

LOST LAKE AND KNOPS POND AQUATIC VEGETATION MANAGEMENT PROGRAM 2013 ANNUAL REPORT

October 2013

Prepared for:

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And the Town of Groton
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AQUATIC CONTROL TECHNOLOGY

POND AND LAKE MANAGEMENT SPECIALISTS

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INTRODUCTION

A comprehensive program to control invasive aquatic plants species was initiated at Lost Lake and Knops Pond in 2011. During a 2011 inspection of the pond, five submersed invasive plants were observed: fanwort (*Cabomba caroliniana*), variable milfoil (*Myriophyllum heterophyllum*), Eurasian milfoil (*Myriophyllum spicatum*), spiny naiad (*Najas minor*), and curlyleaf pondweed (*Potamogeton crispus*). In 2011 an estimated 130 acres (greater than 60 percent of the surface area) of the 204 acre waterbody were inundated with nuisance-level growth of submersed invasive non-indigenous plant species. After considering the extent of the infestation and the limited number of management options available for such a wide-scale infestation, a decision was made to pursue funding and permit approval for an herbicide treatment program. Sonar (active ingredient fluridone) was selected as the herbicide of choice due to its proven efficacy at controlling the invasive species in Lost Lake and Knops Pond and its favorable toxicology. Over the course of 2011 and 2012 The Groton Lakes Association worked to secure the funding and with the help of Aquatic Control Technology completed the permitting process for a management program. An approved Order of Conditions permit was issued during the fall of 2012 and planning efforts continued for a spring 2013 treatment.

Lost Lake and Knops Pond was successfully treated with Sonar herbicide during the 2013 season. The following report summarizes the results of the 2013 treatment program and details findings from the late summer comprehensive aquatic plant survey. Recommendations for ongoing milfoil management efforts at Lost Lake and Knops Pond are also provided. The treatment and survey work in 2013 was performed by Aquatic Control Technology (ACT) for the Lost Lake and Knops Pond Association and its project partner, the Town of Groton Board of Selectmen.

HERBICIDE TREATMENT PROGRAM - 2013

Program Chronology

A chronology of the 2013 treatment program is provided below:

Date	Task	Notes
4/08/13	Pre-treatment inspection	Invasives actively growing. Variable milfoil growth extensive and appeared to be overwintering 2012 growth. Dense filamentous algae mats observed in several locations in Lost Lake
4/24/13	Initial Sonar herbicide treatment	Applied 25 ppb of Sonar One in fanwort infested areas; 7ppb of Sonar One in Eurasian milfoil infested areas
5/14/13	FasTEST sampling	2.25 ppb average surface sample concentration
5/22/13	Follow-up Sonar herbicide treatment	Applied 15 ppb Sonar One in fanwort infested areas; 3 ppb Sonar One in Eurasian milfoil infested areas; 5 ppb Genesis lake-wide
6/03/13	FasTEST sampling	8.9 ppb average concentration
6/20/13	FasTEST sampling	6.75 ppb average concentration
6/30/13	FasTEST sampling (2 samples only)	8 ppb average concentration
7/9/13	Final Sonar herbicide application	Applied 4 ppb of Sonar Genesis lake-wide
7/25/13	FasTEST sampling	4.4 ppb; irrigation restriction lifted
8/23/13	Comprehensive late season survey	No viable EWM found

Pre-Treatment Inspection

On 8 April 2013, the entire shoreline littoral area of the lake was surveyed by Aquatic Control Technology to determine the stage of milfoil growth and to make adjustments to the 2013 treatment scope. Fanwort plants appeared to be showing less than one foot of new active growth. Eurasian milfoil and curlyleaf pondweed had reached heights of 2-3 feet in the water column. Variable milfoil growth was high in the water column and at the surface in many locations. Due to the brown color and rigidity of the plants the variable milfoil growth appeared to be overwintered growth from 2012. Water temperatures were greater than 10 °C (50 °F) throughout the majority of the water column and the water level was favorably low. A mutual decision was reached to schedule and perform the initial Sonar herbicide application on 24 April 2013.

