2012 Aquatic Vegetation Survey and Water Quality Monitoring Report
Foster's Pond
Andover, Massachusetts

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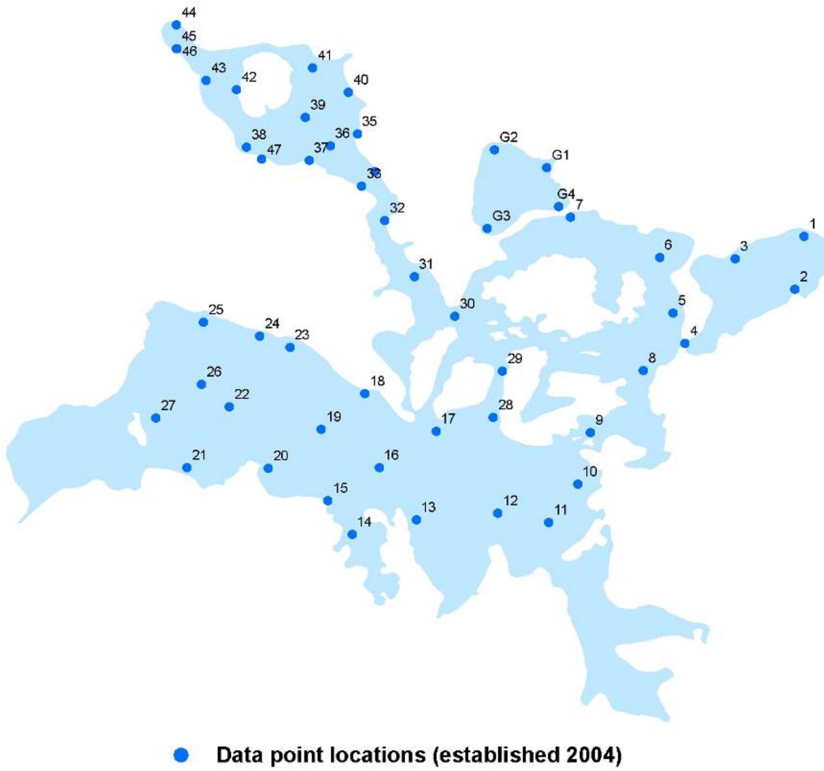
INTRODUCTION

Aquatic vegetation and water quality monitoring efforts continued at Foster's Pond in Andover during the 2012 season. No active in-lake management was performed at Foster's Pond during the 2012 season. It was one year after the whole-lake Sonar (fluridone) herbicide treatment that was performed in 2011 to control invasive fanwort (*Cabomba caroliniana)*. That treatment proved to be very effective, with no remaining or recovering fanwort plants seen during the late season survey performed in September 2011. Similar results were seen following the 2005 whole-lake Sonar herbicide treatment, but scattered fanwort regrowth was seen by mid summer of the following season. Changes to the treatment approach in 2011 to try and increase the duration of fanwort control included: use of the newest available time-release pellet formulation of Sonar (Sonar One) to allow for more targeted application to infested areas, and initiating the treatment program approximately four-weeks earlier when the fanwort plants were in an earlier stage of active growth and more susceptible. The purpose of the 2012 survey and monitoring effort was to document the level of carryover control that was achieved one-year after treatment, and to evaluate alternatives for ongoing lake management. The 2012 survey and monitoring work was performed by Aquatic Control Technology under contract with the Foster's Pond Corporation.

SURVEY METHODS

A comprehensive aquatic plant survey of Foster's Pond was performed on August 23, 2012. The objectives of the survey were to document aquatic plant composition and distribution and specifically to identify the presence of fanwort or other invasive species. The survey methodology used was consistent with surveys performed in prior years and utilized the same transects and data points that were established in 2004. In total 49 data points were surveyed. Plants were identified by visual inspection and by using a throw-rake. At each location the dominant plant was recorded along with all other species present. Plant cover was estimated as a percentage of the bottom covered with plant growth. A biomass index was assigned at each data point and was estimated on a scale ranging from "0"=no plants to "4"=plants filling the water column. A species richness index was assigned at each data point based on the total number of plant species found. Locations where invasive fanwort was encountered were georeferenced using a handheld GPS unit. A map depicting transect and data point locations follows; the data collected on 9/19/11 is attached to this report.

