SŌLITUDE
LAKE MANAGEMENT

Annual Report

2018 Aquatic Management Program
Hardy Pond
Waltham, MA

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Introduction

In accordance with the existing aquatic plant management contract between the City of Waltham and SŌLitude Lake Management for Hardy Pond, the following document serves to provide a summary of the survey results, treatment and harvesting program, and management recommendations for the 2019 season.

All work performed at Hardy Pond this season was conducted in accordance with the current Order of Conditions (OOC) issued by the Conservation Commission (DEP #316-0552) and the MA DEP – Office of Watershed Management issued License to Apply Chemicals (#18018).

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

2018 Program Chronology

- Received MA DEP License to Apply Chemicals 03/28/18
- Early season pre-treatment survey, water quality sampling 05/02/18
- Herbicide / algaecide treatment 05/25/18
- Post-treatment survey, water quality sampling 07/23/18

Early Season Pre-Treatment Survey

On May 2, a SŌLitude biologist conducted the pre-treatment survey to assess the distribution and abundance of aquatic vegetation, specifically curlyleaf pondweed (*Potamogeton crispus*) to determine the most appropriate treatment approach. Overall, curlyleaf pondweed growth was scattered, in varying densities throughout the littoral zone of the pond, occupying approximately 50-75% of the water column at the time of the survey. Other native vegetation consisted of other pondweed species (*Potamogeton* spp.) and some waterlilies (*Nymphaea & Nuphar* spp.) were rising within the water column. Water chestnut (*Trapa natans*) and Eurasian watermilfoil (*Myriophyllum spicatum*) were not present.

At the time of the pre-treatment survey, water quality samples were also collected. Results are provided in the table below (Table 1).

Herbicide Treatment

Based on conditions observed during the pre-treatment survey, treatment of submersed aquatic vegetation and algae was conducted on May 25 by SŌLitude's state licensed applicators. Prior to treatment, the Waltham Conservation Commission was notified, and water-use restriction signs were posted around the shoreline of the pond.

Due to shallower water conditions, treatment was conducted using a small jonboat equipped with a low-pressure pump system in which the herbicide was diluted onboard in a mixing tank with pond water and applied subsurface via trailing hoses. A GPS unit was used to ensure real-time tracking of the boat within the treatment areas. Diquat herbicide and a copper-based algaecide were applied to the areas of submersed nuisance growth and algae, respectively. At no time during the treatment were adverse impacts to fish or other aquatic organisms either observed or reported.

Hand Harvesting Efforts

Hand harvesting of water chestnut was conducted on June 6 and June 27 by SŌLitude specialists. Similar to historical conditions, the efforts were focused on the edges of the pond, specifically the western half leading up to the northern cove.

Post-Treatment Inspection

On July 23, a post-treatment inspection of Hardy Pond was conducted to assess the treatment's impacts and successes, as well as the overall aquatic vegetation composition and distribution. Consistent with prior years, waterlilies and watershield (*Nymphaea* spp., *Nuphar* spp., *Brasenia screberi*) were observed in varying density patches along most of the pond's shoreline. Other vegetation consisted of various pondweeds at healthy densities throughout the pond. Waterweed (*Elodea canadensis*) was observed within the shallower, northwestern cove growing at moderate densities.

Water quality samples were again collected at the time of the post-treatment survey. Results are in the table below (Table 1).

Water Quality Sampling

A comprehensive water quality program was conducted again this year, encompassing general indicative parameters to assess the overall water quality of the pond, as well as parameters to analyze for presence of metals. Results were relatively consistent with those from 2015 for all parameters. The results are shown in the table below and brief explanations of desirable ranges and how they apply to Hardy Pond's results follow.

Table 1. 2018 Water Quality Sampling Results

Parameter	Units	05/02		07/23	
		Inlet	Middle	Inlet	Middle
E. coli	colonies/100mL	5.0	7.0	98	11
Alkalinity	mg $CaCO_3$/L	33.6	30.8	51.0	46.9
Salinity	SU	ND	ND	ND	ND
Total dissolved solids	mg/L	620	630	730	760
Total suspended solids	mg/L	ND	ND	28.0	10.0
Ammonia	mg/L	ND	ND	0.159	ND
Nitrate	mg/L	ND	ND	ND	ND
Total Kjeldahl nitrogen	mg/L	0.660	0.663	2.12	1.06
Total phosphorus	mg/L	0.064	0.027	0.350	0.059
Surfactants	mg/L	0.050	ND	ND	ND
Metals					
Arsenic, total	mg/L	ND	ND	0.013	0.015
Barium, total	mg/L	0.057	0.056	0.085	0.071
Cadmium, total	mg/L	ND	ND	ND	ND
Chromium, total	mg/L	ND	ND	ND	ND
Lead, total	mg/L	ND	ND	ND	ND
Mercury, total	mg/L	ND	ND	ND	ND
Selenium, total	mg/L	ND	ND	ND	ND
Silver, total	mg/L	ND	ND	ND	ND

E. coli: Coliform bacteria are an indicator of the presence of human or animal waste inputs. In general, acceptable levels in "swimmable waters" for total coliform bacteria are less than 1000 organisms per 100 mL; the current E. coli standard in swimmable waters is less than 235 colonies per 100 mL. All E. coli samples resulted within the desirable limits.

