AQUATIC CONTROL TECHNOLOGY, INC.
POND AND LAKE MANAGEMENT SPECIALISTS

November 24, 2008

Mr. Stephen E. Cotton, President
Foster's Pond Corporation
19 Pomeroy Road
Andover, MA 01810

Re: 2008 Aquatic Plant Survey and Water Quality Monitoring at Foster's Pond - Andover MA

Dear Steve:

The following report documents the aquatic plant survey and water quality monitoring performed at Foster's Pond during the 2008 season and provides on-going lake management recommendations.

Introduction:

Aquatic Control Technology Inc. was contracted to survey the invasive aquatic plant growth in Foster's Pond in 2004 and to help develop a recommended management program. The whole-lake Sonar herbicide treatment of Foster's Pond performed in 2005 provided excellent control of the invasive fanwort (*Cabomba caroliniana)* infestation throughout the balance of the 2005 season. Good carryover control was observed early in 2006 in the majority of the lake, while fanwort and Brazilian elodea (*Egeria densa*) were spot-treated in the 4-acre Glenwood Road Basin that was not included in the 2005 treatment program. By mid-summer in 2006 the Foster's Pond Corporation reported seeing fanwort regrowth in the shallow channels leading to Mill Reservoir and the Outlet Cove. Fanwort regrowth was confirmed and documented during inspections performed by Aquatic Control in August and September 2006. A spot-treatment program using the time-release, pellet formulations of Sonar was performed in 2007 to control fanwort in these locations and to hopefully slow reinfestation in other portions of the lake. The 2008 comprehensive Plant Transect/data point Survey served to determine the effectiveness of the 2007 Sonar treatment program and will be useful in planning management strategies for 2009. Additionally, the 2008 survey replicated the transect/data point survey that was conducted in 2004. The results will help show how the lake has responded to management, while providing a long-term record and database for Foster's Pond.

Aquatic Plant Survey:

Methods:
Marc Bellaud, Aquatic Control's Senior Biologist, surveyed Foster's Pond on September 2, 2008. Weather conditions consisted of sunny skies and light wind, providing good visibility. The entire pond was systematically toured by boat. A comprehensive transect/data point sampling

methodology was used to gather qualitative and quantitative information on existing conditions in the lake. The data points used in 2004 were again sampled in 2008 along with 10 additional points. The location of each new data point was geo-referenced using a Differential GPS system equipped with sub-meter accuracy. This information was transferred into a GIS software application providing for accurate mapping. Data point locations are depicted in Figure 1. A total of 49 data points were sampled.

At each data point the following information was recorded: aquatic plants present, total plant cover, total fanwort cover, and plant biomass.

The plant community was assessed through visual inspection, use of a throw-rake and an AquaVu underwater camera system. Plants were identified to genus and species where possible. Plant cover was given a percentage rank based on the areal coverage of plants within an approximate 400 square foot area assessed at each data point. Percentages less than 100% indicated the amount of bottom area covered by plant growth. The presence and areal coverage of fanwort was also recorded at each location. In addition to cover percentage, a plant biomass index was assigned at each data point to document the amount of plant growth vertically through the water column. Plant biomass was estimated on a scale of 0-4, as follows:

0 No biomass; plants generally absent
1 Low biomass; plants growing only as a low layer on the sediment
2 Moderate biomass; plants protruding well into the water column but generally not reaching the water surface
3 High biomass; plants filling enough of the water column and/or covering enough of the water surface to be considered a possible recreational nuisance or habitat impairment
4 Extremely high biomass; water column filled and/or surface completely covered, obvious nuisance conditions and habitat impairment severe

Information recorded at each data point is provided in the Field Survey Data Table found in the Appendix.

Findings:
Good carryover control of Fanwort from the 2007 spot-treatment was observed in 2008. Fanwort was found at only 4 of the 49 data points. At one of these locations a floating fragment was observed rather than rooted plants and the average fanwort cover was less than 15% at the other three locations. Most of the rooted fanwort growth was observed near the mouth of the Mill Reservoir cove.

Native plant coverage seems to be re-bounding quite well following the 2005 and 2007 treatments. The plant assemblage observed in 2008 was comprised of plant species documented in previous years including white waterlily (*Nymphaea odorata*), bladderwort (*Utricularia spp.*), ribbonleaf pondweed (*Potamogeton epihydrus*), stonewort (*Nitella spp.*), and arrowhead (*Sagittaria spp.*) as well as filamentous algae. (See the Survey Data Table for a full listing).

