Saratoga Lake

Aquatic Vegetation Management Program
2009 - Year Three Report

Prepared for:

Saratoga Lake Protection & Improvement District
P.O. Box 2551
Ballston Spa, NY 12020

Prepared by:

Aquatic Control Technology, Inc.
11 John Road
Sutton, MA 01590

First Version: November 30, 2009

AQUATIC CONTROL TECHNOLOGY, INC.
POND AND LAKE MANAGEMENT SPECIALISTS

TABLE OF CONTENTS

TABLE OF CONTENTS ..... **i**

INTRODUCTION **1**

HERBICIDE TREATMENT PROGRAM - 2009 ..... **2**

Program Chronology *2*

Treatment Areas *2*

Treatment Planning and Protocol *3*

Treatment Summary *4*

Herbicide Residue Testing *4*

Post –Treatment Inspections *5*

SUMMARY OF LATE SEASON COMPREHENSIVE AQUATIC VEGETATION SURVEY **6**

SUMMARY OF THREE-YEAR HERBICIDE TREATMENT PROGRAM **7**

RECOMMENDATIONS FOR FUTURE AQUATIC PLANT MANAGEMENT EFFORTS **7**

APPENDICES

Appendix A: 2009 Triclopyr Residue Testing Results

Appendix B: Interim Report – Comprehensive Aquatic Vegetation Survey (prepared by DFWI)

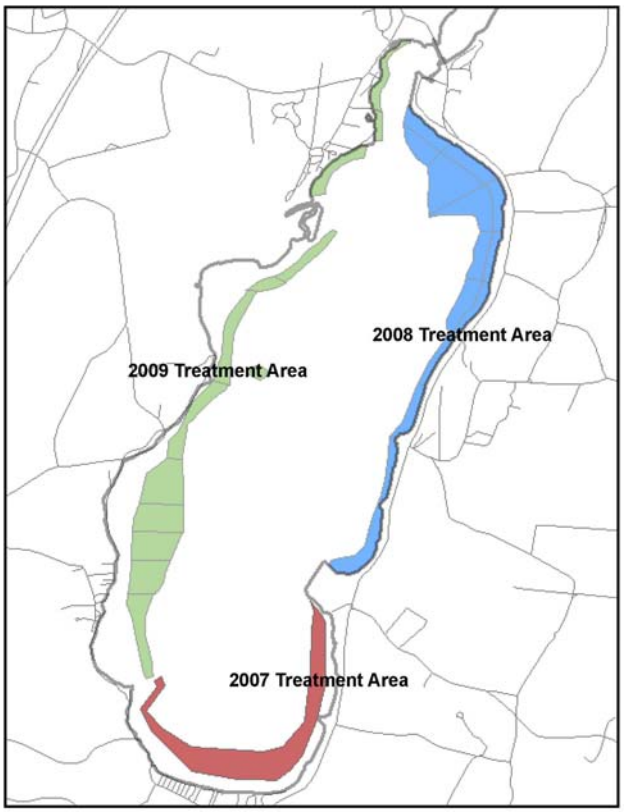
INTRODUCTION

The 2009 season represented Phase 3 or the third and final year of an herbicide treatment program targeting control of the dense beds of Eurasian watermilfoil (*Myriophyllum spicatum)* in Saratoga Lake. This three-year program was the culmination of a decade-long effort led by the Saratoga Lake Protection and Improvement District (SLPID) of evaluating available control strategies and developing a program with greatest potential to control nearly 800 acres of invasive Eurasian watermilfoil growth while preserving the lake's diverse native aquatic plant community.

Herbicide treatments were evaluated as a potential large-scale management strategy for Eurasian watermilfoil (EWM) control as part of the watershed management plan prepared by The LA Group between 1999 and 2002. Time-release pellet formulations of fluridone herbicide (Sonar SRP and Sonar PR) were used during demonstration treatments in 2000 and 2003. Results suggested that fluridone could provide effective EWM control, but large-scale treatments were needed to overcome the effects of dilution. However, whole-lake treatment with fluridone was not considered a realistic alternative due to high cost projections and concerns over impacts to non-target native plants. Large-scale, partial lake herbicide treatments were recommended in the *Long-Term Aquatic Vegetation Management Plan* prepared by Aquatic Control Technology, Inc. in 2004 and 2005. This approach was adopted by SLPID and detailed in the *Environmental Impact Statement (EIS) for Saratoga Lake Invasive Species Long-Term Management Plan* (The LA Group, July 2006).

A three-year project targeting treatment of all dense beds of EWM was planned for the 2007, 2008 and 2009 seasons. Fluridone herbicide (Sonar PR and Sonar Q pellet formulations) was applied to approximately 300 acres located at the southern end of the lake in 2007. Fluridone was the only systemic-acting herbicide registered for use in New York in 2007 that could be used to treat the extensive beds of EWM found in Saratoga Lake. The southern end of the lake between Stony Point and Snake Hill was determined to be the area least likely to be influenced by dilution. Three applications of Sonar pellets were made between mid-May and early July 2007. By the end of the summer, excellent control of EWM was achieved and native plant species were preserved.

Figure 1: Herbicide treatment areas by year



However, fluridone was not expected to be as effective in the northern two-thirds of the lake because of excessive water movement and dilution. Fortunately, triclopyr (Renovate) herbicide was registered for use in New York State in 2007. Triclopyr is a systemic-acting herbicide with a different mode of action that only required hours of exposure time with the targeted EWM plants as opposed to the 2-3 months of exposure time needed for successful fluridone treatments. A granular formulation of triclopyr (Renovate OTF) was applied along the Eastern shoreline of the lake between Snake Hill and Franklin Beach in late May 2008. Within

one-month of treatment, complete EWM control was seen with no obvious impact to native plant species. The efficacy and selectivity of the triclopyr treatment was validated by comprehensive surveys later in the summer. Plans were made to target the remaining EWM beds along the western shoreline with triclopyr herbicide during the 2009 season.

SLPID continued to serve as the project applicant/proponent and as the Lead Agency for the 2009 treatment project. SLPID was responsible for coordination of the various entities involved in the treatment program, as well as continuing to operate the sizeable mechanical harvesting operation. The LA Group continued to serve as SLPID's primary lake management consultant and was largely responsible for permitting and project oversight. The herbicide treatment program was performed by Aquatic Control Technology, Inc. (ACT). The Darrin Fresh Water Institute (DFWI) conducted the comprehensive post-treatment aquatic vegetation survey. SUNY Cobleskill was retained to perform the fish surveys required by the New York State Department of Environmental Conservation (NYSDEC).

The following report details the 2009 Renovate OTF herbicide treatment performed by ACT and summarizes the result of the three-year herbicide treatment program. An interim report of the aquatic vegetation survey performed by DFWI is provided, which should fulfill the requirements of the NYSDEC permit. A copy of the full DFWI report will be submitted under separate cover, as will the results of the SUNY Cobleskill fish survey.