Figure 1: Aquatic Plant Data Point Locations



VEGETATION SURVEY RESULTS

Overall, the lakewide aquatic plant distribution and density appeared to be lower in 2012 than was documented in other non-treatment years. We expect that this was caused by two primary factors. First, the lake was still in a recovery mode following the 2011 Sonar herbicide treatment program. Second, there was a microscopic algae bloom at the time of the survey. The bloom was dominated by bluegreen algae (Cyanobacteria) that caused reduced water clarity of only 2-3 feet through large portions of the lake. The shading effects of the algae bloom likely limited vascular aquatic plant growth in large sections of the lake.

Table 1: Aquatic Vegetation Data Summary

Year	Estimated % Total Plant Cover	Estimated % Fanwort Cover	Biomass Index	Species Richness Index
2004	78.9	54.5	2.9	3.6
2005[1]	25.5	0.1	1.4	1.7
2008	15.9	0.9	1.6	1.7
2009	34.2	6.1	1.6	5.5
2011[1]	19.0	0	1.2	1.4
2012	21.2	0.1	1.3	1.6

[1]Whole-lake Sonar (fluridone) treatment performed

By all measures, the aquatic plant distribution and density was reduced at Foster's Pond in 2012. There was still diversity of plant types consistent with prior years, but only 14 species were encountered at data point sampling locations.

A list of the plants observed in 2012 with historical comparison of plant presence and absence follows:

Table 2: Aquatic Species List (2004-2012)

Type	Macrophyte Species	Common Name	2004	2005	2008	2009	2011	2012
Submersed	*Bidens beckii*	Water marigold	X			X		
	Cabomba caroliniana	Fanwort	X	X	X	X		X
	Callitriche palustris	Water starwort				X		
	Ceratophyllum demersum	Coontail	X	X	X	X	X	X
	Chara vulgaris	Musk grass				X	X	
	Chlorophyta	Filamentous algae	X	X	X	X	X	X
	Egeria densa	Brazilian elodea		X	X	X		
	Elodea canadensis	Common waterweed				X		
	Hypericum boreale	Northern St. John's wort				X		
	Isoetes	Quillwort		X	X	X	X	X
	Ludwigia palustris	Water purslane				X	X	X
	Musci	Water moss		X	X	X		X
	Myriophyllum humile.	Lowly Milfoil		X	X	X	X	
	Najas flexilis	Bushy pondweed		X	X	X		X
	Najas minor	Spiny naiad				X		
	Nitella sp.	Stonewort		X	X	X	X	X
	Potamogeton amplifolius	Largeleaf pondweed	X					
	Potamogeton epihydrus	Ribbonleaf pondweed	X		X	X	X	X
	Potamogeton gramineus	Variable-leaf pondweed	X			X		X
	Potamogeton natans	Floating leaf pondweed			X	X		
	Potamogeton perfoliatus	Clasping-leaf pondweed	X					
	Sagittaria sp.	Arrowhead			X	X		X
	Utricularia	Bladderwort	X	X	X	X	X	X
	Valliseria americana	Wild celery	X			X		
Floating Leaf	*Brasenia schreberi*	Watershield	X		X	X		X
	Lemna minor	Lesser duckweed				X		
	Nuphar variegatum	Yellow waterlily		X	X	X	X	X
	Nymphaea odorata	White waterlily	X	X	X	X	X	X
	Spirodela polyrhiza	Big duckweed				X		
Emergent	*Decodon verticillatus*	Water willow	X	X	X	X	X	X
	Eleocharis sp.	Spikerush				X		
	Eriocaulon sp	Pipewort	X	X	X			
	Lythrum salicaria	Purple loosestrife	X	X	X	X	X	X
	Peltandra viginica	Arrow arum				X		
	Pontederia cordata	Pickerelweed	X	X	X	X	X	X
	Scirpus sp.	Rushes	X	X	X			
	Sparganium sp.	Burreed	X		X	X	X	X
	Typha sp.	Cattail	X	X	X	X	X	X

Carryover control of fanwort remained favorable one year after treatment. Only a small area of scattered fanwort growth was found extending from the mouth of Mill Reservoir through the narrow channel that runs north towards the Azalea Drive basin. An additional small cluster of fanwort plants (10-12 stems) was found on the eastern shoreline of Dug Pond. The fanwort plants in Dug Pond were removed by hand-pulling by wading into the pond. Removal of all of the plants was attempted, but once a few stems were pulled the bottom sediment was stirred-up limiting visibility. The fanwort plants found between Mill Reservoir and Azalea Drive were very small (generally <1 foot tall) and were intermixed with dense growth of native plants and filamentous algae. The area was so shallow that it was difficult to navigate through using a small jon boat and visibility was immediately eliminated through disturbance of the bottom sediment. Hand removal was not attempted in this location. Aside from scattered growth of purple loosestrife that appeared to severely impacted by the herbivorous insect stocking program, no other invasive aquatic plant species were observed during the survey.