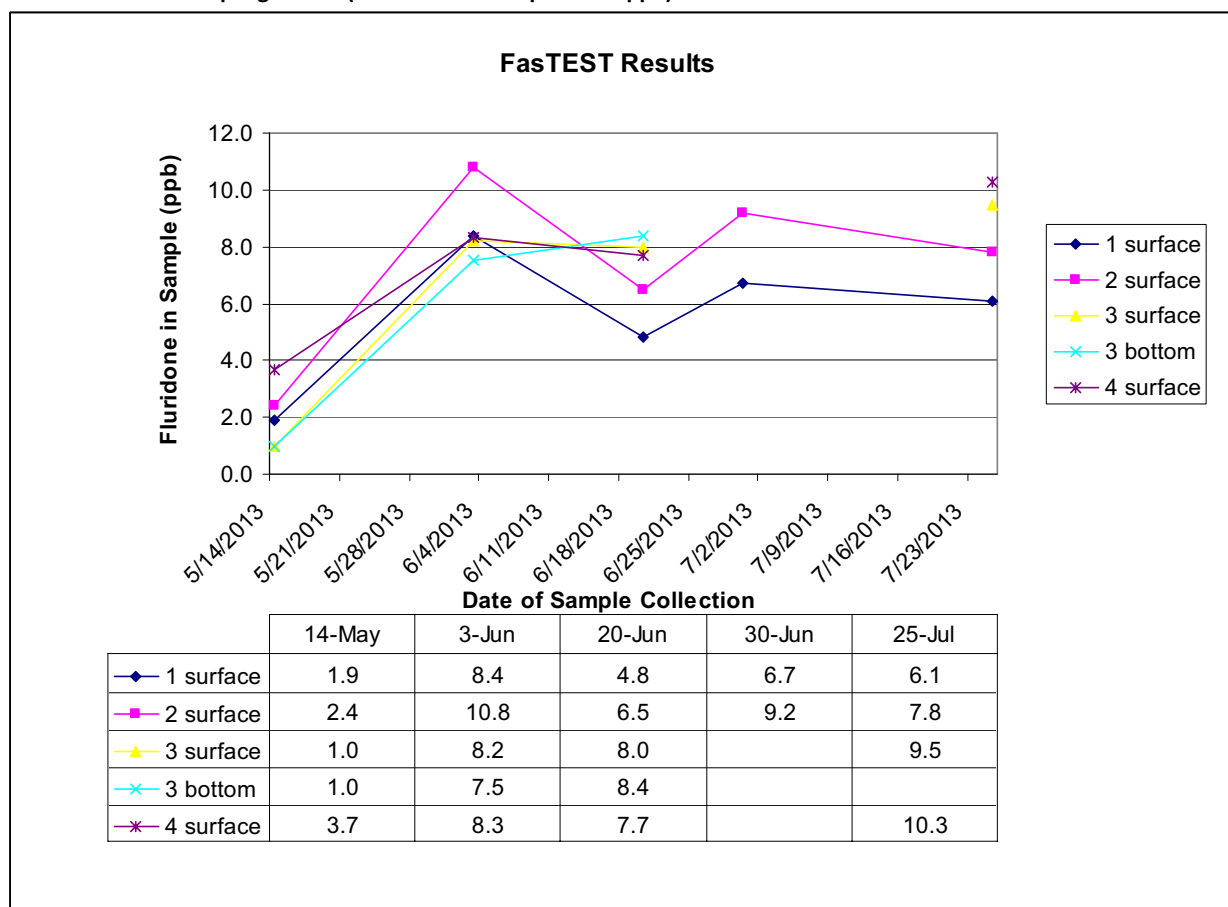
Details of 2013 Treatment Program

The recommended treatment plan was to initiate treatment early in the growing season and utilize Sonar One, a time-release pellet formulation of fluridone. The proposed treatment protocol was to apply an initial application of 25 parts per billion (ppb) of Sonar One throughout the fanwort and variable milfoil infested acres and 7 ppb of Sonar One throughout the areas only infested with Eurasian milfoil. The targeted placement of the pellets and time-release of the active ingredient was intended to maintain higher fluridone concentrations around the less sensitive fanwort and variable milfoil plants. This approach was also favored to limit the lake-wide dose being applied and reduce the chance for downstream transport of herbicide. A booster treatment (second application) with 15 ppb of Sonar One throughout the fanwort and variable milfoil infested acres and 3 ppb of Sonar One throughout the areas only infested with Eurasian milfoil was planned approximately 4-6 weeks after the initial treatment. A second booster treatment (third application) was planned for as a contingency. Herbicide concentration sampling was planned approximately two to three weeks after each application to determine timing of booster treatments.

The initial Sonar One application was scheduled and performed on 24 April 2013. The treatment was performed in accordance with the Groton Order of Conditions (DEP: 169-1086) and the annual DEP License to Apply Chemicals (#13058). Weather conditions on the day of treatment were favorable, with partly sunny skies and an air temperature of roughly 60° F. There was no significant wind at the time of the treatment and the water surface was calm. Surface water temperature was approximately 12.8° C with a dissolved oxygen concentration of 9.5 mg/L. The treatment was conducted using an 18 foot Airboat outfitted with a calibrated cyclone spreader system. The Sonar One pellets were loaded into the spreader and evenly applied throughout pre-determined treatment sectors. A GPS unit was used to ensure that an even application was made within the targeted treatment areas. The State boat ramp located in the northeastern cove of Lost Lake was used as the base of operations. Approximately 4.0 hours were required to evenly apply the 940 pounds of Sonar One herbicide. The only challenge encountered during the initial application was the low water level limited mobility into a couple of the small coves on the southern shore of Lost Lake. We are confident that Sonar concentrations moved into these coves due to the solubility of the herbicide.

On May 14th approximately two weeks after the initial application, water samples were collected from four in-lake locations located within the treatment area and one sample was collected below the thermocline using a Van Dorn collection bottle (Figure A_1 in Appendix A). There was no outflow from the lake, so downstream fluridone sampling was not performed. The in-lake concentrations were uniform and still below the targeted lake-wide concentration, so plans were made to proceed with the second application immediately.

Table 1: FastTEST sampling results (concentrations reported in ppb)



The second herbicide application was scheduled and performed on May 22nd. Again an Airboat equipped with a bow-mounted cyclone seeder/spreader was used for the Sonar One herbicide application. Sonar Genesis was applied using an on-board 100 gallon calibrated spray tank and herbicide was applied directly to the plants through weighted hoses. Treatment proceeded systematically around the lake applying the targeted 15 ppb of Sonar One to the fanwort and variable milfoil infested areas and 3 ppb of Sonar One to the areas infested with only Eurasian watermilfoil. Additionally, 5 ppb of liquid Sonar Genesis was applied lake-wide. Weather conditions were again favorable with partly cloudy skies, a 75° F air temperature and a light variable wind. The surface water temperature had increased to 20.5° C and the dissolved oxygen concentration was still approximately 11.10 mg/L. A total of 560 pounds of Sonar One and 48 gallons of Sonar Genesis were applied. The treatment took about 3.5 hours to complete. The areas in the southern portion of Lost Lake that were not accessible during the initial treatment were accessible during the booster application. A hand blower and small pump were used to boost the herbicide concentrations in these areas. Eurasian milfoil and fanwort plants were already showing visible signs of chlorosis, bleaching symptomatic of exposure to fluridone, and curlyleaf pondweed plants had lost rigidity and were covered in periphytic algae.

FasTEST samples were collected from the four in-lake surface stations on June 3rd and June 20th. The average in-lake concentration increased to 8.9 ppb on June 3rd and to 6.75 ppb on June 20th. On June 30th two additional surface samples were collected with an average concentration of 8 ppb. The increase in concentrations between June 20th and June 30th may have indicated that fluridone was still releasing off of the clay pellets several weeks after the herbicide was applied. During the June 30th sample collection it was noted that curlyleaf pondweed and Eurasian milfoil plants were completely controlled in the majority of locations; fanwort was highly chlorotic and

the leaves were stripped from base of the stems; variable milfoil however was still up in the water column in places. Due to the fact that both fanwort and variable milfoil had not been completely controlled a final booster application was scheduled for July 9th.