HERBICIDE TREATMENT PROGRAM - 2009

Program Chronology

A chronology of the 2009 treatment program is provided below:

- NYSDEC permit issuance (#5-4199-00002/00008)..... May 15
- Pre-treatment inspection and finalize treatment areas..... May 12
- Renovate OTF treatment..... May 26 – May 29
- Herbicide residue monitoring.....June 4, June 15, June 29, August 4
- Inspections (ACT)..... July 15, October 1
- Comprehensive aquatic plant survey (DFWI)..... August

Treatment Areas

The Phase 3 treatment area for the 2009 season included the entire western shoreline of the lake, extending from the Route 9P Bridge at the north end to Stony Point at the south end. The potential treatment area was estimated at 350 acres based on the extent of EWM growth mapped by DFWI during their 2004 survey. However, some reduction in treatment area was anticipated due to partial EWM control seen following the 2007 and 2008 treatments.

A pre-treatment survey was performed on 12 May 2009. The outer edges of EWM growth were identified using a high-resolution depth finder and underwater camera system and were geospatially referenced with a GPS unit. The final treatment area was mapped at approximately 285 acres, nearly a 20% reduction from what was originally proposed.

The treatment area extended out more than 2000 feet from shore near the Riley's Cove and Silver Beach areas towards the southern end of the treatment area, and only about 250 feet from shore by Water's Edge at the northern end. The most significant reductions in treatment area were seen between Manning's

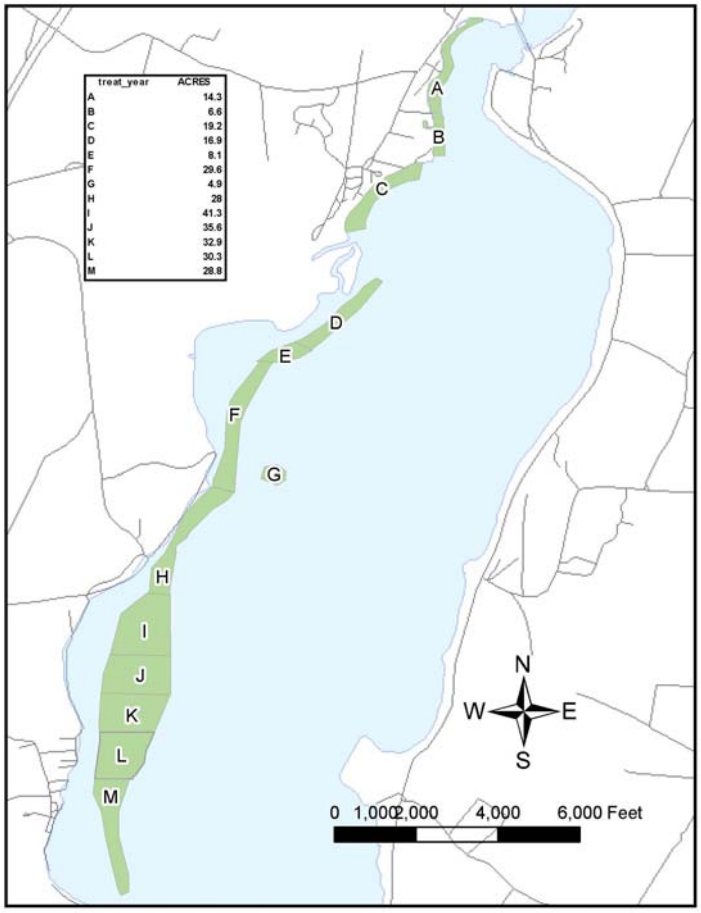
Cove and the mouth of the Kayaderosseras Creek inlet. Consistent with the two prior years, the majority of EWM growth was found in water depths between 5 and 20 feet. The average water depth of EWM beds throughout the treatment area was estimated to be 7-8 feet. The milfoil density and biomass was lower than what was seen immediately prior to the 2007 and 2008 treatments. EWM cover typically ranged between 25-50% and EWM plants were only estimated to be 4-5 feet tall at the time of treatment.

Treatment Planning and Protocol

The 2009 treatment protocol remained unchanged from what was used in 2008. Renovate OTF (EPA Reg. No. 67680-42 / SLN NY 070004) a 10 percent formulation of triclopyr was used for the treatment. The proposed dose was approximately 2.0-2.25 ppm in the bottom 4 feet of the water column. This required the application of 215 to 240 pounds of Renovate OTF per acre treated. In total, 65,200 pounds of Renovate OTF was applied to 285 acres.

SLPID secured approval to use a private shoreline, garage and barn located on Manning Cove Road to serve as the application staging area. This location was near the north-south midpoint of the treatment area and provided optimal access for the loading and unloading operation.

Figure 2: Treatment Sectors (285 acres)



The treatment area was divided into 13 sectors that ranged in size from 5 to 40 acres. The total number of pounds of Renovate OTF (and number of 40 pound bags) was calculated for each sector and a log sheet was created as an application record for the two treatment boats.

The treatment was performed using two work skiffs. Both boats were outfitted with a granular eductor spray system that fed the granular herbicide into a stream of water using a calibrated venturi-type eductor. The mixture was then sprayed off the stern of each boat through fan-jet pattern nozzles. This system allowed for the granular herbicide to be evenly distributed throughout the treatment areas as a course spray and the "flash-mixing" the granules with water before application significantly reduced the potential for airborne dust and off-target drift. Both boats were equipped with Differential/ WAAS GPS navigation systems to insure that the herbicide was evenly applied to the designated treatment areas.

Treatment Summary

The treatment was completed as scheduled between 26 May 2008 and 29 May 2009. Weather conditions were fairly consistent during all four days of the treatment. Air temperature ranged between 60-65° F, skies were overcast with drizzle and light rain, and wind was generally out of the south/southeast at 5-10 mph. There was some gradual clearing on Friday morning.

Despite the adverse weather conditions, the central located staging area allowed for steady application of the 65,200 pounds of Renovate OTF> The granular eductor systems distributed Renovate OTF at an average rate of 25 pounds per minute. Each treatment boat had a New York State Certified Applicator and one assistant. There were two additional ACT assistants' on-shore delivering 2000 pound pallets of Renovate OTF to the treatment boats using an extended reach forklift. No problems were encountered during the four days of application. All empty Renovate OTF bags were triple rinsed on-site and then brought back to ACT's Sutton, MA facility for recycling/disposal.