Figure 2: Fanwort Locations During 2012 Survey

WATER QUALITY MONITORING

Consistent with efforts in prior years, water quality sampling was performed throughout Foster's Pond in 2012. Surface grab water samples were collected from five locations as shown in Figure 3. Four of the locations (WQ1, WQ2, WQ3 and WQ4) were sampled in prior years. One additional location was sampled at the Azalea Drive basin (WQ5) due to the significantly higher water clarity noticed at that location during the survey. Laboratory analysis of the samples was performed for the following parameters: pH, Alkalinity, Total Phosphorus, Turbidity, True Color, Apparent Coler, and E. coli bacteria. In addition, measurements of Secchi Disk water clarity were recorded at each sampling location and on temperature/dissolved oxygen profile was measured at the deep hole located in the Main Pond.

Additional water samples were also collected from the five sampling locations and from a few select additional locations for microscopic analysis of planktonic (free-floating) algae. Samples were preserved and analyzed by ACT. Algae was identified to the basic taxa level and estimates of algal density were made through enumeration using a Sedgewick-Rafter counting cell.

Figure 3: Water Quality Sampling Locations

Table 3: Water Quality Sampling Results

		Mill Reservoir	Dug Pond	Main Pond	Outlet Cove	Azalea Drive
Parameter	**Units**	**WQ1**	**WQ2**	**WQ3**	**WQ4**	**WQ5**
pH	S.U.	7.11	6.78	6.83	6.59	6.48
Alkalinity	mg/L CaC03	29	60	25	24	18.5
Phosphorus	mg/L	0.04	0.014	0.04	0.06	0.04
Turbidity	NTU	5.7	1.8	6	7.75	1.5
True Color	Pt-Co	40	25	30	40	40
Apparent Color	Pt-Co	45	60	45	40	50
E. coli	CFU/100 ml	ND	ND	ND	ND	20
Secchi Disk	Feet	3.1	7	2.3	2	8.5

ND = non-detect or below the laboratory detection limit

The water quality results were similar to results reported in prior years. The pH values were slightly lower in Foster's Pond proper than was reported in prior years, but they are still near neutral (7.0 S.U.) and are within normal ranges for freshwater systems in the Northeast. Adverse impacts to fish and other aquatic organisms are generally not seen if the pH is above 5.0 and below 9.0. Alkalinity was nearly the same at all locations, except Dug Pond were it was considerably higher. This may be due to inorganic or organic material (e.g. algae). Total phosphorus values were elevated at most locations, except Dug Pond. Typically, phosphorus concentrations above

0.02 mg/L can support algal bloom conditions. The concentrations throughout Foster's Pond proper were sufficient to support algal blooms; however, curiously there was not a visible bloom occurring in the Azalea Drive basin. Turbidity values less than 5 NTU generally do not impact recreational uses. The elevated turbidity values seen in Mill Reservoir, the Main Pond and the Outlet Cove were probably due to increased algal densities. True color is a measure of filtered water and apparent color is a measure of the raw water. Values were similar to prior years and suggested that that both suspended particles (e.g. algae, suspended sediment) and dissolved material (e.g. tannins) impart color to the water. However, the algal bloom conditions are likely responsible for the majority of water coloration. Secchi disk readings were low everywhere except Dug Pond and the Azalea Drive basin. The only location where E.coli was detected was in the Azalea Drive basin. This was a low, background concentration as the Massachusetts standard for accredited bathing beaches is <235 CFU/100 ml.

Table 4: Temperature/Dissolved Oxygen Profile

Depth (M)	Temperature (°C)	Dissolved Oxygen (mg/L)
Surface	27.3	9.33
1	24.8	10.00
2	24.4	6.18
3	22.1	2.19

The temperature/dissolved oxygen profile measured at the deep hole location in the Main Pond showed that the water was super-saturated with oxygen in the upper portion of the water column, but oxygen concentrations dropped off rapidly as the depth increased. This is commonly seen in lakes that are experiencing algal blooms. This often causes diurnal fluctuations in oxygen concentrations that can stress fish and other aquatic organisms. In addition, when the bottom layers of the water column become anoxic (devoid of oxygen), phosphorus can actually leach out of the sediment and serve as an internal source to fuel additional algae growth.