The final application of Sonar was performed on July 9th. Sonar Genesis was applied using the 18 foot airboat and on-board 100 gallon calibrated spray tank. Herbicide was applied directly to the plants through weighted hoses. Treatment proceeded systematically around the lake applying the targeted 4 ppb of liquid Sonar Genesis lake-wide. Weather conditions consisted of light rain and a 70°F air temperature and a light variable wind. A total of 30 gallons of Sonar Genesis were applied. The treatment took about 3 hours to complete.

A final round of FasTEST samples were collected on July 25th. Only surface samples were collected during the final sampling round. The average Sonar concentration during the July 25th sampling round was 8.4 ppb. Given the length of time that the herbicide was held at this level in the water column and the efficacy observed on the plants, it was determined that no further treatment would be necessary in 2013.

2013 LATE SEASON COMPREHENSIVE AQUATIC VEGETATION SURVEY

Survey Methods

The comprehensive aquatic vegetation surveys performed at Lost Lake and Knops Pond on 23 August 2013 used the same methods as the September 2011 survey, which are described below:

Using ArcView software, 81 points along 20 transects were created and superimposed over the lake's littoral zone. Points were distributed across both Lost Lake and Knops Pond so as to create an accurate representation of the vegetation in the waterbody (figure 1).

Data points were navigated to by boat using a Garmin 76Cx GPS unit. At each data point vegetation was identified using an AquaVu underwater camera, collection with a throw-rake, and visual identification.

Vegetation was classified by overall cover/density ranging from 0 to 100% and biomass ranging from 1-4. Vegetation cover/density was classified based on overall cover of all plants at a particular data point. Overall biomass was estimated based on the relative volume (height of plant growth in the water column) at each data point. The index ranges from 0-4 according to the following breakdown: 0 – no plants, 1 – plants generally low-growing within a foot of the bottom, 2 – plants generally half-way through the water column, 3 – plants within 1-2 feet of the surface, 4 – plants just below or at the surface.

Findings

Consistent with the 2011 surveys, all plant species present at each data point were recorded during the comprehensive late-season survey. This allows for some quantitative comparison of the pre and post-treatment conditions.

A total of 10 species of native macrophytes were observed following treatment in 2013.

Table 2: Aquatic Plant Species and Frequency of Occurrence

Species	Common Name	2011 Frequency of Occurrence (%)	2013 Frequency of Occurrence (%)
<i>Cabomba caroliniana</i>	Fanwort	52	1
<i>Myriophyllum heterophyllum</i>	Variable milfoil	47	22
<i>Myriophyllum spicatum</i>	Eurasian milfoil	46	1
<i>Najas minor</i>	Spiny naiad	5	0
<i>Ceratophyllum demersum</i>	Coontail	15	4
<i>Potamogeton robbinsii</i>	Robbins pondweed	53	59
<i>Potamogeton pusilus</i>	Thinleaf pondweed	0	1
<i>Potamogeton zosterformis</i>	Flatstem pondweed	1	0
<i>Potamogeton natans</i>	Floating-leaf pondweed	5	0
<i>Potamogeton diversifolius</i>	Variable-leaf pondweed	2	0
<i>Utricularia vulgaris</i>	Common bladderwort	6	2
<i>Utricularia purpurea</i>	Purple bladderwort	2	1
<i>Utricularia gibba</i>	Humped bladderwort	0	5
<i>Isoetes sp.</i>	Quillwort	1	0
<i>Elodea canadensis</i>	Waterweed	0	1
<i>Eleocharis sp.</i>	Spike rush	7	0
<i>Valisneria americana</i>	Tapegrass	25	0
<i>Nymphaea odorata</i>	White waterlily	11	2
<i>Brassenia schreberi</i>	Watershield	11	0
<i>Nymphoides cordata</i>	Little floating heart	1	0
<i>Nuphar variegatum</i>	Yellow waterlily	4	1
<i>Lemna sp.</i>	Duckweed	5	0
<i>Wolffia sp.</i>	Watermeal	5	0
<i>Chara sp.</i>	stonewort	2	4

As expected there were significant year-of-treatment impacts to the non-native aquatic plant community in Lost Lake and Knops Pond. The most noteworthy change is the almost complete control of the fanwort (*Cabomba caroliniana*), Eurasian milfoil (*Myriophyllum spicatum*), spiny naiad (*Najas minor*) and curlyleaf pondweed (*Potamogeton crispus*). Eurasian milfoil and fanwort were only observed at one point each. At both points, chlorosis was apparent and only five percent of the bottom was covered with invasives. Spiny naiad was completely controlled with the treatment. Curlyleaf pondweed typically scenses prior to August and as a result did not show up in either of the point surveys. That said, curlyleaf pondweed had dropped out of the water column by late May, well before natural senescence. Variable milfoil coverage was reduced by greater than fifty-percent in the year-of-treatment. The variable milfoil growth remaining at the end of the season was brown, de-foliated in places and covered in periphytic algae. Given these observations we expect only minimal re-growth of variable milfoil in 2014.

Impacts to several native aquatic plants were expected due to their sensitivity to fluridone. These species are usually impacted during the year-of-treatment, but typically begin active recovery the year-after-treatment. Among the species the native species observed after the treatment program Robbin's Pondweed was the most dominant. Robbin's Pondweed is a desirable native plant species because it creates a dense bottom cover of native plants, which helps to shade out non-native competitors. Additionally due to its low growing nature Robbin's Pondweed rarely negatively impacts recreational use.

SUMMARY AND DISCUSSION

The Sonar herbicide treatment program performed at Lost Lake and Knops Pond in 2013 provided exceptional control of the non-native plant species. The effectiveness of the 2013 treatment program is believed to be most attributable to the early start date and the lack of outflow from the lake throughout the duration of the treatment program. Reductions in the native plant population were observed, but the species that were impacted are usually the most sensitive to fluridone herbicide during the year-of-treatment. Additional recovery of the native plant population is anticipated in 2014 and in subsequent years.

It is difficult to predict the duration of control that will be achieved following a fluridone herbicide treatment program. Given our observations during the late season survey we remain optimistic that excellent carryover control will persist into the 2014 season and beyond. Evidence from other lakes treated with fluridone in the Northeast suggests that plants will eventually recover from surviving root or stem tissue and possibly from seeds. The longer that recovering plants are allowed to grow unmanaged, the more expansion of the root crowns will occur, which will make the plant that much more difficult to control in the future. Diligent monitoring and immediate management of regrowth will help to slow the rate of re-colonization.