Herbicide Residue Testing

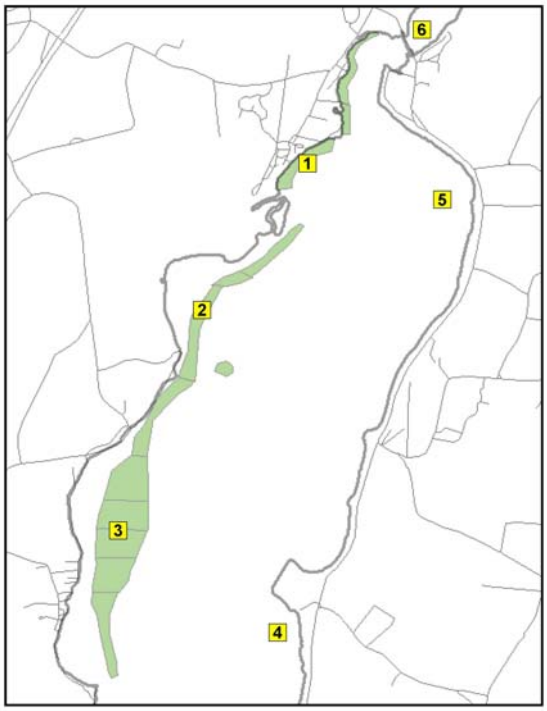
Since triclopyr only requires a relatively short contact time, extensive monitoring of in-lake concentrations was not performed. The sampling that was conducted was performed to determine when in-lake herbicide concentrations dropped below the 50 ppb drinking water threshold established by NYSDEC.

Lake water samples were collected from six locations by ACT for analysis of in-lake triclopyr residues. Collected samples were shipped via overnight delivery to SePRO's laboratory in Whittakers, North Carolina and analyzed using their immunoassay procedure. Laboratory results are provided in Appendix A.

Table 1: Post-treatment triclopyr concentrations (reported in ppm)

Collection Date	6/4	6/15	6/29	8/4
1	0.029	0.023	0.020	0.005
2	0.033	0.030	0.018	0.005
3	0.027	0.029	0.023	0.006
4	0.021	0.029	0.022	0.005
5	0.028	0.029	0.023	0.005
6	0.031	0.028	0.016	0.005
Lake Average (1-6)	0.028	0.028	0.020	0.005
Days after treatment	7	18	32	61

Figure 3: Triclopyr residue sampling locations



Within approximately one-week of the completion of the treatment, triclopyr concentrations had dissipated to nearly uniform levels lake-wide were below the NYSDEC established drinking threshold of 50 ppb. Not much additional loss of the in-lake triclopyr concentration was noted during the month of June. By the time the final round was collected on August 4th, a trace in-lake

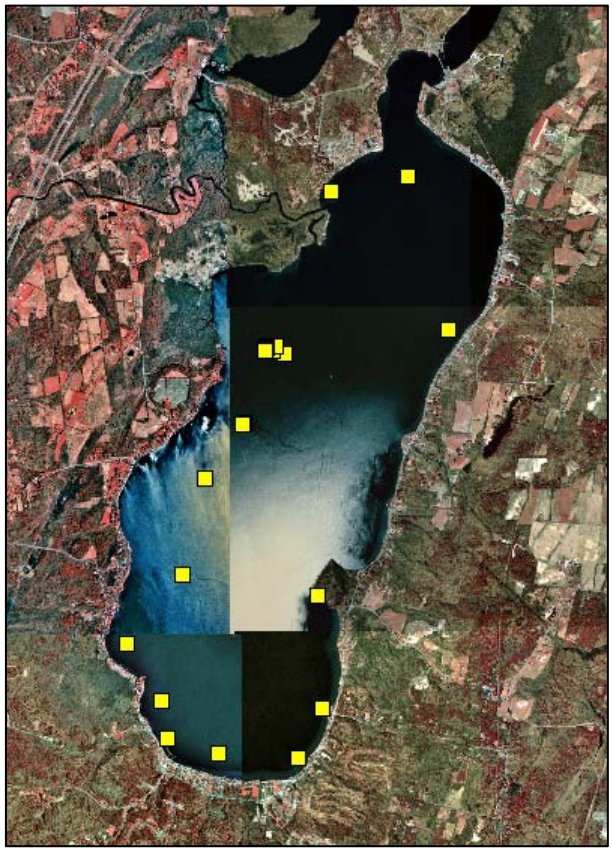
concentration of 5 ppb was still present in the lake. In 2008, triclopyr concentrations were <1 ppb within three weeks of the treatment. Similarly slow rate of triclopyr dissipation were seen at two sites that were treated with Renovate herbicide in Vermont in 2009. One possible explanation is that the cool, cloudy and rainy conditions experienced during the months of June and July slowed the rate of photodegradation, which is one of the primary degradation pathways for triclopyr.

Post –Treatment Inspections

ACT toured the entire perimeter of the lake on 4 June 2009 to collect first round of water samples for analysis of triclopyr residues. By that time, EWM was already showing significant stress from the treatment. EWM plants were bending over in the water column and the leaves were showing signs of epinasty, which is the bending and twisting associated with exposure to triclopyr herbicide. No visible impacts were noted on other non-target species. In fact, curlyleaf pondweed (*Potamogeton crispus*) the other dominant invasive species had grown and was breaking the surface in many locations including areas that were treated a week earlier.

Another visual inspection was performed by representatives from ACT, SLPID and SePRO on 15 July 2009. Weather conditions were favorable with sunny skies and a light (5-10 mph) wind out of the south that provided for good visibility. The treatment area was toured by boat and visually assessed. A throw rake was used to sample the submersed plant community in several locations. No viable, rooted EWM plants were seen in the treatment area or in any other area of the lake that was inspected. Many native plants were exhibiting robust growth, most notably: *Elodea canadensis, Najas spp., Potamogeton praelongus,* and *Stuckenia pectinata.* Similar to 2008, the native plant biomass within the treatment area was significant enough that SLPID was directing the harvester operators to cut off the top 2 feet along high-use, developed shorelines.

Figure 4: August 2009 EWM distribution reported by DFWI



DFWI reported that some widely scattered EWM growth was found throughout the littoral zone. EWM growth was reported as "limited" except for a cluster of points found near the sunken island at the southern end of Manning's Cove.

ACT conducted a late season visual inspection on 1 October 2009 with representatives from SLPID, The LA Group and NYSDEC. Scattered EWM plants were encountered in several locations. The most abundant EWM growth was seen in the shallows at the mouth of the Kayaderosseras inlet and around the sunken island. Widely scattered EWM plants were seen along the southwest and southern shorelines. In these areas, individual EWM plants or small clusters of EWM growth were mixed in with dense native plant growth.

No adverse impacts to water quality or water clarity were noted or reported following treatment. No planktonic algal blooms were observed or reported following treatment. During each

inspection ACT made at Saratoga Lake, water clarity was estimated to be in excess of 3 meters.

SUMMARY OF LATE SEASON COMPREHENSIVE AQUATIC VEGETATION SURVEY

An interim report of the comprehensive aquatic vegetation survey performed by the DFWI is provided in Appendix B.

The Point-Intercept Rake Toss method utilized was consistent with requirements for NYSDEC Tier III lakes. This approach also replicated the point-intercept survey of Saratoga Lake that was conducted by DFWI in 2004, 2007 and 2008.