There were also several different emergent plants documented along the shoreline including spikerush (*Eriocaulon sp)*, pickerelweed (*Pontederia cordata*), cattail (*Typha sp.*), burreed (*Sparganium sp.*), and invasive purple loosestrife (*Lythrum salicaria*).

A list of the plant species encountered during the 2008 survey and prior surveys at Foster's Pond is provided below:

Table 1: Plant Species List:

Macrophyte Species	Common Name	Abbreviation	Type	2004	2005	2008
Submersed						
Bidens beckii	Water marigold	Bb	Submersed	X		
Cabomba caroliniana	Fanwort	Cc	Submersed	X	X	X
Ceratophyllum demersum	Coontail	Cd	Submersed	X	X	X
Chlorophyta	Filamentous algae	Fa	Submersed	X	X	X
Egeria dense	Brazilian elodea	Ed	Submersed		X	X
Isoetes	Quillwort	I	Submersed		X	X
Musci	water moss	Mu	Submersed		X	X
Myriophyllum humile.	Lowly Milfoil	Mh	Submersed		X	X
Najas flexilis	Bushy pondweed	Nf	Submersed		X	X
Nitella	Stonewort	Ni	Submersed		X	X
Potamogeton amplifolius	Largeleaf pondweed	Pa	Submersed	X		
Potamogeton epihydrus	Ribbonleaf pondweed	Pe	Submersed	X		X
Potamogeton gramineus	Variable-leaf pondweed	Pg	Submersed	X		
Potamogeton natans	Floating leaf pondweed	Pn	Submersed			X
Potamogeton perfoliatus	Clasping-leaf pondweed	Pp	Submersed	X		
Sagittaria sp.	Arrowhead	Sg	Submersed			X
Utricularia	Bladderwort	U	Submersed	X	X	X
Valliseria americana	Wild celery	V	Submersed	X		
Floating Leaf & Emergent						
Brasenia schreberi	Watershield	B	Floating leaf	X		X
Decodon verticillatus	Water willow	Dv	Emergent	X	X	X
Eriocaulon sp	Spikerush	Eo	Emergent	X	X	X
Lythrum salicaria	Purple loosestrife	Ls	Emergent	X	X	X
Nuphar variegatum	Yellow waterlily	Nu	Floating leaf		X	X
Nymphaea odorata	White waterlily	Ny	Floating leaf	X	X	X
Pontederia cordata	Pickerelweed	Po	Emergent	X	X	X
Scirpus sp.	Rushes	Sc	Emergent	X	X	X
Sparganium sp.	Burreed	Sp	Emergent	X		X
Typha sp.	Cattail	T	Emergent	X	X	X

The species diversity does appear to have rebounded following the reduction seen during the year of treatment. Some of the differences seen from year to year are probably attributable to sampling variability.

Looking at some of the more quantitative values, there appeared to be an overall reduction in the amount of submersed plant growth in Foster's Pond in 2008. Excluding values from the Glenwood Road Basin data points, there was a significant reduction in the plant cover and biomass values.

Table 2: Qualitative Plant Data:

Year	% Total Plant Cover	% Fanwort Cover	Biomass Index	Species Richness
2004	78.9	54.5	2.9	3.6
2005	25.5	0.1	1.4	1.7
2008	15.9	0.9	1.6	1.7

The absence of widespread fanwort growth accounts for some of the reduction seen in the plant cover and biomass indices. We expect that reduced water clarity caused by microscopic algal bloom conditions limited light penetration and the inhibited the growth of submersed species in most of the deeper water (>6-7 feet) sampling locations.

Water Quality:

In addition to the plant survey, some limited water quality analysis was performed. Water samples were collected from several locations in the lake and analyzed for several parameters. Surface grab water sample were collected at each site for analysis of a suite of water quality parameters by an independent, MA Certified Laboratory (Table 3; Figure 1). Results of the 2008 water quality testing and the data recorded prior to treatment in 2004 are presented below.