The planktonic algae growth was dominated by bluegreen algae (cyanobacteria). The dominant taxa present was *Anabaena*. It accounted for more than 70% of the alga growth at the Mill Reservoir, Main Pond and Outlet Cove sampling stations, and was the dominant type of algae in all of the surface-scum samples that were tested. No *Anabaena* was found at the Dug Pond or Azalea Drive sample sites, which probably explains the higher water clarity. Other cyanobacteria present included *Microcystis, Aphanizomenon* and *Aphanocaspa*. These cyanobacteria are often associated with noxious bloom conditions. Some species are even capable of producing algal toxins that can be injurious to animals and humans. We understand that public health experts recommended imposing a swimming advisory after the cyanobacteria bloom was identified on Foster's Pond in 2012. This is becoming more common throughout the region, as awareness of cyanobacteria blooms and algal toxins increases.

SUMMARY AND ONGOING RECOMMENDATIONS

Even though there was not much recovery of invasive fanwort seen in Foster's Pond during the 2012 season, conditions in the lake were less than ideal. Algal bloom conditions probably dominated the lake for large period of the growing season, resulting in reduced water clarity and limited recovery of the native plant community. following the 2011 Sonar herbicide treatment program. If algal densities were lower, there would likely be improved water clarity and better recovery of native plants. Of course, they may have been more recovery of fanwort as well. The algal bloom conditions also proved to be problematic, causing concern among lake residents and users and prompting public health experts to recommend a swimming advisory. Ultimately, the recovery of diverse native plant community is needed to help provide fish and wildlife habitat, to utilize available phosphorus, to stabilize the bottom sediments and to serve as a natural impediment to fanwort and other invasive species. Specific recommendations for in-lake fanwort and algae management are provided below.

Fanwort Management

All of the herbicide treatments performed at Foster's Pond since 2005 targeting fanwort control, have relied on various liquid and time-release pellet formulations of Sonar (fluridone) herbicide. Until recently, fluridone was the only herbicide registered for aquatic use that effectively controlled fanwort. It is a proven herbicide with a favorably toxicology profile and its systemic mode of action targets the entire plant include the root structures, and it usually provides multiple years of nuisance-level fanwort control. The major limitation of fluridone is that its high-solubility and slow mode of action (i.e. long concentration-exposure-time requirement) greatly limits its effectiveness for partial lake or spot-treatment applications. The partial lake fluridone treatment that was performed in 2007 was reasonably effective, but the treated portions of the lake were isolated from the untreated section in the Main Pond using impermeable limno-curtains, which allowed essentially the entire northern half of the lake to be treated. Treating smaller areas with fluridone in Foster's Pond would be challenging. Treating the entire lake is effective, but it carries a high cost and impacts on the native plant community are unavoidable. Drastic reductions in total plant cover in the lake, can lead to more unstable conditions and the lake may be more subject to algal blooms developing.

In late 2010, a new herbicide called Clipper (active ingredient flumioxazin) was registered for aquatic use by the EPA. Clipper is contact-herbicide that has a rapid mode of action and a favorable toxicology profile. The only use restrictions on the EPA label following treatment are not to use treated water for irrigation purposes for a period of 1-5 days, depending on the dose applied and what is being irrigated. There are no swimming or even drinking restrictions listed on the EPA label. Clipper has demonstrated to be very effective at controlling fanwort. We applied Clipper to several waterbodies in New Hampshire, Connecticut and Rhode Island over the past two years, including a large lake in northeast CT and as a Research Project that we performed for NH DES on an impounded section of the Nashua River in the City of Nashua this past year. We are seeing complete control fanwort during the year of treatment with reduced regrowth seen the year after treatment. We performed spot-treatments at Quaddick Lake in Thompson, CT for two consecutive years, and no late season fanwort recovery was seen after the second consecutive year of treatment in 2012.

Clipper should be considered for future maintenance fanwort control work at Foster's Pond. Its rapid mode of action allows it to be used for spot-treatments. Treating a smaller percentage of Foster's Pond at a time should reduce impacts to the lakewide native plant cover. Where applied, Clipper is fairly broad-spectrum on aquatic plants – species susceptibility data is still being developed – but its mode of action is so fast that migration and impact to plants located outside of direct treatment areas are limited. Clipper is still not registered for use in Massachusetts, but the Department of Agricultural Resources in currently completing its review and they recently indicated that they expect Clipper to be registered for use in 2013. We think it would be worthwhile to modify the existing Order of Conditions to include the use of Clipper herbicide at Foster's Pond after its registration in Massachusetts.