A total of 24 species were documented during by the point-intercept survey and the list was comparable with the prior years. Two quantitative indices were provided in the interim report. Species richness or the average number of species per sample point was higher in 2009 (2.74 ± 0.12) as compared to 2008 (2.47 ± 0.12). Frequencies of occurrence values for the dominant aquatic plant species were also provided. EWM frequency was reduced from 13% of the sample points in 2008 to 7% of the sample points in 2009. This dropped EWM from the seventh to the ninth most widely distributed plant in Saratoga Lake. Changes to some of the other predominant species are shown below:

Table 2: Species frequency comparison between 2004, 2008 and 2009 lake-wide surveys (reported by DFWI)

Species	2004	2008	2009
Myriophyllum Spicatum	54.2%	13.0%	6.8%
Ceratophyllum demersum	38.2%	59.0%	61.4%
Zosterella dubia	28.6%	23.1%	20.4%
Vallisneria americana	23.4%	30.6%	31.2%
Najas guadalupensis	11.4%	30.9%	38.3%
Elodea canadensis	7.4%	25.3%	40.7%
Chara / Nitella	6.8%	6.8%	10.5%
Potamogeton zosteriformes	6.2%	14.5%	17.3%
Najas flexilis	5.5%	8.6%	13.6%
Potmogeton perfoliatus	2.8%	5.9%	8.0%
Potamogeton crispus	1.2%	5.6%	3.1%
Potamogeton illinoensis	1.8%	4.0%	4.6%
Megalodonta beckii	1.8%	0.9%	0.9%
Potamogeton praelongus	1.5%	2.8%	3.1%
Potamogeton pusillus	0.6%	8.6%	6.5%

No significant reductions of native species frequency of occurrence were noted between the three different data sets. The most noteworthy increases include: *Ceratophyllum demersum, Najas guadalupensis* and *Elodea canadensis*. All three of these species appear to be filling space that was previously occupied by EWM growth. Additional survey data was collected by DFWI in 2007, but a lake-wide survey was not performed.

SUMMARY OF THREE-YEAR HERBICIDE TREATMENT PROGRAM

Results of measured indices as well as anecdotal reports from SLPID all indicate that the three-year herbicide treatment program targeting control of Eurasian watermilfoil at Saratoga Lake was a success. Effective EWM control was achieved in the designated treatment area during each year of treatment, and carryover control was maintained for two years after treatment in the south end and for one year after treatment along the eastern shoreline. Dense floating beds of EWM did not develop on the lake during the 2007, 2008 or 2009 seasons, due to the increased harvesting efficiency in non-treatment areas and carryover control following the 2007 and 2008 herbicide treatments. Overall, the lake was described as being more usable by recreational boaters.

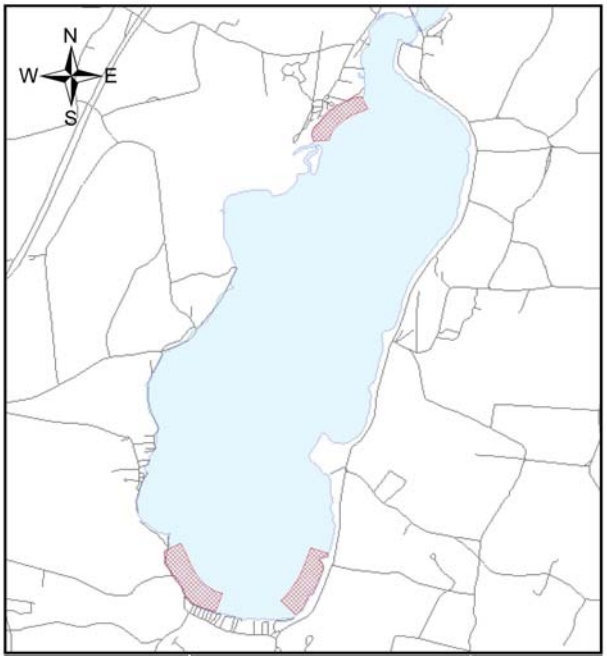
The frequency of occurrence of EWM at the 324 point-intercept sampling locations was reduced from 55% in 2004 to 7% in 2009. EWM was reduced from being the most commonly encountered plant in 2004 to the ninth on the list in 2009. The mean species richness at each sample point increased from 1.43 in 2004 to 2.47 in 2008 to 2.74 in 2009. No significant reductions or loss of native species were documented by the DFWI survey. In fact, several species showed significant increases in frequency of occurrence values between the three data sets.

Both fluridone and triclopyr herbicides provided multiple-year control of EWM with excellent selectivity and preservation of native species. The 2007 fluridone (Sonar PR and Sonar Q) treatment of the southern end of the lake has now achieved nearly three complete summer seasons of effective EWM control. The triclopyr (Renovate OTF) treatment of the eastern shoreline in 2008 has provided two summers of nearly complete EWM control. There is not yet enough Northeast treatment experience to accurately predict the duration of EWM control following triclopyr treatment, but at least three years is expected.

RECOMMENDATIONS FOR FUTURE AQUATIC PLANT MANAGEMENT EFFORTS

EWM control will need to continue at Saratoga Lake for the foreseeable future. Eradication is probably not a realistic objective given current technology, but the previous three years demonstrated that multiple-year, species-selective EWM can be achieved.

Figure 5: Potential 2010 herbicide spot-treatment areas



EWM plants were still found at nearly 7% of the survey points during the 2009 survey. Some EWM plants were found within the 2009 treatment area on the western shoreline, primarily near the mouth of the Kayaderosseras inlet and by the sunken island at the south end of Manning's Cove. Both of these areas were most likely subject to excessive dilution and the lethal concentration-exposure-time for triclopyr was not maintained. The southern shoreline probably supported the most extensive EWM regrowth. EWM plants were part of a diverse plant assemblage and were estimated to comprise less than 5% of the total plant cover where encountered.

Triclopyr, specifically the Renovate OTF (granular) formulation, has achieved species-

selective EWM control at Saratoga Lake and in several other large lake systems treated in New York and Vermont over the past few years. Triclopyr will undoubtedly continue to be an important EWM management tool at Saratoga Lake in future years. The 2008 and 2009 treatments at Saratoga Lake were of large contiguous areas that helped maintain sufficient concentration-exposure-times. Efficacy of some of the smaller scale triclopyr treatments performed on Vermont lakes in recent years suffered from dilution with untreated lake water. In order to minimize the effects of dilution and to insure effective EWM control, the following considerations should be taken for future triclopyr treatments at Saratoga Lake:

1. Treat a minimum of 5 contiguous acres
2. Increase treatment dose accordingly as the treatment area is reduced; dosing may need to calculated on the volume of the entire water column and not just the bottom 4 feet
3. Delay treatment until at least 4-5 feet of active EWM growth is present to help maximize herbicide uptake
4. Consider a split-application approach to maximize the concentration-exposure-time

Another aquatic herbicide treatment approach being evaluated by several government and academic based research groups is treating with a combination of two herbicides that have different modes of action. Probably the most studied combination treatment for EWM control in recent years has been the use of an auxin-mimic herbicide like triclopyr (or 2,4-D) and endothall a contact-acting herbicide. There is reportedly a synergistic effect from applying the herbicides at the same time that improves herbicide uptake. The primary advantages of this herbicide combination are 1.) EWM is controlled with lower rates triclopyr than if triclopyr were applied alone and 2.) curlyleaf pondweed is also controlled. Saratoga Lake does support nuisance levels of curlyleaf pondweed. The early season density and biomass of curlyleaf pondweeed appears to have increased in recent years, likely due to the reduction of EWM and the resulting lack of competition for early season growth. The current harvesting program cannot adequately address the rapid growth of curlyleaf pondweed. Combination treatments with triclopyr and endothall may prove to be a cost-effective means of targeting two invasive species in Saratoga Lake in future years. Additional combination treatments are also being evaluated between penoxsulam, endothall and triclopyr. Penoxsulam (trade name Galleon) recently received its full EPA label registration for treatment of submersed aquatic vegetation. It is an ALS-inhibitor that is classified by EPA as a reduced-risk pesticide.

