

Annual Report
2018 Aquatic Management Program
Foster's Pond
Andover, MA

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Introduction

Invasive aquatic vegetation control, cyanobacteria management, and water quality monitoring were again the focus of this year's lake management efforts at Foster's Pond. This year's treatments included spot-treatments of both fanwort (*Cabomba caroliniana*) and spiny naiad (*Najas minor*), and one half-pond cyanobacteria treatment. This season marked three years since a whole-pond Sonar herbicide treatment program was conducted (2015) to control invasive fanwort (*Cabomba caroliniana*), and some areas of the most prolific growth were targeted for treatment with Sonar again this season. The purpose of the 2018 survey was to document the level of control from this year's treatments, track the biodiversity of aquatic vegetation, and assess water quality. Again this season, hydro-raking was conducted in some areas of private shoreline to remove nuisance aquatic vegetation and accumulated organic matter. The treatments, survey, and monitoring described in this report were performed by SÖLitude Lake Management under contract with the Foster's Pond Corporation. Hydro-raking, which was also performed by SÖLitude Lake Management, was coordinated by the Foster's Pond Corporation (FPC), but contracted by individual homeowners.

All work performed at Foster's Pond this season was conducted in accordance with the current Order of Conditions (OOC) issued by the Andover Conservation Commission (DEP #090-535) and the MA DEP – Office of Watershed Management issued License to Apply Chemicals (#18112).

A chronology of this year's management and brief description of events is as follows:



2018 Program Chronology

- Hydro-raking of shoreline areas commenced04/24/18
- MA DEP License to Apply Chemicals issued.....04/20/18
- Pre-treatment inspection04/27/18
- Hydro-raking completed05/03/18
- Initial Sonar treatment.....05/04/18
- Sonar booster treatment06/04/18
- Spiny naiad pre-treatment survey07/11/18
- Sonar booster treatment and spiny naiad diquat treatment07/17/18
- Interim inspection.....08/15/18
- Algaecide treatment08/23/18
- Late-season vegetation survey08/23/18
- Collection of water quality and algae (round 3) samples08/23/18

Hydro-raking

Private shoreline hydro-raking services were provided for various residents of Foster's Pond to remove nuisance aquatic vegetation as well as accumulated organic matter. Thirty-eight (38) hours of hydro-raking services were provided between April 24 and May 3. All removed material was placed on the respective residents' shoreline. Pursuant to the OOC, property owners were responsible for proper upland disposal.

This was the second consecutive year when hydro-raking operations were scheduled for the spring. In years prior to 2017, hydro-raking was performed in the fall. However, planned fall hydro-raking was rendered impossible in 2016 due to drought conditions as many coves were too shallow for effective rake operation.

The 2018 spring operations proved highly effective, as higher water made shorelines more accessible. As a result, it appears that spring hydro-raking will continue as a feasible option for Foster's Pond in future years.

Algae Monitoring

Nuisance algae blooms and corresponding poor water clarity have exhibited themselves periodically through the years at Foster's Pond. The blooms are commonly dominated by cyanobacteria, or blue-green algae, due to elevated phosphorus concentrations within the various basins. The Foster's Pond Corporation diligently monitors water clarity, conducts periodic algae sampling, and requests formally reported laboratory analyses and algaecide treatments as necessary to avoid potential toxic blooms of cyanobacteria.

This season based upon visual observation of microscopic algae blooms, multiple rounds of algae samples were collected by FPC and brought to the Andover Water Treatment Plant for informal analysis. Visual cues, such as shoreline scums, were the primary factors guiding the decision to conduct an algaecide treatment. Secchi disk measurements recorded by SŌlitude immediately prior to treatment were as follows:

Table 1. Secchi disk readings

Date	Secchi Disk Depth (ft)				
	Mill Reservoir	Dug Pond	Main Basin	Outlet Cove	Azalea Drive
08/23/18	3'5"	13'8"	4'1"	5.2 to bottom	8'2"

*Denotes to basin bottom



Algaecide Treatment

Only one copper sulfate treatment was necessary and conducted in 2018. Prior to application, the treatment date was determined in consultation with the Foster's Pond Corporation, based on examination of samples, and prior / contemporaneous Secchi disk readings. Prior notification of treatment was submitted to the Conservation Commission, email notifications were provided to shoreline property owners and local residents on the FPC's email list, notice was posted on the FPC's website of treatment areas and water-use restrictions, and posters warning of the water-use restrictions following treatment were posted at key access points along the shoreline of the pond.

Treatment was conducted on August 23rd by SŌLitude's licensed aquatic applicators in accordance with conditions of the DEP License to Apply Chemicals, the copper sulfate product label, and the OOC.

Approximately 60 acres of the total surface area of Foster's Pond were treated. The treatment was conducted in the Main Pond, part of Outlet Cove and the channel to Main Pond, and Mill Reservoir. The copper sulfate dose was calculated based on the upper five feet of the water column and resulted in 300-acre feet of water to be treated. A dose of 0.25 ppm or 150 pounds of copper sulfate was applied. The copper sulfate was dissolved in 50-gallon mixing tanks onboard an 18-foot jonboat and applied subsurface using a calibrated pump system. A hand-held GPS unit was used on the boat to ensure the designated treatment area received an even application of the diluted copper sulfate solution. Treatment took approximately an hour and a half. Immediate conditions the day following the algaecide treatment showed more scum present within the Main Pond, but conditions improved following that day.

Fanwort Herbicide Treatment

Based on the late season 2017 survey results, fifteen (15) acres of fanwort growth were targeted for treatment with Sonar (fluridone) herbicide in 2018. Granular Sonar One pellets were the only formulation utilized during the treatment program to better apply the herbicide directly to the fanwort plants.

On May 27, a SŌLitude biologist conducted the cursory, pre-treatment survey to assess the fanwort growth stage for timing of the initial Sonar application. At this time, fanwort plants were not yet growing within the water column, but other native species had begun to grow. Based on other and prior Sonar applications for fanwort, it is imperative to apply the Sonar pellets early to allow the plants to "grow into" the fluridone concentration within the water. This treatment approach allows for lower concentrations of Sonar to be used as there is less plant biomass to impact. Following the pre-treatment survey, the initial treatment was scheduled for May 4.

All treatment dates for the Sonar treatment applications were coordinated with the FPC. Notification of treatment was submitted to the Conservation Commission, email notifications of the treatment areas and water-use restrictions were provided to shoreline property owners and local residents on the FPC's email list, notice was posted on the FPC's website, and warning posters were posted along the shoreline at key access points of the pond prior to treatment by FPC members. The initial treatment was completed on May 4, with follow-up booster treatments completed on June 4, and July 17; all treatments were applied to the same pre-determined fifteen acres by SŌLitude's licensed aquatic applicators in accordance with conditions of the DEP License to Apply Chemicals, the Sonar One herbicide label, and the OOC. The Sonar pellets were applied via airboat bow-mounted cyclone spreader and/or backpack blower. The pre-determined treatment areas were preloaded into a GPS unit which was used for navigation during the treatment to ensure even application of the herbicide within those areas.



A map of the Sonar treatment areas is attached.

Spiny Naiad Herbicide Treatment

Spiny naiad growth has been observed in various areas of Foster's Pond over the last few seasons. In anticipation of this again in 2018, the FPC sought approval from the Conservation Commission for a treatment, with the precise locations determined on the basis of pre-treatment observations. A locative pre-treatment survey was conducted on July 11 to assess the spiny naiad growth and further determine areas requiring treatment. Treatment was scheduled for July 17, in conjunction with the final Sonar booster treatment, in coordination with FPC. Notification of treatment was submitted to the Conservation Commission, email notifications of the treatment areas and water-use restrictions were provided to shoreline property owners and local residents on the FPC's email list, notice was posted on the FPC's website, and warning posters were posted along the shoreline at key access points of the pond prior to treatment by FPC members.

Treatment of approximately 5.5 acres with Tribune (diquat) herbicide was conducted on July 17 by SŌLitude's licensed aquatic applicators in accordance with conditions of the DEP License to Apply Chemicals, the diquat herbicide label, and the OOC. The diquat liquid was diluted with pond water and applied subsurface using a calibrated pump system. The pre-determined treatments areas were preloaded into a GPS unit which was used for navigation during the treatment to ensure even application of the herbicide within those areas.