Treatment costs with Clipper herbicide will likely vary between $600 and $1000 per acre, depending on the size and water volume of the area being treated. Treatment can occur whenever there is active plant growth, but due to its contact mode of action, we recommend delaying treatment until mid-late June so that all of the targeted fanwort plants are actively growing and to try and target the low-point of the energy reserves in their roots, after most of the energy has been expended to produce the stems and foliage.

Algae Management

It is our understanding that Foster's Pond has long suffered from elevated nutrient levels and nuisance algal blooms, but 2012 was an especially challenging year. Algae growth is seasonal and usually varies considerably from year to year. Bloom conditions are usually triggered by excessive nutrient levels (e.g. >0.02 mg/L of phosphorus) and adequate environmental conditions (e.g. temperature, sunlight). In systems like Foster's Pond that receive a sizeable percentage of total inflow from surface water runoff, dry summer weather conditions often reduce the amount of flushing and can stimulate algal blooms.

Many types of algae, including *Anabaena*, are readily controlled by copper-based algaecides. Copper sulfate is the most common and least expensive algaecide available. We treat numerous large lakes and several municipal drinking water reservoirs with copper sulfate annually. Treatment of one-half of the lake at a time is required per the product labels to guard against oxygen depletion and fish kills, but this is usually sufficient to see lakewide reductions in algal densities. *Anabaena* is typically controlled within a matter of days following treatment, but algal populations can often recover in a matter of weeks if conditions favoring their growth still exist. The cost to treat one-half of Foster's Pond with copper sulfate would probably run in the $1500-$2000 range.

Treating algae with an algaecide is akin to treating the symptom, rather than dealing with the cause, which in the case of Foster's Pond appears to be elevated phosphorus concentrations. Managing phosphorus levels can be challenging. Inputs from the lake's watershed are usually contributed via stormwater runoff and it is difficult to achieve significant reductions through Best Management Practices (BMP's), especially in portions of the watershed that do not directly abut or have access to the lake. We expect that there is also an internal source of phosphorus from the bottom sediments in Foster's Pond that contributes to the elevated in-water concentrations. In part this is due to the lake's extensive shallow-water zones and adjacent wetland areas that are hydraulically connected to the lake.

In-lake phosphorus reduction is usually achieved with precipitants that bind with phosphorus and make it unavailable for algae growth. Buffered alum (aluminum sulfate) is most commonly used compound for this purpose in lake management. Lower doses buffered alum are used to strip phosphorus out of the water column, while higher doses can be applied to try and inactivate the sediment. Buffered alum treatments can run on the order of $100 per acre for precipitation treatments to upwards of $1000 per acre for sediment inactivation treatments. Buffering agents (e.g. soda ash, sodium aluminate) usually need to be applied to prevent drops in pH that occur as alum hydrolyzes in the water. There is a new product called Phoslock (lanthanum modified bentonite clay) currently being reviewed in Massachusetts as an alternative to alum. Like alum it binds with phosphorus, but the reaction does not alter the pH of the water. Phoslock is expected to carry a higher cost than a comparable buffered alum treatment. Use of either buffered alum or Phoslock will require considerable upfront assessment and planning to develop hydrologic and nutrient budgets for the lake, in order to determine the proper dosing and predict the duration of benefit that can be achieved.

One alternative to consider is the use of SeClear, which is a newly registered algaecide that achieves some phosphorus removal. Copper sulfate is the active ingredient in SeClear that acts as an algaecide, plus there is a proprietary ingredient that binds with and removes phosphorus from the water column. The potential benefit is that by incrementally removing phosphorus from the water column will help to slow or prevent blooms from developing in the future. Multiple applications of SeClear may be needed to elimate enough phosphorus to get below the threshold levels that support cyanobacteria blooms, but even limited reductions in phosphorus may help change the composition of the algal community. The estimated cost of a half-lake treatment with SeClear is probably in the $4000-$4500 range. We recommend modifying the existing Order of Conditions to allow the use of copper sulfate and SeClear to manage algae in Foster's Pond.