Alkalinity: Alkalinity is a measure of the buffering capacity of a waterbody against acid additions such as acid rain and pollution, which can be detrimental to fish and other aquatic organism populations. The alkalinity levels within the pond were generally low, between 25-40 mg $CaCO_3$/L. These levels of alkalinity are considered to be low, but are common for waterbodies within this region.

Solids

Total dissolved solids: This is the sum of ions in the water. It does not indicate specific sources, but gives a more general idea of water quality. Its components are comprised of inorganic salts and some organic matter dissolved in water. Ultimately, it comes from both sources within the lake and the watershed surrounding the pond, and will be higher after a wind or rain weather event as it brings in sewage, run-off, wastewater and natural sources. Road salts can be a large contributor. Currently, 500 mg/L is the Secondary Drinking Water Standard, and all results from the pond this season were above that threshold.

Total suspended solids: This is comprised of material that can be caught and/or removed with a filter. Total suspended solids are often related to the color of the water sample and are made up of plant/animal matter, wastewater, sewage, silt. All sample results were either non-detect or had low values.

Ammonia: Ammonia is a transitional byproduct of the conversion from organic nitrogen to nitrate and is relatively short-lived in oxygen rich environments. There should be little to no detectable ammonia in surface pond water, although it may be anticipated in the bottom layer of deep, stratified lakes. All of the samples from the pond detected very low levels of ammonia, most being non-detect.

Nitrate: Nitrate nitrogen is usually the most prevalent form of inorganic nitrogen in the water and results from such things as natural aerobic bacterial activity and fertilizer use. For most waterbodies, levels of nitrate over 0.3 mg/L are considered elevated. The values observed were all below this threshold at non-detect.

Total Kjeldahl Nitrogen: Total Kjeldahl Nitrogen (TKN) is a measure of the nitrogen contained in organic compounds, such as proteins and amino acids, and as ammonia. It is created from biological growth and decomposition. A concentration of 1.0 mg/L or below is considered desirable. The July samples were both above this threshold and could be a result of increased runoff prior to sampling.

Phosphorus: This is generally considered the limiting nutrient for plant and algae growth. Concentrations of 0.03 mg/L are considered sufficient enough to stimulate algae blooms or excessive plant growth. The results from this year's phosphorus analysis were all above the desirable threshold, with the exception of the May middle sample. However, these results only illustrate a snapshot of continually fluctuating phosphorus levels, which can come from both external and internal sources.

Arsenic: The EPA limit in drinking water is 0.010 mg/L, which both July samples were greater than. Sources of arsenic in water can stem from natural sources, such as rocks, soil, water, air and man-made sources, tanning practices and electronic devices.

Barium: The EPA limit in drinking water is 2 mg/L; all samples resulted in less than the limit. Sources of barium include mineral deposits, drilling wastes, copper smelting, and motor vehicle part manufacturing.

Cadmium: The EPA limit in drinking water is 0.005 mg/L; all samples were non-detect. Cadmium comes from weathering/erosion, and anthropogenic sources such as: fertilizer, mining, car combustion, smelting, municipal effluent, and runoff.

Chromium: The EPA limit in drinking water is 0.1 mg/L; all samples were non-detect. Sources of chromium include rocks and volcanic activity.

Lead: The EPA has an action limit of 0.015 mg/L; all samples were non-detect. Lead can enter freshwater from many man-made sources such as mining and manufacturing.

Mercury: The EPA limit in drinking water is 0.002 mg/L; all samples were non-detect. Most mercury in waterbodies is a result of atmospheric input.

Selenium: The EPA limit in drinking water is 0.05 mg/L; all samples were non-detect. Selenium naturally occurs in sedimentary rocks, shale, coal and soils, but also can enter from mining, power plants and agriculture.

Silver: Drinking water standard is 0.1 mg/L; all samples were non-detect. Silver is usually naturally occurring, but typically is produced as a byproduct of other precious metals.

Ongoing Management Recommendations
Results of the pre- and post-management inspections suggest that the 2018 herbicide treatment was successful in reducing distribution and density of nuisance pondweed species. In 2019, we recommend continued treatment of these species with diquat and a copper-based algaecide for treatment of filamentous algae. We also recommend sample collection of microscopic algae for cyanobacteria (blue-green algae) testing. Certain species emit toxins which can be potentially harmful to humans, pets and wildlife. If sample results come back positive for those species and at high levels, we recommend treatment utilizing copper sulfate. This will both decrease the amount of toxin producing cyanobacteria within the waterbody as well as restore clarity to the water column. If phosphorus results continue to increase in future years, it is worth considering conducting an aluminum sulfate treatment; this product binds with available phosphorus within the water column as it sinks and deactivates it. By doing so, this reduces the available phosphorus for plant and algae species and can potentially mitigate future cyanobacteria blooms.

To effectively continue management in the future, it would be helpful if some of the rocks at the boat launch could be moved out of the way. The shallow, flat launch already makes launching the treatment boat difficult. For us to continue utilizing the most effective methods of application via trailered boats, removal or moving of these rocks would be helpful, as well as promote more trailered boat recreation within the pond.