A map of the diquat treatment areas is attached.

Annual Late-Season Vegetation Survey

On August 23rd, 2018, a SŌLitude Biologist conducted the annual aquatic vegetation survey of Foster's Pond, including the Main Pond, Outlet Cove, Azalea Drive, Mill Reservoir, the channels connecting these basins, and Dug Pond. This annual survey documents the aquatic plant composition and distribution utilizing consistent survey methodology, transects and data points established at the time of the first survey in 2004. Supplementary survey points have been added into the survey based on client recommendation and request: ten data points including G1-G4 in Dug Pond in 2008 A-E in 2016, and F-J in 2018. A total of 61 data points were surveyed. A map illustrating the transect and data point locations follows; the raw data collected is attached.

Figure 1. Aquatic plant survey data point locations



Overall, the basins supported similar levels of vegetation to those observed over the last few years, with regard to Total Percent Cover, Biomass, and Species Richness (Table 2). Filamentous algae remains the dominant species within the lake, along with white waterlily. Other plant species in the lake are fairly sporadic across the basins – most notably creeping bladderwort (*Utricularia gibba*), common bladderwort (*Utricularia vulgaris*), muskgrass (*Chara sp.*), and yellow waterlily (*Nuphar variegata*).



Table 2. Aquatic vegetation analysis 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
2014	53.6	10.9	2.4	2.7
2015 ¹	41.7	0	1.6	0.8
2016	70.3	0.2	2.4	1.3
2017 ²	67.6	17.7	2.2	1.8
2018 ²	59.3	11.7	2.0	1.4

¹Whole-lake Sonar (fluridone) treatment performed

²Excludes additional points A-J, compares to 2016 data points

Percent fanwort cover decreased from 17.7% in 2017 to 11.7% in 2018 comparing only the 2016 point locations. The additional points A-J should not be used for past comparison, but rather documentation for future efforts. Consequently, the frequency of fanwort documentation across all points still decreased regardless of the point additions – from 29% to 5% frequency. Of the 2018 F-J points, F and H supported fanwort growth. Additional growth of fanwort was noted between point locations, and as such the point survey should not be used to determine the specific locations of fanwort, rather for just the whole-lake percentage. No brittle naiad was documented at the historical survey points, however, the cove containing new point H supported trace growth along with the previously noted fanwort and waterlilies, little floating bladderwort (*Utricularia radiata*), and filamentous algae.

Notably, an individual fanwort plant was observed at point G4, immediately in Dug Pond near the access from Azalea Cove Drive. This is the firsttime fanwort has been observed in Dug Pond since 2006.

The shallow and cove areas support the majority of white waterlilies. Other species encountered, including but not limited to pondweeds (*Potamogeton* spp.), coontail (*Ceratophyllum demersum*), grassy bulrush (*Schoenoplectus subterminalis*), floating heart (*Nymphoides cordata*), water starwort (*Callitriche* sp.), and other bladderwort species had generally low-density scattered growth. One location of native low watermilfoil (*Myriophyllum humile*) was noted at one location in Dug Pond, on the opposite side of the fanwort growth.

A list of the aquatic plant species observed in 2018 with historical comparison of presence and absence is as follows:



Table 2. Aquatic species list (2005-2018)

Type	Macrophyte Species	Common Name	2005	2008	2009	2011	2012	2014	2015	2016	2017	2018	
Submersed	<i>Bidens beckii</i>	Water marigold			X								
	<i>Cabomba caroliniana</i>	Fanwort	X	X	X		X	X		X	X	X	
	<i>Callitriche</i> sp.	Water starwort			X					X		X	
	<i>Ceratophyllum demersum</i>	Coontail	X	X	X	X	X	X	X	X	X	X	
	<i>Chara</i> sp.	Muskgrass			X	X						X	
	<i>Chlorophyta</i>	Filamentous algae	X	X	X	X	X	X	X	X	X	X	
	<i>Egeria densa</i>	Brazilian elodea	X	X	X								
	<i>Elodea canadensis</i>	Common waterweed			X								X
	<i>Hypericum boreale</i>	Northern St. John's wort			X								
	<i>Isoetes</i> sp.	Quillwort	X	X	X	X	X						
	<i>Ludwigia palustris</i>	Water purslane			X	X	X						
	<i>Musci/Fontinalis</i>	Water moss	X	X	X		X	X	X		X	X	
	<i>Myriophyllum humile</i>	Low Watermilfoil	X	X	X	X		X			X	X	
	<i>Najas flexilis</i>	Slender naiad	X	X	X		X	X					
	<i>Najas guadalupensis</i>	Southern naiad											X
	<i>Najas minor</i>	Spiny naiad			X			X		X	X	X	
	<i>Nitella</i> sp.	Stonewort	X	X	X	X	X	X	X	X	X		
	<i>Potamogeton amplifolius</i>	Largeleaf pondweed											X
	<i>Potamogeton epihydrus</i>	Ribbonleaf pondweed		X	X	X	X	X	X	X	X	X	X
	<i>Potamogeton gramineus</i>	Variable-leaf pondweed			X		X					X	X
	<i>Potamogeton natans</i>	Floating leaf pondweed		X	X				X			X	
	<i>Potamogeton perfoliatus</i>	Clasping-leaf pondweed											
	<i>Potamogeton pusillus</i>	Thin-leaf Pondweed							X		X		X
<i>Potamogeton robbinsii</i>	Robbins' Pondweed									X	X		
<i>Sagittaria</i> sp.	Arrowhead		X	X		X							
<i>Schoenoplectus subterminalis</i>	Grassy bulrush											X	
<i>Utricularia</i> spp.	Bladderwort	X	X	X	X	X	X	X	X	X	X	X	
<i>Vallisneria americana</i>	Wild celery			X							X		
Floating Leaf	<i>Brasenia schreberi</i>	Watershield		X	X		X	X	X		X		
	<i>Lemna minor</i>	Lesser duckweed			X								
	<i>Nuphar variegata</i>	Yellow waterlily	X	X	X	X	X	X	X	X	X	X	
	<i>Nymphaea odorata</i>	White waterlily	X	X	X	X	X	X	X	X	X	X	
	<i>Nymphoides cordata</i>	Floating heart										X	
	<i>Spirodela polyrhiza</i>	Big duckweed			X								
Emergent	<i>Decodon verticillatus</i>	Water willow	X	X	X	X	X		X*	X*	X*	X*	
	<i>Eleocharis</i> sp.	Spikerush			X								
	<i>Eriocaulon</i> sp.	Pipewort	X	X									
	<i>Lythrum salicaria</i>	Purple loosestrife	X	X	X	X	X	X	X*	X*	X*	X*	
	<i>Peltandra virginica</i>	Arrow arum			X							X*	
	<i>Pontederia cordata</i>	Pickerelweed	X	X	X	X	X				X*	X*	
	<i>Scirpus</i> sp.	Rushes	X	X								X*	
	<i>Sparganium</i> sp.	Burreed		X	X	X	X	X	X*	X*	X*	X*	
<i>Typha</i> sp.	Cattail	X	X	X	X	X		X*	X*	X*	X*		

* Observed in the pond, but not at data point locations. Red font indicates species considered invasive.



Water Quality Monitoring

Water quality sampling was performed at Foster's Pond in 2018 consistent with prior year's efforts and locations, in addition to Azalea Drive that was added in 2017. Surface grab water samples were collected from five locations, shown on below map, on August 23rd. Laboratory analysis was performed for the following parameters: pH, alkalinity, total phosphorus, turbidity, true and apparent color, fecal and total coliform.