Attachments

- Aquatic Plant survey field data table
- Water quality laboratory reports
- Algae count data

Foster's Pond - Aquatic Plant Survey Data Table survey date: 8/23/12

Data Point	Water Depth (ft.)	Cc	Mu	Pe	Pp	Pn	U	Cd	Mhu	Sg	Ni	Ed	Fa	Nu	B	Ny	Eo	Po	T	Sp	Nf	% Total Plant Cover	%Fanwort Cover	Biomass index	Species Richness index
1	13																					0	0	0	0
2	11		X																			10	0	1	1
3	4							X			D		X			X						30	0	3	4
4	2	X		X			D			X	X		X	X	X	X				X	X	100	5	4	11
5	2										D		X			X						100	0	4	3
6	11				D																	10	0	1	1
7	4						D			X						X				X		40	0	3	4
8	2										D		X			X						20	0	2	3
9	2										D		X			X						50	0	2	3
10	4												D									5	0	1	1
11	5												X			D						20	0	2	2
12	7																					0	0	0	0
13	7												X									5	0	1	1
14	2												X			D						15	0	2	2
15	7																					0	0	0	0
16	9																					0	0	0	0
17	6															D						5	0	1	1
18	6																					0	0	0	0
19	10																					0	0	0	0
20	8																					0	0	0	0
21	4												X	X		D						30	0	2	3
22	9																					0	0	0	0
23	7																					0	0	0	0
24	5																					5	0	1	0
25	4												D			X						25	0	2	2
26	7																					0	0	0	0
27	4															D						30	0	2	1
28	3												X	D		X						30	0	2	3
29	3												D									80	0	1	1
30	3										D											5	0	1	1
31	2																					0	0	0	0
32	2			X							X		D									20	0	2	3
33	4										X		D									30	0	1	2
34	3			X									D			X						30	0	2	3
35	3												D									40	0	2	1
36	4															D						10	0	2	1
37	2			D							X		X			X						40	0	3	4
38	6																					0	0	0	0
39	6												D									5	0	1	1
40	6																					0	0	0	0
41	3			D									X			X						40	0	3	3
42	5																					0	0	0	0
43	7																					0	0	0	0
44	3																					0	0	0	0
45	6																					0	0	0	0
G1	5			X			X									D						60	0	3	3
G2	6			D												X						30	0	2	2
G3	5						X									D						60	0	3	2
G4	4			X			X									D						60	0	3	3
	#X	1	1	5	0	0	3	1	0	2	4	0	12	2	1	12	0	0	0	2	1				
	#D	0	0	3	1	0	2	0	0	0	5	0	8	1	0	9	0	0	0	0	0				
	total #	1	1	8	1	0	5	1	0	2	9	0	20	3	1	21	0	0	0	2	1				
	% FOC	2.0%	2.0%	16.3%	2.0%	0.0%	10.2%	2.0%	0.0%	4.1%	18.4%	0.0%	40.8%	6.1%	2.0%	42.9%	0.0%	0.0%	0.0%	4.1%	2.0%				
																						21.2	0.1	1.3	1.6

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CERTIFICATE OF ANALYSIS

AQUATIC CONTROL TECHNOLOGY 11 JOHN ROAD SUTTON, MA 01590	Project: Foster's Pond Project Number: Water Testing Project Manager: Gerry Smith	Report: 1227594 Reported: 08/30/2012 13:37

MILL RESERVOIR WQ1

1227594-01 (Surface Water) Sampled: 08/20/2012 12:00; Type: Grab

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
MICROBIOLOGY (MASSACHUSETTS DIVISION)								
E. coli	ND	10.0	CFU/100 ml	082112 1255	082112 1255	LBL	SM9213D	
WET CHEMISTRY (MASSACHUSETTS DIVISION)								
Alkalinity to pH 4.5	**29.0**	2.00	mg CaCO3/L	082912 0851	082912 0851	NGB	SM 2320B	
Color, Apparent	**45.0**		Pt-Co	082112 1540	082112 1541	RGC	SM18 2120B	
Color, True	**40**	0	Pt-Co	082112 1540	082112 1541	RGC	SM 2120B	
pH	**7.11**	0.0100	S.U.	082112 1543	082112 1610	RGC	SM 4500-H B	
Phosphorus, P	**0.0400**	0.0100	mg/L	082812 0918	082812 0918	NGB	SM18 4500-P B, E	
Turbidity	**5.70**	0.200	NTU	082112 1545	082112 1546	RGC	SM 2130B	