ONGOING MANAGEMENT RECOMMENDATIONS

Invasive aquatic plant management is unfortunately an ongoing process. The 2013 fluridone herbicide treatment provided the initial control of the invasive plants in Lost Lake and Knops Pond. Despite the control achieved, recovery will occur; it is only a question of when and where. It would not be surprising to see some mild recovery during the 2014 season because there may be root or shoot structures that were not completely controlled by the fluridone in 2013. There is also a chance for recovery from an existing seed bank. Either way, most lakes that have been treated with fluridone in the Northeast, exhibit some mild recovery within one to three years following treatment. That is not to say that we anticipate the plants to reach pre-management densities in the year following treatment, but rather that in some locations small patches of non-native plants may begin to recover.

We anticipate that the first non-native plants to begin to recover will be curly-leaf pondweed and variable milfoil and as such spot treatment of these plants in select areas with the contact herbicide diquat is recommended in 2014 to prevent further recovery. In particular, based on the amount of variable milfoil biomass observed remaining in Springy Cove at the end of the 2013 treatment program, we recommend treatment with diquat in this cove early in the spring of 2014 to stave off potential re-growth.

In 2013, signs of increased blue-green algal densities were noted in a few locations. We understand the concern of the GLA regarding the potential for blue-green algae blooms. Although the native plant population will continue to recover in 2014, there is potential that the nutrients in the water no longer being utilized by non-native plants will be utilized by algae populations and as such algal blooms may occur. It would be advisable to secure permit approval on the local and state level for algal control measures in the winter of 2013/2014. This will allow for a quick response to algal bloom conditions should they occur. Over the summer of 2014 the GLA may want to consider implementing an algae monitoring program. Triggers for treatment would be best based upon a combination of a drop Secchi disk water clarity readings, observation of visual signs of blue-green algae blooms, or potentially the results of rapid sample analysis of algal species utilizing an outside laboratory. ACT would be happy to help the GLA find an appropriate lab for this analysis.

APPENDIX A

Treatment Information and FasTEST Monitoring Data

- Application 1 Report (4/24/13)
- Application 2 Report (5/22/13)
- Application 3 Report (7/9/13)
- FasTEST Sample Location Map (Figure 1)
- FasTEST Laboratory Reports (5/14, 6/3, 6/20, 6/30, 7/25)
- Photo-documentation of treatment program

Lost Lake / Knops Pond 2013 Sonar Herbicide Treatment Program

Date: 4/24/2013

Activity: First Herbicide Application

Secchi Disk Reading: 9 feet
2.74 meters

Temperature / Dissolved Oxygen Profile:

<i>Depth (m)</i>	<i>Temp (Deg C)</i>	<i>(Deg F)</i>	<i>DO (mg/l)</i>
Surf	12.8	55.0	9.52
1	12.3	54.1	9.10
2	11.8	53.2	8.95
3	18.7	65.7	9.81
3.5 bottom	11.8	53.2	9.29

Treatment Summary:

Product Applied: Sonar One (EPA Reg. No. 67690-45)

Quantity: 940 lbs

Target Concentration: 25 ppb in fanwort infested areas (100 acres)
7 ppb in Eurasian watermilfoil infested areas (114 acres)

Application Time: 10:30 PM start - 2:30 PM finish; 4.0 hours of application time

Equipment Used: 18 foot Airboat; calibrated cyclone spreader

Weather Conditions: partly sunny skies; air temperature ~60 F; Wind none significant
water surface calm to small ripple

Problems Encountered: None

Notes:

- 1) No outflow, 30 inches of freeboard at dam
- 2) Eurasian watermilfoil showing most active growth 1-3 foot tall plants
- 3) Variable milfoil appeared to mostly remaining stems from last year's growth
- 4) Fanwort was just beginning to show active growth on the bottom
- 5) Filamentous algae most evident in boat launch cove; some on bottom in Lost Lake; not much seen in Knops Pond

Lost Lake / Knops Pond 2013 Sonar Herbicide Treatment Program

Date: 5/22/2013

Activity: Second herbicide Application

Secchi Disk Reading: 10 feet
3.05 meters

Temperature / Dissolved Oxygen Profile:

<i>Depth (m)</i>	<i>Temp (Deg C)</i>	<i>(Deg F)</i>	<i>DO (mg/l)</i>
Surf	20.5	68.9	11.10
1	20.4	68.7	11.00
2	19.9	67.8	11.80
3	19.6	67.3	4.70

Treatment Summary:

Product Applied: Sonar One (EPA Reg. No. 67690-45)
Sonar Genesis (EPA Reg. No. 67690-54)

Quantity: Sonar One :560lbs
Sonar Genesis:48 gal

Target Concentration: 15 ppb in fanwort infested areas (100 acres)
3 ppb in Eurasian watermilfoil infested areas (114 acres)
5 ppb Genesis lake-wide

Application Time: 100 PM start - 430 PM finish; 3.5 hours of application time

Equipment Used: 18 foot Airboat; calibrated cyclone spreader and calibrated on board 100 gal spray tank

Weather Conditions: partly cloudy skies; air temperature 75 F; light variable wind
water surface calm to small ripple

Problems Encountered: None

Notes:

- 1) No outflow, 18 inches of freeboard at dam
- 2) Eurasian watermilfoil showing most active growth 4-5 foot tall plants
- 3) Variable milfoil appeared to mostly remaining stems from last year's growth -4-5 foot tall with flowering spikes
- 4) Fanwort showing the most evident chlorosis
- 5) Filamentous algae again most evident in boat launch cove; some mats in Lost Lake;
not much seen in Knops Pond