Figure 2. Water quality sample locations

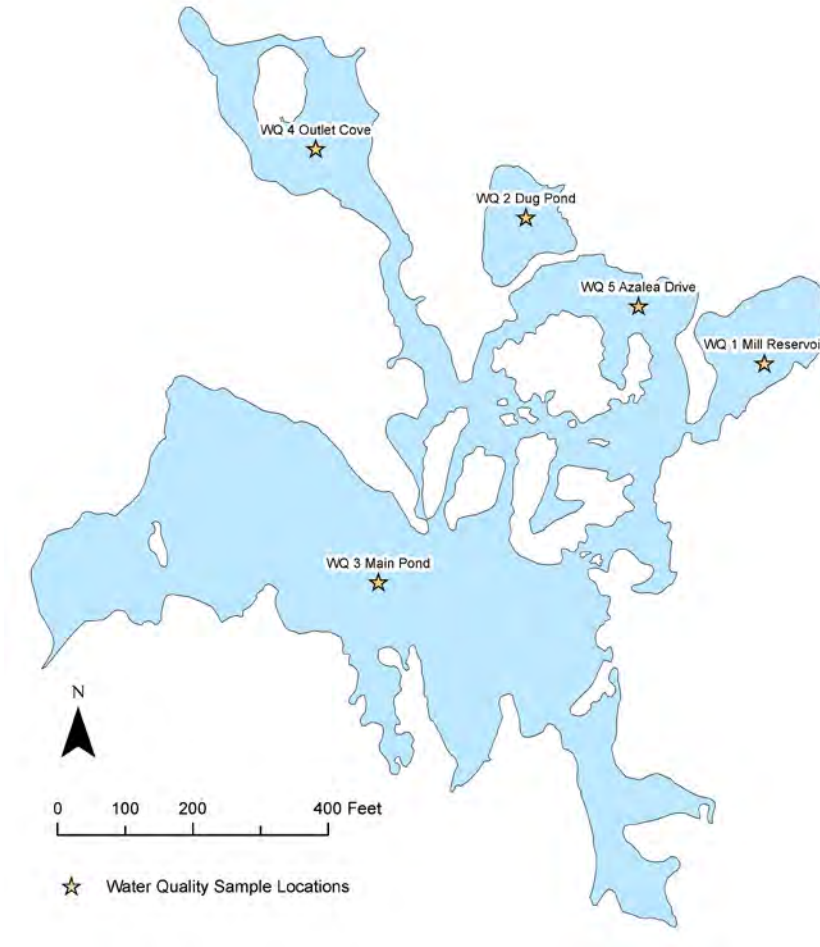




Table 3. Water quality results

Parameter	Units	Desirable Thresholds	Mill Reservoir (WQ1)	Dug Pond (WQ2)	Main Pond (WQ3)	Outlet Cove (WQ4)	Azalea Drive (WQ5)
pH	S.U.	5.5 – 8.5	7.0	6.9	7.0	6.8	6.8
Alkalinity, total	mg/L CaCO ₃	>20	26.3	17.0	21.3	18.3	20.4
Phosphorus, total	mg/L	<0.03	0.034	ND at 0.010	0.034	0.026	0.012
Turbidity	NTU	<5	3.3	0.81	6.1	3.0	1.1
True Color	Pt-Co	<100	72	7.0	32	28	26
Apparent Color	Pt-Co	<100	88	12	46	36	32
Fecal Coliform	MPN ¹ /100mL	<200	350	21	11	23	130
Total Coliform	MPN/100mL	-	7800	1200	17,000	2000	22,000

¹MPN (most probable number) is a method for estimating the concentration of microorganisms in a sample.

In general, the water quality results were similar to those reported in previous years. The pH values of all locations were close to neutral and within normal ranges for northeast freshwater systems. If the pH is between 5.0-9.0, adverse impacts to fish and other aquatic biota are generally not observed. Alkalinity values varied between locations, as some values were slightly lower than desirable, but are characteristic for waterbodies in the region. Total phosphorus levels in the Mill Reservoir and the Main Pond locations were elevated at the time of the sampling, whereas all other sample locations fell within the desirable threshold. Total phosphorus was not detected in Dug Pond. Based on the measured phosphorus levels, three of the basins were capable of supporting some level of algal blooms at >0.02 mg/L. Turbidity values were nearly all lower than 5 NTU; only the Main Pond measured about 5 NTU. True color is a measure of filtered water, whereas apparent color is the measure of the raw water. Color results were similar to prior years, with dissolved material and suspended particles both likely contributing to the relative clarity of the basins.

Coliform bacteria can be understood as a series of concentric circles: the outermost ring of total coliform bacteria encompasses all forms; the next ring is fecal coliform which is a sub-group of total coliform and is composed of many strains of bacteria commonly found in the intestines and feces of people and animals; the innermost ring is that of *E. coli* which is a specific strain of fecal coliform linked to causing illness in humans. Measuring fecal coliform allows for an indicator to the presence of human or animal waste inputs. Acceptable values for "swimmable waters" for fecal coliform bacteria is less than 200 organisms per 100 mL. The Mill Reservoir measured above the established threshold, whereas all other basins fell below concerning thresholds. Due to higher than normal rainfall during this season, the higher fecal coliform results are a result of the increased groundwater runoff, which likely carried more fecal matter with it than has been found in prior years.

Conclusions and Recommendations

In Foster's Pond, and other managed waterbodies throughout Massachusetts, in years following Sonar treatments, native aquatic vegetation rebounds quickly and a more diverse plant composition is observed. Most native and desirable aquatic plant species reproduce via seed each year, so continued recovery is possible as seeds remain in the pond sediment. Although waterlilies and other floating leaf species are originally impacted by Sonar treatments, they show



a continual increase in abundance and distribution throughout the pond in years following Sonar treatments.

Based on the history of conditions and management at Foster's Pond, as well as the presence of invasive aquatic species, specifically fanwort, it is likely that problematic aquatic plant growth will continue in the future. Future, timely management will be required to maintain control of non-native species, fanwort and spiny naiad. It is highly recommended that the Foster's Pond Corporation continue annual monitoring efforts to assess fanwort distribution and watch for potential pioneer infestations of other invasive species.

Fanwort control: Based on the success of this season's Sonar herbicide spot-treatment, we are recommending spot-treatment with Sonar to control areas of regrowth that were observed this season. We will work with the Foster's Pond Corporation to determine the most appropriate areas of growth to target for treatment following an early-season pre-treatment inspection. Based on the results of the late summer 2018 survey, there was approximately 9 acres of fanwort growth observed at varying densities.

Fanwort alternatives analysis: The Massachusetts Department of Conservation and Recreation (MA DCR) has provided guidance that considers alternative methods of controlling fanwort. MA DCR reviewed eradication and control options, including hand harvesting, suction harvesting, benthic barriers, water level drawdown, and herbicides.

The MA DCR alternatives analysis, as applied to conditions in Foster's Pond, indicates that there is no practicable non-herbicidal control alternative. This analysis considers the number of acres found this year to be affected by fanwort (about 20), the number of stems per 100 square feet (in excess of 10 through much or all of the affected area), the absence of sensitive protected species, the ability to control dilution and flushing during the treatment period, and the physical limitations at the Foster's Pond Dam to draw down the pond lower than about 18 inches.

Hand harvesting would be limiting, given the cost associated with efforts, extent and density of the fanwort, and potential for fragmentation and further spread of the species. When fanwort colonies cover even a small fraction of an acre, suction harvesting would be impossible given the thick and silty sediments, increasing the turbidity of the water body and rendering the target plants invisible, and the cost would be exorbitant. However, with the new fanwort growth in Dug Pond, the FPC plans to utilize volunteer hand-pulling to manage the limited growth while feasible to do so this way and continue to diligently monitor the remainder of Dug Pond for other areas of infestation.

Large benthic barriers require significant time and effort to install, relocate and remove over the course of a season and have additional, negative impacts to other aquatic species present within the immediate area. However, recent experience with smaller scale barriers has shown promising feasibility when used in isolated areas of growth. During the 2018 season, the FPC and SŌLitude coordinated the use of nine (9), small scale (5' x 5') benthic barriers within Foster's Pond on individual and/or small areas of fanwort growth that were observed later in the season outside of any treatment areas. The barriers proved difficult for the volunteers to install, as fanwort was detected in locations that were too deep and heavily silted for the volunteers to stand. The installation caused some fragmentation. The results of this experiment will be evaluated next spring, when volunteers will determine whether fanwort re-emerges in the locations where the barriers were placed.