GLENWOOD ROAD BASIN

1227594-02 (Surface Water) Sampled: 08/20/2012 12:00; Type: Grab

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
MICROBIOLOGY (MASSACHUSETTS DIVISION)								
E. coli	ND	10.0	CFU/100 ml	082112 1255	082112 1255	LBL	SM9213D	
WET CHEMISTRY (MASSACHUSETTS DIVISION)								
Alkalinity to pH 4.5	**18.5**	2.00	mg CaCO3/L	082912 0851	082912 0851	NGB	SM 2320B	
Color, Apparent	**60.0**		Pt-Co	082112 1540	082112 1541	RGC	SM18 2120B	
Color, True	**25**	0	Pt-Co	082112 1540	082112 1541	RGC	SM 2120B	
pH	**6.78**	0.0100	S.U.	082112 1543	082112 1610	RGC	SM 4500-H B	
Phosphorus, P	**0.0140**	0.0100	mg/L	082812 0918	082812 0918	NGB	SM18 4500-P B, E	
Turbidity	**1.80**	0.200	NTU	082112 1545	082112 1546	RGC	SM 2130B	

MAIN POND WQ3

1227594-03 (Surface Water) Sampled: 08/20/2012 12:00; Type: Grab

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
MICROBIOLOGY (MASSACHUSETTS DIVISION)								
E. coli	ND	10.0	CFU/100 ml	082112 1255	082112 1255	LBL	SM9213D	
WET CHEMISTRY (MASSACHUSETTS DIVISION)								
Alkalinity to pH 4.5	**25.0**	2.00	mg CaCO3/L	082912 0851	082912 0851	NGB	SM 2320B	
Color, Apparent	**45.0**		Pt-Co	082112 1540	082112 1541	RGC	SM18 2120B	

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CERTIFICATE OF ANALYSIS

AQUATIC CONTROL TECHNOLOGY 11 JOHN ROAD SUTTON, MA 01590	Project: Foster's Pond Project Number: Water Testing Project Manager: Gerry Smith	Report: 1227594 Reported: 08/30/2012 13:37

MAIN POND WQ3

1227594-03 (Surface Water) Sampled: 08/20/2012 12:00; Type: Grab

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
WET CHEMISTRY (MASSACHUSETTS DIVISION)								
Color, True	**30**	0	Pt-Co	082112 1540	082112 1541	RGC	SM 2120B	
pH	**6.83**	0.0100	S.U.	082112 1543	082112 1610	RGC	SM 4500-H B	
Phosphorus, P	**0.0400**	0.0100	mg/L	082812 0918	082812 0918	NGB	SM18 4500-P B, E	
Turbidity	**6.00**	0.200	NTU	082112 1545	082112 1546	RGC	SM 2130B	

OUTLET COVE WQ4

1227594-04 (Surface Water) Sampled: 08/20/2012 12:00; Type: Grab

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
MICROBIOLOGY (MASSACHUSETTS DIVISION)								
E. coli	ND	10.0	CFU/100 ml	082112 1255	082112 1255	LBL	SM9213D	
WET CHEMISTRY (MASSACHUSETTS DIVISION)								
Alkalinity to pH 4.5	**24.0**	2.00	mg CaCO3/L	082912 0851	082912 0851	NGB	SM 2320B	
Color, Apparent	**50.0**		Pt-Co	082112 1540	082112 1541	RGC	SM18 2120B	
Color, True	**40**	0	Pt-Co	082112 1540	082112 1541	RGC	SM 2120B	
pH	**6.59**	0.0100	S.U.	082112 1543	082112 1610	RGC	SM 4500-H B	
Phosphorus, P	**0.0600**	0.0100	mg/L	082812 0918	082812 0918	NGB	SM18 4500-P B, E	
Turbidity	**7.75**	0.200	NTU	082112 1545	082112 1546	RGC	SM 2130B	

AZALEA DRIVE WQ5

1227594-05 (Surface Water) Sampled: 08/20/2012 12:00; Type: Grab

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
MICROBIOLOGY (MASSACHUSETTS DIVISION)								
E. coli	**20.0**	10.0	CFU/100 ml	082112 1255	082112 1255	LBL	SM9213D	
WET CHEMISTRY (MASSACHUSETTS DIVISION)								
Alkalinity to pH 4.5	**18.5**	2.00	mg CaCO3/L	082912 0851	082912 0851	NGB	SM 2320B	
Color, Apparent	**50.0**		Pt-Co	082112 1540	082112 1541	RGC	SM18 2120B	
Color, True	**40**	0	Pt-Co	082112 1540	082112 1541	RGC	SM 2120B	
pH	**6.48**	0.0100	S.U.	082112 1543	082112 1610	RGC	SM 4500-H B	
Phosphorus, P	**0.0400**	0.0100	mg/L	082812 0918	082812 0918	NGB	SM18 4500-P B, E	
Turbidity	**1.50**	0.200	NTU	082112 1545	082112 1546	RGC	SM 2130B	