Ongoing monitoring and a commitment to an integrated management approach will be paramount to the continuation of a successful EWM management program at Saratoga Lake. SLPID is currently working with The LA Group and ACT to evaluate options for future management of EWM and other invasive aquatic plants. A Supplemental EIS is currently being prepared to address the use of aquatic herbicides for “maintenance” control in the coming years.

APPENDIX A

- 2009 Triclopyr Residue Testing Results

Saratoga Lake 2009 Renovate Assay Results

Treatment date: 5/26/09 - 5/29/09

	Residue (ppm)			
Collection Date	**6/4**	**6/15**	**6/29**	**8/4**
1	0.029	0.023	0.020	0.005
2	0.033	0.030	0.018	0.005
3	0.027	0.029	0.023	0.006
4	0.021	0.029	0.022	0.005
5	0.028	0.029	0.023	0.005
6	0.031	0.028	0.016	0.005
Lake Average (1-6)	0.028	0.028	0.020	0.005
Days after treatment	7	18	32	61

FasTEST Results Confidential - Not For Distribution

Cooperator:	Aquatic Control Technology, Inc	**Phone:**	**Fax:**
Gerald Smith	11 John Rd	(508) 865-1000	(508) 865-1220
Territory: Sarah Miller	Sutton MA 01590-		

Sample	Date(s) Treated	Herbicide	Date Collected	Rate Applied	Acres Treated	Sample Location Description	Results	UOM
1.	05/26/09	Renovate	6/4/2009	2.0-2.25 ppm	285	1	0.029	ppm
2.						2	0.033	ppm
3.						3	0.027	ppm
4.						4	0.021	ppm
5.						5	0.028	ppm
6.						6	0.031	ppm
7.								
8.								
9.								
10.								

Depth Sample Collected:

Date Sample Received: 6/5/2009

Storage Conditions: Analyzed upon receipt

Condition of Sample(s) Box/Water Containers: Excellent

Date Shipped to SePRO: 6/4/2009

Date Analysis was Performed: 6/5/2009

Run #: TR0104 **% Control Rec:** 103 **Correlation:** 0.994

Date Results Sent to Cooperator: 6/8/2009

Back of Data Sheet

Name of Waterbody: Saratoga Lake

Average Depth in Feet:

Back of Data Sheet

Size of Waterbody in Acres:

Target Plant(s) to Control:

FasTEST Results Confidential - Not For Distribution

Cooperator:	Aquatic Control Technology, Inc	**Phone:**	**Fax:**
Gerald Smith	11 John Rd	(508) 865-1000	(508) 865-1220
Territory: Sarah Miller	Sutton MA 01590-		

Sample	Date(s) Treated	Herbicide	Date Collected	Rate Applied	Acres Treated	Sample Location Description	Results	UOM
1.	05/26/09	OTF	6/15/2009	2.0-2.25 ppm	285	1	0.023	ppm
2.						2	0.030	ppm
3.						3	0.029	ppm
4.						4	0.029	ppm
5.						5	0.029	ppm
6.						6	0.028	ppm
7.								
8.								
9.								
10.								

Depth Sample Collected: surface grab

Date Sample Received: 6/18/2009

Storage Conditions: Analyzed upon receipt

Condition of Sample(s) Box/Water Containers: Excellent

Date Shipped to SePRO: 6/17/2009

Date Analysis was Performed: 6/19/2009

Run #: TR0112 **% Control Rec:** 106 **Correlation:** 0.997

Date Results Sent to Cooperator: 6/19/2009

Back of Data Sheet

Name of Waterbody: Saratoga Lake

Average Depth in Feet:

Back of Data Sheet

Size of Waterbody in Acres: 4000

Target Plant(s) to Control: M. Spicatum

FasTEST Results Confidential - Not For Distribution

Cooperator:	Aquatic Control Technology, Inc	**Phone:**	**Fax:**
Gerald Smith	11 John Rd	(508) 865-1000	(508) 865-1220
Territory: Sarah Miller	Sutton MA 01590-		

Sample	Date(s) Treated	Herbicide	Date Collected	Rate Applied	Acres Treated	Sample Location Description	Results	UOM
1.	05/29/09	Renovate 3	6/29/2009	2.0-2.25ppm	285	site 1	0.020	ppm
2.	05/29/09	Renovate 3	6/29/2009	2.0-2.25ppm	285	site 2	0.018	ppm
3.	05/29/09	Renovate 3	6/29/2009	2.0-2.225ppm	285	site 3	0.023	ppm
4.	05/29/09	Renovate 3	6/29/2009	2.0-2.225ppm	285	site 4	0.022	ppm
5.	05/29/09	Renovate 3	6/29/2009	2.0-2.225ppm	285	site 5	0.023	ppm
6.	05/29/09	Renovate 3	6/29/2009	2.0-2.225ppm	285	site 6	0.016	ppm
7.								
8.								
9.								
10.								

Depth Sample Collected: surface grab

Storage Conditions: Refrigerated

Date Shipped to SePRO: 6/29/2009

Date Sample Received: 6/30/2009

Condition of Sample(s) Box/Water Containers: Excellent / excellent

Date Analysis was Performed: 7/1/2009

Run #: TR0117 **% Control Rec:** 115 **Correlation:** 0.991

Date Results Sent to Cooperator: 7/1/2009

Back of Data Sheet

Name of Waterbody: Saratoga Lake

Average Depth in Feet: 0

Back of Data Sheet

Size of Waterbody in Acres: 4000

Target Plant(s) to Control: m. spicatum

FasTEST Results Confidential - Not For Distribution

Cooperator:	Aquatic Control Technology, Inc	**Phone:**	**Fax:**
Gerald Smith	11 John Rd	(508) 865-1000	(508) 865-1220
Territory: Sarah Miller	Sutton MA 01590-		

Sample	Date(s) Treated	Herbicide	Date Collected	Rate Applied	Acres Treated	Sample Location Description	Results	UOM
1.	05/26/09	OTF	8/4/2009	2.0-2.25 ppm	285	1	0.005	ppm
2.						2	0.005	ppm
3.						3	0.006	ppm
4.						4	0.005	ppm
5.						5	0.005	ppm
6.						6	0.005	ppm
7.								
8.								
9.								
10.								