With respect to chemical alternatives, only two herbicides are currently approved for use in Massachusetts to manage fanwort infestations. Fluridone and Clipper (flumioxazin) are both registered by the Massachusetts Department of Agricultural Resources and authorized by the



current OOC for Foster's Pond. Clipper has proven effective in spot-treating fanwort growth in Massachusetts lakes and ponds; however, the Department of Environmental Protection limits treatment to less than 25% of the total waterbody's acreage in one year, and a treated area may not be retreated for 3 years. Since Clipper is a contact herbicide, regrowth can be expected in the year after treatment. Experience in other jurisdictions indicates that at least several years of consecutive treatment followed by periodic re-treatment are usually required to manage an infestation with Clipper. Given the current restrictions on the use of Clipper in Massachusetts and the past success of treatments with fluridone in Foster's Pond, addressing the re-growth using Clipper is not likely to provide a substantial benefit to Foster's Pond. We will continue to evaluate new technologies as they become available or re-visit options should regulatory restrictions change.

In the meantime, spot-treatment with Sonar remains the best alternative for controlling regrowth in 2019 and beyond. Based on this year's and past experience in Foster's Pond, it is anticipated that treating a limited number of acres in 2019 will minimize the need for a whole-lake treatment in the immediate future.

Spiny naiad control: Spiny naiad is a late germinating species which spreads via seed production. Plants typically emerge in mid to late July from seeds dropped by plants in the previous year or two. A late-July survey is necessary to assess growth and determine the extent requiring a spot-treatment. Multiple years of successful treatment can effectively reduce the viable seed bank.

We again recommend that in 2019 the FPC conduct a survey focusing on the presence of spiny naiad and, to the extent treatable infestations are observed, proceed with a spot-treatment of those areas with diquat. Timely application would require securing Conservation Commission approval, and a DEP license, in advance for this contingency, as was done in 2017 and 2018. Based on the 2018 annual survey, it is preliminarily estimated that 7+ acres might require treatment in 2019, though actual observations in 2019 could vary considerably from this estimate.

Spiny naiad alternatives analysis: According to NOAA's Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS), use of aquatic herbicides is the most effective method of controlling spiny naiad growth, especially as it relates to the infestation within Foster's Pond. Diquat and fluridone herbicides are two of the recommended aquatic herbicides that provide control of spiny naiad, and are also included in the current OOC for Foster's Pond. Mechanical removal of spiny naiad is also possible (but not recommended), using a mechanical harvester or hydro-rake. However, spiny naiad is an incredibly brittle plant which spreads via fragmentation and thus mechanical removal may provide short-term relief, but would likely increase the infestation within the pond overall. Benthic barriers are also a viable option, but as mentioned previously in regards to fanwort control, these are time consuming to manage while having non-target impacts. However, a smaller scale option may be more feasible within isolated areas of growth. The FPC and SOLitude will assess the feasibility during 2019 of utilizing smaller barriers where appropriate for spiny naiad growth and do so accordingly, if possible.

Algae control: Continued algal composition and density monitoring through the summer months is recommended as it allows for appropriately timed algaecide treatment(s) when necessary.

Based on the Watershed-Based Plan developed by Geosyntec for the FPC, we understand that overall phosphorus remains an extensive challenge within the surrounding watershed. To better understand the phosphorus loading, we recommend conducting in-pond sediment sampling to be analyzed for available phosphorus. By gaining this information, and utilizing the Watershed-



Based Plan, we can develop the most effective in-water nutrient management plan to correlate with the watershed plan.

Based on the in-lake sediment phosphorus analysis, SOLitude can work with the FPC to align nutrient management techniques with their goals. Management of phosphorus within the pond, among other nutrients, will likely limit algal growth. Using various management techniques together can prevent excessive algae growth, potential health hazards and associated waterbody closures from state agencies.

Copper-based algaecides effectively manage an active algae bloom, however an algaecide treatment is merely controlling the symptom of excessive nutrients present within Foster's Pond. Low-dose aluminum treatments have proven to be effective in reduction of nutrients, specifically phosphorus, while limiting the need for conducting copper-algaecide treatments. Ultimately, by reducing the phosphorus readily available for uptake by algae, the frequency and severity of algal blooms is also reduced. Annual, low-dose alum treatments have been found to have cumulative effects on reducing iron-bound phosphorus released from sediments during anoxic times. Prior to any alum treatment implementation, a detailed plan would need to be established. Higher dose alum treatments are also available as an option for Foster's Pond, however, we recommend conducting more in-lake phosphorus sampling before proceeding with any alum treatments.

SeClear is another available product that combines algaecidal properties with a phosphorus reducing agent. SeClear will not reduce the available phosphorus levels as significantly as alum would, but it could be a viable alternative to conducting copper sulfate treatments. A SeClear treatment would carry a cost in between that of traditional copper sulfate treatments and a low-dose alum treatment, while potentially reducing phosphorus levels enough to minimize the potential for subsequent blooms later in the season.



Attachments

- 2018 Sonar Treatment Areas Map
- 2018 Spiny Naiad Treatment Areas Map
- Fanwort and Spiny Naiad Distribution Map
- Potential 2019 Sonar Treatment Areas Map
- Aquatic Plant Survey Field Data Table
- Water Quality Laboratory Reports

Figure 1: 2018 Sonar Treatment Areas



Legend

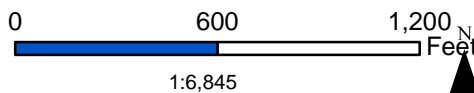
 Sonar treatment areas (15 ac.)