Lost Lake / Knops Pond 2013 Sonar Herbicide Treatment Program

Date: 7/9/2013

Activity: Third Herbicide Application

Secchi Disk Reading: not collected prior to third application

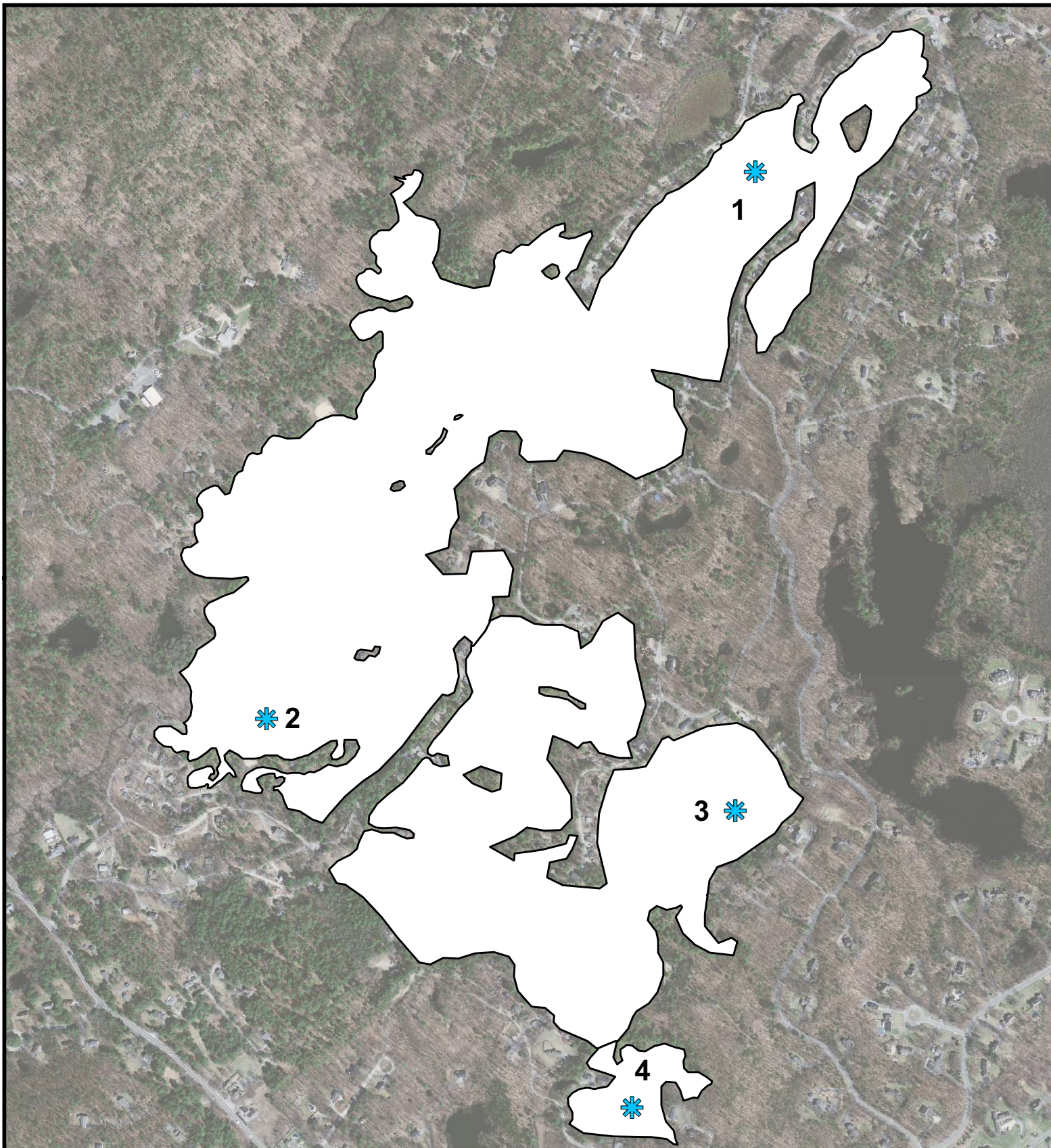
Temperature / Dissolved Oxygen Profile: not collected prior to third application

Treatment Summary:

Product Applied:	Sonar Genesis (EPA Reg. No. 67690-54)
Quantity:	Sonar Genesis:30 gal
Target Concentration:	3-4ppb lake-wide
Application Time:	1230 PM start - 330 PM finish; 3 hours of application time
Equipment Used:	18 foot Airboat; calibrated on board 100 gal spray tank
Weather Conditions:	light rain; air temperature 70 F; light variable wind water surface ripple
Problems Encountered:	None

Notes:

- 1) No outflow,
- 2) Eurasian watermilfoil showing strong signs of herbicide efficacy. Dropped out of the water column in most locations. Covered in periphytic algae where observed
- 3) Variable milfoil 4-5 foot tall with flowering spikes leaflets brown and disintegrating. Stems red.
- 4) Fanwort showing the most evident chlorosis. Lower leaflets stripped
- 5) Filamentous algae clear in boat launch cove; some mats in Lost Lake
not much seen in Knops Pond



Lost Lake and Knops Pond

Groton MA
FastTEST Sample Site Locations

FIGURE:	SURVEY DATE:	MAP DATE:
--	9/9 & 12/11	10/24/11

Legend

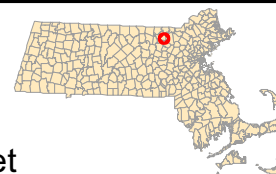
 FastTEST Sample Location



0 500 1,000 2,000 Feet

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LABORATORY REPORT

Chain of Custody: 2013-08335-00

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Customer Company

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Customer Contact

Contact Person: Gerald N Smith
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Phone:
Fax:

Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
22477	1	Sonar/Fluridone (µg/L)	1.9	05/14/2013		
22478	2	Sonar/Fluridone (µg/L)	2.4	05/14/2013		
22479	3 SURFACE	Sonar/Fluridone (µg/L)	< 1.00	05/14/2013		
22480	3 THERODINE	Sonar/Fluridone (µg/L)	< 1.00	05/14/2013		
22481	4	Sonar/Fluridone (µg/L)	3.7	05/14/2013		

Original



Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
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ANALYSIS STATEMENTS:

SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made unless noted in the report.

Laboratory Information

Date Received: 05/15/2013

Time Received: 10:00

Date Results Sent: 05/16/2013

Sample Preparation Date: 05/15/2013

Date Analysis Performed: 05/16/2013

Disclaimer: The results listed within this Laboratory Report relate only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a dry weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the exclusive use of SRTC Laboratory and its client. This report shall not be reproduced, except in full, without written permission from SRTC Laboratory. The Chain of Custody is included and is an essential component of this report.

This entire report was reviewed and approved for release.