Table 3: 2004 and 2008 Water Quality Data

		2004	2008			
Parameter	**Units**	**Main Pond**	**Mill Reservoir**	**Glenwood Rd. Basin**	**Main Pond**	**Outlet Cove**
pH	S.U.	6.6	7.37	6.9	7.12	7.04
Alkalinity	CaCO3/L	24	32	15	23	23
Turbidity	NTU	0.65	0.69	1.3	5.2	3.9
Phosphorous	Mg/L	0.022	<0.01	<0.01	0.03	0.03
True Color	Pt-Co	20	34	4	28	34
Apparent Color	Pt-Co	25	48	12	60	60
Total Coliform	CFU/100ml	<50	<50	<50	-- *	<50
Fecal Coliform	CFU/100ml	<10	<10	<10	<10	<10
Secchi Disk	Feet	10.3	6.3	8.1	3.5	3.7

*Lab error

The 2008 results were similar to the 2004 data for most parameters tested. The pH values were near neutral and alkalinity was essentially unchanged. Total and fecal coliform bacteria were favorable, again being below the laboratory detection limit. Phosphorus, which is usually the limiting nutrient in fresh water systems, was below the detection limit in the deeper Mill Reservoir and Glenwood Road Basins. In the Main Pond and Outlet Cove, phosphorus values were at the level (0.03 mg/l) that is considered to be sufficient to support nuisance algal bloom conditions.

The most notable differences were seen in various tests of water clarity. Water color can affect light penetration and, as a result, can limit rooted plant and algae growth. The disparity between true (filtered) and apparent color (unfiltered) can indirectly indicate the amount of suspended material in the water and signal potential elevated levels of particulate material including algae, silt or other solids. The true and apparent color results indicate a greater proportion of suspended material than dissolved material in 2008 as compared to 2004. The turbidity results were higher in 2008. High levels of microscopic algae were likely an important factor in causing the high tubidity levels, the true/apparent color results and the low Secchi Disk clarity readings recorded during the 2008 survey.

Field testing of a temperature/dissolved oxygen profile was performed at four sites on the pond. Foster's Pond is too shallow to stratify as deeper lakes would. However, the pond is oxygenated well enough to support fish and wildlife populations (Table 4).

Table 4: 2008 Temperature (Temp.) and Dissolved Oxygen (D.O.) Data

	site 1		site 2		site 3		site 4	
	Mill Reservoir		Glenwood Rd Basin		Main Pond		Outlet Cove	
Depth (m)	Temp. (˚C)	D.O. (mg/L)	Temp. (˚C)	D. O. (mg/L)	Temp. (˚C)	D. O. (mg/L)	Temp. (˚C)	D. O. (mg/L)
surface	24.0	10.3	24.5	9.64	23.5	8.86	23.7	8.55
1	22.2	10.8	23.4	9.65	23.3	8.53	22.2	8.62
2	18.6	4.5	22.8	9.61	22.0	4.99	21.5	7.7
3	14.8	0.99	22.5	9.47	21.5	0.85		
4			22.1	6.37	20.1	0.68		

A water sample was also collected for microscopic analysis of the planktonic algae composition. . Elevated levels of microscopic algae were observed. The dominant algae groups observed were Chlorophytes (greens) and Cyanophytes (blue-greens). Two blue-greens commonly associated with algal blooms, *Anabaena* and *Microcystis*, were present in moderate densities, but the sample was dominated by colonial greens. The dominance by green algae yielded the olive-brown water color instead of a brighter green color that is usually associated with blue-green blooms.

The total algal density, estimated by enumeration, was 29,450 cells/ml. For the small cell, colonial types of algae seen at Foster's Pond, counts in excess of 20,000 cells/ml would be indicative of bloom conditions. If these densities of planktonic algae persisted during the summer months, the resulting loss of water clarity (<4 feet found in Main Pond on 9/2/08) could have limited submersed aquatic plant growth, due to the shading effect.

High water and weather patterns could have played a role in the elevated algae growth seen at Foster's Pond in 2008. The water clarity in the Main Pond was significantly reduced from what was seen in 2004, but we do not have a large data set to compare. Routine monitoring of water clarity using a Secchi disk would provide the Corporation with valuable information about water quality conditions in the pond.