Depth Sample Collected: surface

Storage Conditions: Analyzed upon receipt

Date Shipped to SePRO: 8/4/2009

Run #: TR0139 **% Control Rec:** 99 **Correlation:** 0.996

Date Sample Received: 8/5/2009

Condition of Sample(s) Box/Water Containers: Excellent

Date Analysis was Performed: 8/5/2009

Date Results Sent to Cooperator: 8/5/2009

Back of Data Sheet

Name of Waterbody: Saratoga Lake

Average Depth in Feet:

Back of Data Sheet

Size of Waterbody in Acres: 4000

Target Plant(s) to Control: M spicatum

APPENDIX B

Interim Report - Comprehensive Aquatic Vegetation Survey 2009

(prepared by Darrin Fresh Water Institute)

Interim Report on Vegetation of Saratoga Lake, New York
Lawrence W. Eichler and Charles W. Boylen
Darrin Fresh Water Institute
Bolton Landing, NY 12814
(518) 644-3541 (voice) (581) 644-3640 (fax)
eichll@rpi.edu boylec@rpi.edu

Background.

Quantitative aquatic plant surveys were undertaken for Saratoga Lake, New York as part of a cooperative effort between Aquatic Control Technologies (ACT) and the Darrin Fresh Water Institute, and supported by the Saratoga Lake Protection and Improvement District (SLPID). The aquatic plant survey was designed to be comparable to pre-treatment and post-treatment data collected by the author in 2004, 2007 and 2008 (Eichler & Boylen 2004; 2007; 2008) to evaluate a treatment program based on application of the herbicide fluridone (SONAR^{TM}) in 2007 and the herbicide triclopyr (Renovate) in 2008 and 2009 (Figure 1) to control Eurasian watermilfoil (*Myriophyllum spicatum*). The Point-Intercept Rake Toss method presently required by NYS DEC for Tier III Lakes was employed.

The project was designed to obtain data to evaluate current aquatic plant management efforts and review potential new strategies. The assessment will generate the information necessary to: 1) review effectiveness of aquatic plant management efforts, 2) meet all permit requirements and 3) provide data for comparison of post-treatment conditions to prior survey information.

Methods

1. Species List and Herbarium Specimens. As the lake was surveyed, the occurrence of each aquatic plant species observed was recorded and adequate herbarium specimens collected. Herbarium specimens were pressed, dried, and mounted (Hellquist 1993) at the Darrin Fresh Water Institute Laboratory in Bolton Landing, NY, where they became part of the permanent collection.

2. Point Intercept. The frequency and richness of aquatic plant species were evaluated using a point intercept (rake toss) method (Madsen 1999). At each grid point intersection, all species located at that point were recorded, as well as water depth. Species were located by a visual inspection of the point and by deploying a rake to the bottom, and examining the plants retrieved. A differential global positioning system (DGPS) was used to navigate to each point for the survey observation. Point intercept plant frequencies were surveyed in August of 2008, at the time of maximum aquatic plant abundance. Based on an 80 m grid and excluding the majority of points outside the littoral zone, we surveyed a total of 324 points on Saratoga Lake (Figure 2). The point intercept method allows a large number of discrete observations in a short

period of time facilitating statistical analysis and comparisons. Point intercept methods also allow for production of distribution maps for all species listed.

Figure 1. Aquatic plant management plan for Saratoga Lake prepared by Aquatic Control Technologies, Inc.