Foster's Pond

Andover, MA
Essex County
42.6060° N, 71.1382° W

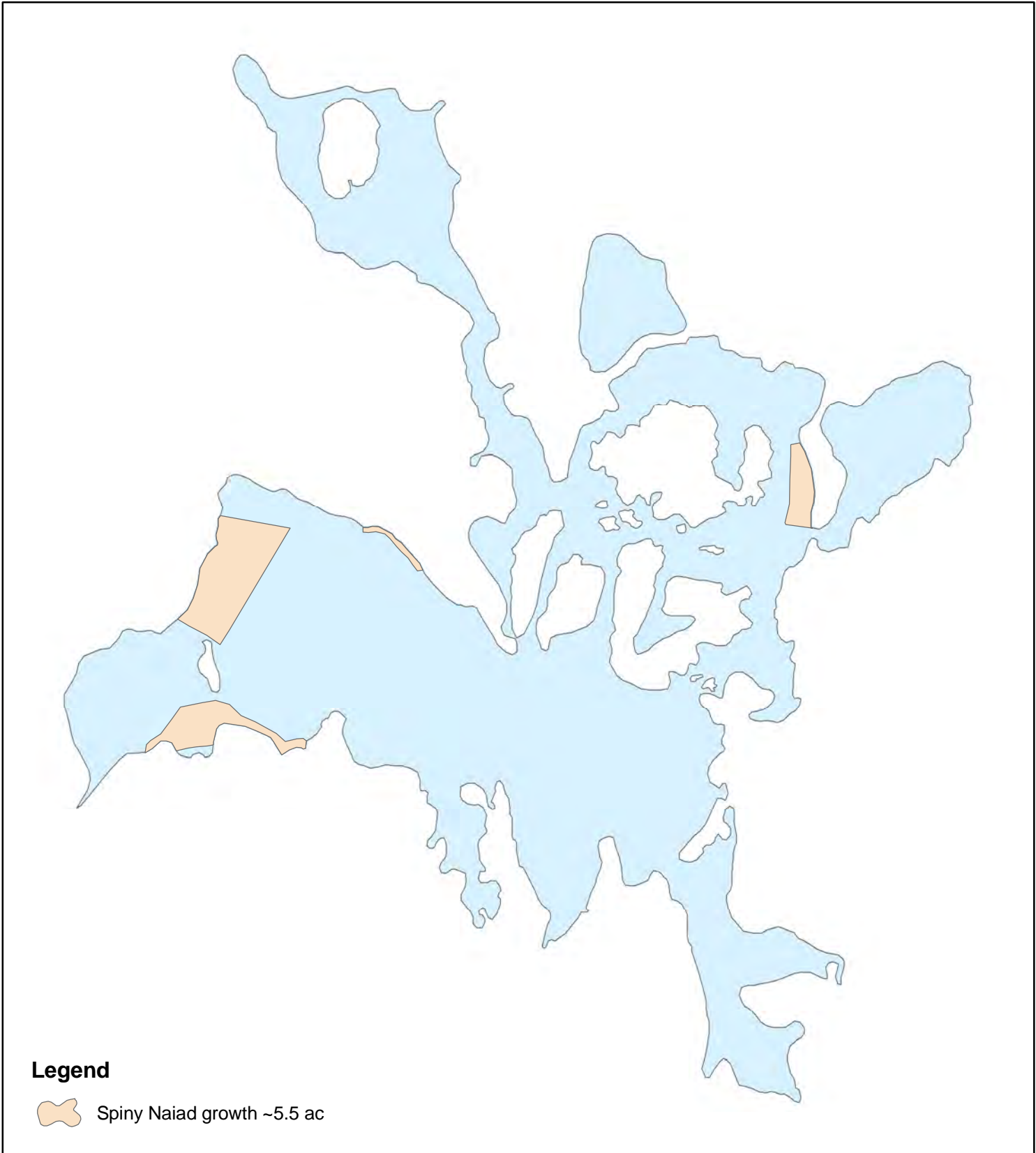


Foster's Pond




Map Date: 11/03/18
Prepared by: KS
Office: Shrewsbury, MA

Figure 2: 2018 Spiny Naiad Treatment Areas



Legend

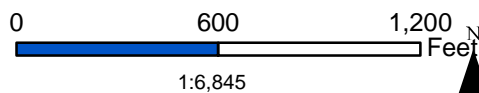
 Spiny Naiad growth ~5.5 ac

Foster's Pond

Andover, MA
Essex County
42.6060° N, 71.1382° W

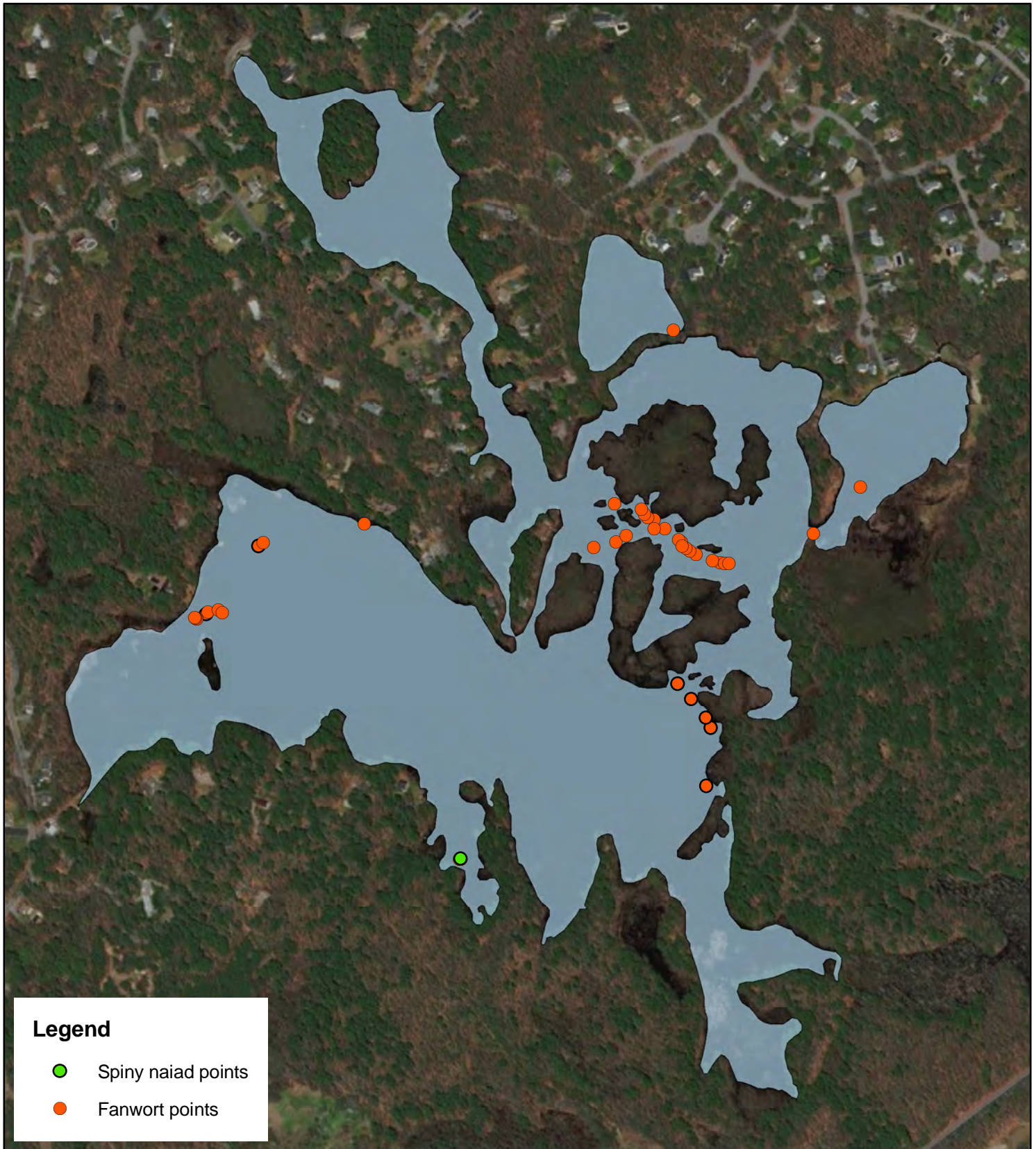


Foster's Pond



Map Date: 11/03/18
Prepared by: KS
Office: Shrewsbury, MA

Figure 3: August 2018 Fanwort and Spiny Naiad Distribution



Legend

- Spiny naiad points
- Fanwort points

Foster's Pond
Andover, MA
Essex County
42.6060° N, 71.1382° W

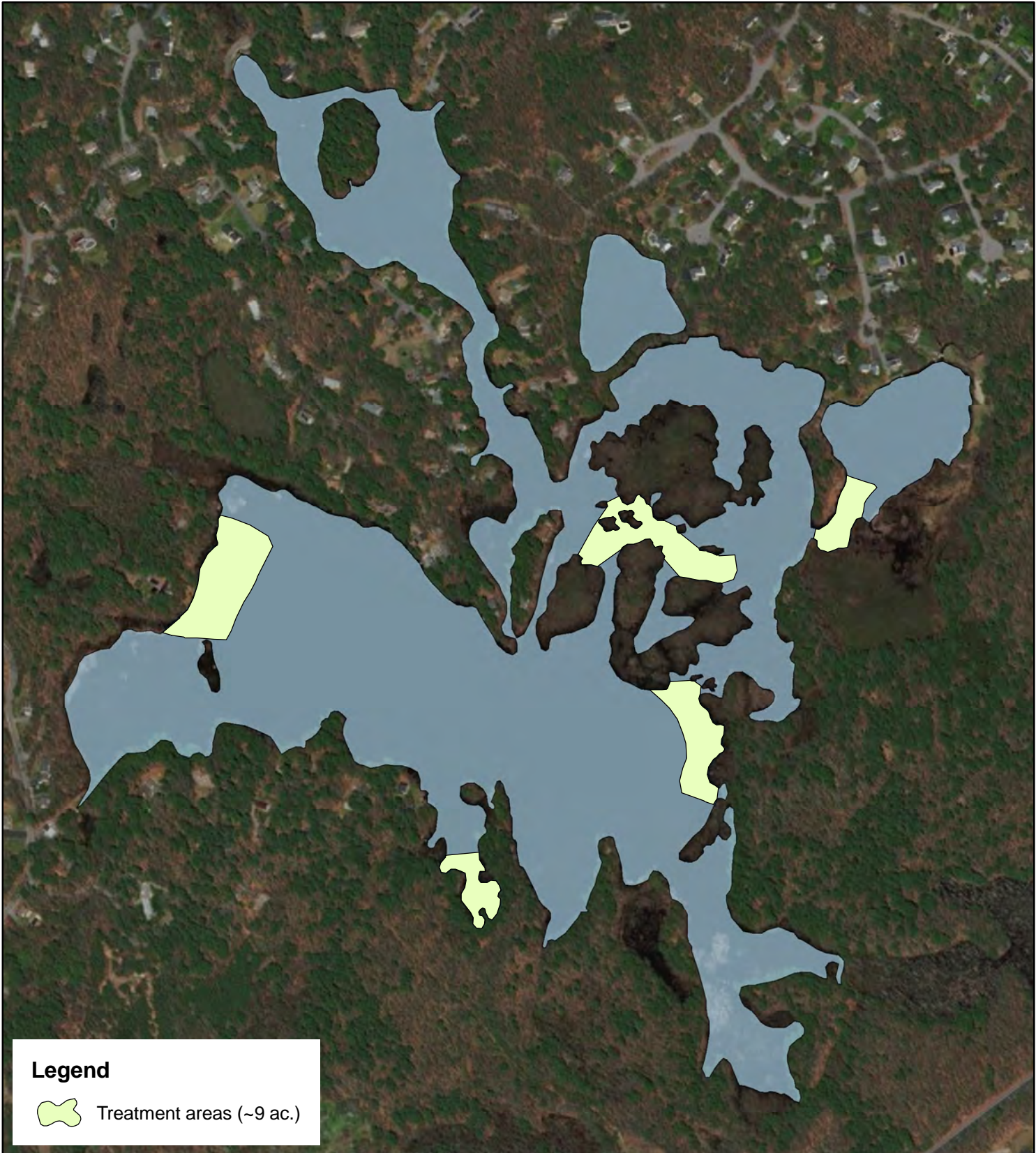
Foster's Pond

0 550 1,100 Feet


1:6,845

Map Date: 11/07/18
Prepared by: KS
Office: Shrewsbury, MA


Figure 4: Potential 2019 Sonar Treatment Areas



Legend

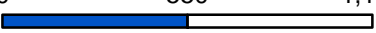
 Treatment areas (~9 ac.)

Foster's Pond
Andover, MA
Essex County
42.6060° N, 71.1382° W




Foster's Pond

0 550 1,100 Feet



1:6,845



Map Date: 11/07/18
Prepared by: KS
Office: Shrewsbury, MA

Data Point	Water Depth (ft.)	Cc	Mu	Pg	Pe	F	Pa	Pp	FH	Ug	Uv	Nm	Ca	Ng	Fa	WL	Gb	YL	Cd	Ch	Up	Ur	% Total Plant Cover	%Fanwort Cover	Biomass index	Species Richness index
1	13																						0		0	0
2	11										X				X				X				40		2	3
3	4												X	D	X								65		2	3
4	2	X					X						X		X					D			100	25	4	5
5	2														D		X			X			100		4	3
6	11																						0		0	0
7	4										X										D		70		3	2
8	2									X					X					D		X	100		4	3
9	2														X	D						X	100		4	2
10	4														D	X							100		2	1
11	5														D								5		1	0
12	7																						0		0	0
13	7																						0		0	0
14	2														D								100		2	0
15	7														D								100		2	0
16	9														D								40		1	0
17	6				X										X	D		X					100		4	3
18	6																						0		0	0
19	10																						0		0	0
20	8														D								5		1	0
21	4														X	D							15		1	1
22	9																						0		0	0
23	7														D								50		2	0
24	5														D	X							80		4	1
25	4														X	D							50		4	1
26	7														D								5		1	0
27	4														D	D							10		4	1
28	3																	X					100		3	1
29	3									X	X				D	X						X	100		2	4
30	3														X					D			100		4	1
31	2									X					D	X				X			100		4	3
32	2														D								100		4	0
33	4									X	X									D			80		2	3
34	3									X					D								100		2	1
35	3									X					D								80		1	1
36	4									D					X								80		1	1
37	2									X					D	X							100		4	2
38	6									X					D					X			100		2	2
39	6																						0		0	0
40	6					D																	5		1	1
41	3									X	X				D	X							90		3	3
42	5																			D			100		2	1
43	7										D												5		1	1
44	3					D																	75		1	1
45	6									X										D			5		1	2
46																							0		0	0
47															D								100		3	0
G1	5															X					D		100		2	2
G2	6			X												X					D		100		3	3
G3	5				X															D	X	X	80		2	4
G4	5	X	X							X						D					X	X	90	10	4	6