Microbac®

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CERTIFICATE OF ANALYSIS

AQUATIC CONTROL TECHNOLOGY	Project: Foster's Pond	Report: 1227594
11 JOHN ROAD	Project Number: Water Testing	Reported: 08/30/2012 13:37
SUTTON, MA 01590	Project Manager: Gerry Smith	

Notes and Definitions

ND Analyte NOT DETECTED at or above the reporting limit

dry Sample results reported on a dry weight basis

Certifications

Below is a list of certifications maintained by Microbac Laboratories, Inc. All data included in this report has been reviewed for and meets all project specific and quality control requirements of the applicable accreditation, unless otherwise noted. A complete list of individual analytes pursuant to each certification below is available upon request.

Massachusetts DEP M-MA003
Massachusetts DPH State Dairy Laboratory 0056

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Nancy Burnett

Nancy Burnett, Laboratory Director

For any feedback, please contact Nancy Burnett, Laboratory Director. You may also contact Sean Hyde, Chief Operating Officer at sean.hyde@microbac.com or James Nokes, President at james.nokes@microbac.com.

AQUATIC CONTROL TECHNOLOGY, INC

Microbac Laboratories, Inc. 100 Barber Avenue Worcester, MA 01606 Phn: 508-595-0010 Fax: 508-59

1227594

	PARAMETERS REQUESTED	Mill Reservoir WQ1	Glenwood Rd Basin WQ2	Main Pond WQ3	Outlet Cove WQ4	Azalea Drive WQ5			
✓	pH	●	●	●	●	●			
✓	TOTAL ALKALINITY	●	●	●	●	●			
	SUSPENDED SOLIDS								
	DISSOLVED SOLIDS								
✓	TURBIDITY	●	●	●	●	●			
	CONDUCTIVITY								
	CHLORIDE								
	KJELDAHL NITROGEN								
	AMMONIA NITROGEN								
	NITRATE NITROGEN								
✓	TOTAL PHOSPHORUS	●	●	●	●	●			
	TOTAL DISSOLVED PHOSPHORUS								
✓	TRUE COLOR	●	●	●	●	●			
✓	APPARENT COLOR	●	●	●	●	●			
	TOTAL COLIFORM BACTERIA								
	FECAL COLIFORM BACTERIA								
✓	E. COLI BACTERIA	●	●	●	●	●			
	CHLOROPHYLL-A								

A.C.T. JOB#__________

TITLE: Foster's Pond

TASK: Water Quality

DATE SAMPLED: 8/20/12

SAMPLED BY: MDB

MICROBAC LAB

REC"D BY: MAM

DATE & TIME: 8/21/12 1100?

NOTE: *Aquatic Control requires the following minimum detection limits for all samples: Nitrate (<0.1 mg/l); Ammonia (<0.1 mg/l); Total and Dissolved Phosphorus (<0.01 mg/l) and Alkalinity (<5 mg/l). Total and dissolved phosphorus detection limits of <0.001 mg/l are only to be performed upon Aquatic Control's request and at an additional charge.*

Foster's Pond - 2012 Algae Count Data

survey date: 8/20/12

			Algal Divison	Cyanophytes	Chlorophytes	Bacillariophytes	Chrysophytes	Euglenophytes	Pyrrhophytes
			Common Name	blue-green algae	green algae	diatoms	golden algae	euglena	dinoflagelates
Location		Secchi Disk Clarity on 8/20/12	*Dominant Taxa*	*Anabaena*	*Chlorella, Dictyosphaerium, Elakatothrix, Gleocystis*	*Asterionella*	*Mallomonas*	*Trachelomonas*	*Peridinium*
Mill Reservoir	**WQ1**	3.1 ft	215,000 cells/ml total	74%	24%	<1%	2%	<1%	0%
Dug Pond	**WQ2**	7.0 ft	31,000 cells/ml total	24%	73%	<1%	<1%	2%	1%
Main Pond	**WQ3**	2.3 ft	99,000 cells/ml total	87%	11%	<1%	<1%	<1%	0%
Outlet Cove	**WQ4**	2.0 ft	67,000 cells/ml total	82%	16%	<1%	1%	<1%	0%
Azalea Drive	**WQ5**	8.5 ft	28,000 cells/ml total	21%	74%	<1%	1%	3%	<1%