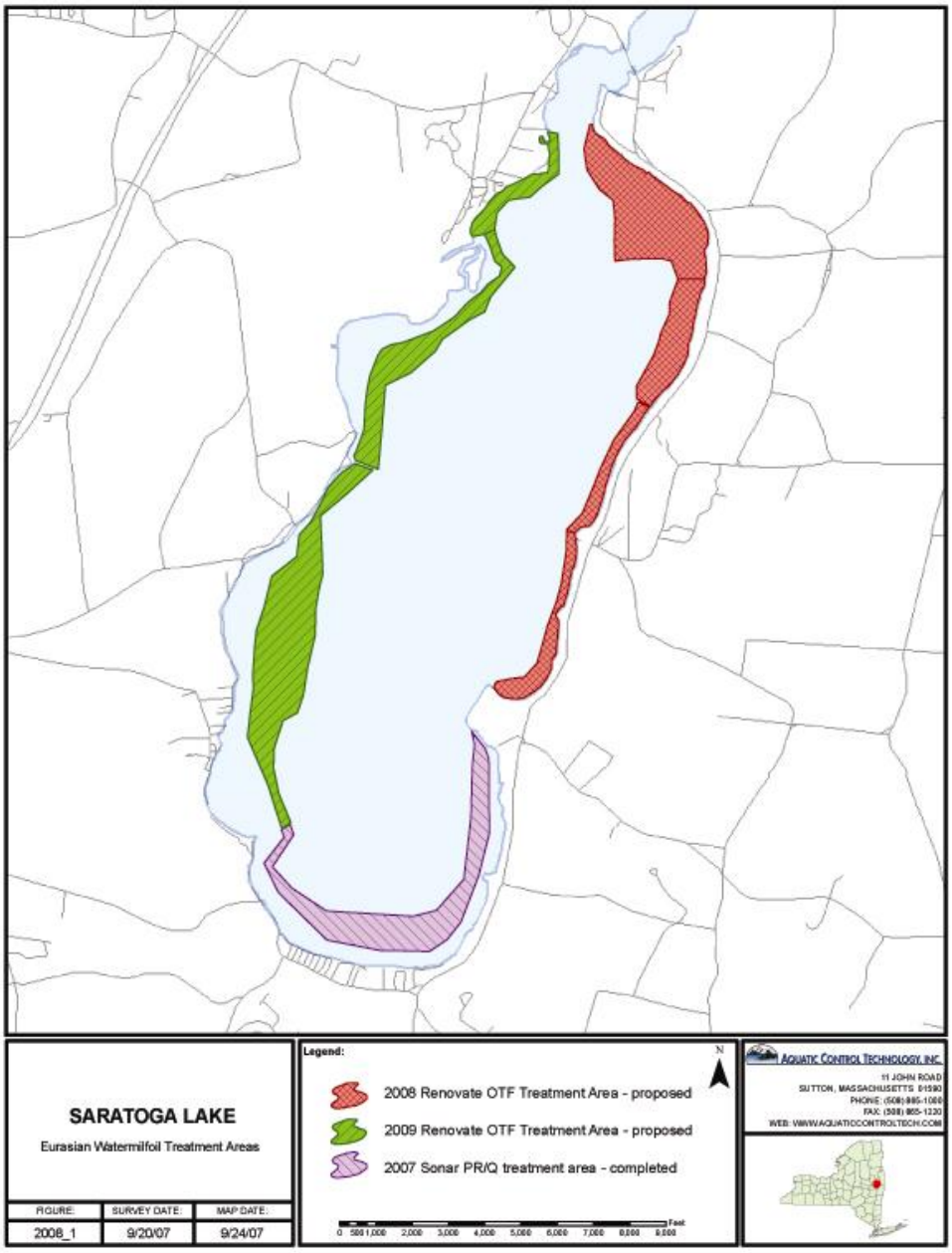
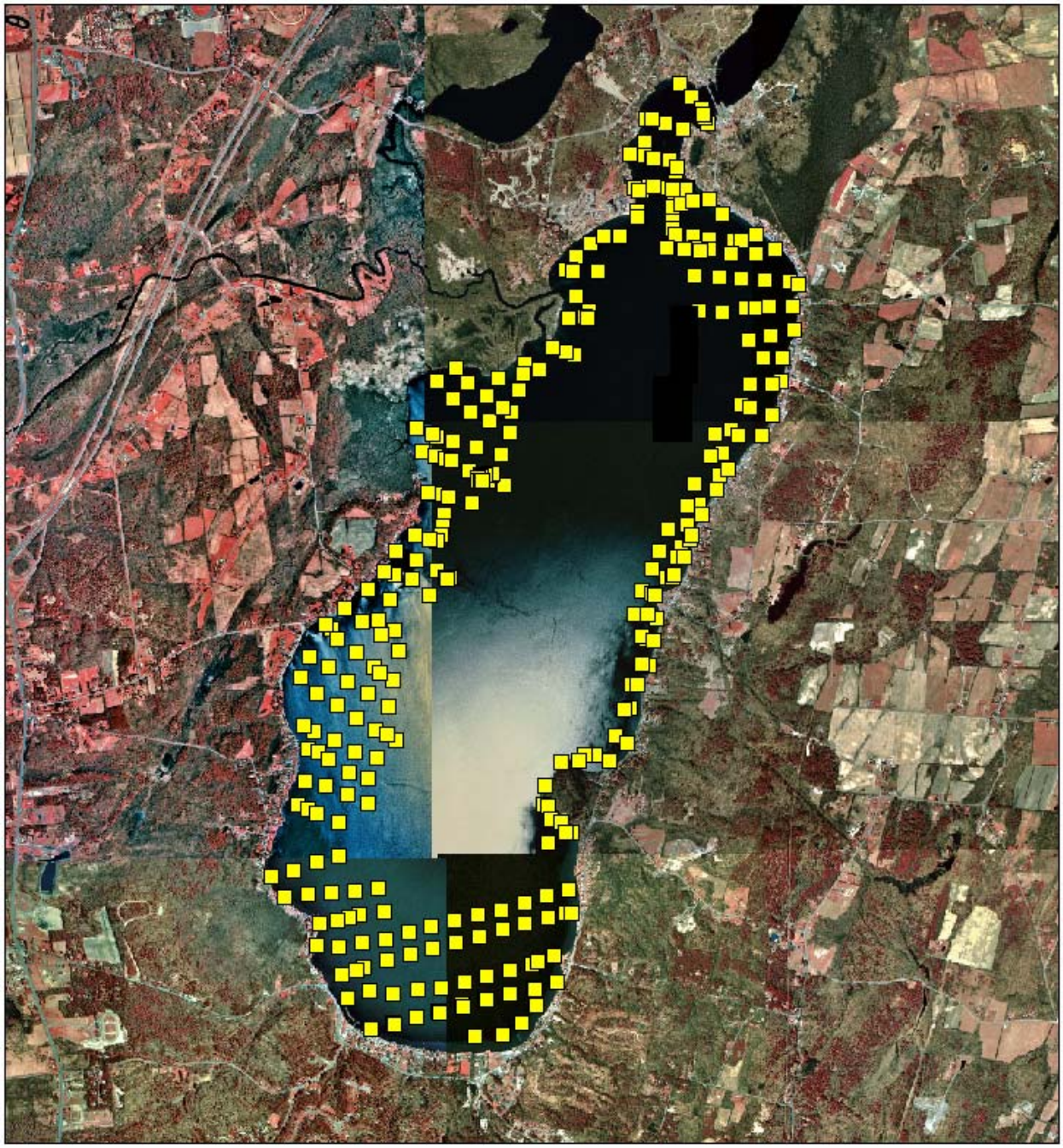


Figure 2. Sampling points for 2009 Saratoga Lake aquatic plant survey.



Results

1. Species List. A preliminary list of species observed for Saratoga Lake is provided in Table 1. A total of 24 species were collected in the point intercept portion of the survey and 29 species were observed in Saratoga Lake in 2009. These results are comparable to previous surveys in 2007 - 2008 (25 species, Eichler and Boylen 2008), 2004 (21 species, Eichler and Boylen 2004), 1994 (22 species, Eichler and Boylen 1995), 1982 (21 species, Hardt et al. 1983) and 1969 (20 species, Dean 1969).

2. Species Frequency. Species richness in Saratoga Lake was quite high, with a large number of species occurring in more than 5% of survey points (Table 2). Eurasian watermilfoil was the ninth most widely distributed plant (7% of survey points, Figure 3), a decline from seventh in 2008 (Figure 3). Common native species included *Ceratophyllum demersum* (61%), *Elodea canadensis* (41%), *Najas guadalupensis* (38%), *Vallisneria americana* (31%), *Zosterella dubia* (20%), *Potamogeton zosteriformis* (17%), *Najas flexilis* (14%), *Potamogeton perfoliatus* (8%) and *Potamogeton pusillus* (7%). Average number of species per sample point was greater in 2009 (2.74 ± 0.12) than in 2008 (2.47 ± 0.12).

Figure 3. Distribution of Eurasian watermilfoil (*Myriophyllum spicatum*) in surveyed areas of Saratoga Lake in 2009.