Reviewed By:  SRTC Laboratory Manager

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Customer Company

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Customer Contact

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Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
23870	1	Sonar/Fluridone (µg/L)	8.4	06/03/2013		
23871	2	Sonar/Fluridone (µg/L)	10.8	06/03/2013		
23872	3	Sonar/Fluridone (µg/L)	8.2	06/03/2013		
23873	3 DEEP	Sonar/Fluridone (µg/L)	7.5	06/03/2013		
23874	4	Sonar/Fluridone (µg/L)	8.3	06/03/2013		

Original



Chain of Custody: 2013-09473-00

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Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
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ANALYSIS STATEMENTS:

SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made unless noted in the report.

Laboratory Information

Date Received: 06/05/2013

Sample Preparation Date: 06/05/2013

Time Received: 10:00

Date Analysis Performed: 06/06/2013

Date Results Sent: 06/06/2013

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This entire report was reviewed and approved for release.

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Phone: (508) 865-1000
Fax:

Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
24558	1	Sonar/Fluridone (µg/L)	4.8	06/20/2013		
24559	2	Sonar/Fluridone (µg/L)	6.5	06/20/2013		
24560	3	Sonar/Fluridone (µg/L)	8.0	06/20/2013		
24561	3 DEEP	Sonar/Fluridone (µg/L)	8.4	06/20/2013		
24562	4	Sonar/Fluridone (µg/L)	7.7	06/20/2013		

Original



Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
--------	-----------------	-------------	---------	---------------	---------------	---------------------

ANALYSIS STATEMENTS:

SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made unless noted in the report.

Laboratory Information

Date Received: 06/25/2013

Time Received: 10:00

Date Results Sent: 06/26/2013

Sample Preparation Date: 06/25/2013

Date Analysis Performed: 06/26/2013

Disclaimer: The results listed within this Laboratory Report relate only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a dry weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the exclusive use of SRTC Laboratory and its client. This report shall not be reproduced, except in full, without written permission from SRTC Laboratory. The Chain of Custody is included and is an essential component of this report.

This entire report was reviewed and approved for release.

Reviewed By:  SRTC Laboratory Manager

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LABORATORY REPORT

Chain of Custody: 2013-11211-00

Page 1 of 1 Total Pages

Customer Company

Company Name: Aquatic Control Tech Inc
Address: 11 John Road
Sutton, MA 01590-2509

Customer Contact

Contact Person: Marc Bellaud
E-Mail Address: mbellaud@aquaticcontroltech.com
Phone: (508) 865-1000
Fax:

Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
24735	1	Sonar/Fluridone (µg/L)	6.7	06/30/2013		
24736	2	Sonar/Fluridone (µg/L)	9.2	06/30/2013		

ANALYSIS STATEMENTS:

SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made unless noted in the report.

Laboratory Information

Date Received: 07/02/2013
Time Received: 10:00
Date Results Sent: 07/03/2013

Sample Preparation Date: 07/02/2013
Date Analysis Performed: 07/03/2013

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This entire report was reviewed and approved for release.

Reviewed By:  SRTC Laboratory Manager

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Chain of Custody: 2013-12683-00

Page 1 of 1 Total Pages

Customer Company

Company Name: Aquatic Control Tech Inc
Address: 11 John Road
Sutton, MA 01590-2509

Customer Contact

Contact Person: Marc Bellaud
E-Mail Address: mbellaud@aquaticcontroltech.com
Phone: (508) 865-1000
Fax:

Waterbody Information

Waterbody: Lost Lake - MA Waterbody Size (acres): 000 Depth Average: 000

Sample Information

Lab ID	Sample Location	Test Method	Results	Sampling Date	Sampling Time	Temp at Receipt (C)
25420	1			/ /		
		Sonar/Fluridone (µg/L)	6.1			
25421	2			/ /		
		Sonar/Fluridone (µg/L)	7.8			
25422	3			/ /		
		Sonar/Fluridone (µg/L)	9.5			
25423	4			/ /		
		Sonar/Fluridone (µg/L)	10.3			

ANALYSIS STATEMENTS:

SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made unless noted in the report.

Laboratory Information

Date Received: 07/30/2013
Time Received: 10:00
Date Results Sent: 07/31/2013

Sample Preparation Date: 07/30/2013
Date Analysis Performed: 07/31/2013

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This entire report was reviewed and approved for release.

Reviewed By:  SRTC Laboratory Manager

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Lost Lake and Knops Pond – Groton, MA

Dense Fanwort and Eurasian milfoil cover September 2011



A mix of 2012 growth and an understory of 2013 growth of Eurasian milfoil. April 2013 (Pre-treatment)



Dense Eurasian milfoil matted to the surface September 2011



2012 growth of variable milfoil remaining in the water column in April 2013 (Pre-treatment)



