotifera		Westella		Oscillaria				
Anuraea		Ulothrix	2	Pseudanabaena				
Asplanchna		Volvox*		Spirulina				
Brachionus		Xanthidium		Rivularia*				
Conochilus		Zygnema		Xenococcus				
Euchlanis								
Keratella								
Notholca				Miscellaneous				
Polyarthra				Acarina				
Rotifer				Anguillula				
Synchaeta				Bosmina				
Kellicottia				Canthocamptus			* Odor Producing	
				Cyclops				
				Daphnia				
				Diaptomus				

TOTAL NATURAL UNIT COUNT: 120/ ml

BLUE GREEN CELL COUNT: 170/ml

Comments: Results are based on sample, as submitted to Northeast Laboratories, Inc. on: 6/16/2017.

Approved by:

Northeast Laboratories, Inc.

ANALYTICAL REPORT

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

EMAIL ADDRESS:

BArvidson@solitudelake.com

Report Date:	7/05/2017	Date Sampled:	6/07/2017
Laboratory ID#:	1770409-02	Date Received:	6/16/2017
		Date Tested:	6/26/2017

Sample Site: SURFACE WATER: SCHOOLHOUSE POND

MICROSCOPIC EXAMINATION == Natural Units Count & Blue/Green Cell Counts

ORGANISM	#/ml	ORGANISM	#/ml	ORGANISM	Cell #/ml	#/ml	ORGANISM	#/ml
Diatomaceae		Chlorophyceae		Cyanophyceae			Protozoa	
Amphora		Actinastrum		Anabaena*			Actinophrys	
Asterionella*	23	Arthrodesmus		Anabaenopsis			Amoeba	
Amphiprora		Ankistrodesmus		Aphanocapsa			Arcella	
Cocinodiscus		Chorella		Aphanizomenon*			Bursaria*	
Cyclotella*		Closterium		Aphanothece			Ceratium	
Cymbella	27	Coelastrum	8	Aulosira			Cercomonas	
Diatoma*		Cosmarium		Arthrospira			Chilomonas	
Frustulia		Dictyosphaerium*		Chroococcus			Chlamydomonas	
Fragilaria	12	Eudorina*		Clathrocystis*			Codonella	
Gyrosigma		Elakatothrix		Coelosphaerium*			Cryptomonas*	
Gomphonema		Gleocystis		Cylindrospermum			Difflugia	
Melosira		Micrasterias		Cuspidothrix			Dinobryon*	
Meridion*		Mougeotia		Dactylococcopsis			Euglena	
Navicula		Pandorina*		Eucapsis			Glenodinium*	
Nitzschia		Pediastrum		Gleocapsa			Gonium	
Pleurosigma		Protococcus		Galucocystis			Halteria	
Stephanodiscus		Quadrigula		Gloeothece			Mallomonas*	
Surirella		Scenedesmus		Gomphosphaeria			Monas	
Synedra	23	Sphaerocystis		Hydrocoleum			Peridinium*	
Tabellaria*	12	Sphaerozosma		Microcystis			Synura*	
		Spirogyra		Merismopedia			Trachelomonas	
		Staurastrum	4	Nostoc			Uroglenopsis*	
		Tetraspora		Nodularia			Vorticella	
Rotifera		Westella		Oscillaria				
Anuraea		Ulothrix		Pseudanabaena				
Asplanchna		Volvox*		Spirulina				
Brachionus		Xanthidium		Rivularia*				
Conochilus		Zygnema		Xenococcus				
Euchlanis								
Keratella								
Notholca				Miscellaneous				
Polyarthra				Acarina				
Rotifer	2			Anguillula				
Synchaeta				Bosmina				
Kellicottia				Canthocamptus			* Odor Producing	
				Cyclops				
				Daphnia				
				Diaptomus				

TOTAL NATURAL UNIT COUNT: 111/ ml

BLUE GREEN CELL COUNT: 0/ml

Comments: Results are based on sample, as submitted to Northeast Laboratories, Inc. on: 6/16/2017.

Approved by: [signature]