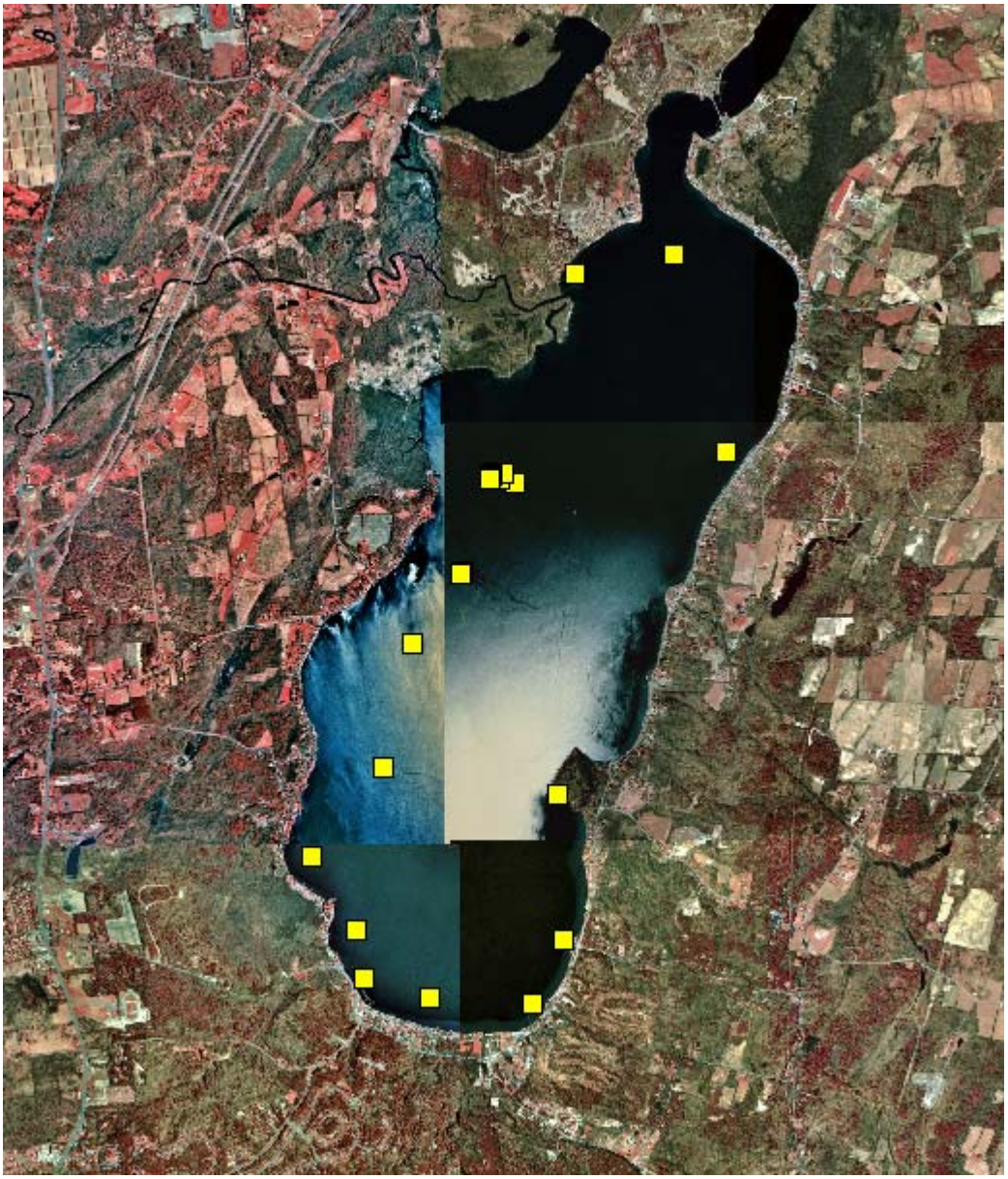


Table 1. Aquatic plant species present in Saratoga Lake in recent surveys.

Species	**Common Name**	**1932**	**1969**	**1982**	**1994**	**2004**	**2007**	**2008**	**2009**
Ceratophyllum demersum L.	coontail	x	x	x	x	x	x	x	x
Chara/Nitella sp.	muskgrass, chara		x	x	x	x	x	x	x
Eleocharis acicularis (L.) Roemer & Schultes	needle spike-rush	x		x	x	x			
Elodea canadensis Michx.	elodea	x	x	x	x	x	x	x	x
Eriocaulon septangulare With.	pipewort				x				
Lemna minor L.	duckweed	x	x	x	x	x	x	x	x
Lemna trisulca	duckweed					x	x	x	x
Megalodonta beckii Torr.	water marigold				x	x	x	x	x
Myriophyllum sibiricum	northern watermilfoil		x						
Myriophyllum spicatum L.	Eurasian watermilfoil			x	x	x	x	x	x
Najas flexilis (Willd.) Rostk. & Schmidt.	bushy pondweed		x		x	x	x	x	x
Najas minor				x					
Najas guadalupensis (Spreng.) Magnus	Southern naiad			x	x	x	x	x	x
Nuphar luteum (Ait.) Ait. f.	yellow pondlily		x	x	x	x	x	x	x
Nymphaea odorata	white pondlily		x	x		x	x	x	x
Pontederia cordata	pickerelweed	x	x			x	x	x	x
Potamogeton amplifolius Tuckerm.	largeleaf pondweed	x	x	x	x	x	x	x	x
Potamogeton crispus L.	curlyleaf pondweed	x	x	x	x	x	x	x	x
Potamogeton epihydrus Raf.	ribbon-leaf pondweed				x				
Potamogeton gramineus L.	variable-leaf pondweed				x	x	x	x	x
Potamogeton illinoensis L.	Illinois pondweed					x	x	x	x
Potamogeton natans	pondweed	x	x						
Potamogeton perfoliatus L	Clasping-leaved Pondweed				x	x	x	x	x
Potamogeton praelongus Wulfen	white-stem pondweed	x			x	x	x	x	x
Potamogeton pusillus L.	small pondweed		x		x	x	x	x	x
Potamogeton richardsonii (Ar. Benn.) Rydb.	Richardsons' pondweed		x	x		x			
Potamogeton robbinsii Oakes	Robbins' pondweed		x	x	x			x	x
Potamogeton zosteriformis Fern.	flat-stem pondweed				x	x	x	x	x
Ranunculus longirostris Godron	white watercrowfoot				x	x			x
Sagittaria graminea Michx.	arrowhead	x	x	x	x	x			
Scirpus	rush	x	x						x
Sparganium sp.	burreed	x			x				x
Spirodela polyrhiza (L.) Schlieden	great duckweed			x	x				

Species	**Common Name**	**1932**	**1969**	**1982**	**1994**	**2004**	**2007**	**2008**	**2009**
Stuckenia pectinata L.	sago pondweed			**x**	**x**	**x**	**x**	**x**	**x**
Trapa natans L.	waterchestnut				**x**	**x**	**x**		
Typha	cattail	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Utricularia vulgaris L.	great bladderwort				**x**				**x**
Vallisneria americana L.	wild celery	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Wolffia	watermeal		**x**	**x**					
Zosterella dubia Jacq.	water stargrass			**x**	**x**	**x**	**x**	**x**	**x**

Table 2. Percent frequency of occurrence of aquatic plant species in Saratoga Lake. Invasive species are in bold.

Species	**2008**	**2009**
Ceratophyllum demersum	59.0%	61.4%
Chara/Nitella	6.8%	10.5%
Elodea canadensis	25.3%	40.7%
Lemna trisulca	2.2%	2.5%
Megalodonta beckii	0.9%	0.9%
Myriophyllum spicatum	**13.0%**	**6.8%**
Najas flexilis	8.6%	13.6%
Najas guadalupensis	30.9%	38.3%
Nuphar variegata	0.6%	0.3%
Nymphaea odorata	0.6%	0.3%
Potamogeton amplifolius	1.2%	1.2%
Potamogeton crispus	**5.6%**	**3.1%**
Potamogeton gramineus	0.3%	1.9%
Potamogeton illinoensis	4.0%	4.6%
Potamogeton perfoliatus	5.9%	8.0%
Potamogeton praelongus	2.8%	3.1%
Potamogeton pusillus	8.6%	6.5%
Potamogeton robbinsii	0.3%	0.9%
Potamogeton zosteriformes	14.5%	17.3%
Ranunculus longirostris	0.0%	0.3%
Stuckenia pectinata	2.5%	0.3%
Utricularia vulgaris	0.0%	0.3%
Vallisneria americana	30.6%	31.2%
Zosterella dubia	23.1%	20.4%

3. References

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