Lost Lake and Knops Pond – Groton, MA

Progression of chlorosis in fanwort and variable milfoil on
May 7, 2013



Dying Eurasian milfoil covered in periphytic algae



Chlorosis of Fanwort visible from the surface June 20 2013



Healthy bottom cover of low growing native Robbins
pondweed August 23, 2013



Lost Lake and Knops Pond – Groton, MA

Before Lake Restoration Project. Photo taken by the Groton Lakes Association



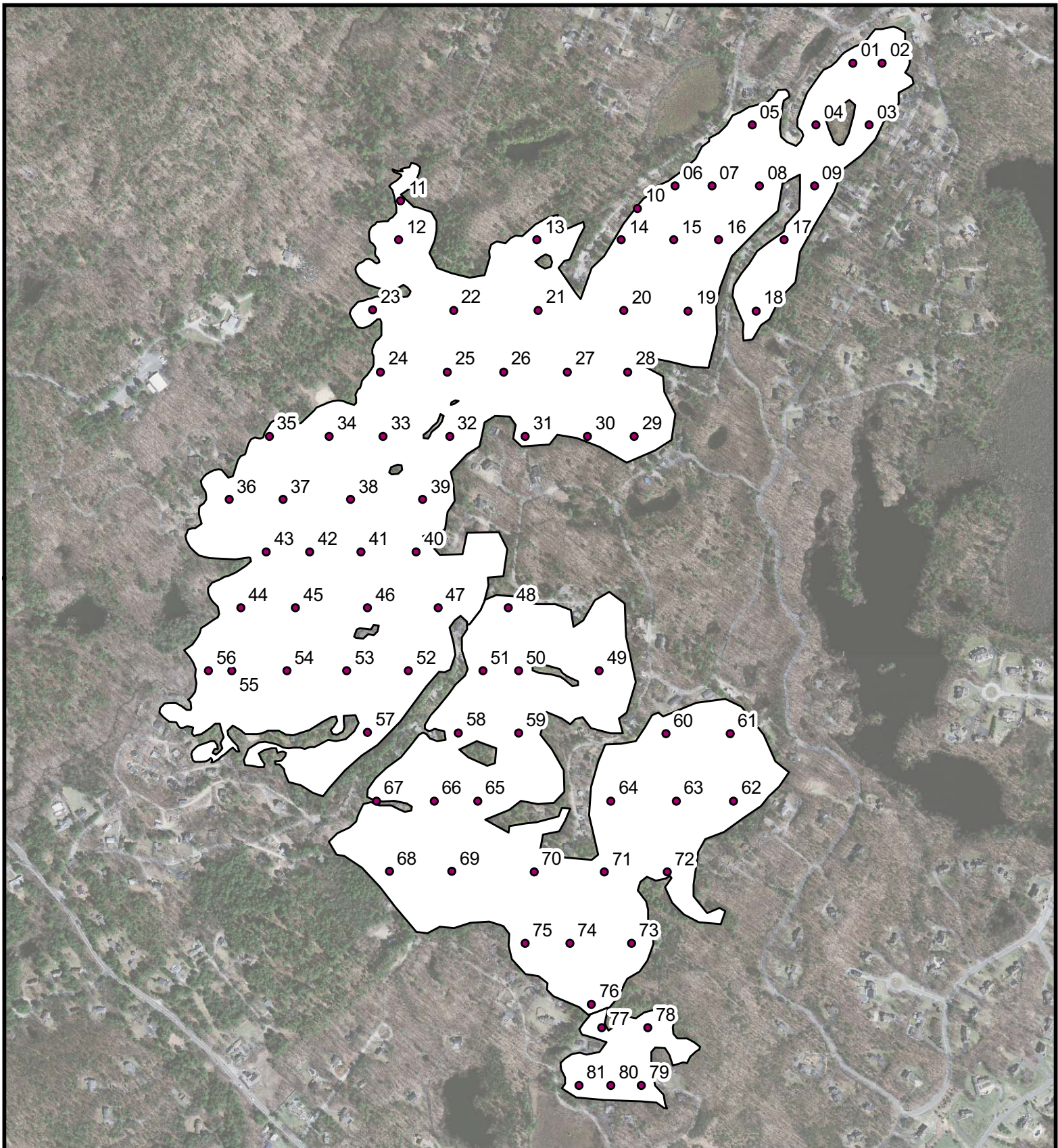
After Lake Restoration Project. Photo taken by the Groton Lakes Association



APPENDIX B

Comprehensive Aquatic Vegetation Survey Information

- Data Point Sampling Locations
- Field Data Table 2011
- Field Data Table 2013



Lost Lake and Knops Pond

Groton MA
Transect Point Locations

Legend

- Transect Point Location



0 500 1,000 2,000
Feet



11 JOHN ROAD
SUTTON, MASSACHUSETTS 01590
PHONE: (508) 865-1000
FAX: (508) 865-1220
WEB: WWW.AQUATICCONTROLTECH.COM

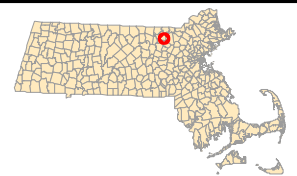


FIGURE:

SURVEY DATE:

MAP DATE:

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Point Number	Water Depth	Sediment Depth	Sediment Type	Biomass	Percent Cover	Invasive Species Percent Cover	Plant Species Percent Cover																				
							Cabomba caroliniana	Myriophyllum heterophyllum	Myriophyllum spicatum	Najas minor	Ceratophyllum demersum	Potamogeton robbinsii	Potamogeton zosterformis	Potamogeton natans	Potamogeton diversifolius	Utricularia vulgaris	Utricularia purpurea	Isoetes sp.	Eleocharis sp.	Valisneria americana	Nymphaea odorata	Brassenia schreberi	Nymphoides cordata	Nuphar variegatum	Lemna sp.	Wolfla sp.	Chara sp.
1	7	4	muck	4	100	90	50	30	10			10															
2	5.5			2	100	80	20	5	5	50		5				1				5	5	5					
3	7	3	muck	3	100	38	20	10	5	3		60											1				
4	7			3	100	90	20	60	10			10															
5	11			1	80	10	10					70															
6	8			1	100	0						100															
7	9.5	13	muck	1	100	10	10				10	80															
8	11			1	100	0						100															
9	7.5	3.5	muck	2	100	70	8	60	2			20															
10	8			1	100	0						100															
11	3.5	2	muck/sand	3	60	50	30		20												8				1	1	
12	4			4	70	60	40		20																5	5	
13	6	0.33	muck/sand	3	100	30			15	15		60								10							
14	8			1	100	0						100															
15	8.5	3.5	muck	1	100	0																					
16	9			3	90	5			5		40	45															
17	6.5	3	muck	4	70	51	40	10	1			15										4					
18	5.5			4	100	66	60	6			1	30										3					
19	11	>2	muck	1	100	0						100															
20	8			2	100	5			5		10	85															
21	7.5	4	muck	2	100	10			10		5	85															
22	8			2	100	10			10		10	80													5	5	
23	6	1.5	muck/rock	4	100	15	5		10		5	60	2							10		5		3			
24	7			3	100	10			10			70								20							
25	8.5	3.5	muck	2	100	20			20		40	40															
26	10			2	100	20			20		20	60															
27	8	4.0	muck	2	100	10			10		30	60															
28	7			2	80	0						30								50							
29	7	3.0	muck	2	100	10			10			85								5							
30	7.5			2	100	10			10		20	70															
31	7.5	4.0	muck	2	100	10			10		90																
32	8			2	85	10			10			70								5							