A															X	X				D			100		4	4
B										X						D				X			15		4	3
C															D	X				X			100		2	2
D		X									X				X	D				X			100	20	4	4
E															X	D							10		2	1
F		X				X		X					X			D			X				75	25	2	6
G															X	D			X				75		4	2
H		X										X			X	D			X			X	85	25	4	5
I																D			X				80		4	2
J									X							D			X				20		4	3
61																							60.4	21.0	2.3	1.7

#X	5	1	1	2	1	1	1	3	11	6	1	3	0	12	13	1	9	2	4	2	6
#D	0	0	0	0	2	0	0	0	1	1	0	0	1	20	15	0	0	0	8	3	0
total #	5	1	1	2	3	1	1	3	12	7	1	3	1	32	28	1	9	2	12	5	6
% FOC	8.2%	1.6%	1.6%	3.3%	4.9%	1.6%	1.6%	4.9%	19.7%	11.5%	1.6%	4.9%	1.6%	52.5%	45.9%	1.6%	14.8%	3.3%	19.7%	8.2%	9.8%

- Cc Fanwort
- Mu Low watermilfoil
- Pg Variable-leaf pondweed
- Pe Ribbonleaf pondweed
- F Water moss
- Pa Largeleaf pondweed
- Pp Thinleaf pondweed
- FH Floating heart
- Ug Bladderwort
- Uv Bladderwort
- Nm Spiny naiad
- Ca Water starwort
- Ng Southern naiad
- Fa Filamentous algae
- WL White waterlily
- Gb Grassy bulrush
- YL Yellow waterlily
- Cd Coontail
- Ch Muskgrass
- Up Bladderwort
- Ur Bladderwort



ANALYTICAL REPORT

Lab Number:	L1833365
Client:	Solitude Lake Management LLC 590 Lake Street Shrewsbury, MA 01545
ATTN:	Brea Arvidson
Phone:	(508) 865-1000
Project Name:	FOSTERS POND
Project Number:	Not Specified
Report Date:	08/30/18

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com



Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1833365-01	MAIN POND	WATER	ANDOVER, MA	08/23/18 13:19	08/23/18
L1833365-02	MILL RESERVOIR	WATER	ANDOVER, MA	08/23/18 11:15	08/23/18
L1833365-03	OUTLET COVE	WATER	ANDOVER, MA	08/23/18 10:15	08/23/18
L1833365-04	DUG POND	WATER	ANDOVER, MA	08/23/18 12:20	08/23/18
L1833365-05	AZALEA DRIVE	WATER	ANDOVER, MA	08/23/18 12:00	08/23/18

Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY

For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

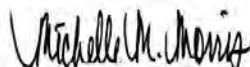
Case Narrative (continued)

Coliform, Fecal (MPN)

L1833365-03 was analyzed with the method required holding time exceeded.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:



Michelle M. Morris

Title: Technical Director/Representative

Date: 08/30/18

INORGANICS & MISCELLANEOUS

Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

SAMPLE RESULTS

Lab ID: L1833365-01
Client ID: MAIN POND
Sample Location: ANDOVER, MA

Date Collected: 08/23/18 13:19
Date Received: 08/23/18
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Coliform, Total (MPN)	17000		MPN/100ml	200	NA	200	-	08/23/18 18:10	121,9223B	AJ
Coliform, Fecal (MPN)	11		MPN/100ml	2.0	NA	1	-	08/23/18 18:45	121,9221E	AJ
General Chemistry - Westborough Lab										
Turbidity	6.1		NTU	0.20	--	1	-	08/23/18 22:14	121,2130B	AS
Color, True	32		A.P.C.U.	5.0	--	1	-	08/23/18 19:17	121,2120B	AS
Color, Apparent	46		A.P.C.U.	10	--	2	-	08/23/18 19:17	121,2120B	AS
Alkalinity, Total	21.3		mg CaCO3/L	2.00	NA	1	-	08/28/18 09:56	121,2320B	BR
pH (H)	7.0		SU	-	NA	1	-	08/23/18 18:02	1,9040C	AS
Phosphorus, Total	0.034		mg/l	0.010	--	1	08/29/18 12:20	08/30/18 09:33	121,4500P-E	SD



Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

SAMPLE RESULTS

Lab ID: L1833365-02
Client ID: MILL RESERVOIR
Sample Location: ANDOVER, MA

Date Collected: 08/23/18 11:15
Date Received: 08/23/18
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Coliform, Total (MPN)	7800		MPN/100ml	200	NA	200	-	08/23/18 18:10	121,9223B	AJ
Coliform, Fecal (MPN)	350		MPN/100ml	2.0	NA	1	-	08/23/18 18:45	121,9221E	AJ
General Chemistry - Westborough Lab										
Turbidity	3.3		NTU	0.20	--	1	-	08/23/18 22:14	121,2130B	AS
Color, True	72		A.P.C.U.	10	--	2	-	08/23/18 19:17	121,2120B	AS
Color, Apparent	88		A.P.C.U.	20	--	4	-	08/23/18 19:17	121,2120B	AS
Alkalinity, Total	26.3		mg CaCO3/L	2.00	NA	1	-	08/28/18 09:56	121,2320B	BR
pH (H)	7.0		SU	-	NA	1	-	08/23/18 18:02	1,9040C	AS
Phosphorus, Total	0.034		mg/l	0.010	--	1	08/29/18 12:20	08/30/18 09:39	121,4500P-E	SD



Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

SAMPLE RESULTS

Lab ID: L1833365-03
Client ID: OUTLET COVE
Sample Location: ANDOVER, MA

Date Collected: 08/23/18 10:15
Date Received: 08/23/18
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Coliform, Total (MPN)	2000		MPN/100ml	1.0	NA	1	-	08/23/18 18:10	121,9223B	AJ
Coliform, Fecal (MPN)	23		MPN/100ml	2.0	NA	1	-	08/23/18 18:45	121,9221E	AJ
General Chemistry - Westborough Lab										
Turbidity	3.0		NTU	0.20	--	1	-	08/23/18 22:14	121,2130B	AS
Color, True	28		A.P.C.U.	5.0	--	1	-	08/23/18 19:17	121,2120B	AS
Color, Apparent	36		A.P.C.U.	5.0	--	1	-	08/23/18 19:17	121,2120B	AS
Alkalinity, Total	18.3		mg CaCO3/L	2.00	NA	1	-	08/28/18 09:56	121,2320B	BR
pH (H)	6.8		SU	-	NA	1	-	08/23/18 18:02	1,9040C	AS
Phosphorus, Total	0.026		mg/l	0.010	--	1	08/29/18 12:20	08/30/18 09:40	121,4500P-E	SD



Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

SAMPLE RESULTS

Lab ID: L1833365-04
Client ID: DUG POND
Sample Location: ANDOVER, MA

Date Collected: 08/23/18 12:20
Date Received: 08/23/18
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Coliform, Total (MPN)	1200		MPN/100ml	1.0	NA	1	-	08/23/18 18:10	121,9223B	AJ
Coliform, Fecal (MPN)	21		MPN/100ml	2.0	NA	1	-	08/23/18 18:45	121,9221E	AJ
General Chemistry - Westborough Lab										
Turbidity	0.81		NTU	0.20	--	1	-	08/23/18 22:14	121,2130B	AS
Color, True	7.0		A.P.C.U.	5.0	--	1	-	08/23/18 19:17	121,2120B	AS
Color, Apparent	12		A.P.C.U.	5.0	--	1	-	08/23/18 19:17	121,2120B	AS
Alkalinity, Total	17.0		mg CaCO3/L	2.00	NA	1	-	08/28/18 09:56	121,2320B	BR
pH (H)	6.9		SU	-	NA	1	-	08/23/18 18:02	1,9040C	AS
Phosphorus, Total	ND		mg/l	0.010	--	1	08/29/18 12:20	08/30/18 09:41	121,4500P-E	SD



Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

SAMPLE RESULTS

Lab ID: L1833365-05
Client ID: AZALEA DRIVE
Sample Location: ANDOVER, MA

Date Collected: 08/23/18 12:00
Date Received: 08/23/18
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
Coliform, Total (MPN)	22000		MPN/100ml	200	NA	200	-	08/23/18 18:10	121,9223B	AJ
Coliform, Fecal (MPN)	130		MPN/100ml	2.0	NA	1	-	08/23/18 18:45	121,9221E	AJ
General Chemistry - Westborough Lab										
Turbidity	1.1		NTU	0.20	--	1	-	08/23/18 22:14	121,2130B	AS
Color, True	26		A.P.C.U.	5.0	--	1	-	08/23/18 19:17	121,2120B	AS
Color, Apparent	32		A.P.C.U.	5.0	--	1	-	08/23/18 19:17	121,2120B	AS
Alkalinity, Total	20.4		mg CaCO3/L	2.00	NA	1	-	08/28/18 09:56	121,2320B	BR
pH (H)	6.8		SU	-	NA	1	-	08/23/18 18:02	1,9040C	AS
Phosphorus, Total	0.012		mg/l	0.010	--	1	08/29/18 12:20	08/30/18 09:42	121,4500P-E	SD



Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01-05 Batch: WG1149994-1										
Coliform, Total (MPN)	<1		MPN/100ml	1	NA	1	-	08/23/18 18:10	121,9223B	AJ
Microbiological Analysis - Westborough Lab for sample(s): 01-05 Batch: WG1149998-1										
Coliform, Fecal (MPN)	<2		MPN/100ml	2	NA	1	-	08/23/18 18:45	121,9221E	AJ
General Chemistry - Westborough Lab for sample(s): 01-05 Batch: WG1150038-3										
Turbidity	ND		NTU	0.20	--	1	-	08/23/18 22:14	121,2130B	AS
General Chemistry - Westborough Lab for sample(s): 01-05 Batch: WG1151314-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	08/28/18 09:56	121,2320B	BR
General Chemistry - Westborough Lab for sample(s): 01-05 Batch: WG1151679-1										
Phosphorus, Total	ND		mg/l	0.010	--	1	08/29/18 12:20	08/30/18 09:31	121,4500P-E	SD



Lab Control Sample Analysis

Batch Quality Control

Project Name: FOSTERS POND

Project Number: Not Specified

Lab Number: L1833365

Report Date: 08/30/18

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1149982-1								
pH	101		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1150038-1								
Turbidity	100		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1151314-2								
Alkalinity, Total	102		-		90-110	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-05 Batch: WG1151679-2								
Phosphorus, Total	100		-		80-120	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: FOSTERS POND

Lab Number: L1833365

Project Number: Not Specified

Report Date: 08/30/18

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Qual	MSD Found	MSD %Recovery	MSD Qual	Recovery Limits	RPD	RPD Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1151314-4 QC Sample: L1833365-03 Client ID: OUTLET COVE												
Alkalinity, Total	18.3	100	126	108	-	-	-	-	86-116	-	-	10
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1151679-3 QC Sample: L1833365-01 Client ID: MAIN POND												
Phosphorus, Total	0.034	0.5	0.543	102	-	-	-	-	75-125	-	-	20

Lab Duplicate Analysis

Batch Quality Control

Project Name: FOSTERS POND

Project Number: Not Specified

Lab Number: L1833365

Report Date: 08/30/18

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1149982-2 QC Sample: L1833134-22 Client ID: DUP Sample						
pH	5.9	5.8	SU	2		5
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1150002-1 QC Sample: L1833365-05 Client ID: AZALEA DRIVE						
Color, Apparent	32	33	A.P.C.U.	3		
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1150003-1 QC Sample: L1833365-05 Client ID: AZALEA DRIVE						
Color, True	26	25	A.P.C.U.	4		
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1150038-2 QC Sample: L1833380-01 Client ID: DUP Sample						
Turbidity	2.3	2.3	NTU	0		13
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1151314-3 QC Sample: L1833365-01 Client ID: MAIN POND						
Alkalinity, Total	21.3	21.5	mg CaCO3/L	1		10
General Chemistry - Westborough Lab Associated sample(s): 01-05 QC Batch ID: WG1151679-4 QC Sample: L1833365-01 Client ID: MAIN POND						
Phosphorus, Total	0.034	0.034	mg/l	0		20

Project Name: FOSTERS POND**Lab Number:** L1833365**Project Number:** Not Specified**Report Date:** 08/30/18**Sample Receipt and Container Information**

Were project specific reporting limits specified?

YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1833365-01A	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		T-COLI-QT(.33)
L1833365-01B	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		F-COLI-MPN(.33)
L1833365-01C	Plastic 250ml unpreserved/No Headspace	A	NA		5.0	Y	Absent		ALK-T-2320(14)
L1833365-01D	Plastic 500ml H2SO4 preserved	A	<2	<2	5.0	Y	Absent		TPHOS-4500(28)
L1833365-01E	Plastic 950ml unpreserved	A	7	7	5.0	Y	Absent		TURB-2130(2),COLOR-T-2120(2),COLOR-A-2120(2),PH-9040(1)
L1833365-02A	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		T-COLI-QT(.33)
L1833365-02B	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		F-COLI-MPN(.33)
L1833365-02C	Brown Plastic 1000ml unpreserved	A	NA		5.0	Y	Absent		ALK-T-2320(14)
L1833365-02D	Plastic 500ml H2SO4 preserved	A	<2	<2	5.0	Y	Absent		TPHOS-4500(28)
L1833365-02E	Plastic 950ml unpreserved	A	7	7	5.0	Y	Absent		TURB-2130(2),COLOR-T-2120(2),COLOR-A-2120(2),PH-9040(1)
L1833365-03A	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		T-COLI-QT(.33)
L1833365-03B	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		F-COLI-MPN(.33)
L1833365-03C	Plastic 250ml unpreserved/No Headspace	A	NA		5.0	Y	Absent		ALK-T-2320(14)
L1833365-03D	Plastic 500ml H2SO4 preserved	A	<2	<2	5.0	Y	Absent		TPHOS-4500(28)
L1833365-03E	Plastic 950ml unpreserved	A	7	7	5.0	Y	Absent		TURB-2130(2),COLOR-T-2120(2),COLOR-A-2120(2),PH-9040(1)
L1833365-04A	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		T-COLI-QT(.33)
L1833365-04B	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		F-COLI-MPN(.33)
L1833365-04C	Brown Plastic 1000ml unpreserved	A	NA		5.0	Y	Absent		ALK-T-2320(14)
L1833365-04D	Plastic 500ml H2SO4 preserved	A	<2	<2	5.0	Y	Absent		TPHOS-4500(28)
L1833365-04E	Plastic 950ml unpreserved	A	7	7	5.0	Y	Absent		TURB-2130(2),COLOR-T-2120(2),COLOR-A-2120(2),PH-9040(1)
L1833365-05A	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		T-COLI-QT(.33)
L1833365-05B	Bacteria Cup Na2S2O3 preserved	A	NA		5.0	Y	Absent		F-COLI-MPN(.33)

Project Name: FOSTERS POND**Lab Number:** L1833365**Project Number:** Not Specified**Report Date:** 08/30/18**Container Information**

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1833365-05C	Brown Plastic 1000ml unpreserved	A	NA		5.0	Y	Absent		ALK-T-2320(14)
L1833365-05D	Plastic 500ml H2SO4 preserved	A	<2	<2	5.0	Y	Absent		TPHOS-4500(28)
L1833365-05E	Plastic 950ml unpreserved	A	7	7	5.0	Y	Absent		TURB-2130(2),COLOR-T-2120(2),COLOR-A-2120(2),PH-9040(1)

Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

- 1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Report Format: Data Usability Report



Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

Data Qualifiers

- A** - Spectra identified as "Aldol Condensation Product".
- B** - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).
- C** - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
- D** - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
- E** - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- G** - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.
- H** - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
- I** - The lower value for the two columns has been reported due to obvious interference.
- M** - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
- NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
- P** - The RPD between the results for the two columns exceeds the method-specified criteria.
- Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedances are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
- R** - Analytical results are from sample re-analysis.
- RE** - Analytical results are from sample re-extraction.
- S** - Analytical results are from modified screening analysis.
- J** - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
- ND** - Not detected at the reporting limit (RL) for the sample.

Project Name: FOSTERS POND
Project Number: Not Specified

Lab Number: L1833365
Report Date: 08/30/18

REFERENCES

- 1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - IV, 2007.
- 121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.



Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility

EPA 624: m/p-xylene, o-xylene

EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.

EPA 8270D: NPW: Dimethylnaphthalene, 1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene, 1,4-Diphenylhydrazine.

EPA 300: DW: Bromide

EPA 6860: SCM: Perchlorate

EPA 9010: NPW and SCM: Amenable Cyanide Distillation

SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO₂, NO₃.

Mansfield Facility

SM 2540D: TSS

EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.

EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene,

3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.

Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water

EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE,**

EPA 180.1, SM2130B, SM4500CI-D, SM2320B, SM2540C, SM4500H-B

EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.

Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.**

Non-Potable Water

SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1:**

Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2:** Nitrate-N, **EPA 351.1, SM4500P-E, SM4500P-B, E,**

SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.

EPA 624: Volatile Halocarbons & Aromatics,

EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs

EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.

Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, SM9222D.**

Mansfield Facility:

Drinking Water

EPA 200.7: Al, Ba, Be, Cd, Cr, Cu, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1 Hg.**

EPA 522.

Non-Potable Water

EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.

EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.

EPA 245.1 Hg.

SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.



CHAIN OF CUSTODY

PAGE _____ OF _____

Date Rec'd in Lab: 8/23/18

ALPHA Job #: L1833365

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Project Information

Project Name: Fosters Pond

Project Location: Andover MA

Project #:

Project Manager: Kara Skuzoski

ALPHA Quote #:

Report Information - Data Deliverables

ADEX EMAIL

Billing Information

Same as Client info PO #:

Client Information

Client: Solitude

Address: Shrewsbury MA

Phone:

Email: BArnudson@solitudelake.com

Additional Project Information:

T+A color in plastic - OK
if out of temp - OK
Brown bottles - OK

Turn-Around Time

Standard RUSH (only confirmed if pre-approved)

Date Due:

Regulatory Requirements & Project Information Requirements

Yes No MA MCP Analytical Methods Yes No CT RCP Analytical Methods
 Yes No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
 Yes No GW1 Standards (Info Required for Metals & EPH with Targets)
 Yes No NPDES RGP
 Other State / Fed Program _____ Criteria _____

ANALYSIS		SAMPLE INFO
VOC: <input type="checkbox"/> 8260 <input type="checkbox"/> 624 <input type="checkbox"/> 324.2	SVOC: <input type="checkbox"/> ABN <input type="checkbox"/> PAH	
METALS: <input type="checkbox"/> MCP 13 <input type="checkbox"/> MCP 14 <input type="checkbox"/> RCP 15	METALS: <input type="checkbox"/> RCR45 <input type="checkbox"/> RCR48 <input type="checkbox"/> RCP-13	Preservation <input type="checkbox"/> Lab to do
EPH: <input type="checkbox"/> Ranges & Targets <input type="checkbox"/> Ranges Only	VPH: <input type="checkbox"/> Ranges & Targets <input type="checkbox"/> Ranges Only	
TPH: <input type="checkbox"/> PEST	TPH: <input type="checkbox"/> Quant Only <input type="checkbox"/> Fingerprint	
	<u>PH, Turb, Turb + App Color</u>	
	<u>Talk</u>	
	<u>TPHorph</u>	
	<u>Total + Fecal coli form</u>	
		Sample Comments

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection		Sample Matrix	Sampler Initials
		Date	Time		
33365-01	Main Pond	8/23/18	13:19	SW	BA
-02	Mill Reservoir	8/23/18	11:15	SW	BA
-03	Outlet Cove	8/23/18	10:15	SW	BA
04	Dug Pond	8/23/18	12:20	SW	BA
05	Agalea Drive	8/23/18	12:00	SW	BA

Container Type	Preservative
P= Plastic	A= None
A= Amber glass	B= HCl
V= Vial	C= HNO ₃
G= Glass	D= H ₂ SO ₄
B= Bacteria cup	E= NaOH
C= Cube	F= MeOH
O= Other	G= NaHSO ₄
E= Encore	H= Na ₂ S ₂ O ₃
D= BOD Bottle	I= Ascorbic Acid
	J= NH ₄ Cl
	K= Zn Acetate
	O= Other

Container Type	Preservative

Relinquished By:	Date/Time	Received By:	Date/Time
<u>Bregina</u>	8/23/18 1600	<u>Chris Sebeau</u>	8/23/18 1600

All samples submitted are subject to Alpha's Terms and Conditions
See reverse side
FORM NO: 01-01 (rev. 13-Mar-2012)