Summary and 2009 Management Recommendations:

Fanwort did not become significantly reestablished in Foster's Pond during the 2008 season. In fact, compared to 2007, there was a reduction in fanwort distribution in the Main Pond portion of the lake. The most obvious explanation for this reduction was the limited water clarity due to planktonic or microscopic algal bloom conditions seen during the September 2nd survey. If these conditions persisted for much of the summer months, they likely limited light penetration and inhibited the growth of submersed plants through the deeper portions of the pond. No observable changes were seen in the floating-leaf and emergent plant populations seen in shallow pond margins in the adjacent wetland areas. Some widely scattered Brazilian elodea was seen in the Glenwood Road Basin, but it was not at levels requiring management.

We do not feel that there is enough fanwort growth to warrant an herbicide treatment at Foster's Pond during the 2009 season. Most of the fanwort plants encountered were found near the mouth of the Mill Reservoir cove, but this would be a difficult area to spot-treat effectively. The Corporation should continue to monitor fanwort growth throughout the 2009 season. A late

summer survey could then be performed to determine if there is enough to warrant management efforts in 2010.

Because of the algal bloom conditions seen in 2008, we would recommend that the Corporation purchase a Secchi disk and start recording water clarity on a fairly regular basis (every 1-2 weeks). Sustained algal bloom conditions can have adverse impacts on water quality. There are some blue-green species that are also known to produce toxins that could potentially be harmful to wildlife or people. If water clarity drops below 3 feet for prolonged periods of time, it might be worthwhile to have the algal composition checked.

We appreciate your business and look forward to assisting with your on-going invasive plant management efforts at Foster's Pond. Please feel free to contact our office if you have questions or require additional information.

Sincerely,

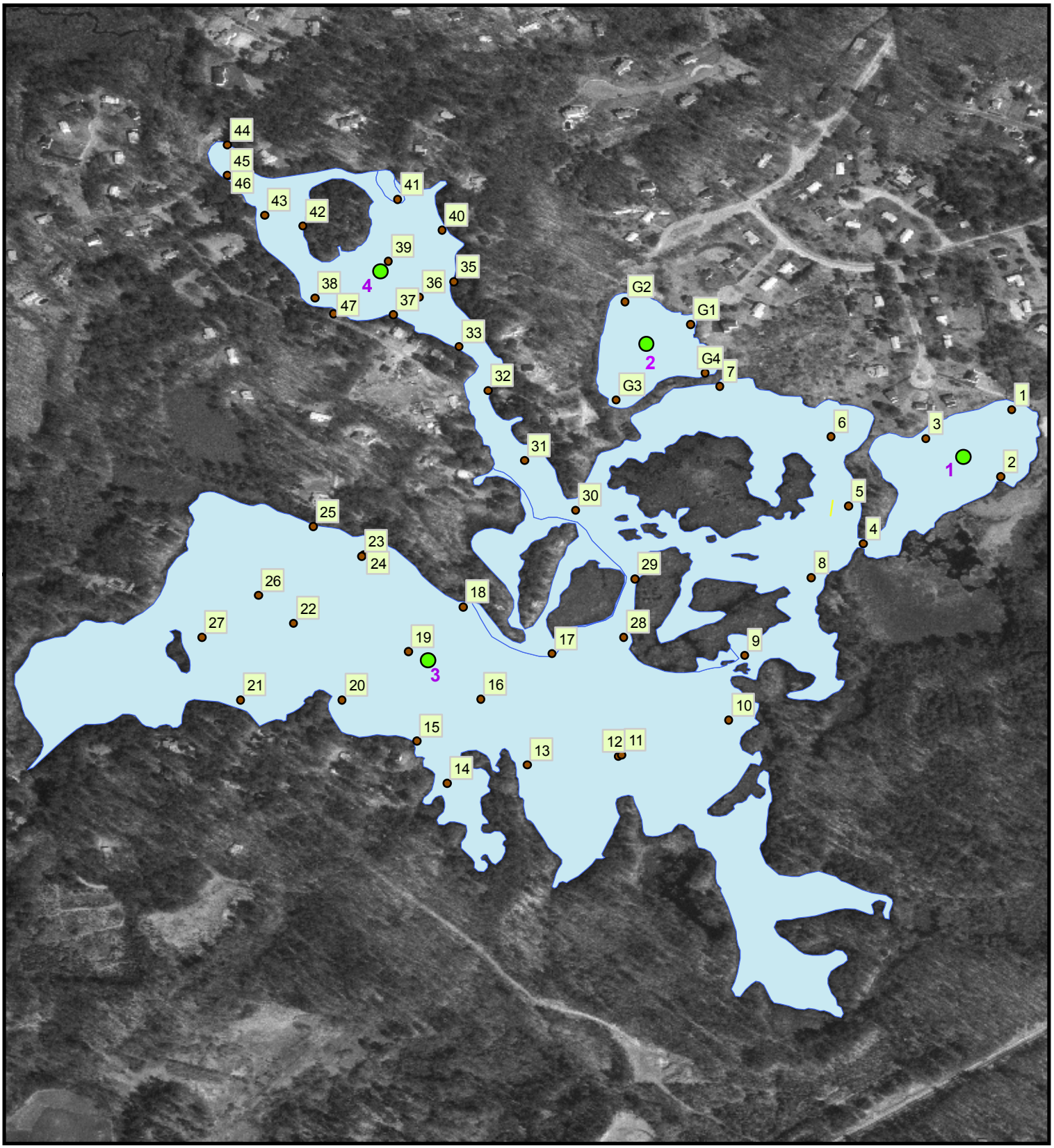
AQUATIC CONTROL TECHNOLOGY, INC.