Point Number	Water Depth	Sediment Depth	Sediment Type	Biomass	Percent Cover	Invasive Species Percent Cover	Plant Species Percent Cover																	
							Cabomba caroliniana	Myriophyllum heterophyllum	Myriophyllum spicatum	Najas minor	Ceratophyllum demersum	Potamogeton robbinsii	Potamogeton zosterformis	Potamogeton natans	Potamogeton diversifolius	Utricularia vulgaris	Utricularia purpurea	Isoetes sp.	Eleocharis sp.	Valisneria americana	Nymphaea odorata	Brassenia schreberi	Nymphoides cordata	Nuphar variegatum
33	10	>3	muck	3	90	30																		
34	8			3	100	70	20	10	40															
35	8	2.0	muck/sand	4	100	40		10	30									10	5					
36	8			3	100	90	70	10	10									5						
37	8	3.0	muck	3	100	40	10	10	20															
38	7.5			2	90	10			10															
39	8	4.0	muck	3	100	20			20								20				10	10		
40	7.5			3	100	10	5		5								60							
41	7	5.0	muck	1	100	0						100												
42	8			2	100	30		10	20															
43	4	0.0	rock/sand	1	5	0										5								
44	7			4	100	80	10	60	10			18		2										
45	7	4.0	muck	3	100	15		10	5						5		80							
46	7			2	100	2		1	1			48					50							
47	7.5	2.5	muck	2	95	15		10	5			10					70							
48	7			4	100	90	50	40										10						
49	6.5	2.5	muck	4	100	45	20	20	5					5			10	10	20					
50	6.5			3	100	30	20	10								30		20	20					
51	7.5	5.5	muck	3	100	40		40				15			15		30							
52	7			2	100	10		5	5			30					60							
53	7	4.0	muck	2	100	20		20				80												
54	7			3	100	100	80	20																
55	6.5	2.5	muck	4	100	90	90										5			5				
56	4			4	100	30	5	5	20								20	10	5		5		30	
57	7	1.5	muck/sand	3	100	80	70	10							5		20							
58	6			2	60	50	30	20								5								
59	4	0.0	rock/sand	0	0	0																		
60	>15			1	5	5	5																	
61	>18			0	0	0																		
62	>15			0	0	0																		
63	>20			0	0	0																		
64	>15			0	0	0																		

Point Number	Water Depth	Sediment Depth	Sediment Type	Biomass	Percent Cover	Invasive Species Percent Cover	Plant Species Percent Cover																				
							Cabomba caroliniana	Myriophyllum heterophyllum	Myriophyllum spicatum	Najas minor	Ceratophyllum demersum	Potamogeton robbinsii	Potamogeton zosterformis	Potamogeton natans	Potamogeton diversifolius	Utricularia vulgaris	Utricularia purpurea	Isoetes sp.	Eleocharis sp.	Valisneria americana	Nymphaea odorata	Brassenia schreberi	Nymphoides cordata	Nuphar variegatum	Lemna sp.	Wolfia sp.	Chara sp
65	10.5				3	90	90	80	10																		
66	9				2	90	90	10	80																		
67	6	4.0	muck		4	100	100	90	10																		
68	10				2	95	90	80	10								5										
69	>15				2	50	50	50																			
70	13		rock		3	40	40	20	20																		
71	>15				1	10	10	10																			
72	4.5	0.0	sand		3	90	60	20	40				10					20									
73	13				3	80	80	80																			
74	>15				2	60	55	40	15								5										
75	14				2	50	50	50																			
76	6	0.0	sand		1	95	5	5																			
77	6	0.5	sand		1	100	80	40	40								10		10								
78	7				4	100	30	20	10									20	20		10						20
79	13.5				2	70	60	20	40												10						
80	14				2	20	10		10										10								
81	5.5	2.5	muck		4	100	60	30	30				10				10		10		10			10			

Point Number	Water Depth	Sediment Depth	Sediment Type	Biomass	Percent Cover	Invasive Species Percent Cover		Plant Species Percent Cover																									
								Cabomba caroliniana	Myriophyllum heterophyllum	Myriophyllum spicatum	Najas minor	Ceratophyllum demersum	Potamogeton robbinsii	Potamogeton pusilus	Potamogeton zosterformis	Potamogeton natans	Potamogeton diversifolius	Utricularia vulgaris	Utricularia purpurea	Utricularia gibba	Isoetes sp.	Elodea	Eleocharis sp.	Valisneria americana	Nymphaea odorata	Brassenia schreberi	Nymphoides cordata	Nuphar variegatum	Lemna sp.	Wolffia sp.	Chara sp.		
1	7	4	muck	2	75	25			25					50																			
2	5.5			1	50	5			5						40						5												
3	7	3	muck	1	75	0								75																			
4	7			1	25	0								20						5													
5	11			2	100	0							25	75																			
6	8			1	100	0								100																			
7	9.5	13	muck	1	75	0								75																			
8	11			2	20	0								20																			
9	7.5	3.5	muck	1	75	0								75																			
10	8			1	100	0								100																			
11	3.5	2	muck/sand	2	20	5			5					15																			
12	4			1	10	0								10																			
13	6	0.33	muck/sand	1	75	0								75																			
14	8			1	100	0								100																			
15	8.5	3.5	muck	1	30	0								30																			
16	9			1	30	0							10	20																			
17	6.5	3	muck	1	25	0							5	20																			
18	5.5			1	25	0								25																			
19	11	>2	muck	1	100	0								100																			
20	8			2	25	0								25																			
21	7.5	4	muck	1	100	0								100																			
22	8			1	100	0								100																			
23	6	1.5	muck/rock	1	75	0								75																			
24	7			1	100	0								100																			
25	8.5	3.5	muck	1	100	5				5				95																			
26	10			1	100	0								100																			
27	8	4.0	muck	1	100	0								100																			
28	7			1	100	0								100																			
29	7	3.0	muck	1	100	0								95						5													
30	7.5			1	100	0								100																			
31	7.5	4.0	muck	1	100	0								100																			
32	8			1	100	0								100																			
33	10	>3	muck	1	100	0								100																			
34	8				0	0																											
35	8	2.0	muck/sand		0	0																											
36	8			2	20	20			20																								
37	8	3.0	muck	1	100	0								100																			
38	7.5			1	100	0								100																			
39	8	4.0	muck	1	100	0								100																			
40	7.5			1	100	0								100																			

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