Marc Bellaud
Senior Biologist

Enclosures

APPENDIX

- Figure 1 – Vegetation Data Point and Water Quality Sampling Locations
- Figure 2 – Dominant Aquatic Vegetation Cover
- Field Data Table (9/2/08)



Fosters Pond

Andover, MA

Data Points and
Water Quality Sampling Locations

FIGURE:	SURVEY DATE:	MAP DATE:
1	09/02/08	11/11/08

Legend

N

Water Quality Sampling Locations

Data Points

0 150 300 600 900 1,200 1,500
Feet

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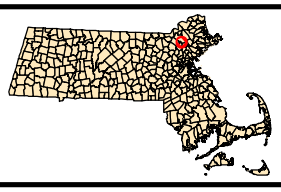

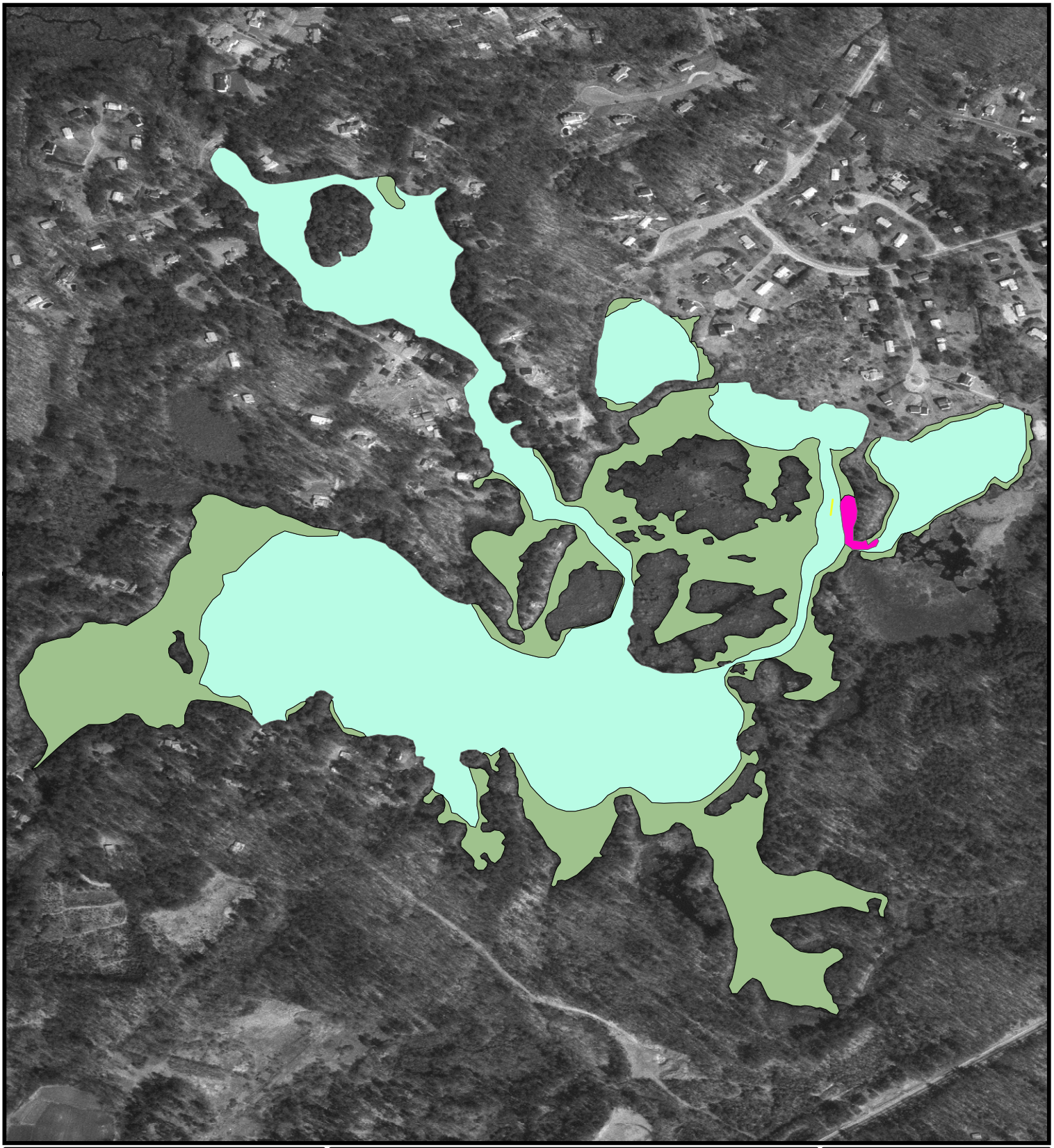

Fosters Pond

Andover, MA

Dominant Aquatic Vegetation

FIGURE:	SURVEY DATE:	MAP DATE:
2	09/02/08	11/11/08

Legend

- Fanwort
- Low density or no submersed vegetation
- Water lilies and emergent plants

N

0 150 300 600 900 1,200 1,500 Feet

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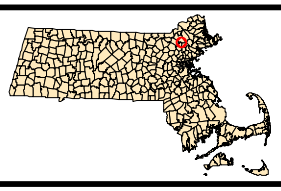

Foster's Pond - Field Data (9/2/08)

Data Point	Water Depth (ft.)	Sediment Type	Cc	Mu	Pe	Pp	Pn	U	Cd	Mhu	Sg	Ni	Ed	Fa	Nu	B	Ny	Eo	Po	T	Sp	Ls	% Total Plant Cover	%Fanwort Cover	Biomass index
1	15			1																			5	0	1
2	10				1	1	1	1						1			1						40	0	3
3	3	G				1	1	1		1				1			1						30	0	2
4	13		1		1			1			1						1						70	30	3
5	8	M/G	1								1					1	1	1					30	5	2
6	5.5	M															1						20	0	2
7	9	M	1		1			1						1			1						30	5	2.5
8	7	M															1						5	0	1
9	3	M												1			1						5	0	1
10	7	G															1						20	0	2
11&12	9.5	M												1									5	0	1
13	9	M															1						10	0	2
14	11																						0	0	0
15	6.5	M/G															1						10	0	2
16	5	M																					0	0	0
17	11																1						30	0	2.5
18	9	M															1						10	0	2
19	5	M/G																					0	0	0
20	9.5	M												1			1						15	0	2
21	7	M										1					1						40	0	3
22	4.5	M																					0	0	0
23&24	6	M	1														1						10	0	2
25	4	M							1								1						60	0	3
26	4	M															1						10	0	2
27	3	S/G															1						20	0	2
28	7	M													1		1						40	0	3
29	4.5	M/S															1						5	0	1
30	5	M															1						5	0	1
31	3	G/M												1			1						5	0	1
32	6	S/M										1											10	0	1
33	7.5	M												1									5	0	1
34	7	M			1			1						1									15	0	1
35	5.5	M												1									5	0	1
36	6	M															1						10	0	1
37	8.5	S/M			1							1					1						30	0	3
38	6	S/M			1						1												10	0	2
39	3.5	S/M																					0	0	0
40														1									5	0	1
41					1									1			1						30	0	3
42																	1						10	0	2
43																							0	0	0
44					1																		25	0	2
45																							0	0	0
G1	5	M/G			1			1									1						80	0	3
G2	6	M/R						1					1				1						50	0	2.5
G3	5	M/S						1					1				1						60	0	3
G4	4	M/S			1			1		1													50	0	2